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Lost Worlds: Locating submerged archaeological sites in southeast Alaska

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LOST WORLDS: LOCATING SUBMERGED ARCHAEOLOGICAL SITES IN SOUTHEAST ALASKA

by

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DISSERTATION

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DEDICATION

This dissertation is dedicated to my mother, Claudia Monteleone, and my brother and sister, Adam and Lindsey Monteleone.

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ABSTRACT

Synthesis and interpretation of archaeologically documented land-use patterns and ethnographic data are used to identify and model where people chose to live, hunt, and gather prehistorically. This project tests the hypothesis that the archaeological record of SE Alaska extends to areas of the continental shelf that were submerged by post-Pleistocene sea level rise beginning around 10,600 cal years BP (9,400 ^{14}C years). Digital elevation models (DEM) and sea-level curve for southeastern Alaska are used to create time slices between 16,000 to 10,500 cal BP. The variables (slope, aspect, distance from paleo-stream, paleo-lakes, paleo-coastlines, and known archaeological sites, and coastal sinuosity) included in the predictive model are incorporated in model identifying high potential areas for archeological sites. This model has been used to delineate survey areas for underwater archaeological surveys during two fields and will be used for two more field season.

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1. Project Description

The primary objectives of this research are to develop and test an archeological land-use pattern model designed to identify areas of high archeological potential on the continental shelf of Southeast (SE) Alaska (Figure 1-1). Sea-level history and glacial geology suggest that the archaeological record prior to 10,600 cal BP[1] (9,400 ^{14}C years) may be submerged on the continental shelf. To locate and test for sites older than 10,600, it is essential to extend archeological survey to the continental shelf in areas that were either unglaciated refugia or areas that were deglaciated during the interval between 16,000 -10,500 cal BP. This research facilitates the exploration and the interpretation of the origins and character of early maritime adaptations along the Northwest Coast (NWC) of North America.

Archaeological sites document continuous occupation of SE Alaska following sea-level rise above modern levels around 10,600 cal BP. The few documented earlier occupations are small interior sites that include locations where people occasionally engaged in hunting bears at hibernacula. These sites, which date between 12,700 and 10,000 cal BP, demonstrate that the region was occupied at times of lower sea-level (Dixon 1999, Fedje et al. 2008, Fedje and Mathews 2005). They support the possibility of submerged coastal sites located on the continental shelf where maritime subsistence resources were abundant.

The hypothesis this research is testing is that the archaeological record of Southeast Alaska extends to areas of the continental shelf that were submerged by post-Pleistocene sea-level rise from 16,000 to 10,500 cal BP. People chose to live along the coast to exploit maritime resources and they would have moved progressively landwards as sea-level rose. An important goal for this project is to limit the area of the continental shelf for marine archaeological survey to increase the likelihood of locating a submerged archaeological site. An archaeological land-use or high potential model was developed

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[1] cal BP = calibrated using Calib 6.0 (http://calib.qub.ac.uk/calib/calib.html) IntCal 09 (Reimer et al. 2009)

using the weighted overlay function in ESRI's ArcGIS. The variables incorporated are slope, aspect, sinuosity, and distance from streams, lakes, tributary junctions, and known archaeological sites. The model was produced at 500 cal BP intervals from 10,500 to 16,000 cal BP.

This is the first project to explore the continental shelf in southeast Alaska and one of only a few in North America (see 2.4 Underwater Archaeology). It is an exploratory project with a low probability of locating archaeological sites in the limited time available. This is partially due to the need to refine methods for survey and excavation, the large expanse of the continental shelf within the study area, the scarcity of early hunter-gather archaeological sites, the probable small size of possible sites, and the time since the deposit of these sites. Though the underwater environment can provide excellent preservation for organic and lithic artifacts, taphonomic processes will limit the length of time an archaeological site will remain in an identifiable state on the sea floor. The land-use model focuses the survey areas to high potential locations. These high potential areas are mainly flat areas near fresh water and the coast. Areas were past people would have used the landscape for resource extraction, i.e. land-use. Potential problems include the scarcity of available input information (more detailed bathymetry and topography would produce a more precise model), changes in the environment over the last 16,000 year (including storms and tectonic events which may have destroyed or moved possible archaeological sites), difficulties during marine geophysical surveys and sampling, and the vast area to be surveyed and sampled.

High potential areas are defined based on synthesis and interpretation of archaeologically and ethnographically documented land-use patterns applied to reconstructions of the submerged landscape. The model incorporates both inductive, utilizing known archaeological site data, and deductive, utilizing anthropological theory and the ethnographic record, types of modeling (Verhagen and Whitley 2012). The scale of measurement for this analysis are interval or ratio, and both the analytic (archaeological) and the systemic (dynamic living system) contexts were analyzed to develop the model (Kohler 1988: 35-37, Schiffer 1972).

The analytic units are the ranked valued for each of the model variables. The synthetic units are the larger groupings of the variables. These are slope and aspect, water variables, and sites. Slope and aspect defined as specific location properties, based on rank. Water variables include distance from streams, lakes, the coast, and tributary junctions. This variable type not only provides access to fresh water but also is the main location for diet. Sinuosity is incorporated into the synthetic unit because it is combined with distance from coast. Sinuosity reflects the amount of coastline available from a location. Increase sinuosity often indicates more resources available (Mackie and Sumpter 2005). The last synthetic unit is sites and incorporates distance from known archaeological sites. This increase the potential for archaeological sites near known sites Binford's (1980) logistical collectors, whereby people move to nearby camps, stations, and caches. People exploit resources near each of these site types. Camps, stations, and caches then become sites and new sites will be "near" other sites or camps.

Statistical models are a means to estimate appropriate weights for theoretically derived variables (Kvamme 2006: 12). Statistics were generated from known archaeological site locations. These statistics were then qualitatively compared to ethnographic accounts and general anthropological theory. For example, a theory such as 'people live near fresh water' was compared to the median distance from streams, lakes, and tributary junctions. Because the median values for lakes and streams were closer to 500 m than 100m, the highest rank was assigned to the 500 m buffer for these variables. This means that people still live near water, but more often, they were a short distance from these sources of fresh water. Based on these qualitative assessments, the variables in the model were ranked and were weighted out of 100%. This means using inductive modeling techniques to derive deductive variables (Kvamme 2006: 12), which is the method employed for this research.

This project will contribute to ongoing debates concerning the peopling of the Americas and particularly the Coastal Migration Hypothesis (Fladmark 1979, Heusser 1960, Mandryk et. al 2001, Surovell 2003). The Coastal Migration Hypothesis states that early people moved along the coastal margins of the Americas from Asia. The model is based on evidence that indicates the west coast of the Americas was deglaciated by at least 16,000 cal BP (13,500 ^{14}C years) and that refugia existed along the coast during the

Last Glacial Maximum (LGM), specifically in the Alexander Archipelago (Ager et al. 2010, Carrara et al 2007, Heaton and Grady 2003).

Along the NW Coast, the timing of intensification of maritime adaptation is an ongoing discussion, specifically if the early inhabitants were full maritime adapted and exploiting a maritime culture, or if they developed these technologies after moving to the coast. A maritime culture is adapted to the sea and acquires the majority of its dietary and economic needs from the sea (McCartney 1974: 158-159). The non-maritime adapted theory assumes that people moved into the NWC from riverine environments and then developed technology for salmon harvesting and deep sea fishing later. This maritime culture was then only fully developed by approximately 5000 years ago (Borden 1950, 1951, Fladmark 1979, Kroeber 1939). The fully-adapted maritime view assumes the cultures that migrated into the NWC were already utilizing the sea (Borden 1975, Cannon 1998, Drucker 1955). This theory is synergistic with the coastal migration hypothesis. Early maritime adaptation is supported by recent evidence including site location models on Haida Gwaii (Mackie and Sumpter 2005), human remains from On Your Knees Cave with an isotopic signature of a marine carnivore (Dixon 1999), and consistency in salmon harvesting since at least 7000 cal BP at Namu (Cannon and Yang 2011).

The study region is the southwestern Alexander Archipelago in SE Alaska (Figure 1-1) in the northern Northwest Coast (NWC) of North America. This is the region investigated by the Gateway to the Americas I and II projects (NSF OPP # 0703980 and 1108367). The study region is approximately 40,520 km^2. Recent research indicates SE Alaska and western British Columbia were largely glaciated beginning around 21,000 to 17,000 cal BP (18,000 to14,000 ^{14}C years) albeit with refugia (unglaciated areas capable of supporting humans) existing along the coast (Carrara et al. 2003, 2007, Clague et al. 2004). By 16,000 cal BP (13,500 ^{14}C years), much of the region was deglaciated and ecologically viable for human habitation, although a few valley glaciers from the Coast Mountain Range still extended to the coast (Carrara et al. 2007; Clague et al. 2004: 94, Mathews 1979, Shafer et al. 2010). Sea-level reconstructions for Haida Gwaii (Queen Charlotte Islands; Fedje and Josenhans 2000: 101) and SE Alaska (Baichtal and Carlson 2010) indicate sea-level has risen approximately 165 m since the last glacial maximum, briefly rising above modern sea-level in many areas around 10,600 cal BP. Although the character of the NWC continental shelf within the study area varies, it extended from 3 to 50 km (1 to 30 mi) seaward from the mainland coast prior to 10,600 cal BP.

Within the study region, Shakan Bay was identified specifically for this dissertation as this area had not been previously identified as a high potential location for archaeological sites. The larger Gateway to the Americas project has identified several study areas for survey. These include Keku Strait, the Gulf of Esquibel, and Arena Cove on the south side of Suemez Island (Figure 1-1). Keku Strait was selected based on a report from a local fisherman of an artifact recovered from the seafloor. Arena Cove was selected based on its proximity to a known obsidian source and paleoenvironmental reconstructions that indicate that it may have been part of a larger ice-free refugia during the LGM (Carrara et al. 2003, 2007). The Gulf of Esquibel was selected because it was a paleo-lake at lower sea-level, which would provide a favorable habitat for humans. Shakan Bay was identified because it would have been an intertidal estuary from at least 12,000 to 13,000 cal BP and a series of connected lakes from 13,000 cal BP to 16,000 cal BP. Both options would have been a highly productive environment for past peoples. In addition, Shakan Bay is sheltered by Baranof Island to the west and does not receive the full fetch of the Pacific Ocean, but Sumner Strait, to the west, is deep and would have support diverse marine resources. Areas that were surveyed are referred to as survey areas or locales.

This research significantly advances knowledge of NWC archaeology by surveying an archeologically unexplored region: the continental shelf of SE Alaska. As off-shore wind and oil exploration intensify in North America, the methods developed in this proposal could aid cultural resource management (CRM) in protecting North American submerged cultural heritage. The Bureau of Ocean Energy Management (BOEM) in Alaska has already recognized the value of this research in advance of oil exploration in the Beaufort and Chukchi Seas. Understanding the human response to sea-level change is also relevant to the anthropogenic acceleration of climate change and the associated rise in global sea-level. Finally, locating early archaeological sites has the potential to contribute to one of the oldest anthropological questions: the colonization of the American continents.

Chapter two presents the theoretical background underlying this research. It overviews landscape theory as high-level theory, archaeological land-use or high potential modeling as middle-range theory, and GIS (geographic information systems) and underwater archaeology as low-level theory. Chapter three reviews the geographic and geologic background for SE Alaska, the Alexander Archipelago, and Shakan Bay. Chapter four discusses the archaeological and ethnographic literature for SE Alaska and the northern Northwest Coast (NWC) in terms of research questions. The region's three Native American ethnographic groups each are reviewed in relation to traditional land-use, seasonal round, social structure, and economic orientations. Chapters five, six, and seven, present the high potential model, and its statistical and geophysical testing. The results of two marine geophysical surveys are reported in chapter seven. Chapter eight summarizes archaeological sites that are older than 9,000 cal BP on the northern NWC, their relevance to this research, and how these sites are located in relation to the land-use model. Finally, chapter nine discusses the geologic history of Shakan Bay based on the multibeam and ROV results, the implications of model resolution on the results, how this research affects SE Alaskan marine archeological research, and its implications for the coastal migration hypothesis.

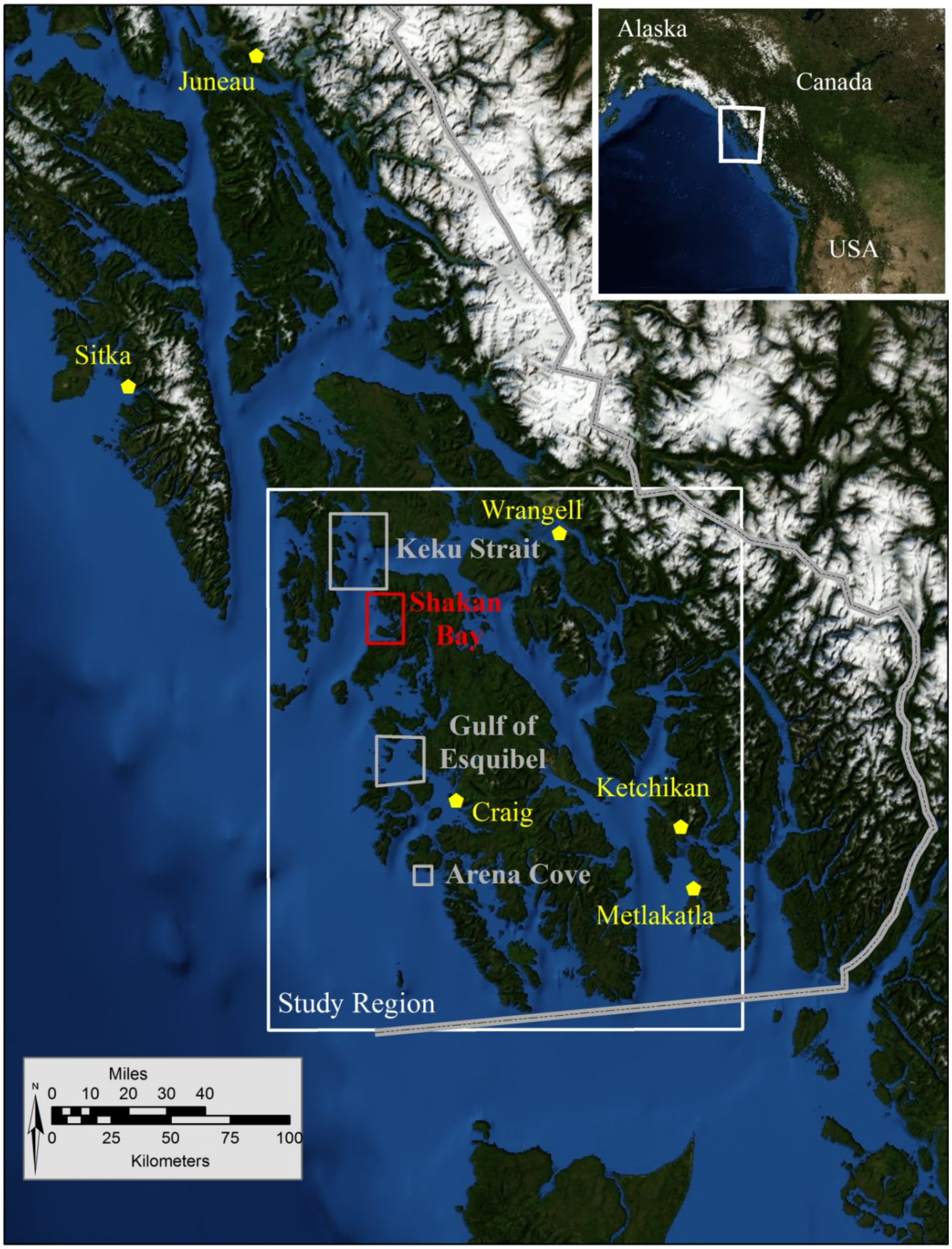


Figure 1-1: Map of study region and area, including study areas for Gateway to the Americas II.

2. Theoretical Background

The theoretical framework has been divided into high, middle, and low theory based on Schiffer (1988). Theory is used generally in the sense of explanations, models, or hypothesis. Essentially this chapter is the theory for each of the four major background areas for this research, landscape, modeling, GIS, and underwater archaeology.

Landscape theory is the overarching or high-level theoretical framework of this research. It provides a theoretical framework whereby the research focus is appropriate for an area that is larger than an archeological site. It facilitates analysis at multiple scales, incorporating regional geomorphology and actualistic studies (e.g. site formation processes and ethnoarchaeology) to answer questions regarding land-use, site distribution patterns, and other spatially related questions (Anschuetz et al. 2001, Bender 2002, Casey 2008, Kantner 2008, Rossignol and Wandsnider 1992). High potential archaeological site location or land-use models are a form of middle range theory (Verhagen and Whitley 2012). GIS and underwater archaeology provide methodological or low-level theoretical frameworks. Though the low-level theories are basic explanations of methods background, they still have a theoretical background.

2.1. Landscape Theory

Modern archaeological landscape theory has its roots in Julian Stewart's concepts of cultural ecology. It is a modern embodiment of human and historical ecology and is related to evolutionary ecological models. *Ecology* is the study of the relationship between organisms and their environment (Dincauze 2000: 3). The *environment* is "all physical and biological elements and relationships that impinge upon a living being" (Dincauze 2000: 3).

Landscape archaeology is protean. It provides a conceptual framework to address all contexts of past human behavior and goes beyond an "environmental" approach. It is focused on things that locate humans spatially (David and Thomas 2008: 38). Landscape archaeology is about place as a basic unit of lived experience (Casey 2008: 44).

Descartes (1991 [1647]: 45-46) distinguished ‘place’ as a position verses ‘space’ as a volume. Following Descartes, landscape is inconceivable without place. It is a set of discrete places (Casey 2008: 49).

> Landscape archaeology is an archaeology of how people visualized the world and how they engaged with one another across space, how they chose to manipulate their surrounding or how they were subliminally affected to do things by way of their locational circumstances. It concerns the intentional and the unintentional, the physical and the spiritual, human agency and the subliminal. (David and Thomas 2008: 38)

Landscape theory includes ‘taskscapes’ (Ingold 1993) and ‘seascapes’ (Bjerck 2009, Chapman and Chapman 2005, Van de Noort 2003). *Landscape* is a cultural construction of modern European society. This western philosophical framework is applied to a region some of which only has been inhabited by the western world for the last few hundred years (Bender 2002: S105, Knapp and Ashmore 1999: 6).

There are three tenets central for archaeological landscape theory. First, there is a dedicated effort to examine the physical environment, often using various suites of natural science techniques, focusing on scientific questions (Feinman 1999: 684, Rossignol and Wandsnider 1992). Secondly, it recognizes that distinct cultural perceptions and past human actions shape human-environment interactions (Anschuetz et al. 2001, Bender 2002, Feinman 1999: 684). Finally, human environments are to a certain degree products or creations of a dynamic interaction with human behavior and the natural environment (Bender 2002, Feinman 1999: 684, Fischer and Thurston 1999, Johnson 1977, Kantner 2008: 61). “Landscapes in this conceptualization are the intersection of a particular group’s history with the places that define its spatial extent” (Anschuetz et al. 2001: 186).

2.1.1. ***Historical Development of Landscape Theory***

Very early (pre-Boasian) geographic and anthropological works focused on the effects the environment had on the development of people, or sometimes the reverse. Environmental determinism created simplistic correlations between environmental and cultural features at large-scales (Kohler 1988: 25). Boas recognized the importance of environment and correlated land-use practices with environmental features by reducing the scale of analysis to assess certain environmental features and certain aspects of human behavior as it pertained to specific groups of people (Boas 1935, Kohler 1988: 25). Kroeber and Wissler, to a lesser extent, disregard the effects of causality from the environment and cultural relationships in developing the culture area concept (Kohler 1988: 25-26). In the 1920s, Carl Sauer, a geographer, recognized that landscape is the repository of a culture's impact on its environment. A landscape is a tangible record of human adaptation to the physical environment (Anschuetz et al. 2001: 164, Darvill 2008: 60, Knapp and Ashmore 1999: 3). Many archaeologists viewed past people as actors who either adapted to the environment in which they lived, transformed the environment, or became extinct. Today many archaeologists assume that the modern landscape was more or less representative of past distribution without any significant changes (Patterson 2008: 78). This is not an assumption of this study.

Julian Steward (Kroeber's student) was interested in causal explanations, not correlations, using the culture-area concept. He emphasized the effect of local aspects of the environment on particular facets of culture, not large-scale correlations of regional environments with culture types. The "culture core" concept, defined as "the constellation of features which are most closely related to subsistence activities and economic arrangements" (Winthrop 1991: 47), was used as a pathway through which environment might influence cultures (Kohler 1988: 26). Steward was then able to extend the culture-core concept to specific site location models. He generalized; some groups in arid portions of western North America were highly responsive to a limited number of mappable environmental determinants (Kohler 1988: 27-28). Steward's views on cultural ecology suggest that settlement behavior is part of the "culture core". Because there is no clear objective procedure for determining what constitutes the core, Steward assumes the environment influences culture, but culture does not influence the environment (Kohler 1988: 28-9). Trigger (1971) refers to this as "deterministic ecology". As a response to the problems with Steward's methods, many archaeologists moved to an ecosystem approach influenced by evolutionary ecology (Flannery 1968, Winterhalder 1981).

Steward's student, Gordon Willey, started settlement pattern archaeology as a new field of inquiry in archaeology beginning with the survey of the Virú Valley in Peru. "The term 'settlement pattern' is defined here as the way in which man disposed himself over the landscape in which he lived' (Willey 1953: 1). Willey associated settlement patterns with environmental, technological, and demographic change (Kohler 1988: 30, Patterson 2008: 78). After Willey's study, archaeological survey methods became increasingly rigorous in applying regional and sub-regional scales of analyses (Anschuetz et al. 2001: 169).

In the 1960s and 70s, there was a divergence in landscape approaches. The first was a positive science emphasizing spatial quantitative approaches. These include network, hierarchical, and surface models, such as Hodder's (1977) macro scale analysis. The second approach focused on humanistic philosophies and human values, beliefs and perspectives, including idealism, feminism, and phenomenology (Anschuetz et al. 2001: 164-165).

In the 1970s, the Southwestern Anthropological Research Group (SARG) introduced more rigorous testing to determine the degree of relationship between site location and environmental variables. They incorporated expected site distributions for comparison with observed site distribution using formal statistical inferential techniques including ANOVA. The final point made in their report focuses on the difference between archaeological site locations and the distribution and movement of people through space in the systemic, behavioral context. "[P]rehistoric peoples most likely did not locate 'sites' anywhere. However, they did establish, occupy, and abandon behaviorally significant spaces, such as activity areas, camps, and settlements" (Sullivan and Schiffer 1978: 169 from Kohler 1988: 32-33). Landscape archaeology began to be cited in academic work in the mid- to late- 1980s. In the 1980s, landscape changed from simply being a unit of analysis, which is larger than a site, to a high-level theoretical approach (David and Thomas 2008: 27).

2.1.2. *Modern Landscape Theory*

Landscape theory is evolving and dynamic. However, there is and has been a difference between European and North American views of landscapes (Lock and Harris 2006). This research incorporates both views of landscapes. Landscape archaeology incorporates land-use patterns, subsistence-settlement systems, ecological habitats, both terrestrial and celestial landscapes, materialization of worldview, built or modified (culturally constructed) environments, and stages for performance (Patterson 2008: 77). There theories are based in phenomenology, ecology, subsistence theory, and practice, though many other interpretative schemas exist. Landscape theory is able to accommodate and integrate different theoretical perspectives, even those that create competing reconstructions of the past (Anschuetz et al. 2001: 159, 176).

Landscape archaeology has expanded beyond Steward's descriptive studies to address observed patterns generated across space and time (Anschuetz et al. 2001: 170, Kohler 1988, Kohler and Parker 1986: 399, Patterson 2008: 78). Land-use analysis seeks to build from the relatively static spatial distribution of material culture and anthropogenic alterations visible in the modern landscape to an understanding of culture dynamics and environmental process (Bevan and Conolly 2005: 218). It incorporates quantitative methods. It explores the correlation between landscape and social or environmental variables and investigates neighborhood dependence, which is the physical relationship between new and existing sites or households. These quantitative methods can be referred to as predictive modeling (Bevan and Conolly 2005).

Phenomenology interprets landscapes from the point of view of the subject. A landscape has to be experienced to be understood. The phenomenological objective is "to provide a rich or 'thick' description allowing others to comprehend these landscapes in their nuanced diversity and complexity" (Tilley 2008: 271). The main research tool for phenomenology is the physical body using the medium of the researcher's senses. A landscape can have agency. It can act on a person by effecting thoughts and interpretations. Landscapes can be material. They are real and physical, not only a cognitive or imagined reality. Landscapes exist in space-time. They are always changing and are never the same twice. Phenomenology seeks to ascertain how others experience a landscape through learning how others see and experience them (Tilley 1994, 2004, 2008). This research recognizes the importance of phenomenological studies, but acknowledges that the submerged continental shelf, physically, only can be experienced through digital reconstructions. There are several arguments against phenomenological landscape. The most notable argument is the 'highly questionable results' of field work (Fleming 2006: 267). Phenomenology provides a broader mentality for this research. The landscapes are reconstructed and visualized to attempt to understand them using phenomenological methods; how would people have viewed their landscape in the past.

Evolutionary ecology and human behavioral ecology (HBE also referred to as behavioral ecology) provide a platform upon which landscape archeology has been applied in this research. Evolutionary ecology is "the application of natural selection theory to the study of adaptive design in behavior, morphology, and life history" (Cannon and Broughton 2010: 1). HBE is a sub-area of evolutionary ecology that is most directly relatable to archaeology. "HBE focuses on functional variability by applying natural selection theory to the study of human behavior in socioecological context" (Bird and Codding 2008: 396). It draws on formal optimization and game theory models to develop hypotheses for fitness related trade-offs actors may face in variable environments and circumstances. Evolutionary ecological models use assumptions relevant to the evolution or expression of a phenotypic variant, whereas HBE focuses on behavioral components of the human phenotype. The evolution and expression of a behavior are affected by the natural and social features of the environment (Cannon and Broughton 2010: 2, Bird and O'Connell 2006: 143, Shennan 2002).

Landscapes are the context in which decisions or behavior choices are made. These choices affect an individuals' survival and reproductive successes (Bird and Codding 2008: 396, Johnson 1977: 479, Kantner 2008: 61). "They [choices] form the ecology of human life – the social history, individual development, and local environmental circumstances that constrain our behavior" (Bird and Codding 2008: 396). HBE attempts to explain complex cultural patterns based on individual interactions and decisions. The two basic assumptions are: [1] resources are finite and individuals make trade-offs because of resource finality; and [2] natural selection determines the capacity to evaluate the cost and benefits of these trades-offs (Bird and Codding 2008: 397, Shennan 2002). Research involves two tasks: reconstructing behaviors from the archaeological record and explaining the reconstruction (Bird and O'Connell 2006: 144). This research evaluates a regional land-use model in terms of behavior choices utilizing HBE.

Behavioral choices or "cognitive variables" are the difference between an 'ecologically deterministic' and a humanistic approach (van Leusen et al. 2005: 30). These decision-making processes make hunter-gatherer subsistence economies uniquely suited to landscape and GIS studies (Boaz and Uleberg 2000). For this research, the behavioral choice being modeled is access to maritime or marine resources. This means that greater preference is given to coastlines where coastal resources can be accessed and stream, lakes, and tributary junctions were other marine resources, such as anadromous fish, could be accessed.

Subsistence or economic landscapes are amenable to investigating the distribution of resources and interpreting economic strategies. Landscape-scale ethnoarchaeological research investigates the organization of subsistence strategies at the regional level, how these strategies shift through time, and how organization influences the structure of the archaeological record (Stern 2008, Rossignol and Wandsnider 1992: 7, Wandsnider 1992b). This model maps changes in coastlines, streams, lakes, and tributaries but implies that these locations are where the resources were. This means that by changing these variables, the location of past resources is being mapped. Whitley and Burns (2008) developed a high potential model for South Carolina incorporating resources and the distance to these resources. It utilizes a combination of land-use and subsistence resource patterns to develop the model. Ethnographic research was vital to developing a model appropriate for the continental shelf of SE Alaska to incorporate cultural decision-making.

Though in the past some archaeologists have viewed landscapes as stagnant, contemporary landscape theory incorporates the environmental and cultural changes that have occurred through time (Patterson 2008: 78, Rossignol and Wandsnider 1992). This requires environmental reconstruction for each time-space investigation (Tilley 2008). Modern landscapes are the culmination of past landscapes or "time materialized" (Bender

2002). Many researchers do not reconstruct the environment and this is a serious flaw in many landscape studies. Ideally, reconstructions will incorporate regional geomorphology and actualistics studies. Actualistic studies examine present-day, dynamic systems, which can be related to the deposition of archaeological remains. These come in three forms: [1] inquiry into formation of the fossil assemblages (taphonomy), [2] investigation of the effects of interactive human and natural processes on archaeological assemblages, and [3] examination of the impact of hunter-gatherer and agropastoral mobility strategies of the landscape (Rossignol and Wandsnider 1992: 6). Another actualistic approach is ethnoarchaeology that explores anthropogenic impacts on archaeology within systemic regional patterns of human behavior in space and time (Rossignol and Wandsnider 1992: 7). For this research, early archaeological sites have been located in caves and in intertidal areas. This means that older sites are not preserving in open environment or are not surviving. The underwater environment can provide an anaerobic environment to preserve archaeological site remains. The taphonomic processes at work underwater are complex. The environment can be more destructive than most open-air environment, but by simply covering a site by a few centimeters of sediment, a site can be preserved almost indefinitely, such as Bouldner Cliffs in England and La Mondrée in France (see 2.4.2.2 Other Projects). Chapter three specifically deals with the underwater environment and the interactions that the waves, tide, and other processes have on submerged environments through time. Finally, because of the few sites that have been located prior to 9000 cal BP in the region, it is unknown what effects the people of the NWC had on the environment that is now submerged. Rock aliments for fish weirs, depressions or houses and caches, and shell middens are all expected on the sea floor. Unfortunately, the amount they are buried will affect both their preservation (positively) and our ability to identify them (negatively). The changes expected from actualistic studies for the underwater environment along the NWC are inconsistent and difficult to determine. This research anticipates that some areas will still contain submerged archaeological sites that can be identified.

2.1.3. *Non-sites*

In the early 1980s, Dunnell and Dancey (1983) questioned the usefulness of 'site' as a unit of analysis. This was part of the growth of landscape archaeological theory (Patterson 2008: 78-79). People did not choose to locate sites. They interacted with the environment and landscape. Archaeologists identify archaeological sites and define their boundaries. Sites are areas where artifacts are found (Willey and Phillips 1958: 18). Dunnell and Dancey (1983: 272) suggest, "the archaeological record is most usefully conceived as a more or less continuous distribution of artifacts over the land surface with highly variable density characteristics". The density of artifacts characterizes land-use and reflects its frequency. Willey and Phillips (1958: 18), while defining the unit of 'site', recognize that a site is "often impossible to fix". They mean that the exact location of a site is difficult to determine.

Dunnell and Dancey's (1983) concept of non-site opens the entire landscape or region for analysis and survey. Clusters, or densities, of artifacts or human modification of the landscape can be utilized to interpret the past. Even without the limitation of the concept of sites, data can be organized into sites as classificatory units. Ebert and Kohler (1988: 144) point out that looking for non-sites would be very expensive, and suggest, "archaeological sites… are rare phenomena that only occur 'about 1 percent of the time'." From this perspective, sites are viewed as nodes in a continuous distribution of archaeological material. Therefore, one out of 100 random points distributed through a landscape, will actually be an archaeological site by chance. Despite their resistance to the concept, Ebert and Kohler (1988: 145) support a "non-site" sampling approach. By incorporating the premises of non-site landscape analysis, the minimum operating units of archaeological analysis are artifacts and features. This research incorporates the non-site concept for survey. Sites and site boundaries will be difficult to determine on the sea floor; any distribution of artifacts would equate to a positive response during survey for this model. Maritime archaeology has focused on shipwrecks, which are sites; however, underwater archaeology has focused on individual finds such as faunal remains and a single utilized flake from Haida Gwaii (see 2.4.2 Underwater Archaeological Projects). Essentially, this model is trying to locate archaeological remains and features and is not specifically looking to locate archaeological sites. The model specifically focuses on land-use or areas where people could have collected the maritime resources they required for subsistence and economic purposes.

2.1.4. ***Seascapes***

McNiven (2008: 150) defines seascapes as "views from land to sea, views from sea to land, views along coastline, and the effect on landscape of the conjunction of sea and land". Seascapes are viewed as synergistic incorporating both landscape and maritime archaeology (Bjerck 2009, Van de Noort 2003: 405). These seascapes incorporate names, myths, legends, and property or political boundaries vital to the identity of maritime people. The sea can be anthropomorphized and thus imbued with agency and intentionality (McNiven 2008: 150). Seascapes also can have interesting phenomenological interpretations, but 'seascape' often is used interchangeably with landscape when referring to coastal areas (Bjerck 2009, Breen and Lane 2003, Chapman and Chapman 2005, Van de Noort 2003).

Ford (2011a: 4) defines seascapes as "constructed of the factors that allow an individual to perceive his or her location out of the sight of land". This incorporates aspects of astronomy and mental maps integral to navigation (Lewis 1972). Westerdahl (1992: 5) defined the "maritime cultural landscape" as the remnants of maritime culture on land and underwater. The maritime cultural landscape incorporates "human utilization (economy) of maritime space by boat: settlement, fishing, hunting, shipping and its attendant subcultures" (Westerdahl 1992: 5). It can be integrated in the seascape concept and landscape theory as it applies to settlement, land-use, or high potential modeling.

The seascape concept can be a very generalized view. By combining seascape and phenomenology, this research aims to reconstruct the past (and now submerged) environment so that it can be viewed as a fluid landscape where people moved, often utilizing water transportation, viewing the land from the sea.

2.2. Archaeological Land-use Models

The goals of a land-use, settlement, or high potential model is to construct "the distribution of related tolerances that influenced the spatially contextual decision of humans in the past, which led to observed settlement patterns in the archaeological record" (Carleton, Conolly, and Ianonne 2012: 3371). A model can be regarded as a collection of irregular polygons, mapped onto a landscape, indicating locations that are 'favorable', 'likely', or 'probable' to contain an archaeological site (Kvamme 2006: 27) or where people chose to locate themselves in relation to resources of the type being modeled. Models to predict high potential, or probable, areas for archaeological sites have been viewed negatively by some academics because of the lack of theory and inappropriate application (Sebastian and Judge 1988). The applicability of archaeological site location models has been exaggerated in the past. This research uses the model solely to limit areas for survey. Identifying an area as high or low potential does not affect the development or preservation of that environment in this case. The problem with past predictive models is that they were viewed as a means to identify areas for development that were low potential and did not require further archaeological investigation.

A basic definition of *predictive modeling* is "a technique that, at a minimum, tries to predict the location of archaeological sites or materials (non-site) in a region, based either on a sample of that region or on fundamental notions concerning human behavior" (Kohler and Parker 1986: 400). Verhagen and Whitley (2012: 52-53) expand this definition to require the model to have "a quantitative estimate of the probability of encountering archaeological remains outside the zones where they have already been discovered".

A *model* is defined as "hypotheses or sets of hypotheses which simplify complex observations whilst offering a largely accurate predictive framework structuring these observations" (Clarke 1968: 32). First, this means that a model is a hypothesis that needs to be tested and must fit within the larger theoretical framework of landscape archaeology. Second, a model is an abstraction that can be generated inductively or deductively, but always incorporates the subjectivity of the observer. Third, a model has predictive capacities. Hence, the term "predictive model" is considered by Sebastian and Judge (1988: 1) as redundant. Nevertheless, it has predominated in the literature since the 1970s. Finally, a high potential model for landscape archaeology is a bridging function, or middle range theory, linking high-level theory to data and the archaeological record (Verhagen and Whitley 2012).

The niche concept from biology has been used as an analogy to archaeological high potential modeling (Kvamme 2006). Kvamme (2006: 14) defines *niche* as “the total range of conditions in the environment under which a population lives and replaces itself”. This is a simplification of the original niche concept. Brown (1995: 30) states that a niche according to Hutchinson “could be represented quantitatively in terms of the multidimensional combination of abiotic and biotic variables required for an individual to survive and reproduce”. Species exhibit distinctive patterns of abundance and distribution which reflects that species environmental requirements. For any species, ‘ideal habitats’ can be represented by measurements of specific variables, usually environmental variables. Human uses of space can be viewed in terms of a subset of environmental variation. Even culturally determined variability can be mapped using environmental variables, though this must be tested and supported in each case. Niche modeling provides a logical basis for this archaeological modeling (Kvamme 2006: 14) and is a recent application of archaeological high potential modeling (Kondo and Oguchi 2012, Kondo et al. 2012).

Predictive modeling in Europe is focused on three primary concepts: 1) sustainability of archaeological-historic resources; 2) method of non-destructive resource management, integrating the historical landscapes and buildings in environmental and spatial planning; and 3) justifying heritage management decisions to future generations (van Leusen et al. 2005: 25, Verhagen 2008). Academic archaeology has focused on identifying location-focused properties based on different functional, chronological, and cultural types or components. Cultural resource management (CRM) and US and Canada government agencies have used predictive models for cost assessment for developers. Archaeological heritage management (AHM) in parts of Europe and CRM in North America have focused on conservation and limiting costs, regardless of the nature of the resource (van Leusen et al. 2005: 27). It is not clear yet if these are appropriate uses of predictive models. Wheatley (1993), who originally was a proponent of predictive models, is adamantly against it now, especially for government agencies.

2.2.1. ***History of High Potential Models***

Green (1973) preformed a location analysis of Maya sites in northern Belize (then British Honduras). She identified soil types, vegetation, and distance from navigable water as the variables significantly associated with settlement. She produced a multivariate statistical model of site locations in areas with large tracts of arable land in proximity to trade routes.

In the United States during the late 1970s, the Bureau of Land Management (BLM), Forest Service, Corps of Engineers, Interagency Archaeological Services, and some State Historic Preservation Officers (SHPO) began to build high potential models. They sponsored surveys to develop the models and built models from existing survey data. The National Historic Preservation Act of 1966, amended in 1976 and 1980, signaled the importance of the growth of high potential modeling (Kohler 1988: 34). The subsequent high potential models utilized divergent methods and variables. Sebastian and Judge's 1988 volume entitled *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling* developed out of this effort and serves as a key text in high potential modeling literature (Verhagen and Whitley 2012).

There have been significant advancements in site location modeling since the mid-1980s. Issues of modeling multiple site types, reconstructing the environment, and site sampling issues were identified. Advancements and adoption of GIS have allowed for new variables, new modeling approaches, and methods for evaluating model performance (Kvamme 2006: 21). GIS has also allowed novice researchers to develop simple models for site locations quickly and easily using new tools and software. Since the 1990s, there were a few publications each year regarding archaeological predictive modeling. In the last five years, the number of citations has exceeded 80 per year (based on citations in Web of Knowledge).

2.2.2. ***High potential Models as Middle-Range Theory***

Middle-range theory consists of the ideas, models, and other interpretative assumptions necessary to link low-level theory or low-level artifactual observations and high level or general theories (Bell 1994: 16). Binford (1977: 6) defines middle-range theory as "(a) how we get from contemporary facts to statements about the past, and (b) how we convert the observationally static facts of the archaeological record to statements of dynamics". He saw these theories as a means to understand the processes responsible for change (Binford 1977: 7). Middle-range theory should be developed hand-in-hand with general theory because middle-range theory is designed to test general theories or upper-level theory (Binford 1977, Tschauner 1996: 10, Raab and Goodyear 1984: 261). Middle-range theory is the critical bridge between general theory and empirical data (Verhagen and Whitley 2012: 64).

Binford's view of middle-range theory is more limited than its use in sociology where it was originally developed (Raab and Goodyear 1984: 256, Verhagen and Whitley 2012: 64-66). It was intended to "be flexible in seeking sources of working hypotheses, and to be aimed at accumulating a body of theory" (Raab and Goodyear 1984: 256). Application of Binford's middle-range theory largely has been reduced to experimental archaeology and ethnoarchaeology (Tschauner 1996). Raab and Goodyear (1984) advocate limiting or restricting middle-range theory development to empirical explorations.

Verhagen and Whitley (2012: 64 - 67) reduce the requirements for middle-range theory into four premises:

1) It is unambiguous.
2) It provides plausible cause and demonstrable effects not based on simple correlation.
3) It follows uniformitarian assumptions, and
4) It is independent of general or high-level theories.

The third premise may be difficult to apply to social theories, because there may not be present-day correlates to use as benchmarks. Binford (1981) emphasizes that middle-range theories should focus on process, and "seems to have been unnecessarily restrictive in this respect [use of uniformitarianism], possibly because he envisaged middle range theory to be used primarily for explaining site formation processes" (Verhagen and Whitley 2012: 67). In relation to the need for independence from general theories, though the middle-range theory is testing a high-level theory, it should be different or "intellectually" independent of the high-level theory it is testing. To be a valid test, a theory cannot be tested by itself and thus has to have an independent theory to test it. Middle-range theory is this independent theory to test high-level theory.

This research conforms to the premises defining middle-range theory. It is unambiguous because it postulates that, at times of lower sea-levels, people would have lived on the continental shelf. The coastline along which they were living, fishing, hunting, and gathering would have moved progressively landward as sea-level rose, and they would have maintained proximity to the coast and coastal resources. Secondly, there is a clear cause of change, late-Pleistocene/early-Holocene sea-level rise. The effect of the change would be a landward movement in land-use and resource procurement sites. Thirdly, where people live in association to coastlines can be uniformitarian in nature. There are numerous modern and ancient examples including Carlson's (2007) record of site locations in relation to sea-level in southeast Alaska during periods of higher sea-level. Finally, this theory is independent of landscape theory, which is the specific high-level theory. Therefore, this middle-range theory meets Verhagen and Whitley's (2012: 64-67) premises.

2.2.3. *Types of High potential Models*

Kohler (1988:35) proposes three distinguishing dimensions to archaeological high potential models: level of measurement, procedural logic, and target context. He defines six types of models (Kohler 1988: 36, Figure 2.1):

1) Has no measurement, uses inductive logic, and has systemic context,
    - Ex. Binford's (1980) forager/collector model.
2) Has no measurement, uses inductive logic, and has analytic context,
    - Ex. Unqualified discussion of ancient land-use patterns.

3) Nominal/ordinal scale measurements, uses inductive logic, and has analytic context.
    - Ex. Soil types associated with archaeological sites
4) Nominal/ordinal scale measurements, uses deductive logic, and has systemic context.
    - ex. Using political boundaries for variable criteria
5) Interval/ratio scale measurements, uses inductive logic, and has analytic context,
    - Most CRM high potential.
6) Interval/ratio scale measurements, uses deductive logic, and has systemic context,
    - Models based on optimal foraging theory.

Model types vary from those with no measurement to models based on interval or ratio level measurements. Lack of measurements means researchers must rely upon qualitative statements, such as sites are frequently located near water. The intermediate scales for measurements are categorical or nominal variables, such as soil types, or ordinal level. This includes variables such as ranked resource lists. Interval or ratio level measurements include measurements like slope, distance to water, estimated net primary productivity, etc.

Secondly, the target context refers to the 'theater of operations' of the model (Kohler 1988: 35). Systemic context (Schiffer 1972) is the dynamic living systems observed by ethnographers and ethnoarchaeologists. The analytic or interpretive context begins when archaeologists start to sample materials or begin to observe the systemic context. The goal of locating archaeological sites implies a focus on analytic context (the archaeological site), but deductive models are concerned with systemic contexts (Kohler 1988). However, it is frequently unclear which context is being modeled despite critical difference in assumptions, approaches, difficulties, and outcomes (Kvamme 2006: 13).

Deductive models start with theory about how people use a landscape and then deduce where archaeological materials would be located. Most CRM models have been inductive. Inductive models are also called inferential or empirical/correlative models based on their logical construct. These begin with survey data regarding the distribution of known archaeological sites and the site's relation to landscape features, usually environmental variables, such as soil, slope, aspect, etc. The model then estimates the spatial distribution of the population of archaeological materials from the sample population. Inductive models work within the analytical context because they are attempting to control the post-depositional and depositional process that separate the analytic from the systemic contexts (Kohler 1988: 37). Explanatory models are neither inductive nor deductive, but instead build the bridge between systemic and analytical contexts. An explanatory inductive model would not have testable predictions, but an explanatory deductive model would result in predictions for analytical contexts. Thus, models are either inductive and analytic or deductive and systemic. Although others have created various schemes to classify models (Altschul 1988: 63), the majority is divided into inductive or deductive (Ejstrud 2003, Kvamme 2006, Kincaid 1988, van Leusen et al. 2005: 29-30, Verhagan and Whitley 2012).

Kohler (1988:52) recognizes that deductive approaches are preferred for predicting the type and location of archaeological sites. A model's utility also can be judged by its ability to extend beyond common sense or causal explanations of site locations. Kvamme (2006: 11) echoes Kohler's comment but states that it was the researchers' processual framework, which was Sebastian and Judge's focus (1988):

> [W]ho [the researchers and editors] informed us that only models generated through deductive reasoning were 'good' and potentially 'explanatory,' while models utilizing statistical methods were not only 'inductive' (a bad word at the time), but 'merely correlative' and incapable of explanatory insight. (Kvamme 2006: 11)

Views have shifted since 1988. Inductive models tend to be statistically based and deductive models are not popular due to their failure to apply statistics. Kvamme (2006: 12) explains how statistical models are a means to estimate appropriate weights for theoretically derived variables. This means using inductive modeling techniques to derive deductive variables. That is the method employed for this research. An example of this approach is Dalla Bona and Larcome's (1996) model for northwestern Ontario, Canada, which is based on variables selected through ethnohistoric and contemporary native informant accounts.

The difference between data driven models (inductive) and theory driven models (deductive) is not universally recognized (Wheatley and Gillings 2002: 162). Models are neither purely deductive nor inductive (Kohler 1988: 52). Data is collected within a theoretical context and is thus theory-laden. Theories are based on empirical observations. Practically, it is impossible to implement a high potential model based entirely on either inductive or deductive methods (Wheatley and Gillings 2002: 162).

2.2.4. ***Testing Models***

Testing includes two main aspects: consistency and evaluation (Verhagen and Whitley 2012: 84). All models, no matter how they are developed, need to be tested before they can be relied upon or operationalized. A model is operationalized if all the terms in the model are carefully defined and different people can make the same predictions using the same model. This also means that a model can be objectively and repeatedly mapped (Kohler 1988: 35).

Validation is "the process of determining the accuracy and precision of the sample-based predictions either on internal criteria or on a portion of the target population not used in building the model" (Kohler and Parker 1986: 430). Validation tests the internal *consistency* of the model and the theory behind the model (Verhagen and Whitley 2012: 84, Ramenofsky and Steffen 1998: 9). There is little agreement about how to validate models and many are not validated. The best way to validate a land-use pattern model is through field survey. This means that unsurveyed areas can be tested for "fit" between the expected and observed site patterns. If the desired fit is not achieved, the model goes through an iterative process whereby it is revised to incorporate new data and other variables (Kohler and Parker 1986: 430-432). Methods to achieve validity include resampling, such as cross-validation, jackknifing, and bootstrapping. These can provide estimates of performance (Kohler 1988: 35, van Leusen et al. 2005: 34-35, Verhagen 2008).

The *evaluation* phase seeks to determine the predictive power of the model. It answers the question of how good the model is and its level of uncertainty (Verhagen and Whitley 2012: 84). This is often assessed using Kvamme's gain statistics (Kvamme 1988b: 329).

$$Gain = 1 - \frac{\text{percentage of total area covered by model}}{\text{percentage of total sites within model area}} \quad [1]$$

This formula compares the percentage of total study area to the total area of high probability. It is recommended that both training and testing data be utilized. Gain values approaching one have high predictive value, while values below 0.50 indicate that a model is not predictive. Results with negative gain values have reverse predictability or low potential areas have a greater chance of having archaeological sites than high potential areas (Mink et al. 2006: 215, van Leusen et al. 2005: 33). The gain value is expressed as a decimal or converted into a percentage. It can be read as the probability to predict the location of a site. Generating the best possible model is a trade-off between accuracy and precision. Boundaries need to be defined to distinguish between high, medium, and low probability. Kvamme's gain can be used to determine these class boundaries to find the optimal threshold (Verhagen 2008: 286-287).

2.2.5. ***Issues with Predictive Models***

Altschul and colleagues (2004) claim that many archaeologists believe that using a GIS equates to predictive modeling. However, others believe GIS is theoretically neutral (Wheatley 1993: 134). Arguments against predictive models focus on the issue that they cannot predict *all* archaeological sites. Other issues identified by Mehrer (2006: ix) include the perspective: 1) that site locations cannot be modeled because ancient cultures cannot be modeled; 2) that site locations cannot be model using known site locations because the population of known sites is biased by sampling errors; and 3) that site models based on environmental factors are flawed because they are environmentally deterministic. Each of these criticisms is a generalization about predictive modeling and it should be understood that a model is not trying to reconstruct all ancient culture, just the decisions underlying the selection of site locations. It also should be recognized that deductive models are not based on the location of known sites. Environmental variables provide independent statistical tests to evaluate objectively site location information and are valid variables as long as human choices are considered.

Kvamme (2006: 7, Table 1.1) provides a list of the archaeological, environmental, behavioral, and technical difficulties associated with archaeological predictive modeling. This includes the fact that many archaeological sites are buried and consequently their location cannot be used for modeling. He also notes that past environments were different from present and may not be applicable for modeling. Finally, GIS data have insufficient resolution and poorly represent the real world. However, he counters this list of twenty-five problems with a list of three reasons why researchers can pursue archaeological location models.

1) Human behavior is patterned with respect to natural and social environments.
2) Human environmental interactions can be observed from the spatial relationships between human residues (i.e., the archaeological record) and environmental features.
3) GIS provides a tool for mapping what is known (Kvamme 2006: 6).

Some of the difficulties, such as poor resolution of GIS are beginning to see improvements. GIS has a theoretical background (discussed in the next section) that has to be incorporated and included when developing any model. GIS make assumptions about the environment that can affect how the model is produced.

With land-use predictive models, there are two types of errors. The first is where a site is predicted and none exists. This can be termed a ‘wasteful errors’, errors of commission, or a Type II error in statistics. Type II errors occur when the null hypothesis is accepted, and it is actually false. The second type is where a location is predicted not to have a site and it does. This type of error is a Type I, errors of omission, or ‘gross error’. Type I errors occur when the null hypothesis is rejected and it is in fact true

(Altschul 1988: 62). Ideally, a model should reduce both types of errors. For archaeology, especially CRM, it is more costly to make gross errors than wasteful errors.

2.2.5.1. *Site Types*

Kvamme's (2006) niche model explanation clearly articulates the need to model activity areas, not all site types. Site inventories often include scatterings of only a handful of lithics, petroglyphs, and culturally modified trees (CMTs). These surface reconnaissance inventories do not allow for reliable reconstructions of other activities that may have contributed to the formation of archaeological sites. Specifically lacking are dates of use for some of these locations.

Modeling specific activity types requires creating a subset of data. These subsets often are small and consequently can be so few as to be meaningless statistically. The use of all possible site types is the reason why most models remain dichotomous, indicating either the presence or the absence of sites. Despite this limitation, simple presence-absence models can be very useful (Kincaid 1988: 561, Kohler and Parker 1986: 414-415). For a meaningful model of specific site types, each class of site included must be a statistically significant site population. Methods to increase site counts or sample size include additional fieldwork, increased funding, retrieval of larger samples of artifacts, and more efficient analysis methods. Larger numbers of sites attributable to specific activities can improve theory related to site function and location (Kohler and Parker 1986: 414, Kvamme 2006: 18).

2.2.5.2. *Archaeological Site Sample*

When creating an inductive site location model, usually the existing archaeological site record is utilized. However, many of these sites were recorded prior to GPS (geographic positioning systems) and the data are flawed because many site locations were not accurately recorded. Even using GPS, recording accuracy can be off by several tens of meters and other errors can occur during data entry. Often polygons are actually provided to the recording agency rather than point specific recordings. Frequently it is not specified whether the site location was recorded as either points or polygons. As a result, often the polygon center is used and there can be significant differences between the centers of the polygon and the site's actual location. These "points" then are used for spatial correlation with environmental variables. However, the amount of error in their locations can result in significant statistical outliers biasing the larger sample. These inaccuracies can result in flawed modeling (Altschul and Nagle 1988, Kvamme 2006: 20, Kvamme 1988a). The high resolution of the model (10 m) means that sites that are more than 10 m from their actual location can affect the statistics used for the inductive portion of the model. These can skew the values further from the real world results. Some sites are not even on land, as per the USGS topographic maps; this is a significant error that propagates throughout the model. Since archaeological site locations are also used as an input in the model, the inaccurate location then also has higher probability of locating other sites in the wrong location. These errors in the location of sites also affect testing the model (6.1 Kvamme's Gain) as the site locations were used to assess the evaluation of the model.

Archaeological site inventories also are biased because archaeologists have a tendency to look for and discover sites where they believe they should be (i.e. along rivers or lakes). They can also be biased by preferentially selecting locations that are easier to access for archeological survey (i.e. near roads and towns). Sites inventories also result from CRM surveys of nonrandom locations selected for development projects. Finally, larger sites and land-use (such as those with mounds, earthworks, or structures) have a higher archaeological visibility (Altschul and Nagle 1988, Kvamme 2006: 20, Kvamme 1988a: 304) and tend to be over represented in relation to other types of sites. These biases then are incorporated into locational models based on existing site inventories. Hence, the assumption that inductive models can only predict locations based on the known site locations is not correct, and a combination of deductive and inductive modeling techniques are necessary to achieve greater accuracy.

Some modeling projects employ random sampling methods and pedestrian surveys in an attempt to create unbiased samples for model development. Usually probabilistic sampling strategies are utilized to minimize cost. This sampling strategy can reduce estimates of site variability and result in a lack of independence between data elements.

Consequently, these data can become spatially autocorrelated (Kohler and Parker 1986: 408-410, Kvamme 2006). This method was not viable for this underwater project.

Despite these problems in using existing archaeological site data, archaeological predictive models have been developed and successfully employed all over the world. Ejstrud (2003) utilized the Danish National Sites and Monuments record for predictive models for Denmark. Kvamme (1988b) provides multiple statistical techniques for accounting for existing archaeological site data.

2.2.5.3. *Paleo-environments*

Models often employ modern environmental variables without acknowledging that modern conditions can be significantly different from those of the past (Kvamme 2006: 16). In SE Alaska, sea-level change prior to 5,730 cal BP (5,000 ^{14}C years) transformed the coastal zone, the area and configuration of available land, and the distribution of biotic resources. The total difference in sea level since the LGM was -180 m. During the LGM sea-level was 165 m lower than modern sea-level. Then sea-level was 15 m higher than modern sea-level (Baichtal and Carlson 2010). This means that models incorporating land/sea-level relationships for the last 5,000 years reliably could utilize modern variables related to sea level, but models for periods prior to that time require paleo-environmental reconstruction. The 5,000-year period is only valid for SE Alaska and needs to be determined for each region based on its sea-level curve.

Researchers use modern data for modeling because it is readily available and the error is often quantifiable (Deeben et al. 1997: 81-84, Kondo and Oguchi 2012: 5-6, van Leusen et al. 2005: 56-57, Wheatley 1993: 135). Terrain forms, such as mountains and valleys, do not change significantly through archaeological time scales. Rivers and streams will meander within valleys. Plant communities will migrate, or become extinct, with climatic changes. Although the shape and slope of a landscape may not change significantly, the scale of changes over time must be understood and regional paleo-environments reconstruction may be required as a first step in site location modeling (Kvamme 2006: 19, Kondo and Oguchi 2012: 5-6, van Leusen et al. 2005: 56-57, Wheatley 1993: 135). Paleo-environmental reconstructions rarely have been undertaken for archaeological site modeling because they are difficult and often require broad generalizations. Errors in the original data used for paleoenvironmental reconstruction can result in "huge errors owing to their imprecision" (Kvamme 2006: 19). However, reconstructions are still better than using modern data when researching the distant past (Deeben et al. 1997: 81-84, Kondo and Oguchi 2012: 5-6, van Leusen et al. 2005: 56-57, Wheatley 1993: 135). The reconstruction for of the paleoenvironment for SE Alaska is reasonable based on testing against NOAA charts and multibeam data. There are areas of the study region that have poor resolution; these areas are not within any of the survey areas. Higher resolution would be beneficial, but the resolution is adequate for locating the variables used in this research.

2.2.5.4. *Scale*

A fundamental question for predictive modeling is geographic and temporal scale, or resolution. Scale in the geographic sense can be divided into three categories: macro-, meso-, and micro-scale (Saile and Lorz 2005: 139). Archaeological research moves between scales of analysis, from the unit of artifact to features to sites to landscapes (Altschul 1988: 71, van Leusen et al. 2005: 58-59, Verhagen and Whitley 2012: 89). The scale of analysis and the scale of results is not always the same, and scales need to be reported. Geographers refer to this problem as 'ecological fallacy' which is the danger of erroneous extrapolation from one scale to another (Lock and Harris 2006: 4-5, Verhagen and Whitley 2012: 90).

Predictive modeling requires a uniform scale of analysis, in terms of both resolution and geographic extent. The analysis must be conducted and interpreted at a defined resolution, which usually is described as a certain number of square meters or square miles for each unit. Whatever scale is used, the environmental and social variables utilized by the model should then be reduced to the same scale. This means that for a one-km^2 grid, any geographic feature smaller than 1 km would not necessarily be identifiable. The one km^2 grid would have an average value for the terrain, water resources, subsistence resources, or any other variable (Altschul 1988: 71). Scales such as one-km^2 are not reasonable units for archeological analysis and this type of large-scale analyses generally is conducted due to lack of computing power or poor data resolution. The resolution of the model needs to be at less than the feature or site that is being modeled. The scale of predictive modeling analyses should continue to decrease to the scale of an archaeological feature, as these factors improve. Saile and Lorz (2005: 146) describe scale on a continuum with the largest scale only suitable for a general (large-scale) approach. The middle, or optimal, is an appropriate scale for the research objectives. Finally there is a scale that is too small, that of an individual case (or artifact). The scale of analysis for this study originally aimed to be that of an archaeological feature. Unfortunately, computer limitations restricted the digital elevation model (DEM) to 5 m, which is too large to identify individual features. The goal was for a sub-meter DEM and 1 m model. . The model scale of 10 m is ideal for identifying landforms where archaeological sites are probable. It can identify the features being mapped by the model variables, such as terraces and flat areas near fresh water.

The exact geographic extent of a study is often determined based on outside influences, such as political boundaries or available data. This imposes limitations on spatial patterns (Lock and Harris 2006, Verhagen and Whitley 2012: 90). The literature rarely includes descriptions of how or why a study area or extent is selected (Wheatley 1993: 136). Maschner (1996) recommends data exploration to help eliminate, or limit, both the extent and scale of analysis. However, the scale of cultural perception needs to be incorporated into analysis (Wheatley 1993: 135). The 'scale of cultural perception' is any scale a person can view the landscape, i.e. how far can you see in a dense forest.

Temporal scale is also important to predictive modeling. Grouping or splitting temporal units can cause models to ignore important events such as significant periods of climatic change (Kohler and Parker 1986: 406). Sites "as they are observed by archaeologists, are created by the act of observation at a particular point in time" Dunnell (1992: 27), and he (Dunnell 1992: 28) goes on to observe that sites and artifacts acquire their attributes over an amount of time. Site activities can be distinguished based on their duration (Wandsnider 1992a: 257).

Chronological schemes are historical constructions rooted in evolutionary theory that have been developed beginning in the 19^{th} century (Peeters 2005: 152). These schemes (for example, Stone Age, Bronze Age, and Iron Age) can still be applicable in predictive modeling. The schemes must be evaluated statistically for similarity and/or differences. Absolute dates (such as radiometric methods or tree-ring dating) are more complex and consequently more difficult to apply. The temporal units of analyses must also be defined and justified based on the goals of the predictive model and research question(s) (Peeters 2005). For this research, calendar years were used to assist with interpretation and analysis. The scale of 500 years is the finest resolution that could be determined with the low resolution of the sea-level curve and the few archaeological sites from these periods. Finally, the lower limit of 10,500 cal BP was selected because it was the closest value to when sea-level rose above modern values. The maximum limit of 16,000 cal BP was selected because that is the farthest back the sea-level curve extents at this point and it corresponds to when the region is thought to have become deglaciated.

2.2.6. *Examples of Predictive Models*

Barber and Roberts (1979 reported in Kohler 1988: 46-47) developed a model for the continental shelf from the Bay of Fundy in Maine to Cape Hatteras in Northern Carolina. This area is currently submerged but was exposed at or after 18,000 cal BP. The authors used both inductive and deductive approaches to estimate site types and densities on the continental shelf. The deductive model was based on optimal foraging theory. Barber and Roberts simplified the model by identifying the potential for food resources, as primary or secondary. Primary resources were in the immediate vicinity of a site, such as fresh water. Secondary resources were further afield from the site, such as larger prey animals. Although they used values that were experimentally estimated, this approach minimized the need for accurate paleoecological-reconstructions. This is a rare and early example of a North American predictive model to locate ancient sites on the continental shelf.

In the early 1990s, the Ontario Ministry of Natural Resources (MNR) in Canada became responsible for identifying and protecting cultural resources through forest management planning. This led to a “first generation” predictive model based on ethnographic and environmental variables by the Centre for Archaeological Resource

Prediction (CARP) (Dalla Bona 1994, Hamilton and Larcombe 1994, Hamilton et al. 1994). It took three years to develop the model, which focused on the Boreal forest ecotone of northwestern Ontario. The model incorporated both an inductive and deductive approach. The ethnographic literature was reviewed to help define subarctic foraging land-use systems, prey selection, and seasonal rounds for the deductive portion of the model. Northwestern Ontario had not had a significant amount of archaeological survey, and the research team conducted extensive surveys to generate a database for inductive modeling (Hamilton and Larcombe 1994: 59). To generate the model, they utilized a weighted overlay method with the weights of the environmental and social variables determined based on statistical analysis of existing sites. The modeling was followed by three additional years of pilot projects to expand the model's applicability to other areas of Ontario (Dalla Bona 2003). This model's methods and weighting system were utilized to guide this research.

Mackie and Sumpter (2005) utilized shoreline intricacy to analyze site distribution patterns on Haida Gwaii. They defined four categories of shoreline complexity: linear, sinuous, elaborate, and intricate, in increasing complexity. Their premise was that greater shoreline length near a site would allow for a more readily accessible intertidal and subtidal resources, and theoretically greater biodiversity and increased opportunity for subsistence activities (Mackie and Sumpter 2005: 350-351). They conclude that early sites (9400-9500 BP) existed on more 'elaborate coasts'. Late sites (2000-200 BP) were distributed more evenly between the shoreline intricacy categories. Mackie and Sumpter utilized habitat and distance from known marine resources as a key parameter. The model uses the modern landscape and modern resource distributions. They never explain why or how the modern landscape is appropriate for this research or justify their choice. Their study employs a landscape approach and provides useful information that helps explain ancient site location choices. It also introduces the concept of coastal sinuosity or intricacy as an archaeological coastal land-use-modeling variable.

Maschner (1992) developed a predictive model for Kuiu Island, north of Keku Strait in southeast Alaska. In three field seasons, Maschner found 148 sites bringing the total to 155 for his study area. He worked from the high water line to the base of the mountains (or until it was too steep to survey). Maschner (and Stein 1995) applied logistic regression to the survey results and a random sample of non-site locations to determine the environmental requirements for ancient decision-making. For camps and villages, the characteristics that Maschner and Stein (1995) determined to be important are southern exposure, a good beach for canoe landing, and protection from storms. Some archaeological sites did not have access to fresh water at the time the survey was conducted.

Recent research by a Tongass National Forest archaeologist (Risa Carlson) and geologist (James Baichtal) has identified the 10,600 to 7,800 cal BP (9,400 to 7,000 ^{14}C years) shorelines. These shorelines are elevated above the modern shoreline by up to 20 meters. Baichtal and Carlson (2010) have developed a high potential model to locate archaeological sites within this time-period in the Tongass National Forest for several areas on the west side of Prince of Wales Island (POWI). The model has high predictive validity, as evidenced by ground truthing. As of October 2010, they had achieved 100% predictability, having documented 27 sites in 27 survey locales predicted prior to field survey (Baichtal and Carlson 2010). They focused their tests in the NW corner of POWI, adjacent to Shakan Bay. Baichtal has proposed that by 9,000 BP, this area was an interaction corridor and that people were on the coast prior to 9,000 BP. This supports the hypothesis that rising sea-levels submerged the evidence of earlier occupations.

2.3. Geographic Information Systems (GIS)

GIS is a tool that researchers use to investigate, store, analyze, and visualize spatial phenomena such as artifact and site distributions. It is both a database system with spatial referencing and a set of operations for working or analyzing data (Wheatley and Gillings 2002: 9). Some practitioners see GIS as a science, not simply a tool. Like high potential modeling, others see GIS as theoretically neutral. Nevertheless, the questions, methods, interpretation, and results that the researcher generates from the program can be tested scientifically. There are many theoretical aspects to GIS and these theoretical frameworks vary based on the program used and the research goals.

As one of the low-level theories employed by this research, GIS provides a tool and methodological framework where both landscape archaeology and land-use modeling can be employed and tested. The analytical units are actually created and measured in the GIS. The final outputs for this model are created in GIS and then developed into maps that were also created in GIS (Appendix C: Maps of Weighted Overlays). The theoretical framework of this research is echoed, restricted, and possible because of ESRI's ArcGIS.

2.3.1. *History of GIS*

The development of GIS for archaeology is dominated by influences from outside disciplines. Originally developed by geographers for map classifications, the first operational integrated GIS were created by the Canada Land Inventory for digitalizing maps (Lock and Harris 1992). As a tool for archaeology, GIS allows complex and time-consuming analyses to be conducted in less time and opens these analyses to non-specialist users.

GIS has been in existence since the 1960s. The Canada Land Inventory's operational integrated GIS were developed by 1972. It was not until the early 1980s that GIS began to be used by archaeologists. By the mid-1980s, user-friendly GIS programs were being developed, such as ESRI's ArcGIS and GRASS, including modules specifically for archaeologists. The movements toward the use of archaeological GIS originally were focused in North America, and there is still expansion and growing awareness of the potential of GIS in the United States (Lock and Harris 1992, Mehrer 2006: ix). "In less than ten years, GIS have progressed from exotic experimental tools, requiring costly workstations and only available to a few specialist researchers, to widely available technological platforms for the routine analysis of spatial information" (Wheatley and Gillings 2002: 1).

GIS is becoming one of the most widely used analytical applications for archaeology. Since 1991, there have been advances in both the complexity of GIS software and the design of applications. This can be related to an increase in the capabilities of both hardware and software. This increase in analytical capacity and capabilities is unquestionably one of the most significant advancements in archaeological modeling (Daly and Lock 1999).

2.3.2. ***GIS Programs***

There were three main programs utilized for this research: ArcGIS from ESRI (Environmental Systems Research Institute), GRASS (Geographic Resource Analysis Support System), and QPS Fledermaus. ArcGIS is proprietary software that costs individuals thousands of dollars for licensed use. Its popularity is based on university and government subscription to its database and file formats. In North America, ArcGIS is the standard platform taught for GIS and utilized by the United States government. In Europe, as a cost cutting measure, governments and universities are encouraged, and often required, to utilize open source platforms such as GRASS, QGIS (Quantum GIS), or GVsig. These open source platforms are free and the source code is available for those capable of correcting errors or developing new tools. This divide between proprietary and open source platforms has caused significant difference in the tools and methodologies used in North America and Europe. QPS Fledermaus is another GIS platform specifically designed for maritime resources and like ArcGIS, is proprietary software.

ArcGIS controls the types and complexity of analytical functions available to the user through licenses. One new tool packages that ESRI is releasing is “ArcGIS for Maritime” which works with the new ESRI Nautical Solution. This tool package allows users to edit NOAA base maps on the fly and download NOAA data. The new tool also includes capabilities to import multibeam data from Fledermaus. This tool is only in development, as of fall 2012, and consequently could not be used for this project.

Data can be characterized as raster, vector, TIN (triangulated irregular network), or terrain models. The last two, TIN and terrain models, have limited functionality (ESRI 2001). Vectors are points, lines, and polygons. They have information attributed to each piece. Data are contained in vertices that are similar to points. For lines and polygons, straight lines join these vertices and this information is not accessible to the user except in specific edit modes. Raster data contain an array of rectangular cells. The geographic information then is assigned to each cell. The resolution of a raster file is based on the cell size (Longley et al. 2005: 74-75).

Each operation in a GIS, either statistical or manipulative, has a theoretical framework. The key operation for this research is ArcGIS's weighted overlay. To utilize this tool, all data must be reclassified into a nominal numbering system. After each raster file is ranked and weighted, the raster is multiplied by its weight. The weighted rasters are added to create the final output (ArcGIS 10.0 help – Weighted Overlay). Other GIS tools are explained in the methods sections.

2.4. Underwater Archaeology

The ocean covers 72% of the earth's surface (Ballard 2008: ix). Sea-level has risen by approximately120 meters globally since the LGM, and the area flooded represents 3% of the earth's land or 4 million km^2 (Coleman 2008: 178). As a result of post-Pleistocene sea-level rise, archaeological remains located on the world's continental shelves are underwater. Underwater archaeology investigates sites that are submerged or located in the intertidal zone. As a sub-discipline within archaeology, a variety of terms has been used to describe the discipline including maritime, marine, nautical, oceanographic, and hydro-archaeology. Each term limits the scope of research. Maritime Archaeology investigates the maritime cultural traditions, including shipwrecks, graves, harbors, ship related technologies, and shipbuilding facilities (Croome 2004, Forrest 2002). Underwater archaeologists investigate paleo-landscapes and other submerged environments (Flatman 2003, Parker 1999). Muckelroy's (1978: 4) definition of maritime archaeology is the most recognized in the sub-discipline. He defines it as "the scientific study of the material remains of man and his activities on the sea". Though Muckelroy allows for the incorporation of aspects of nautical and underwater archaeology, he excludes gravesites and submerged landscapes. Wetland environments (Coles 1998, 2004, Flatman 2011, Lock 2004, Purdy 1991), shipwrecks (Gould 2000, McGrail 1981, Watson 1983), and inland-submerged environments, such as lakes (Ford 2011b, Halligan 2011, Mazurkevich and Dolbunova 2011) were not incorporated in this review.

Underwater archaeological sites can be divided into four categories. The first are shipwrecks. The second are shrines or places of offerings, such as the cenotes of

Mesoamerica. Third are items discarded or lost, refuse sites. These are most common when material purposefully is discarded into the water. Finally are submerged occupation sites (Goggin 1960, Ruppé 1988) which are the focus of this research.

Investigation and artifact retrieval from shipwrecks has occurred throughout history (US Navy 1985). However, underwater archaeology as an academic discipline came into existence with George Bass' 1960 excavation off the coast of Turkey. Bass' excavation of a Bronze Age shipwreck was the first that met the professional criteria and standards of excavation and recording. The scientific standards of underwater archaeology are the same as terrestrial archaeology (Bowens 2009: 6, Dean et al. 1992: 20). In 1854, the Swiss excavated lake dwelling sites when they were exposed due to low water levels (Christensen 1997). Although it is not often recognized or cited, it was Baucaire's (1964) excavation of the Fos. The Fos is a partially submerged ancient village that was technically the first underwater excavation. In North America, underwater archaeology began in the 1930s with the National Park Services excavation in Colonial National Historical Park, Virginia (Fischer 1974).

Technological developments in marine geophysics have increased the range and ability for investigating submerged locations (Coleman and Ballard 2008, Green 2003). Theoretically, there should be no difference between geophysical surveying on land or underwater, except for logistical issues (Coleman and Ballard 2008: 4). Survey methods include bathymetric mapping, side-scan sonar, high-resolution reflection surveys such as sub-bottom profiling, magnetometer surveys, and visual imaging surveys using remotely operated vehicles (ROV). These technologies will be discussed further in the surveying chapter (7 Field Testing Results).

Site preservation is a key issue for underwater archaeology. The anaerobic environment encountered centimeters below the seafloor provides excellent preservation of organic materials (Peterson 1974). Northern oceans provide a cold environment that further decreases microbial activity and increases organic preservation. In addition, preservation is increased by the saturation of the organic artifacts by water (Fischer 1995: 371). Although marine transgression can be destructive to archaeological sites, Coleman and Ballard (2008: 6) describe how rapid burial provides the best chance for site preservation. They describe lithic artifacts, kitchen middens, gravesites, stone foundations, pottery, hearths, postholes, and other cultural features as the types of cultural remains that can survive marine trangression. These 'non-delicate' remains are detectable evidence of former human occupation and clearly indicate a site and provide evidence for archeological analyses.

Kilgii Gwaay is an intertidal site on the south end of Haida Gwaii, British Columbia, Canada that was occupied approximately 10,500 cal BP. It includes delicate basket remains despite the site having survived at least one marine transgression and a subsequent marine regression (Fedje et al. 2001, 2005a). Finally, the existence of paleontological remains located in the Bering Sea implies, by analogy, that archaeological remains can survive marine transgression in this region (Dixon 1983, Dixon and Monteleone in press). Masters' (1983: 211) notes the present sea-level has not adversely affected the underwater Solana Beach reef site, California, which is within a small cove. She postulates that some coastal sites may have survived marine transgressions in similar low energy environments.

Submerged archaeological sites usually are found by accident by divers and few have been located by systematic archaeological survey. Underwater archaeology is very costly and difficult. It has been poorly sponsored by funding agencies (Coleman 2008: 177), despite the fact that submerged landscapes are being eroded due to the death of eelgrass and similar vegetation around the world due to pollution. Once eelgrass dies, the underlying archaeological sites start to erode and can be completely destroyed (Fischer 2011: 303-306). The poor funding is likely linked to the exploratory nature of this type of research and the possibility that no archaeological sites (or non-sites) will be preserved or located within the survey areas.

2.4.1. ***Danish Model***

In Denmark, laws protect submerged land-use and it is illegal to harm or remove them without National Forest and Nature Agency approval (Fischer 1995: 373). As a result of post LGM sea-level rise, many Paleolithic and Neolithic sites in Denmark are now underwater. Many of the Early Mesolithic sites of the Maglemose culture and the Middle and Late Mesolithic cultures of Kongemose and Ertebølle are underwater (Fischer 1995: 372).

Fischer (1995: 373-374, 2004: 27-32) presents a fishing site location model that is based on archaeological and ethnographic data from Roskilde and Karrenæk Fjords (Figure 2-1). Local fisherman from Karrenæk Fjord, who still practice traditional fjord fishing, provided the topographic characteristics of the best fishing locations. They are situated at the mouths of streams, where fjords narrow, or off shore of small island and peninsulas near sloping bottoms. These topographic patterns are seen throughout southern Scandinavia and other places where maritime cultures are common. "The great majority of the coastal settlements from the Ertebølle Culture in Denmark and Scania have been situated immediately by the shore, at places that would have been ideal for fishing with traditional stationary gear" (Fischer 1995: 374). The model works well for Kongemose and Ertebølle cultures (Fischer 1995: 378). This is a simple landscape model incorporating modeling. This would be an example of Kohler's (1988:35) type 1 model, where there are no measurements, uses inductive logic, and has systemic context.

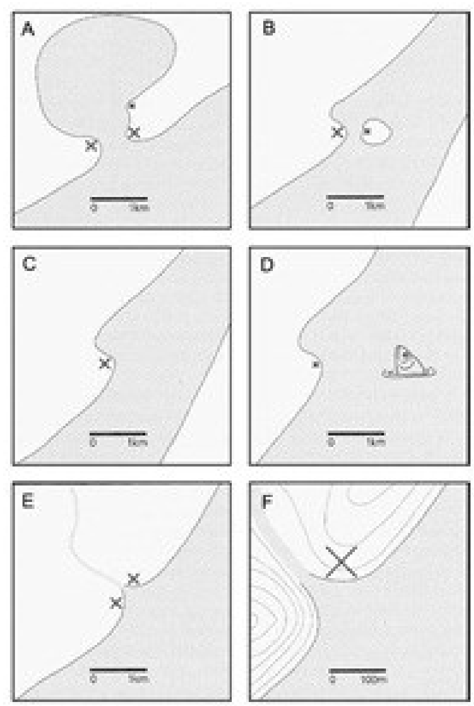


Figure 2-1: Topographic locations of Danish Mesolithic settlements based on fishing model (Fisher 1995: 374, 2004:32, Benjamin 2010: 257). A) Narrow islet connecting large bodies of water. B) Between a small island and mainland. C) and D) At the tip of a headland. E and F) at the mouth of a stream

Benjamin (2010) outlines the steps required to develop the southern Scandinavian model for submerged ancient site discovery, referred to as the 'Danish Model'. Phase I is regional familiarization, including maps, archaeological site types and cultures. Phase II is familiarization of the ethnographic literature. Phase III is location plotting of known sites. Phase IV is geophysical survey of high potential locations. Phase V is investigating possible sites using divers. Finally, Phase VI is post-fieldwork analysis, interpretation, and dissemination (Benjamin 2010: 258). Ford and Halligan (2010: 278) propose a slight variation of this model because some areas are too deep for divers. They amended Phase V to include 'with divers when feasible'. This model is similar to the procedural steps used for this study (5.2.1 The Danish Model).

2.4.2. *Underwater Archaeological Projects*

The majority of underwater archaeology that has occurred since Bass' original excavation in the 1950s has been shipwreck focused. Additionally, there is increased interest in coastal archaeology, focusing primarily on terrestrial archaeological sites and harbor or pier structures. However, submerged archaeological site investigations are still relatively rare. The methods and results of some of the documented projects from the continental shelves are described briefly below.

North American projects include surveys by: Dixon in the Bering Sea, Fedje and Josenhans in Haida Gwaii, Easton in the Gulf Islands, Watts and colleagues in the North Channel Islands, Muche's in San Marino California, Master's in San Diego County, Faught and Gusick in the Gulf of California, various projects in the Gulf of Mexico, a paleo-environmental reconstruction from Rhode Island, and Westley and colleagues work in Newfoundland. These projects are described in geographic orientation circling counterclockwise from the northwest to the northeast. There continues to be extensive work in Europe and project areas include Denmark, Doggerland, the Norwegian gas pipeline project in the North Sea, the Solent, and a Middle Paleolithic site at La Mondrée in Normandy.

2.4.2.1. *North America*

Dixon (1979) conducted a marine geophysical survey off St. George Island in the Bering Sea. He developed a high potential model for archaeological sites based primarily on bathymetric data, paleo-environmental reconstructions, and sea-level history. At this time, there was not a bathymetric map for the Bering Sea and the research was conducted prior to authorized non-military use of GPS. The project attempted to identify areas of high archaeological potential based on high latitude hunter-gather subsistence and land-use patterns. Due to high winds and seas from a Bering Sea storm, the survey was conducted on the lee side of St. George Island, which was an area that had not been identified to be high potential for archaeological site discovery. The survey was conducted using a hull-mounted sub-bottom profiler, side-scan sonar, and proton magnetometer. On-shore radio navigation stations established at prominent locations on St. George Island were used to achieve navigational accuracy of ± 50 feet (15 m). Though no archaeological remains were identified, this survey demonstrated the feasibility of searching in high latitudes for submerged archaeological sites (Dixon 1979, 1989, Dixon and Monteleone in press).

In western Hecate Strait off the coast of Haida Gwaii, 10 km^2 of the seafloor in Juan Perez sound were mapped in 1997 using high-resolution multibeam sonar, side-scan sonar, and a ROV (Fedje and Josenhans 2000). The sonar imagery revealed landscape dominated by alluvial fans, deltaic plains, and a meandering and migrating river system. In 1998 and 1999, Fedje and Josenhans (2000) focused on targets from the DEM generated from the multibeam survey to concentrate investigation for archaeological sites and to facilitate dating late Pleistocene shorelines. They recovered and hydraulically screened sediment using a clamshell grab sampler and screens. Within these sediments, they discovered buried wood and other evidence of the ancient terrestrial environment. They made the significant discovery of a retouched basalt blade-like flake from sediment recovered from a depth of 53 m in Werner Bay. They concluded that this artifact was probably deposited on the continental shelf at a time when sea-level was lower (Fedje and Josenhans 2000, Josenhans et al. 1997).

In Montague Harbour, Gulf Islands, of British Columbia, Canada, Norman Easton conducted four years of underwater excavation. "The goal of the research is [was] to develop an in depth assessment of the potential, distribution, and nature of inundated cultural deposits within the Montague Harbour basin, a well-protected tidal embayment" (Easton 1993: 3). The midden that was excavated was located with a sub-bottom profiler, cored, and then excavated (Easton and Moore 1991). Artifacts recovered include an antler harpoon point from below sediments dating to 6,800 cal BP, non-benthic faunal, unifacial flakes, other flaked tools, and a stone disk bead. Easton (1993: 18) notes the presence of bioturbation in the underwater excavated locations, but indicates that it is restricted to specific depositional zones. Retaining boxes made of metal were used to excavate to a depth of 2.5 m by divers (Easton 1993). The Montague Harbour excavation was a Charles phase (5000-3500 cal BP) or earlier site (Easton 1993).

Marine geophysical and diver surveys were conducted off the coast of California's Northern Channel Island of Santarosae. Santarosae is the island that formed during lower sea-level when San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands were joined as single land mass. Watts (et al. 2001) developed paleo-environmental reconstructions to direct their field survey that led them to select areas near terrestrial Terminal Pleistocene shell middens for underwater survey. In 2008, they used diver survey to investigate high potential areas, and in 2009, they incorporated side-scan sonar with the diver surveys. They recorded video and still images of the seafloor. In 2009, a chert cobble showing possible flake removal scars was identified but was left in situ (Watts et al. 2011: 22).

In 1981, Muche (1998: 254 [1981]) presented a model to locate archaeological sites in the Santa Monica Bay region of California at the Tenth Conference on Underwater Archaeology in San Marino California. He considered eight factors: (1) the ecological setting of known land sites, (2) geographic features, (3) isolated find reports, (4) water depth-time correlation, (5) indications of a preexisting water supply, (6) ethnographic and historic documentation, especially from early Spanish records, (7) paleontological evidence, and (8) paleoclimate reconstructions. A probability factor from one to ten was assigned to locations based on assessment of these eight factors. Eleven out of 24 locations or 32.4% of the locations were designated as high potential. Correlation of submerged geomorphic features produced an additional seven high probability areas. These 18 locations were field-tested and 13 had archaeological remains. Artifacts include mortars or bowls, pestles, points, drills, scrapers, and shell beads. Based on local sea-level curves, these sites were occupied 3000 to 11,000 years ago with an error of approximately 1000 years based on unstable geological conditions.

Patricia Masters (1983) conducted diver survey and located 22 new underwater sites in the San Diego County area including twelve previously recorded sites. Four were remnants of shell fishing. Two were tool manufacture sites. Fourteen of the sites were between 12 and 19 m depth. Others were intertidal.

Bahía Ballena is a submerged landscape off Isla Espírtu Santo in the southern Gulf of California. Faught and Gusick (2011) report a bathymetric survey conducted over an area of 30 km^2 with a maximum depth of 140 m. A total of 2145 depth readings were recorded by hand whenever the depth changed by more than 1.5 m. A DEM was created using the Inverse Distance Weight (IDW) in ArcGIS 9. The bathymetry data were merged with Shuttle Radar Topography Mission (SRTM) digital data to create a 12,000 cal BP landscape. Survey was focused on near shore areas, shallow enough for SCUBA investigation and safe for divers. After initial survey, the research team focused on four submerged rock shelters, the areas outside each rock shelter, an extensive rock outcrop, and adjacent steep slope. Due to tidal action, it was difficult to distinguish between culturally and non-culturally modified flakes. Hand fanning was used for test pits to a depth of 80 cm (Faught and Gusick 2011: 150-154, Gusick and Faught 2011).

The Gulf of Mexico had CRM reports from Coastal Environments, Inc. (CEI 1977) that mapped probability areas for submerged historic and ancient sites. Michael Faught conducted his dissertation research in the Big Ben of Florida investigating site presence and preservation using multibeam sonar and diver survey. Chipped stone artifacts, some characteristic of the mid-Holocene, were located along submerged river channel margins of the Aucilla River (Dunbar et al. 1992, Faught and Gusick 2011: 150). Currently, Adovasio and Hemmings are funded by NOAA for a multi-year project to remotely sense and investigate with divers, sites in the Big Ben area. Florida is the only state that requires sub-bottom profiling for underwater CRM (Faught and Gusick 2011: 147-148). Coastal Environments, Inc. has continued their research funded by the Mineral Management Service (MMS, now the Bureau of Ocean Energy Management (BOEM)). They updated their original 1977 manuscript in the 1980s and work continues within the region for oil and gas exploration and exploration of possible shell middens (Faught and Gusick 2011: 147). Pearson (et al. 1986) conducted sub-bottom profiling and vibracoring of sites offshore from Louisiana and Texas along the Paleo-Sabine River. Two probable archaeological sites were identified. The first was a quarry that included fine lithic debris, burnt bone, organic, and phosphates dating to 8850 cal BP. The second was a concentration of shells thought to be a midden.

In 2000, a paleo-reconstruction of the landscape of Block Island, Rhode Island was conducted using marine geophysics and sediment cores to determine the potential for archaeological sites. Though no archaeological remains were identified, the environment from 8000 to 10,000 cal BP of an area that was once an island was modeled. A total of 15-square miles were surveyed in three days using side-scan sonar, a sub-bottom profiler, and the Datasonic seafloor imaging system. A rock dredge was used to collect seafloor samples. A gravity core was used to collect a core sample, however coring attempts often failed due to rocky seafloor. The sub-bottom data were utilized to select specific locals for sediment cores (Coleman and McBride 2008: 205- 210).

Westley (et al. 2011) modeled the landscape potential for archaeological sites on the northeast coast of Newfoundland, Canada. Based on the Danish model (Benjamin 2010), this project developed a seven-stage approach beginning with reconstructing sea-level history. Second was mapping coastal evolution for detailed evaluation. Third was mapping buried landscapes using sub-bottom profiles. Fourth is sampling the seafloor using grab samplers and samples taken by an ROV or divers. They also used diver-operated hand-cores and cores taken using the sea-ice as the coring platform. Fifth was a creating 3D evolutionary model of the submerged landscapes using the sub-bottom data. Sixth was mapping the archaeological potential based on landscape attributes favored by past humans to identify landscape settings with the highest potential for site preservation. Seventh, was archaeological testing using various methods based on water depth, including diver surveys, dredging, and grab samplers. The project is ongoing and is currently at the modeling stage, stage five. They have conducted an intertidal survey of the study area of Back Harbor, and this survey identified a concentration of non-diagnostic lithic artifacts (Westley et al. 2011: 141).

2.4.2.2. *Other Projects*

Doggerland is the submerged landscape between the British Isles and northern Europe. It is located from 61ºN in the North Sea to the English Channel. It was exposed from 21,000 cal BP (18,000 ^{14}C years) to 6000 years ago (Coles 1998, 2000). Comparable to the Bering Sea, it provided a land connection between the two landmasses during the LGM and paleontological remains were recovered from the ocean floor by dredging. However, in the North Sea, artifacts were also located (Cole 1998). The Southern North Sea project used 3D seismic data from the continental shelf and core and borehole data to ground truth data interpretations and calibrate the Holocene topography. These data were used to create a model for the survival potential for environmental and archaeology deposits. They found that 2D seismic surveys were not detailed enough to penetrate the thick sediments (Gaffney and Thomson 2007: 6-7).

The Ormen Lange Project was a Norwegian gas pipeline project. It created a special excavator that operated similar to an ROV and planed the seabed. Mapping of the seafloor was conducted with an AUV (autonomous underwater vehicle) at 20-25 meters above the seafloor. AUV's can operate without support vessels. In this case, it could operate for two days at which point it needed to recharge batteries and download data. The survey discovered an 18th century shipwreck with thousands of artifacts. The site was excavated because there was another historic shipwreck in the alternative pipeline route. The wreck was at a depth of 165-170 m that is below the level that divers work. The Norwegian University of Science and Technology (NTNU) developed a specialized archaeological ROV for the project, and a smaller ROV was used as a back-up system. A 10-by-10 meter steel frame was positioned on the archaeological site, and the ROV would dock, systematically collect, and record artifacts. Nearly 500 artifacts were recovered from this site and excavated with the same precision and standards as a terrestrial site (Bryn et al. 2007).

During the Mesolithic, England was a peninsula of northern Europe. The Solent is a modern waterway between the Island of Wight and the main island of Britain. The Bouldnor Cliffs are an 11 m deep submerged forest off the northwest shore of the Island of Wight. This area was the focus of an underwater archeological research project. Stratigraphically below the cliff is an 8000-year-old peat terrace that is over one kilometer in length (Momber 2011: 86). There have been numerous lithic artifacts recovered by fisherman dredging the peat bed (Momber 2000: 90). A number of isolated areas containing archeological material have been identified at the site. The first uncovered 83 worked flints consisting mainly of debitage with a few retouched pieces. It had been a streamside environment that turned brackish by 5900 cal BP (Momber 2011: 87, Momber 2000). A second area contained a sectioned pit with burnt flints and fragment of wood that was interpreted as anthropogenic. The pit dates to 6120 to 6010 cal BC and was reused multiple times based on an analysis of the heated stones within the deposit (Momber 2011: 87-88). A third area was an elevated platform of differing shapes of wood about 10-15 cm above the seabed. The feature was 2.1 m across. The stratified deposits below the platform included burnt flint flakes, a flint scraper, blades, black organic materials on twigs, and a piece of alder impaled by a worked flint. The alder was dated to 6100 to 5880 cal BC (Beta-209564) (Momber 2011: 88, Momber 2000: 96). The site is indicative of a lacustrine location, because of lake sediments below the peat layer. The site has been monitored annually since 2003 and has had significant erosion.

La Mondrée is one of a series of sites in Cherbourg harbor near The Hague and Val de Saire on the Cotentin Peninsula in France. The site is located approximately 20 m below sea-level at the foot of a submerged cliff. It was identified and excavated in 1970. The site includes structures from a land-use area with artificial stone arrangements and hearths. Artifacts include worked flints, an equid tooth, and faunal remains. Based on the lithic assemblage, the site is attributed to the Denticulate Mousterian (Cliquet et al. 2011: 112). To evaluate the site further, there were three seasons of diving, including hand coring of sediments. Additionally, high-resolution seismic survey was started but abandoned due to heavy swell. Finally, side-scan sonar was used to complete the seismic survey area (Cliquet et al. 2011: 113-114).

2.5. Conclusion

Underwater archaeology and high potential models often utilize a landscape approach and GIS technology. The examples presented in this chapter illustrate the methods and extent of research current in both underwater archaeology and high potential modeling. Knowledge of underwater archaeology is expanding as a result of several edited volumes published since 2010 and others are in press. The research is progressing quickly and modeling needs to adhere to the theoretical frameworks from landscape approaches. As the capacity of GIS and computer technology continue to increase, high potential modeling will expand in extent and detail.

Although the modeling aspect of this research is similar to other case studies, it is unique in the large areal extent, over 45,000 km^2 and in the refined scale of investigation, 10 m resolution. These attributes increase the computing requirement and time required for model development and to analyze GIS data. The theoretical frameworks described here provide clear methods and requirements to guide this research.

3. Introduction to the Pre – 9,000 cal BP Paleogeography of the northern NWC and Vicinity

The Northwest Coast of North America is a narrow arc of land on the North Pacific Ocean stretching from the Copper River on the Gulf of Alaska southward to the Chetco River on the southern Oregon Coast (Suttles 1990a:1). The coastline mainly runs parallel to the coastal mountain ranges, including the Chugach and Cascade ranges. The region is somewhat crescent-shaped, thin at its northern limit and expanding to a width of 320 km (200 miles) near the center and then narrowing to about 160 km (100 miles) on the southern limit. The coastal plain is narrow and is characterized by two vegetation area. Glaciers extend to the sea at various places. Sitka spruce and western hemlock in the north and western hemlock and Douglas fir south of Johnstone Strait (Suttles 1990b: 16, 20-21).

The region has a wet maritime climate (Carrara et al. 2007:229). Winters are wet and mild. Summers are cool and wet. The climate largely results from the adjacent ocean with westerly winds and adjacent mountains. This causes moisture to fall as heavy rains on the western slopes of the outer ranges of mountains, while the leeward sides have reduced precipitation. Mean temperatures decrease from south to north and sea to shore (Suttles 1990b: 17-18). The average January temperature in Ketchikan (the largest community in the study area) is 0ºC (32ºF). The average July temperature is 11ºC (52ºF). Ketchikan gets 34 cm of snow on average in January. It receives 2724 mm of precipitation on average a year. The wettest month is October with 393 mm of precipitation (Weather Network 2011). The upwelling of colder water offshore keeps the coast cooler in the summer and nourishes plankton, the base of the food chain. The temperature of the sea varies with location and season. The ocean temperature in winter is 6ºC (43ºF) and 15ºC (59ºF) in summer (Suttles 1990b: 18). Salinity is variable with relation to resources. Around river mouths, brackish water may decrease the availability of shellfish. For most of the region, the tide is of a “mixed” type, semidiurnal with two unequal high and low tides a day (Suttles 1990b: 19-20).

3.1. Southeast Alaska

Southeastern Alaska extends from Icy Bay in the north to Dixon Entrance and the international border between the US and Canada in the south. The region is bordered by the Pacific Ocean on the west and northern British Columbia on the east. It is 845 km (525 miles) long and 193 km (120 miles) from east to west, composed of a narrow strip of mainland mountain ranges and over 10,000 islands. The offshore islands form the Alexander Archipelago rise out the sea to a maximum height of 1100 meters (3609 ft.). The largest island is POWI (Figure 3-1) (Carlson 2007, MacDonald and Cook 2009, O'Clair et al. 1992: 11).

There are 11 large rivers in southeast Alaska: Alsek, Chilkat, Taiya, Katzehin, Anteler, Taku, Whiting, Stikine, Unuk, Chickamin, and Salmon (Figure 3-1). Most of these rivers are relatively short, with an average length of 20 km. Characteristically they have steep-sided u-shaped valleys with narrow flood plains, rarely greater than 3.5 km wide, and the Stikine has the only major delta (Johnson et al. 2008:3v- 5). These rivers are all on the mainland. There are no major river systems on the islands in the Alexander Archipelago.

Geologically, SE Alaska has four main regions: the Alexander-Wrangellia, Gravina Belt, Taku, and Coastal Mountain Batholith. The Alexander Terrane originated as an island chain in the tropics as a spine of ancient volcanic rocks fringed by limestone reefs. The volcanic islands and the ones that were added as the island chain travelled northward as a result of continental drift are called the Wrangellia Terrane. The Gravina Belt is the shed sediments from the surface wrinkle in the Alexander-Wrangellia formation. The Alexander-Wrangellia-Gravina terranes collided and fused with the North American plate. As stresses were relieved in the eastern area, rocks that had been forced deep into the earth rebounded forming the Coast Mountains. The areas adjacent to Revillagigedo and Prince of Wales Islands were under less stress than other areas but were still upthrusted (Anderson 1991, Baichtal et al. 1997:12, Brew et al. 1991).

Figure 3-1: Map of the geographic region

The shorelines are indented with numerous embayments and coves with estuary environments (Lee 2007, Moss 1998). Much of SE AK was once glaciated and the landscape is characterized by fiords and drowned valleys adjacent to the continental shelf, which has been flooded by post-Pleistocene sea-level rise. The environment is dominated by water: ocean, rivers, bays, straits, and rainfall. The region is a temperate rainforest (O'Clair et al. 1992), and faunal and floral resources tend to concentrate at the interface between the land and sea in the intertidal and coastal zones (Moss 1998:91).

3.2. Flora & Fauna

The lowlands are heavily forested with western hemlock (*Tsuga heterophyllai),* Sitka spruce (*Picea sitchensis*), and yellow and Western red cedar (*Chamaecyparis nootkatensis* and *Thuja plicata*) (MacDonald and Cook 2009:26). Western red cedar and shore pine (*Pinus contorta*) are present in the southern half of the region. Yellow cedar extends from the middle of the Alexander Archipelago, Johnstone Strait, southward (Lyons and Merilees 1995: 76). Sitka spruce is drought intolerant and is mainly present along the coastline where there is more moisture. Western hemlock extends inland to the mountains (O'Clair et al. 1992: 19). The understory is dominated by huckleberry (*Vaccinium* spp.), devil's club (Oplopanax horridus), and alder (*Alnus* spp.) (MacDonald and Cook 2009:26). Muskeg vegetation is present over large areas of Prince of Wales Island in flat or gently sloping areas (Ager and Rosenbaum 2007: 4).

Southeast Alaska supports a rich mammalian fauna with some species found nowhere else in the state, such as the Pacific marten (*Martes caurina*), fisher (*Martes penanti*), four species of bats (*Lasionycteris noctivagans, Myotis* spp.), and five species of rodent (e.g. *Myodes gapperi, Peromyscus keeni*). Nonnative species include brown rat (*Rattus norvegicus)*, wapiti (*Cervus Canadensis)*, and raccoon (*Procyon lotor*). The native mammalian fauna of SE Alaska include Sitka black-tailed deer (*Odocoileus hemionus sitkensis)*, mountain goats (*Oreamnos americanus*), wolves (*Canis lupus*), black and brown bears (*Ursus americanus, U. arctos*), river otters (*Lontra Canadensis*), and mink (*Neovision vison)*. Sea otters (*Enhydra lutris*) have been reintroduced and are now numerous along the outer coasts (MacDonald and Cook 2009:29).

The region is also rich in marine mammals. These include Stellar's sea lions (*Eumetopias jubatus*), harbor seals (*Phoca vitulina*), harbor and Dall's porpoises (*Phocoena phocoena* and *Phocoenoides dalli*), humpback whales (*Magaptera novaeangliae*), killer whales (*Orcinus orca*), and several species of beaked whales. In more recent years California sea lions (*Zalophus californianus*) and elephant seals (*Mirounga angustirostris*) have become more numerous (MacDonald and Cook 2009:29).

The sequence of plant colonization since the LGM was originally investigated by Heusser (1955, 1960) and subsequently by Ager (Ager et al. 2010, Ager and Rosenbaum 2007). Ager has four sediment cores taken from lakes (Figure 3-8 and Figure 3-3), three in SE Alaska, and the last on the northern end of Haida Gwaii. The general sequence of plant colonization began with tundra, approximately 15, 000 – 12,500 cal BP, Pine is present around 12,500 cal BP, Spruce around 11, 000 cal BP, and cedar around 5,000 cal BP (Fedje 2000). The timing for the appearance of cedar varies with earlier dates to the south and younger dates to the north indicating a northward migration of this species (Ager et al. 2010, Ager and Rosenbaum 2007, Reimchen and Byun 2005). This sequence of vegetation is approximate, but corresponds for Haida Gwaii and SE Alaska.

3.3. Glaciation

Since the Quaternary started 2.58 million years ago, there have been numerous glaciations. They are usually defined by marine isotope stages (MIS) based on oxygen isotope data from deep sea core samples. The Wisconsinan is the most recent glaciation from 110,000 to 10,000 years ago and is MIS 2-4. 'Wisconsinan' is the North American term for this glacial period. In British Columbia, the Wisconsinan glaciation is also called the Fraser glaciation (Blaise et al. 1990: 282). The maximum glaciation or LGM for this period is thought to be approximately 21, 000 BP. Peltier and Fairbanks (2006: 3326) suggest that it might have been 26,000 years ago based on refinements to the Barbados sea-level record. For Haida Gwaii, the glacial peak was approximately 19,000 cal BP (16,000 ^{14}C years). Glacial retreat has been identified by 18,000 cal BP (15,000 ^{14}C years) (Blaise et al. 1990: 292). In southeast Alaska, the last glacial maximum was between 29,000 and 18,000 cal BP (25,000 – 15,000 ^{14}C years) (Clague et al. 2004: 86).

The late Wisconsin glaciation is recorded from 30,700 to 15,700 cal BP (26,000 to 13,000 ^{14}C years) in southeast Alaska (Carrara et al. 2007: 231). Icy Straight was deglaciated by 13,500 cal BP (Mann and Streveler 2008: 202).

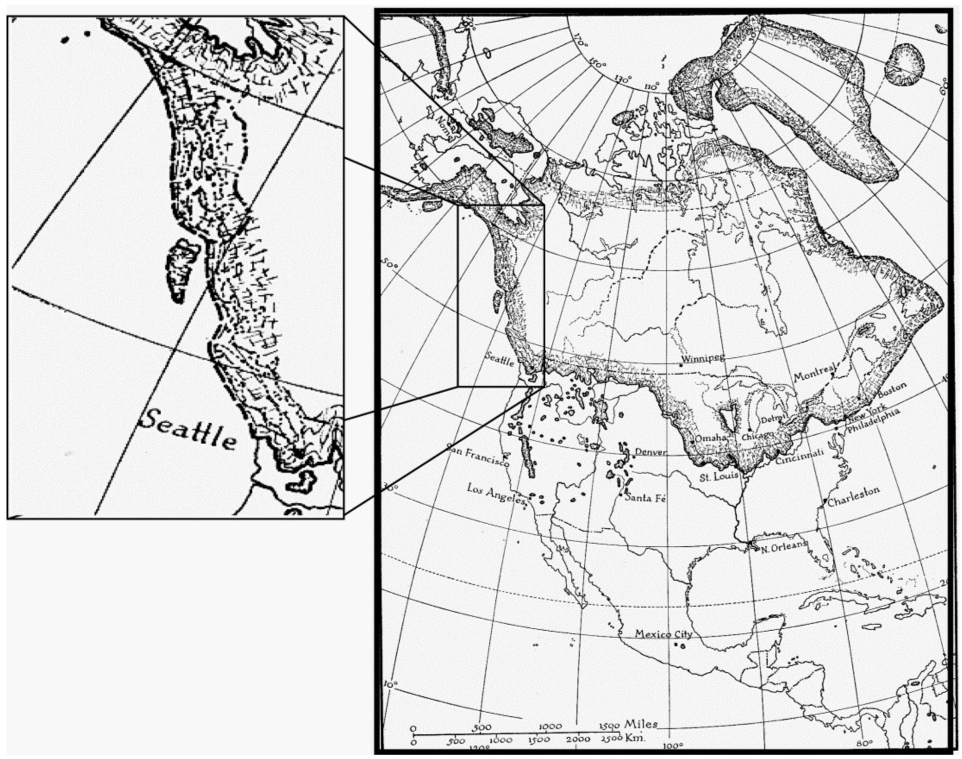


Figure 3-2: Map of Pleistocene glaciation from Antevs (1929: 651) with the North West Coast enlarged

In 1928, Ernst Antevs was asked to produce a volume summarizing the Pleistocene glaciation (Figure 3-2). He based his reconstruction on the assumption that during the largest glacial extent in British Columbia, the ice probably reached the open sea off the skerry-guard (outer islands or rock reef) (based on Dawson 1893: 286). The Queen Charlotte range was covered by an ice cap with glaciers descending the valleys and scouring out the fjords (based on MacKenzie 1916: 117). Ice did not reach the northern shore of the island chain. Antevs differentiates the Admiralty drift and Vashon drift on Vancouver Island. Unfortunately, Antevs was not able to determine which of the two glaciations (Admiralty or Vashon) was more extensive (Antevs 1929: 651).

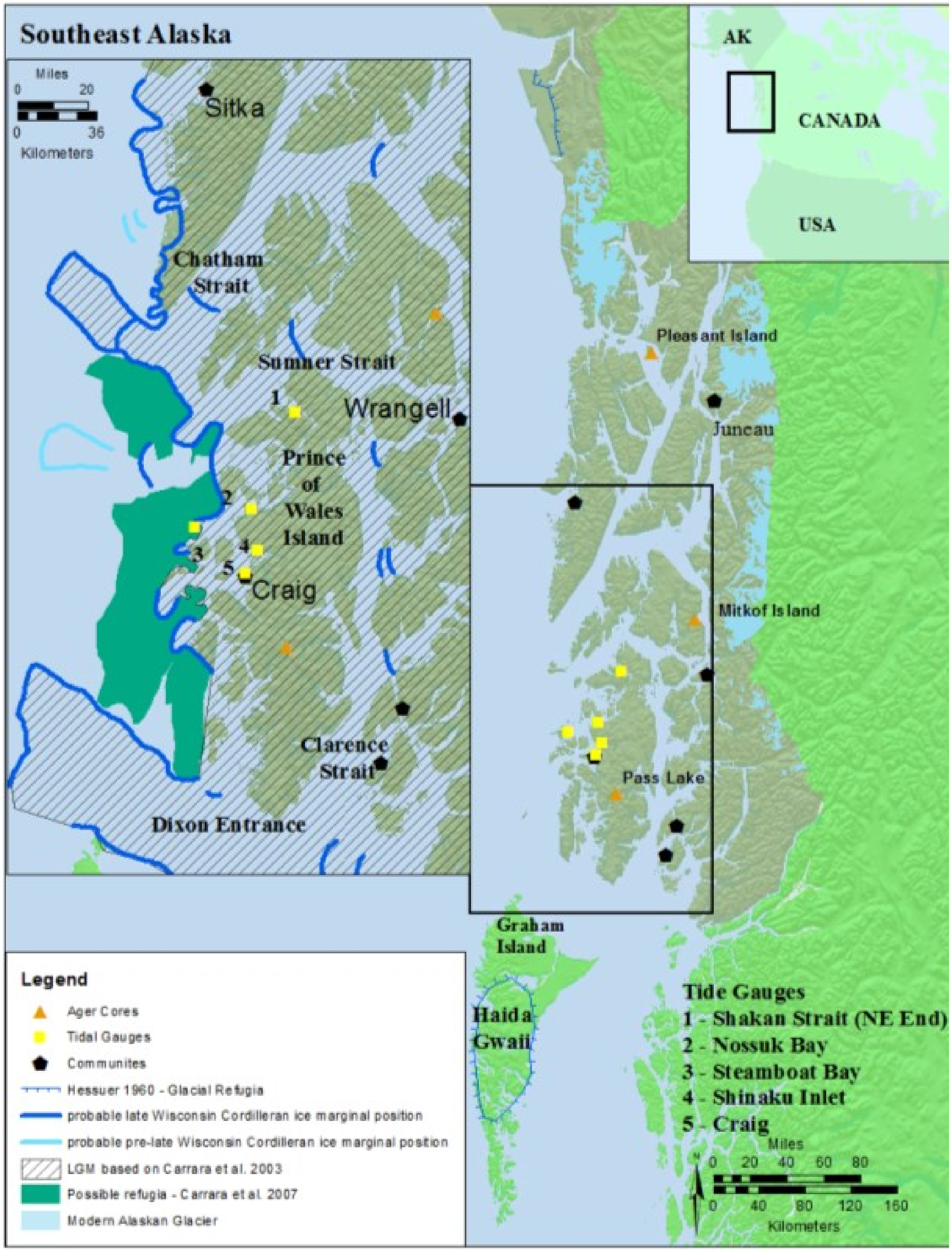


Figure 3-3: LGM glaciation and possible refugia

For Alaska, Antevs used the United States Geological Survey (USGS) maps available at the time. Though generalizing about the state, he realized that the glaciation was limited to the mountains and adjacent parts of the lowlands. "The ever present large and small fjords on the Pacific coast of Alaska were doubtless in part carved out and largely shaped by Quaternary glaciers, which joined to form a system of separate piedmont glaciers or a confluent piedmont glacier that probably covered the entire skerry-guard except the high ranges and summits" (Antevs 1929: 652). Antevs makes no specific comments about southeast Alaska. Capps (1931) suggested that large outlet glaciers of Wisconsinan age terminated on the outer continental shelf of SE Alaska, similar to the modern coast of Antarctica (Mann 1986:239). From Antevs' (1929) map (Figure 3-2) of North America and his comments about both British Columbia and Alaska, it is clear that Antevs interpreted the Pleistocene glaciation as reaching the coast and encompassing the coastal region.

By 1986, the reconstruction of the glacier extent on the continental shelf based on ice flow models and onshore mapping suggests that the glaciers reached only the inner continental shelf in areas lying between major fjord entrances during the LGM (Mann 1986, Mann and Hamilton 1995: 460). Mann (1986: 260) suggests that Haida Gwaii was deglaciated by 16,000 cal BP and that the Alexander Archipelago may have been by that date. The glacial history of the Alexander Archipelago was likely complex during the late Wisconsin. Pleistocene age land mammals (Heaton and Grady 2003, Weckworth et al. 2011) and pollen cores indicate that both the Alexander Archipelago and Haida Gwaii had refugia during the LGM.

The Cordilleran ice sheet was a continental glacier that covered western North America from Washington north to the Yukon during the Wisconsinan glaciation. It is now known that Cordilleran glacial ice sheet flowed west to the Pacific from the interior mountains. It joined local glaciers from the high elevations in SE Alaska as it flowed, though glaciers also formed on local mountains that did not join the continental glacier. These include glaciers on Admiralty, Baranof, Chichagof, and Prince of Wales islands. The large volume of ice was channeled into deep troughs, gouging out the present day fjords, and providing the major outlet for the glaciers. Substantive areas along the outer coast were not glaciated; however, Dixon Entrance was one of the largest outlets, as wide as 60 km (37.3 miles) (Carrara et al. 2007: 232). Other outlet glaciers included (Figure 3-3): Icy Strait, Chatham Strait, Frederick Sound, and Clarence Strait (Mann 1986). These outlet glaciers scoured troughs visible on the bathymetry today. Coastal mountains blocked overflow of ice from the interior and limited glacier accumulation areas causing variation in ice extent on the continental shelf. "Hence, throughout southeast Alaska during Late Wisconsin, glacier cover on the continental shelf may have been locally variable and ice-free areas may have existed near the present coastline" (Mann 1986: 261). By 16,000 cal BP the continental shelf, fiords, and embayments of the Alexander Archipelago were mostly deglaciated. Some valley glaciers would have persisted for several centuries longer (Ager et al. 2010: 266, Mann and Hamilton 1995). Despite this detail, the western glacial extent is known poorly (Carrara et al. 2007: 232-233). The land is difficult to survey for glacial evidence due to the thick rain forest vegetation, the rainy weather, and lack of roads. Other evidence of glacial advances are submerged under water but can be inferred in some areas based on bathymetry.

3.4. Sea-level Reconstructions

The archaeological implications of sea-level change have been known for a long time, and early researchers used bathymetric maps to interpret seafloor geomorphology (Bailey and Flemming 2008: 2153). The sea-level history for SE Alaska is complicated by the glacial history. Due to the loading of the continental glacier on and adjacent to the region, a forebulge raised adjacent parts of the landscape. Due to the complex geology, there are several "hinge" points in the region, where the land would have moved in different directions due to the glacial stresses. This causes the need for sea-level curves to be regionalized based on these hinge areas and ice loading in adjacent areas. Baichtal and Carlson (2010) have compared the sea-level record for the outer islands of the Alexander

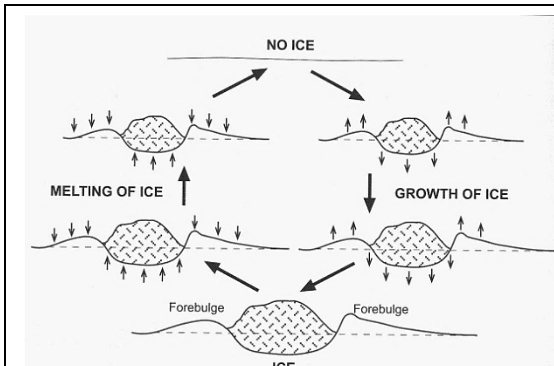


Figure 3-4: Vertical land movements associated with glacio-isostasy (Masselink and Hughes 2003: 26).

Archipelago to that of Fedje and Josenhans (2000: 101) and Hetherington (and Reid 2003, Hetherington et al. 2004) for Haida Gwaii, finding that they are similar (Figure 3-5). There are geologic similarities between the outer Alexander Archipelago, which is of the Alexander-Wrangellia geologic terranes and Haida Gwaii, which is of the Wrangellia terranes (Anderson 1991).

During the LGM, global eustatic sea-level was approximately 120 meters below modern levels (Bailey and Flemming 2008: 2153). Peltier and Fairbanks (2006) have extended the sea-level curve for Barbados back to 32,000 cal BP, based on the fossil coral record. Peltier and Fairbank's primary index points are from *Acropora palmate* because this species is ecologically restricted to 5 m below sea-level. They then apply this sea-level curve to the globe using the ICE-5G (VM2) model (see Peltier 2004). They have tested their model in various regions around the globe. Based on these data, they conclude that global sea-level change since the maximum of 24,000 cal BP was approximately 120 meters.

There are three main processes at work in relation to sea-level change: isostatic, eustatic, and tectonic. Isostasy is the internal processes of mass influencing topography (Figure 3-4). Glacio-isostasy is the response to glacial and interglacial conditions changing the mass that is on the landscape (Ritter et al. 2006:23). The results of glaciation cause isostatic depression of the landscape and a forebulge where the land is elevated. Deglaciation causes isostatic uplift. Eustatic changes are changes in the water level on a global scale (Ritter et al. 2006: 37). Eustatic

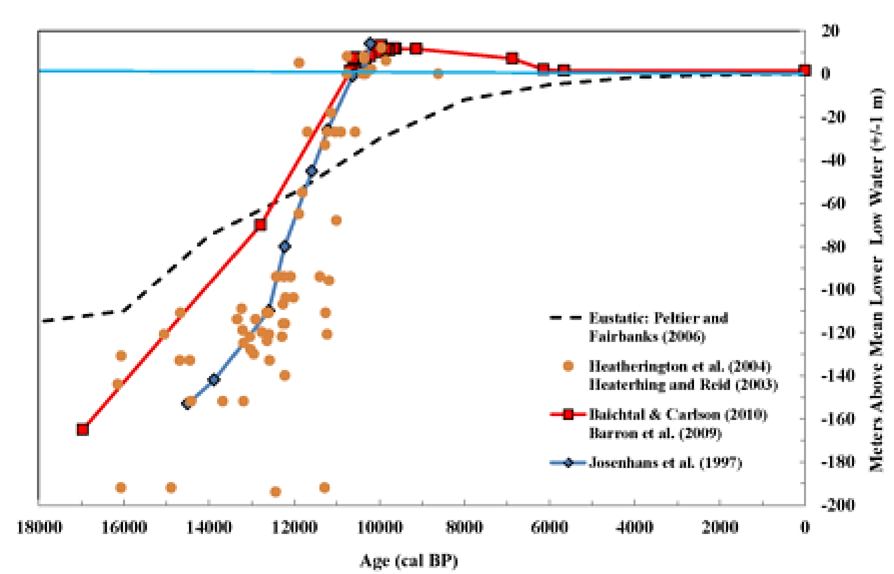


Figure 3-5: Sea-level curves

changes result from the changes in the volume and distribution of water in the ocean basins (Davidson-Arnott 2010: 27). Tectonic processes are caused by shifting tectonic plates or crustal movements, however, only the type of movement can be predicted, not the time or extent. Tectonic processes are sometimes dramatic and can cause sudden shifts in the landscape (Davidson-Arnott 2010: 23), including faulting events or earthquakes. The combination of these factors causes inundations (transgressions) or exposure (regression) of the land relative to the sea (Davidson-Arnott 2010: 19).

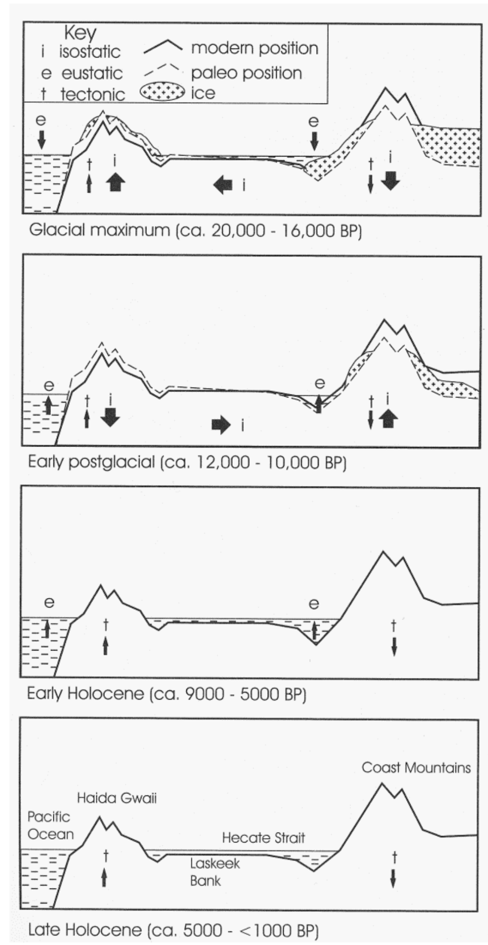


Figure 3-6: Schematic of isostatic, eustatic, and tectonic effects on Haida Gwaii (Fedje et al. 2005a).

3.4.1. ***Sea-level Reconstruction for Haida Gwaii***

Heusser (1960) found that parts of Haida Gwaii were not glaciated during the LGM. The last glaciation (Fraser Glaciation in British Columbia) flowed from small ice caps and coalesced with the Cordilleran ice sheet in Dixon Entrance. This coalescence was likely short-lived (Barrie et al. 2005: 10). Glaciation reached its maximum extent around 21,000 cal BP (Barrie et al. 2005) to 19,000 cal BP (Clague et al. 2004: 86) and had retreated from the lowlands by 15,000 cal BP.

The sea-level record for the region has been determined from sub-aerial and marine cores by recording the transition between fresh and marine sediments (Josenhans et al. 1997). Figure 3-6 depicts the processes on Haida Gwaii as a cross section from the Coast Mountains to the Pacific Ocean; this is a schematic diagram to illustrate the effects of the forbugle. At the glacial maximum (the top figure), Haida Gwaii was raised due to isostatic processes and more land was available because of eustatic lowering of sea level.

In the early postglacial time, the elevation of Haida Gwaii lowered due to forebulge collapse. In the early Holocene, sea-level raised above the modern sea-level by approximately 15 meters. Finally, during the late Holocene, sea-levels stabilized, but there are still tectonic processes that affect the region as they have in all of these time slices (Fedje et al. 2005a: 24).

Hetherington (et al. 2004) calculated the forebulge on Hecata Strait and Queen Charlotte sound to have been over 100 m of crustal uplift, which lasted until after 9,700 cal BP. There was a land connection between Haida Gwaii and the mainland until 11,700 cal BP. The total change in the relationship between land and sea for Haida Gwaii was 150 m (Figure 3-5 yellow dots). Although there were some differences between the northern and southern section, they were only a few meters (Hetherington and Reid 2003).

3.4.2. ***Sea-level Reconstruction for the Outer Islands of the Alexander Archipelago***

Baichtal and Carlson (2010) have developed a sea-level curve for the outer islands of the Alexander Archipelago (Figure 3-5 red line). Carlson (2007) focuses on the elevations of shell middens that formed during the period when sea-level was above modern (since10,600 cal BP). She identifies three terrace levels where people could have lived. The Upper Terraces are between 16-21 meters above modern sea level and would have been occupied during the highest sea-level (10,600 – 5,800 cal BP, 9,400 to 5,000 ^{14}C years). The middle terraces are between 8.5 and 13 meters and were occupied from 5,800 to 2,000 cal BP. Finally, the lower or modern terraces are from 6 – 7 meters and would have been occupied from 2,000 BP to present. Baichtal and Carlson (2010) have identified 430 shell middens; 231 have been dated. This provides reliable dates for the part of the sea-level record that is preserved above modern sea-level.

There are currently only two points below modern sea-level upon which to base the sea-level curve in this area. The first is the -165 m point, which Baichtal refers to as a terrace (Baichtal and Carlson 2010). However, Carrara (et al. 2007: 235) indicates there was a minimum subsidence of the seafloor in Sitka sound of 160 m.

Barron et al. (2009) analyzed and dated a sediment core (EW0408-11JC) from the Gulf of Esquibel, located immediately west of POWI. Their analysis indicates that when sea-level was significantly lower, the Gulf of Esquibel was a fresh water lake. It was later flooded by the rising sea that ultimately formed the present-day Gulf. The core documents the Gulf as a freshwater lake between 14,200 to 12,800 cal BP that transitions to brackish water sometime between 12,800 and 11,100 cal BP. A radiocarbon determination run on shell by Barron (et al. 2009), adjusted for the marine reservoir effect, and calibrated to 11,324 – 11,773 cal BP by Baichtal and Carlson (2010) also provides a minimum limiting date of approximately 11,500 cal BP. Based on contemporary bathymetry, the lowest topographic point along the basin's margins is approximately -70 m (Baichtal and Carlson 2010). This is the probable point at which rising sea-level breached the Esquibel basin. The breach point identified by Baichtal and Carlson (2010) was combined with the diatom record from Barron (et al. 2009) to form the second point below sea-level on the sea-level curve.

By comparing this curve to the Haida Gwaii curve, and incorporating the similarities in glaciation and geology, it has been possible to construct a preliminary sea-level curve for the outer islands of the Alexander Archipelago. However, additional work is needed to improve its reliability.

3.4.3. ***Sea-level Reconstruction for the Inner Islands of the Alexander Archipelago***

As the glaciers retreated, the forebulge caused the elevation of the crust and subsequent collapse. The shoreline rapidly moved landward. On Gravina Island, near Ketchikan, glacial marine shell deposits exist from 24 to 30 meters above sea-level (asl). Within Behm Canal, there is New Eddystone Rock located 72 m asl that has been eroded by waves. In Portland Canal, glacial marine sediments are found from 103 to 152 m above mean sea-level (Baichtal et al. 1997: 24). Although the sea-level change for the inner island and mainland on SE Alaska is complex, similarities can be drawn between the BC curves from Kitimat and Prince Rupert.

These data indicate that the region was largely covered by the Cordilleran ice sheet and its lobes from the east side of Prince of Wales Island to the mainland. This area was in a region of depression during the LGM that subsequently rose when the glacier retreated. The sea-level curve for this region is significantly different from that for Haida Gwaii and the outer islands (the Kitimat and Prince Rupert curves on Figure 3-7 are more similar).

3.5. Last Glacial Maximum Refugia in Southeast Alaska

The proposed refugia locations for SE Alaska are mainly on the continental shelf (Figure 3-4). Heusser's (1960) work clearly demonstrated that parts of Haida Gwaii were not entirely covered by glaciers during the maximum of the Wisconsinan or Fraser glaciation. In addition to pollen evidence for SE Alaska, there are also faunal remains from before, after, and during the LGM (Heaton and Grady 2003, Carrara et al. 2007). Geologically, the evidence for refugia is based on the presence of local geomorphic features indicating that the land was either glaciated or unglaciated (such as U- and V-shaped valleys, glacial moraines, and deep gouges in the sea floor). In addition to the glacial evidence in southeast Alaska, researchers have also focused on the contemporary and fossil faunal and floral evidence (Carrara et al. 2007).

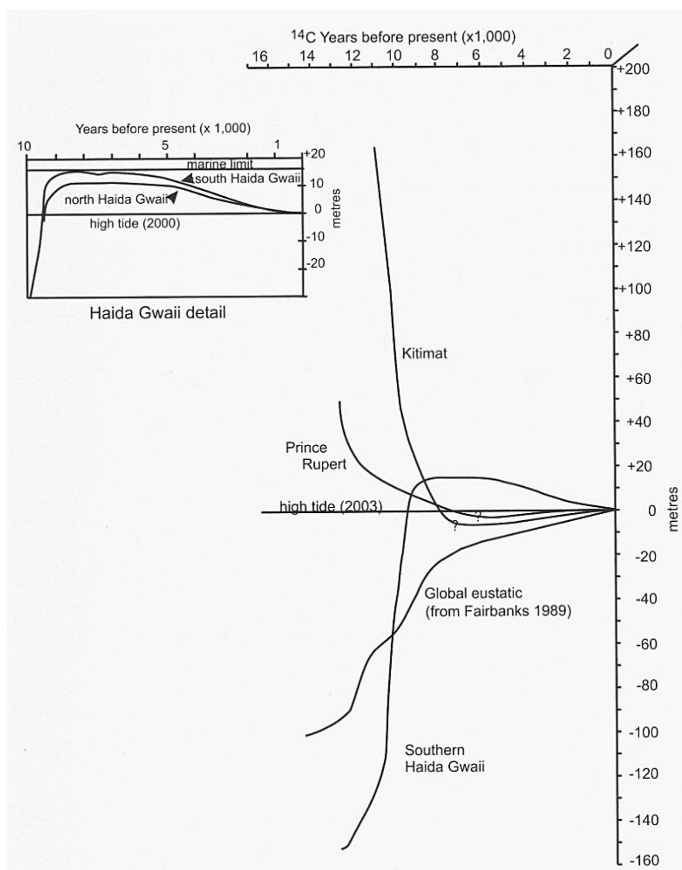


Figure 3-7: Sea-level curves from various location along the northern NWC and the global eustatic (Fedje et al. 2005a: 23)

Table 3-1: Table of fauna radiocarbon dates from On Your Knees Cave spanning the last glaciation (Heaton and Grady 2003: Table 2.2: 28-30)

Lab number	^{14}C yr BP	Error	Species (element)
AA36661	14,520	470	Phoca hispida (skull)
AA37873	17,130	240	Phoca hispida (femur)
AA18450	17,565	160	ringed seal (ulna)
AA44445	17,740	270	Phoca hispida (skull)
AA37874	17,805	465	Phoca hispida (tibia)
AA37878	18,085	230	Phoca hispida (radius)
AA36662	18,770	350	Phoca hispida (vertebra)
AA36658	18,860	280	Phoca vitulina (dentary)
AA36659	18,920	310	Phoca hispida (skull)
AA18450R	19,060	275	Phoca hispida (ulna)
AA33794	19,170	210	Alopex lagopus (rib)
AA36666	19,240	260	Phoca hispida (metacarpal)
AA33793	19,480	320	Vulpes vulpes (canine)
AA33788	19,830	350	Phoca hispida (dentary)
AA22884	20,060	500	Phoca hispida (humerus)
AA33789	20,110	280	Phoca hispida (skull)
AA33790	20,170	450	Eumetopia jubatus (canine)
AA33785	20,210	270	Phoca hispida (ulna)
AA36667	20,300	360	Phoca hispida (metacarpal)
AA36660	20,470	660	Phoca hispida (skull)
AA33197	20,530	330	Melanitta fusca (humerus)
AA36664	20,540	710	Phoca hispida (ulna)
AA33784	20,550	520	Phoca hispida (navicular)
CAMS33980	20,660	80	Phoca hispida (ulna)
AA36646	20,690	520	Alopex lagopus (metacarpal)
AA36657	20,720	350	Phoca vitulina (tibia)
AA36651	20,820	650	Eumetopia jbatus (premolar)
AA36668	20,880	480	Phoca hispida (metacarpal)
AA37875	21,385	3115	Phoca hispida (skull)
AA44444	22,160	400	Phoca hispida (skull)
AA33787	22,490	300	Phoca hispida (metatarsal)
AA36645	23,120	640	vulpes vulpes (humerus)
AA33786	23,260	470	Phoca hispida (phalanx)
AA37876	23,315	865	Phoca hispida (skull)
AA21566	23,560	770	Marmota caligata (incisor)

3.5.1. ***Faunal Evidence Supporting Refugia***

Heaton and Grady (2003: 19) started investigating discoveries of fossil vertebrates in the Alexander Archipelago in 1991. These well-preserved finds had been made in limestone caves by local spelunkers. They investigated 15 cave sites on Prince of Wales Island, surrounding islands, and the adjacent mainland. Of these 15 caves, eight date into the Pleistocene. The Devil's Canopy Cave fauna provide insight into the fauna remains on POWI prior to the LGM (Heaton and Grady 2003: 22).

On Your Knees Cave (OYKC) contains some of the most significant cave deposits in the Alexander Archipelago. It is located on the northwestern tip of POWI and has 10,300 cal BP old human remains and numerous cultural remains (Dixon 1999: 118). Heaton and Grady (2003) report the cave contains brown and black bear that predate and post-date the LGM. There is also ringed seal (*Phoca hispida*) remains that date to the glacial maximum (Table 3-1). There were numerous late Wisconsin age bones recovered in the cave, many have puncture and gnaw marks from mammalian carnivores. Heaton and Grady (2003: 23-24) believe the cave served as a carnivore den both before and during the LGM but that many of the bones were reworked and deposited as a result of different depositional events.

In addition to the fossils, reported by Heaton and Grady (2003), Shafer et al. (2010, 2011) investigate phylogeographic patterns of animals to identify refugium. "Genetic data of a mid-Pleistocene split of vertebrate taxa and geographic distribution of the mitochondrial lineages of stickleback, black bear, marten, and short-tailed weasel cumulatively suggest that a refugium existed on the continental shelf off the central coast of British Columbia" (Reimchen and Byum 2005: 93). Wigen (2005) suggests that the refugia were mainly on the continental shelf. The chestnut-backed chickadee (*Poecile rufescens*), Stellar's jay and northwest song sparrow (*Melospiza melodia*) showed increased genetic diversity on Haida Gwaii, which is a pattern consistent with a refugium. Other animals that are suggested to have survived in the refugia include garter snakes (*Thamnophis sirtalis*), water flea (*Daphnia pulex* complex), the lichen (*Cuvernularia hultenii*), long-tailed vole, Keen's mouse, and Mountain goats. They conclude there was "near conclusive evidence" for refugia in the Alexander Archipelago and Haida Gwaii. Dawson caribou (*Rangifer tarandus dawsoni*) are likely a post-glacial colonist of Haida

Gwaii. This caribou was a dwarf caribou adapted to the island. The last caribou on the island were shot in 1908 (Reimchen and Byum 2005: 82-83).

Ermine (*Mustela ermine*) is a mammal that likely survived the LGM in the Alexander Archipelago refugia. There are three distinct lineages in southeast Alaska, based on mtDNA. Two have a wide distribution outside of southeast Alaska. However, there is an "island" lineage found only on Prince of Wales, Suemez, and Heceta islands in SE Alaska and Graham Island in Haida Gwaii (Carrara et al. 2007: 233-234). Fleming and Cook (2002) conclude that the "island" lineage probably survived the LGM in coastal refugia.

"Rather than a simple postglacial colonization of a formerly inhospitable wasteland, there is a complex interaction of faunas – arctic and temperate, coastal and inland, Asian and North American – all interacting through a period of radical climatic change" (Heaton and Grady 2003: 45). The ring seal represent the arctic fauna. It breeds on land-fast sea ice. The ring seal moved north when the southern limits of sea ice retreated northward. For refugium fauna, genetic studies of modern and fossil brown bear support the refugia theory (Heaton and Grady 2003: 46-47). Of the 108 mammal species or sub-species that inhabit southeastern Alaska, 27 are endemic to the region and 11 have ranges that mainly are confined to the region. These endemic mammals are more frequent on the outer islands (Baranof, Chichagof, Coronation, Forrester and Warren islands). This high degree of endemism and its focus on the outer islands "has been interpreted as suggesting that refugia existed in some areas of the exposed continental shelf and outer islands of the Alexander Archipelago" (Carrara et al. 2007: 233).

3.5.2. ***Flora Evidence Supporting Refugia***

Though Heusser conducted pioneering work with his pollen cores, none of his sites from southeastern Alaska south of Juneau was radiocarbon dated. They only provide a relative chronology of vegetation change. Ager (and Rosenbaum 2007, Ager et al. 2010) has continued these pollen cores in southeastern Alaska and Haida Gwaii (Figure 3-8).

Similar to the faunal evidence, phylogeographic information is useful in providing evidence for the SE Alaska refugia. Subalpine fir (*Abies lasciocarpa*), which is a mainland species, exists in small isolated stands on Dall, Prince of Wales, Heceta, and Kosciusko islands. It has been suggested that subalpine fir survived in refugia within the Alexander Archipelago during the LGM (Carrara et al. 2007:234).

Shore pine (*Pinus contorta* var. *conorta*) was significant in the forest succession of the Pacific Northwest in early postglacial pollen records. "The early arrival of shore pine (by 13,700 cal BP) and mountain hemlock (*Tsuga mertensiana*) at a site on Pleasant island in the Glacier Bay region has been interpreted as suggesting an expansion from refugia in the Alexander Archipelago" (Carrara et al. 2007: 234). There are also specific alleles in this variety of shore pine that indicate it was isolated for a considerable period of time (Carrara et al. 2007:234).Because pine appears almost ubiquitously across the region soon after deglaciation, it suggests shore pine survived the LGM in scattered coastal refugia. Shore pine then spread quickly across the previously glaciated landscape as ice receded (Ager et al. 2010: 265-266).

Glacial refugia are now well documented to have occurred on the outer islands of the Alexander Archipelago. A significant portion of the outer continental shelf of SE Alaska would have been subaerial, unglaciated, and available for flora, fauna, and humans. Some areas of the continental shelf have undergone significant geomorphic changes as a result of post-Pleistocene sea level rise.

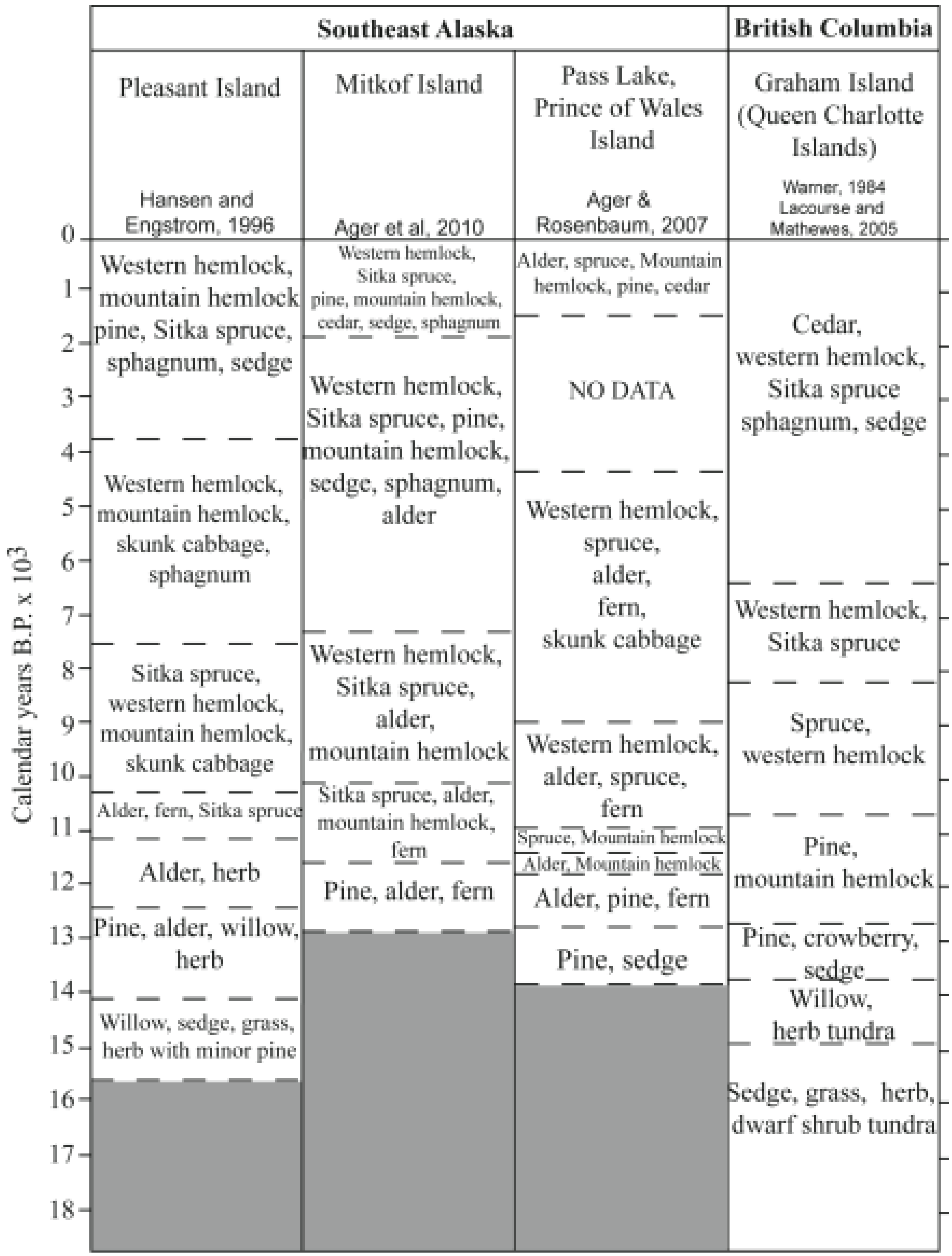


Figure 3-8: Flora pollen sequences (Ager et al. 2010, Ager and Rosenbaum 2007, Dixon 2011a)

3.6. Geomorphology of Southeast Alaska

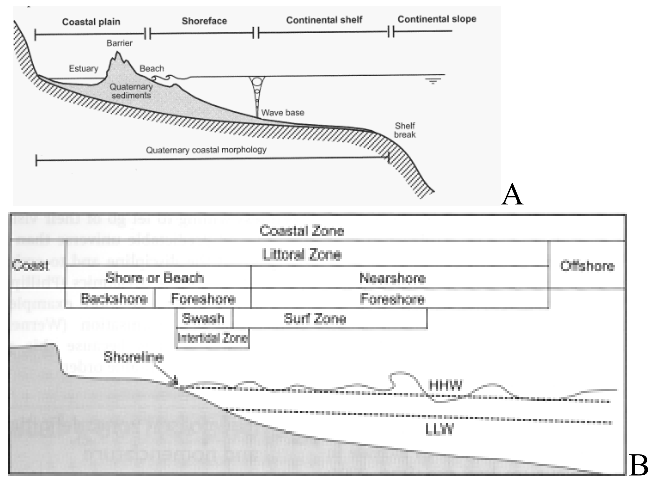


Figure 3-9: Coastal Zone (A) Coastal plane to the continental shelf (Masselink and Hughes 2003: 1),(B) Shoreline model with coastal zones (Davidson-Arnott 2010: 12)

The dynamic nature of the ocean must be considered when investigating the shore and underwater environment. Southeast Alaska has significant variation in the coastal processes. The region is characterized by rocky coasts with minimal beach areas. However, the complex of coastline has sheltered areas where sites are likely to have been preserved as sea level rose (Benjamin 2010, Fischer 1995). The shorelines of this region have changed significantly over the last 16,000 cal years. The areas where coastal processes are relevant include tidal zones, the near shore environment, and the continental shelf (Figure 3-9). The west side of POWI, where this research focuses, does not have large rivers that would bury archaeological sites in deep sediment.

3.6.1. ***Tides***

Generally, modern southeast Alaska has a meso-tidal variation (2 to 4 meter) (Davidson-Arnott 2010), with unequal diurnal tides (Langdon 1977: 19-20). SE Alaska is dominated by tides with a storm waves (Masselink and Huges 2003: 4). The daily cycle is 24 hours, 50 minutes (Suttles 1990b: 18). The complex array of islands protects large areas of the coast from the full fetch of the Pacific Ocean and causes variability in the size, extent, and timing of the tides. The outer coast has a mean tidal range of 2.396 – 2.827 meters (7.86 – 9.27 ft.) and a diurnal tidal range of 3.077 – 3.503 meters (10.09 – 11.49 ft.) (Table 3-2, Figure 3-3). Currently there is no accepted method to determine past tidal ranges. Consequently, modern tidal ranges, adjusted for the paleocoast, are assumed to be a good estimate (Davidson-Arnott 2010).

Table 3-2: Tidal Ranges around POWI in meters (NOAA Tides and Currents 2011) (see study area maps for locations of some gauges)

	Mean Tide Range	Diurnal Tide Range	Mean Higher-High Water	Mean Sea-level	Mean Lower-Low Water	Station Datum
Craig, AK	2.424	3.093	4.707	3.233	1.606	0.000
Shinaku Inlet, AK	2.396	3.077	2.988	1.525	0.327	-0.089
Shakan Strait (NE End), AK	2.827	3.503	2.465	0.798	-1.037	0.000
Nossuk Bay, AK	2.503	3.170	3.344	1.838	0.017	0.000
Steamboat Bay, AK	2.487	3.149	2.416	0.920	-0.733	0.000

3.6.2. *The Near Shore Environment*

The near shore is the portion of the coastal zone (Figure 3-9B) extending from the limit of significant sediment transport by waves to the low tide line. It is also defined as the shoreface (Figure 3-9A). This zone has the potential to be destructive to archaeological sites due to the movement of sediments. The near shore environment is where most sediments move back and forth with the tides, the seasons, and storms. It can extend far off-shore during major storms and tsunamis (Davidson-Arnott 2010, Masselink and Huges 2003). Sea-level rose quickly in some areas, rapidly inundating the continental shelf and removing it from the near shore movement of sediments (Figure 3-5). This could have protected

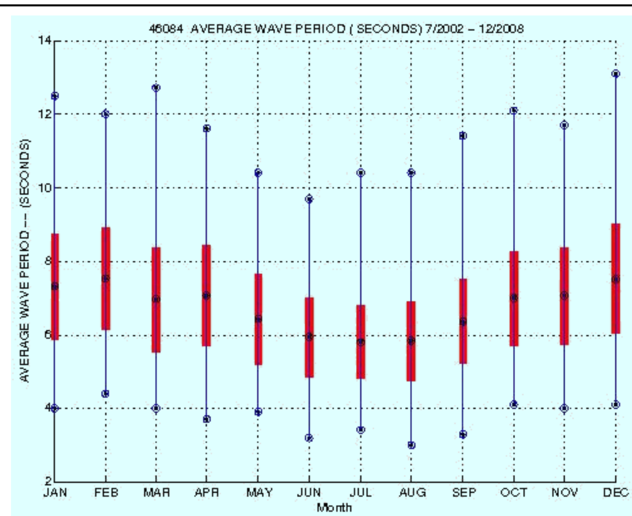


Figure 3-10: Average wave period from Cape Edgecumbe Buoy (46084) (National Data Buoy Center 2011)

archaeological sites from long periods of erosion and extensive sediment loads and wave action. Additionally, there is no evidence for an environment favoring long shore drift in SE Alaska.

The exact location of where the near shore begins varies based on the size of waves within the region. Figure 3-10 shows the average wave height (m) from July 2002 to December 2008 from west of Baranof Island. The typical wave height is less than 5 meters, the period (T) is approximately 7 seconds (Figure 3-10). Therefore waves normally would affect the seafloor to a depth of approximately 38 m based on depth = 0.5λ and $\lambda = (g/2\pi)\ T^2$. The range of variability in the period is from 5.5 seconds to 8.5 seconds. This puts the range of transition from near shore to continental shelf between 23.6 and 56.4 meters deep. The significant wave height of 5 meters is considered a near gale force wind (Wright et al. 2005).

3.6.3. ***The Continental Shelf***

The continental shelf (Figure 3-9A) or offshore zone (Figure 3-9B) is the portion of the profile where there is no significant transport of sediment by wave action. This extends to the shelf margin, or where the shelf breaks to the deep ocean floor (Davidson-Arnott 2010, Masselink and Huges 2003). This environment provides an area where archaeological sites could be preserved indefinitely, provided there is no change in the zone. A significant storm can push sediment onto a possible archaeological site or strip away any protective covering, depending on wave actions, tide, and where on the coast the transition is between the near shore zone and continental shelf specifically is for that storm in relation to an archaeological site. There would have been many of these storms over the last 16,000 years.

3.7. Project Study Area – Shakan Bay

The Alexander Archipelago is a large area making it necessary to select a small subsection for survey (Figure 3-11). This project focused on Shakan Bay in northwestern Prince of Wales Island. Shakan Bay was selected because it is shallow and protected based on the preliminary analysis of the bathymetric data. It is south of On Your Knees Cave (OYKC) and in the ancient cultural interaction area described by Baichtal and Carlson (2010).

There are two large bays within this area, Shakan Bay to the north and Shipley Bay to the south. The northern boundary of the region is POWI. The southern and eastern boundary is Kosciusko Island. Within the Shakan Bay, there is Hamilton, Middle, Divide, Fontaine, and Barrier islands. The surrounding land includes several peaks and mountains, including Mount Calder, Perue Peak, Mount Francie, and Mount Holbrook. Finally, Shakan Bay is connected to Shakan Strait where it wraps around Hamilton Island. The total survey area is 318.7 km^2 (123 sq. mi).

The geology of the region is displayed and described in Table 3-3 and Figure 3-11. The geology includes granodiorite, surficial sedimentary deposits, carbonate rocks, conglomerate, and other sedimentary rocks. These rocks and sediments are of the Ordovician, Silurian, Cretaceous, and Quaternary periods (Gehrels and Berg 1992). The submerged surface geology, based on the NOAA map sediment indicators, is mainly mud, with some sand, and includes rocky and shell areas. The mud and sand would provide excellent environments to preserve archaeological sites.

The morphology of the region changes as sea-level lowers. From 0 to 25 meters depth, this region has two large bays. From 25 to 75 meters depth, the region had two intertidal estuaries. Landscape reconstruction suggests that these areas would have been highly productive for ancient people to collect, fish, and/or hunt. Below 100 m, the region is mostly terrestrial with some rivers. In Shakan Bay, there is a deep valley-like trough through the center that that has been interpreted to have been a river valley, lakes, or estuary when the Bay was exposed as dry land. The adjacent estuarine environments would have provided sheltered areas where ancient archaeological sites could have survived sea-level rise.

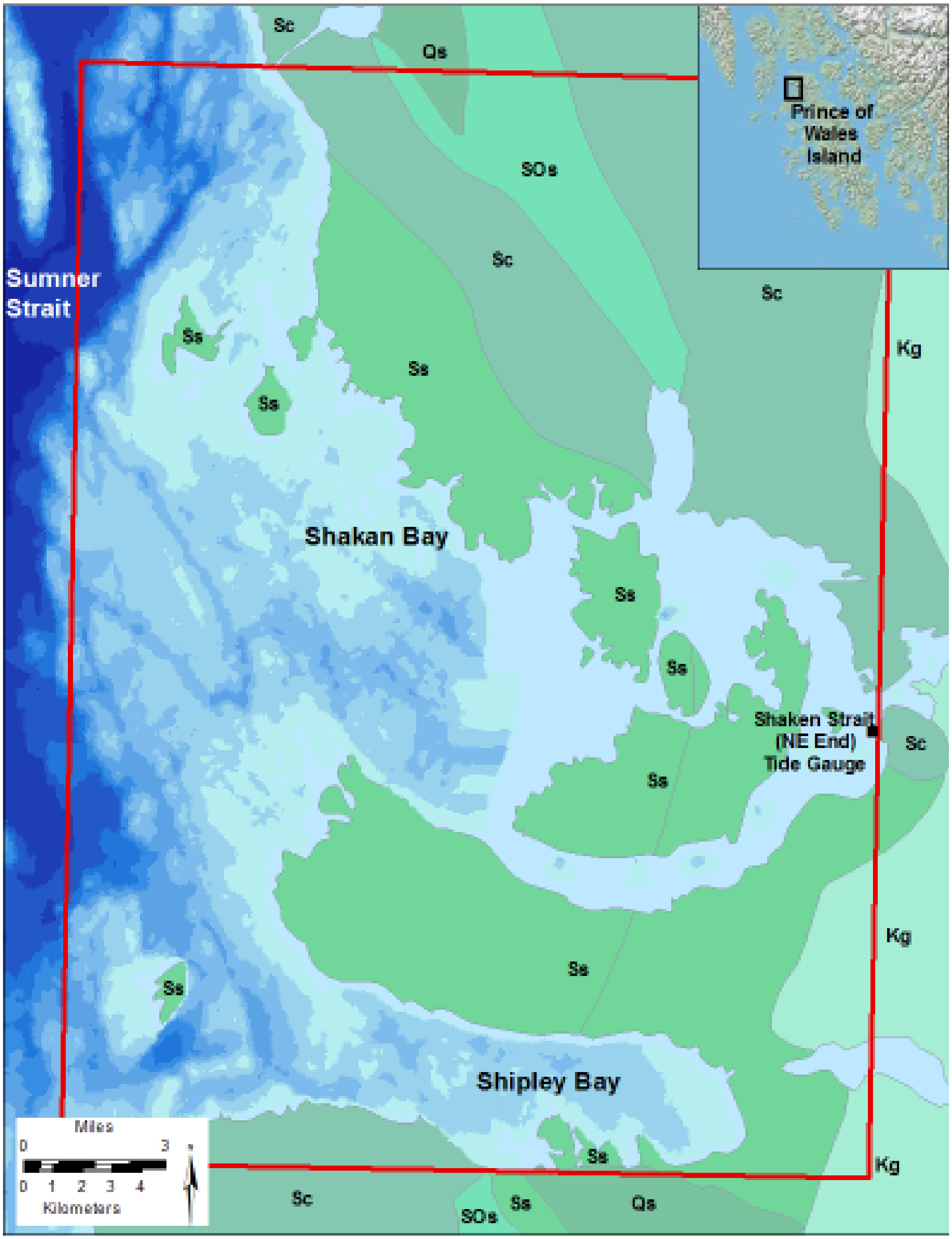


Figure 3-11: Map of Shakan and Shipley Bays depicted the geology (Gehrels and Berg 1992) and the bathymetry

Table 3-3: Geology of Shakan Bay (Gehrels and Berg 1992)

Map Code	Time Period	Short Description	Long Description
Qs	Quaternary	Surficial sedimentary deposits	Unnamed lacustrine, fluvial, colluvial, glacial, beach, and marine deposits.
Kg	Cretaceous	Granodiorite	A heterogeneous suite of plutons consisting primarily of biotite, hornblende, magnetite +/- pyroxene +/- garnet granodiorite and subordinate quartz monzonite, tonalite, trondhjemite, and quartz diorite.
Sc	Silurian	Carbonate rocks	Massive, thin- to thick-bedded, locally reefoidal, light-gray limestone and subordinate shale and polymictic conglomerate.
Scg	Silurian	Conglomeratic rocks	Polymictic pebble and cobble conglomerate and subordinate sedimentary breccia, olistostromal deposits, sandstone, graywacke, mudstone, and limestone. Clasts consist of porphyritic andesite, limestone, graywacke, mudstone, granitic to gabbroic intrusive
Ss	Silurian	Sedimentary rocks	Graywacke and mudstone turbidites and subordinate olistostromal deposits, layers, and lenses of limestone, and conglomerate.
SOs	Silurian and Ordovician	Sedimentary rocks	Mudstone and graywacke turbidites, subordinate conglomerate, sandstone, and shale, and minor limestone, chert, and basalt flows and breccia.

4. Archaeology and Ethnography of the NWC and Vicinity

As a culture area, the Northwest Coast of the Americas (NWC) is defined by several cultural aspects, including distinctive woodworking technology, twined basketry decorated with false embroidery or overlay, basketry hats, emphasis on salmon harvesting, permanent villages or towns, and social stratification with hereditary slavery (Suttles 1990a: 4). Geographically, the region is located along the Pacific Coast from the Copper River in the north to the Chetco River in the south (Figure 3-1). The landward boundary varies by researcher, but generally, it is within the coastal mountain ranges, Chugach, Saint Elias, Coast Mountain, and Cascade Ranges. Though there is no question that the NWC is an ecological and cultural region, its exact boundaries are not precisely agreed upon (Ames and Maschner 1999, Drucker 1955, Kroeber 1939, Moss 2011:9, Wissler 1914). The region has been subdivided many different ways, but most commonly into Northern, Central, and Southern NWC (Figure 4-1) (Ames and Maschner 1999, Suttles 1990a). The focus of this research is on the Northern NWC.

There is significant linguistic variability within the NWC, but culturally the groups are similar. At the time of Euroamerican contact, there were over 40 languages belonging to a dozen language families (Figure 4-2) (Shuttles 1990a: 1). Many of the legends and myths (Boas 1982b [1940]: 425), or oral traditions are shared or are common to various tribes. Other uniformities through the NWC include a lack of pottery and footwear, uses of plank houses, woodworking technology, and a heavy dependency on fish (especially salmon). There were permanent or winter villages or towns without large-scale agriculture (Suttles 1990a: 4), though some plants and mollusks were cultivated (Moss 2011). The NWC was a socially stratified society with inherited titles, commoners, and slaves, which is unusual among non-horticulturalists, if not unique. Slaves were captured from other tribes or born into their rank.

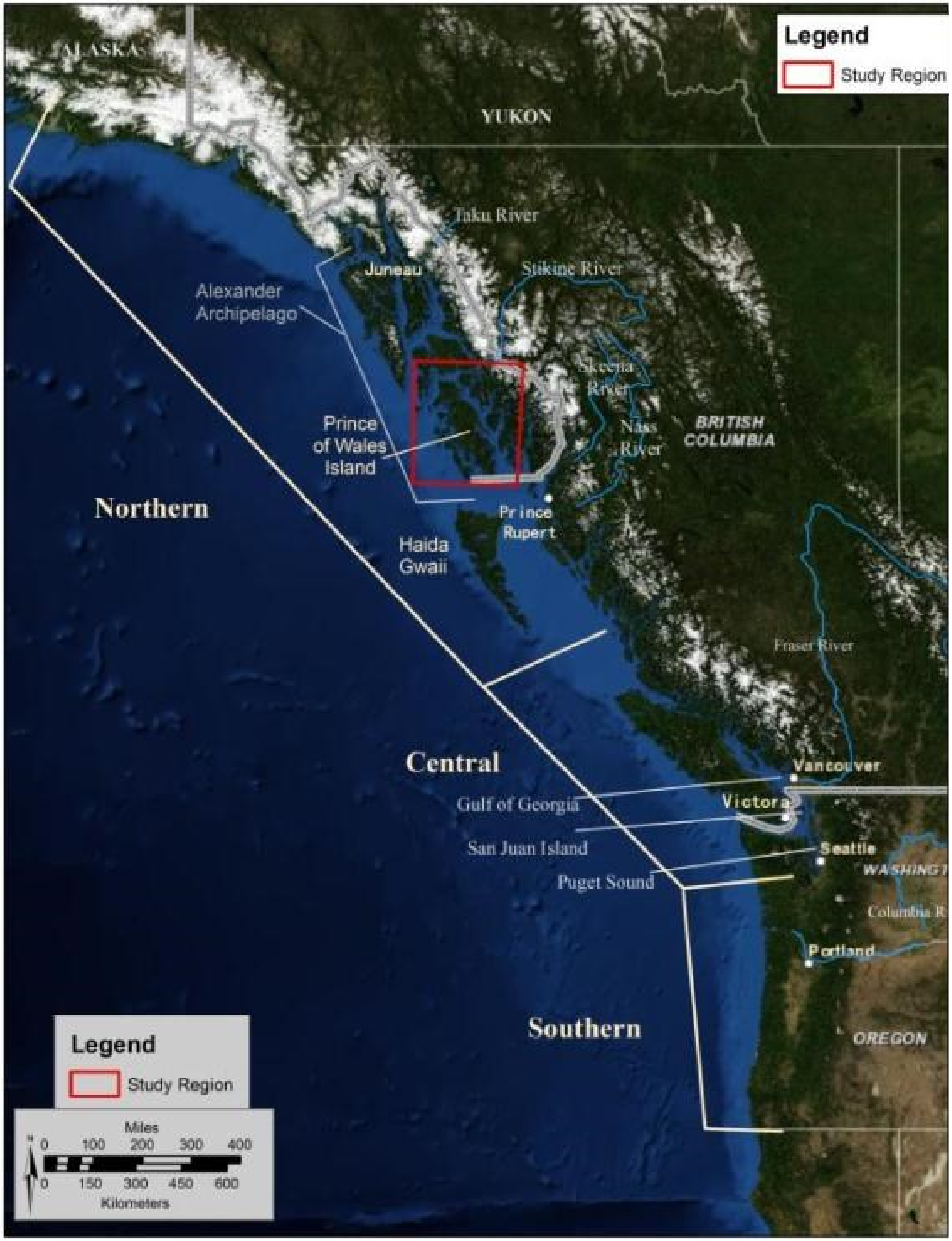


Figure 4-1: Northwest Coast including locations discussed in chapter

NWC archaeology centers on several key questions. First, the origins and land-use history of NWC people are important and is specifically relevant to this research. Second, there is significant archeological variability in material culture from north to south along the NWC, specifically with respect to the presence and absence of early microblade technology, projectile point types, and baskets and other non-lithic artifacts. A third issue related to variability within this region is the development of the NWC cultures (Suttles 1990a). This topic includes research into the timing and development of long distance trade, subsistence strategies, and the transition from chipped to ground stone tools (Moss 2004: 185-187). Finally, the cultural chronologies of the NWC are regionally variable. Different researchers have focused on different aspects of the archaeological and ethnographic records when developing different chronologies (Table 4-1). Fedje and Mackie's (2005) chronology is utilized for this research.

Table 4-1: Published chronologies of the NWC

<table>
<tr><th>Time (^{14}C years)</th><th>Davis (1990)</th><th>Ames and Maschner (1999)</th><th>Moss (1998)</th><th colspan="2">Fedje & Mackie (2005)</th></tr>
<tr><td>AD 2000</td><td rowspan="3">Late Developmental</td><td rowspan="3">Late Pacific</td><td rowspan="3">Late</td><td rowspan="9">The Developmental Stage</td><td rowspan="3">Late</td></tr>
<tr><td>1000 BP</td></tr>
<tr><td>1500 BP</td></tr>
<tr><td>2000 BP</td><td rowspan="2">Middle Developmental</td><td rowspan="3">Middle Pacific</td><td rowspan="6">Middle</td><td rowspan="2">Middle (Marpole)</td></tr>
<tr><td>2500 BP</td></tr>
<tr><td>3000 BP</td><td rowspan="3">Early Developmental</td><td rowspan="2">Transitional (Locarno Beach)</td></tr>
<tr><td>3500 BP</td><td rowspan="3">Early Pacific</td></tr>
<tr><td>4000 BP</td><td rowspan="2">Early (Charles)</td></tr>
<tr><td>5000 BP</td><td rowspan="2">Transitional</td></tr>
<tr><td>6000 BP</td><td rowspan="6">Archaic</td><td rowspan="6">Early</td><td rowspan="6">The Lithic Stage</td><td rowspan="6">Early Coastal Biface Tradition & NWC Microblade Tradition</td></tr>
<tr><td>7000 BP</td><td rowspan="3">Paleomarine</td></tr>
<tr><td>8000 BP</td></tr>
<tr><td>9000 BP</td></tr>
<tr><td>10,000 BP</td><td rowspan="2"></td></tr>
<tr><td>11,000 BP</td></tr>
</table>

4.1. Origins and Land-Use History of the NWC

The people living along the NWC have traditionally practiced what is primarily maritime-based economy. One of the questions that have been prevalent in the literature is whether the original settlers maritime adapted (i.e. did they migrate to the region from other coastal regions) or were they terrestrially and riverine adapted (i.e. did they travel down rivers to the coast) and later developed a maritime adaptation. Maritime culture is an "adaptation to the sea from which it [the culture] derives an essential part of the dietary and economic needs through the use of techniques and equipment particularly adapted to the exploitation of marine resources" (McCartney 1974: 158-59). Maritime economy (as defined for the circumpolar region) is "a general culture-ecological pattern in which the economic base and general cultural orientation is partially or wholly dependent on coastal and maritime resources of the northern littoral" (Fitzhugh 1975: 343). One of the problems with early maritime adaptations was the perception that shell middens were created by the "lowest class" of Native North Americans because a shellfish gathering economy required only the most rudimentary cultural arrangements (Raab and Yatsko 2009: 16).

The early view was that people migrated down the rivers and slowly adapted to a maritime environment. Kroeber's (1939) model focused on adaptation rather than migration and diffusion (Carlson 1998: 24). Using the NWC and the Columbia-Fraser Plateau data, Kroeber divided the areas based on spatial continuity and environmental-adaptation criteria. He postulated that the NWC culture gradually developed from a river or river-mouth culture. It then developed into a beach culture. Eventually, and only in part, into a seagoing culture (Kroeber 1939: 28). He related the earliest stages of cultural development to the Columbia-Fraser Plateau and Intermountain Athapaskan. The intermediate stage, or beach culture, could be seen ethnographically in the Fraser River delta and islands. The open ocean or seagoing culture was related to the northern NWC groups including the Southern Tlingit, Haida, and Tsimishian (Kroeber 1939: 29-31).

Borden (1950, 1951) conducted archaeological excavations to test Kroeber's model. With data derived from the five sites that he excavated on or the near Fraser River delta, Borden developed a chronological sequence. The earliest is the Locarno Beach phase, which was a maritime adapted culture. He equates them with coastal Eskimo people. The next phase was the Marpole phase. Borden thought these people migrated down the river to the delta or river mouth. After excavating the Milliken site, near the mouth of the Fraser Canyon, Borden (1975) changed his view from migration and diffusion model to an adaptation model similar to Kroeber's model.

King (1950) excavated at Cattle Point in the San Juan Islands. It was the first extensive excavation of a single shell midden on the NWC. He applied Kroeber's model of 'from land to sea' divided cultural development into three phases: "Island", "Developmental", and "Maritime". These transitions show an increase in bone and antler artifacts adapted to exploit the sea (King 1950: 12). Cattle Point produced the first dark cultural layer with no molluscan remains under the shell midden (Carlson 1998: 25). King interpreted this as part of the "Island" phase, but ideas that are more recent indicate the dark stain is a result of dissolution of shell through percolating ground water (Stein 1992) or possibly a house floor (Carlson 1993: 19-20).

Matson and Coupland (1995) suggest a very Kroeber-like model. They propose that central NWC maritime cultures developed from Paleo-Indian or Clovis hunters from the interior of the continent. They advocate an initial migration from south to north for the central NWC and a north to south migration for the northern NWC.

By 1975, Borden had changed his conclusions. He proposed two separate initial migrations to the NWC. A northern group migrated down the NWC from north to south and a migration moved north from the Fraser River area (Borden 1975: 7). The Early Boreal tradition (or Northwest Coast Microblade tradition) migrated from Alaska and Yukon, seaward and down the coast. They already were adapted to a maritime economy and occupied the coast as far south as Namu. Borden (1975: 11) saw this group as wearing tailored skin clothing and having some means of watercraft, likely skin-cover frame boats from which they hunted and fished. The southern group used mainly unifacial tools (also called the Pebble Tool tradition by Carlson (1996)). Borden (1975: 84) uses the example of the Glenrose Cannery Site to demonstrate the early people were not able or engaged in hunting sea mammals. They were using intertidal resources by 8,300 cal BP (7430 ± 340 ^{14}C years). According to Borden, the northern and southern groups mixed after 5000 BP (Borden 1975: 116). This seems to be a feasible option, though Borden's timing needs refinement.

In contrast to Borden (1975), King (1950), and Kroeber (1939), Drucker (1955:21) states that the earliest horizons in the Puget Sound areas "represent a culture oriented towards the seas and the utilization of marine resources, particularly the hunting of sea mammals". Interior traits were subsequently adopted by this early maritime adapted tradition, as people adapted to the interior environment. Over time, the maritime economy was lost.

Drucker (1955) incorporates ethnographic information and describes each language group along the coast including their description of where they came from. These may not necessarily be the initial colonization of the region, but do constitute the earliest oral record. The Tsimshian tradition says that they came from "a legendary place called Temlaxam ('Tuma-ham'), 'Prairie Town,' located somewhere far up the Skeena [River]" (Drucker 1955: 13). The Haida have been on Haida Gwaii "since the creation of the world" (Drucker 1955: 12). The Tlingit used to live near the mouth of the Skeena River and have migrated northward (Drucker 1955: 11-12).

Early work had several issues that limited their initial assessment of the archaeological record because it was done prior to, or at the very earliest stages of, radiocarbon dating or other absolute dating methods could not be applied to these sites. Dating was based on stratigraphy and relative positions. Secondly, the faunal remains were not usually analyzed. In the 1970s, Carlson (1998) was told that there was no comparative collection of fish for the NWC. Finally, there is the preconception that maritime adaptations were a more recent development and were a "lower class" resource (Cannon 1998, Maschner 1992, Raab and Yatsko 2009:16).

Drucker's (1955) method of looking at the migration on a group by group basis is likely the most reliable and accurate method, though it does mean applying the oral history of modern ethnographic groups thousands of years into the past. Some groups likely came down rivers, like the Tsimshian and others likely came along the coast from either the north or the south (Moss 2004: 184). The archaeological evidence from the northern NWC has vastly increased and a maritime adapted migration has been gaining support for the initial colonization of the NWC. The human remains discovered in On Your Knees Cave (OYKC) had an isotopic signature of an individual who was raised on a marine diet (Dixon 1999). "Whether they originated on the coast or in the interior is not clear, but they had knowledge of both" (Moss 2004: 184).

4.2. Cultural Chronologies

The cultural chronology for the NWC is still not clearly defined. Issues include the geographic variability and the lack of excavation on the northern NWC. There have been many attempts to unify the coast into a single chronological sequence for the entire coast (Table 4-1). The three chronologies on the left of Table 4-1 have been in use for over fifteen years (Moss 2004: 181) but all are lacking in at least one aspect, as discussed below. The chronology proposed by Fedje and Mackie (2005) incorporates many different aspects of the first three without issues with terminology, such as the use of pre-littoral.

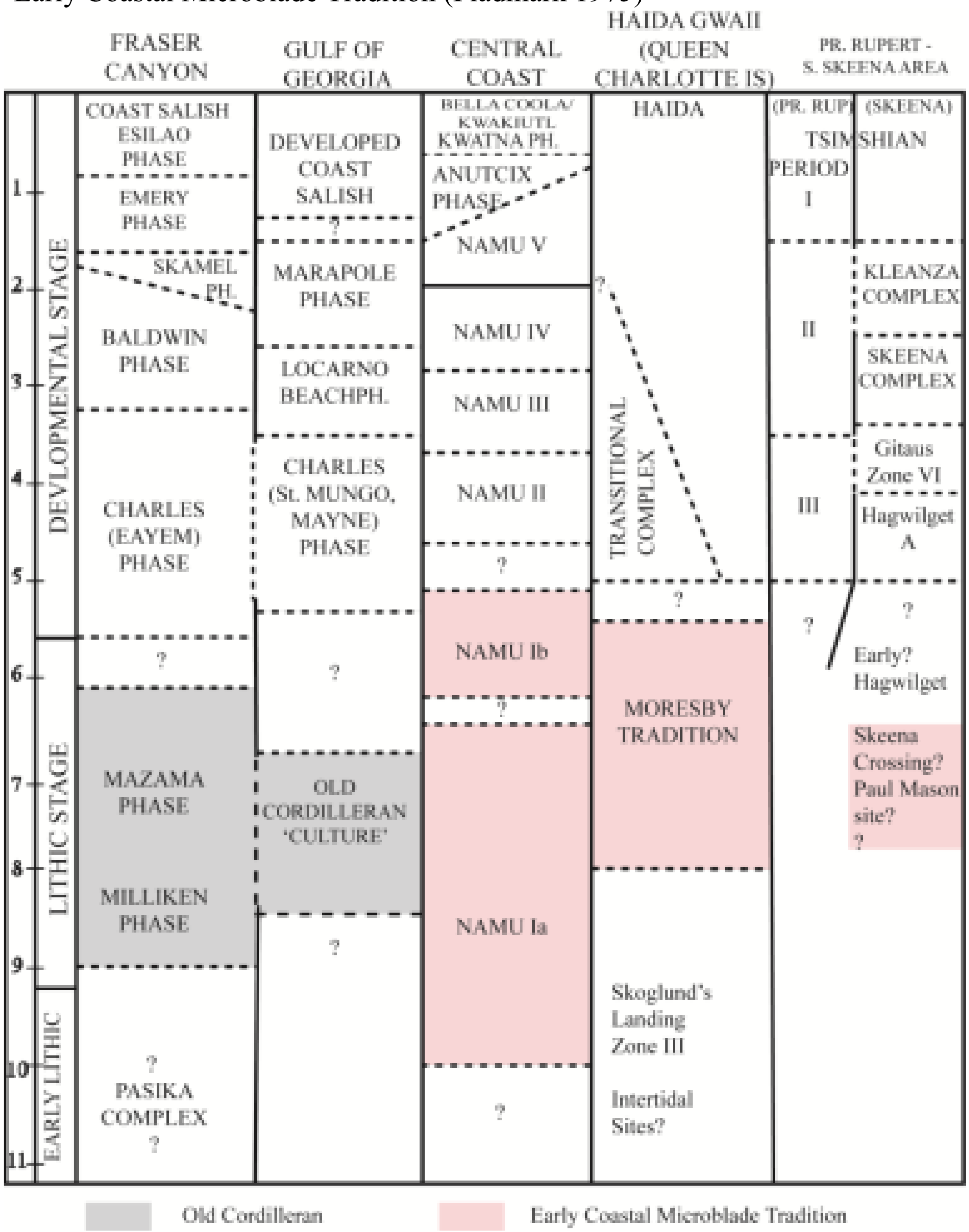
These chronologies were developed based on more complex location specific chronologies such as Fladmark (1982: 103) in Table 4-2. Here the NWC has been divided into five regions, excluding Alaska and the northern states. Fladmark has attempted to combine several nomenclatures into this table. 'Old Cordilleran' was used by Matson (and Coupland 1995), 'Protowestern' was used by Borden (1975), and 'Late Pebble Tool' was used by Carlson (1979) all to describe the same group, or phase, that was the south NWC earliest known phase. On the northern NWC (or central according to Table 4-2), the main tradition was the Early coastal Microblade tradition which was represented by the Moresby tradition and a few other sites (Namu 1a and b, Skeena Crossing and the Paul Mason site). This complex has also been called the 'Early Boreal Tradition' by Borden (1975), the 'Early Coast Microblade Complex' by Fladmark (1975) and the 'Microblade tradition by Carlson (1979). Fladmark eventually defines everything that is pre-5500 BP as the Lithic Stage.

After the Lithic Stage is the Developmental Stage (5,000/5,500 BP to contact), it was named for the development towards the ethnographic cultural present. The Developmental Stage was divided into Early, Middle, and Late. By this period, there is a paucity of evidence and complex cultural variation is recognized as transitions from one phase to another (Table 4-2) especially on the southern NWC. The Gulf of Georgia sequence of Charles, Locarno Beach, and Marpole are recognized in the Fraser Canyon and San Juan Islands making this a generalized southern NWC chronology (Borden 1975).

All of the chronologies share the division of the periods at about 5,000 BP, but the divisions between the Early and Middle Developmental phases are different for each researcher. The late period starting at 1,500 BP is agreed between all of the chronologies. Davis' (1990) chronology is based partly on Fladmark's (1975). It incorporates the Developmental in Early, Middle, and Late Phases. Following Fladmark (1975), Davis' chronology also includes a Transitional Phase, which is seen in Lyman's use of the term 'pre-littoral' in a similar way that Davis uses 'paleomarine'. However, Lyman uses the term based on the exploitation of littoral resources in Oregon (Lyman 1991). Moss and Erlandson (1998: 15) take issue with this term because "pre" indicates that it is before the littoral period and is thus a contradiction in terms. The Paleomarine phase name is derived from coastal-marine subsistence at the Hidden Falls, Ground Hog Bay 2, and Chuck Lake sites (Davis 1990: 197-198). Ames and Maschner (1999) divide the chronology into Archaic, Early Pacific, Middle Pacific, and Late Pacific. There reason for using Pacific was that other qualifying terms are unclear. Moss (1998) uses a very simplistic method of dividing the Holocene into early, middle, and late. This largely ignores the archaeology and uses environmental reasons for these divisions.

The Lithic Stage extends from at least 11,000 to 5,000 RCBYP. It can be divided into (1) the Early Coastal Biface tradition, which is also called the Pebble Tool Tradition (Carlson 1990, Fedje and Mackie 2005) and the Old Cordilleran tradition by Matson (1996) and (2) the NWC microblade tradition. The Early Coastal Biface tradition is characterized by leaf shaped points. On southern Haida Gwaii, karst caves dating to 12,500 cal BP (10,500 ^{14}C years) have the earliest evidence of this tradition (Fedje and Mackie 2005: 156). There are suggestions that these leaf-shaped points are derived from the Nenana tradition in Alaska or its Beringian antecedents (Carlson 1998, Dixon 1999, 2002, Fedje and Mackie 2005). The NWC microblade tradition is characterized by microblades, microblade cores, flake cores, pebble tools, and retouch flakes. Rarely are bifaces, abrasive stone, and ground or notched sinkers found in association with NWC microblade technology. Usually, the NWC microblade tradition is in non-shell midden contexts (Fedje and Mackie 2005: 156).

Table 4-2: NWC cultural sequence from Fladmark (1982: 103). Grey areas are the 'Old Cordilleran' (Matson and Coupland 1995). Pink areas are part of the 'Early Coastal Microblade Tradition (Fladmark 1975)



The Developmental Stage extends from 5,800 to 400 cal BP (5,000 to 250 ^{14}C years). It is divided into Early, Transitional, Middle, and Late. The Early phase dates from 5,800 to 3,800 cal BP (5,000 to 3,500 ^{14}C years) (Fedje and Mackie 2005: 156). It can be correlated with the Charles phase from the Gulf of Georgia that dates from 7,400 to 3,400 cal BP (6,500 to 3,200 ^{14}C years) (Easton 1993). The Early period is marked by occurrence of microblades that are replaced by bipolar core technology, the beginning of ground stone and ground slate lithic technologies, bone and antler wedges, points, bone awls, and shell middens (Fedje and Mackie 2005:156-157). The Transitional phase is suggested by Fladmark (1982) to be associated with the Locarno Beach phase on the south coast as between 3,800 to 2,600 cal BP (3,500 to 2,500 ^{14}C years). The Middle phase is associated with Marpole and dates from 2,600 to 2,300 BP (2,500 to 1,500 ^{14}C years). It is characterized by the traditional NWC cultural pattern including art, woodworking, plank houses, ornaments, exotic goods, and warfare. The Late phase is from 2,300 to 400 cal BP (1,500 to 250 ^{14}C years) and it is associated with the final development of ethnographic NWC cultures (Fedje and Mackie 2005: 157). All these chronologies recognize there is continuity throughout the NWC through time.

4.2.1. *Variability in site locations*

This research utilizes the known archaeological site locations from the study region to develop variables for possible site locations in the past. This means that sites dating to the last 5,800 cal BP (5000 ^{14}C years) are combined for statistical analysis. To test the hypothesis that there were no significant changes in site locations for the last 5800 cal BP, paired t-tests (alpha of 0.05) were conducted using Ames and Maschner's (1999) chronology for the division between early, middle, and late (Table 4-3). The analysis was conducted in SPSS (Statistical Package for the Social Sciences 17.0). The early period is from 5800 to 3800 cal BP (5,000 to 3,500 ^{14}C years). The middle period is from 3,800 to 2,300 cal BP (3500 to 1500 ^{14}C years). The late period is from 2,300 cal BP (1500 ^{14}C years) to modern.

The null hypothesis for the paired t-test is that the means for the variables are the same or have no significant difference. Table 4-3 values in bold can reject this hypothesis, i.e. these variables do not have similar means or site locations. Slope is the change in elevation over a specified distance, 5-m, in degrees. Aspect is the cardinal orientation of the landform. Distance from a water body (lake, stream, or tributary junction) is the Euclidean distance of a site to one of these features. However, slope from middle to late cannot reject the null hypothesis and can be assumed to be similar. Aspect from early to the middle period can only reject the null hypothesis at the 90% confidence interval. Distances from lakes for the early to the late periods and distance from tributaries for the middle to the late periods can also reject the null hypothesis. These statistics indicate that there are substantial similarities between archaeological site locations between the early, middle, and late periods for all variables except slope.

Table 4-3: Paired t-test results for variables by period (bold values can reject the null hypothesis)

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Slope - Early to Middle	***5.452***	***19.6***	***2.72***	***0***	***10.91***	***2.006***	***51***	***.050***
Slope - Early to Late	***8.07***	***16.78***	***2.33***	***3.4***	***12.74***	***3.469***	***51***	***.001***
Slope - Middle to Late	-0.05	12.35	1.23	-2.49	2.38	-.044	100	.965
Aspect - Early to Middle	***36.76***	***157.28***	***21.81***	***-7.03***	***80.54***	***1.685***	***51***	***.098***
Aspect - Early to Late	30.99	148.83	20.64	-10.45	72.42	1.501	51	.139
Aspect - Middle to Late	9.95	157.59	15.68	-21.16	41.06	.635	100	.527
Distance from coast - Early to Middle	-0.17	4.58	0.64	-1.45	1.1	-.272	51	.786
Distance from coast - Early to Late	0.38	4.46	0.62	-0.86	1.62	.623	51	.536
Distance from coast – Middle to Late	-0.12	4.78	0.48	-1.07	0.83	-.251	99	.802
Distance from stream - Early to Middle	-0.58	7.6	1.05	-2.69	1.54	-.548	51	.586
Distance from stream - Early to Late	-0.92	7.1	0.98	-2.9	1.05	-.937	51	.353
Distance from stream – Middle to Late	-0.42	7.02	0.7	-1.8	0.97	-.595	100	.553
Distance from lakes - Early to Middle	-0.46	3.26	0.45	-1.37	0.45	-1.022	51	.312
Distance from lakes - Early to Late	***-1.25***	***3.55***	***0.49***	***-2.24***	***-0.26***	***-2.537***	***51***	***.014***
Distance from lakes – Middle to Late	0.65	4.65	0.46	-0.26	1.57	1.413	100	.161
Distance from tributaries - Early to Middle	-0.67	4.57	0.63	-1.94	0.6	-1.063	51	.293
Distance from tributaries - Early to Late	-0.67	3.79	0.53	-1.73	0.38	-1.280	51	.206
Distance from tributaries - Middle – Late	***-0.78***	***4.69***	***0.47***	***-1.71***	***0.15***	***-1.665***	***99***	***.099***

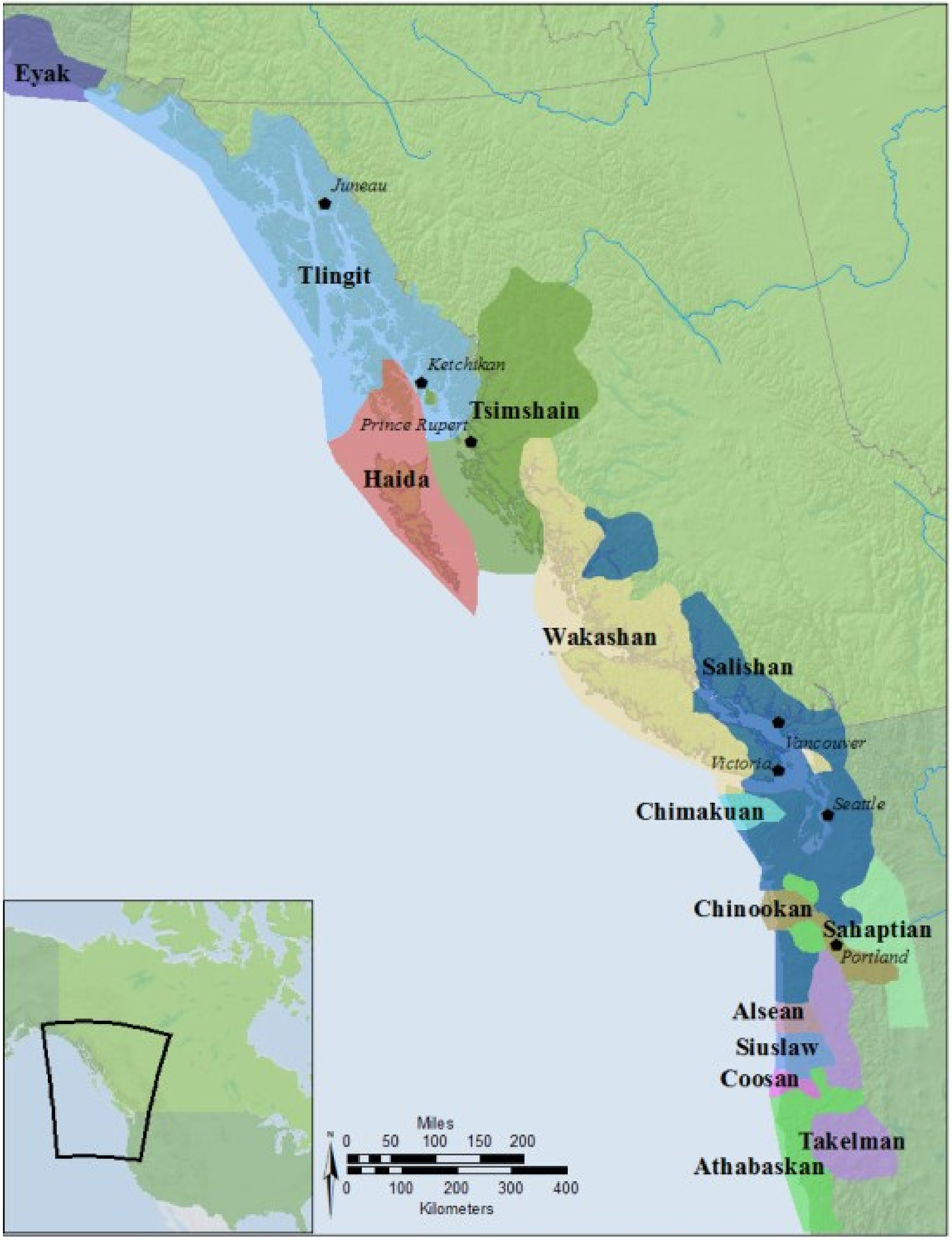


Figure 4-2: NWC language families based on Thompson and Kinkade (1990: 32)

4.3. Geographic Variability

Environmentally, different resources are available in different abundances. This variability results in part from the fact the northern NWC has significantly less available plant resources than other regions. Ethnographically and archaeologically, there is significant variation from north to south within the NWC region. This variability has led to differences in subsistence, social organization, and technology (Ames and Maschner 1999). There is also a difference in the number of archaeological surveys and excavations. As with many regions, areas adjacent to large contemporary populations have more archaeological surveys, such as around Vancouver and Victoria, but the area around Puget Sound and the Fraser River have been the focus of more archaeological work than the northern region (Carlson 1990: 113). Archaeological surveys for logging are the exception in the northern region. These are the most common archaeological survey. These survey location biases are counterbalanced by research projects on Haida Gwaii, specifically in Gwaii Haanas National Park and Reserve (Fedje and Mathewes 2005).

The distribution of yellow and red cedar affects what resources are available for building houses, canoes, clothing, baskets, boxes, and totem poles. Red cedar only grows as far north as Baranof Island, Alaska. Yellow cedar is available throughout the region, and it only grows at sea-level north of Knight Inlet (Stewart 1984: 22 -26). Plant foods were generally more important in the south than the north. Berries were used everywhere and dried for winter use and to sweeten meals. In the south, roots and corms, such as camas (*Camassia quamash*) and wapato (*Sagittaria latifolia*) were used as flour. Acorns and hazelnuts grew and were collected in the most southern areas (Oregon and Washington). In the north, people collected kelp and eel grass (Ames and Maschner 1999: 120).

The northern tribes (Tlingit and Haida) use unilateral kinship terms while the central (Kwakiutlan and Salishan) and southern (Coast Salish) coast tribes use bilateral kinship terms. The northern tribes are matrilineal but live avunculocal (Moss 2011: 121). The central tribes are matrilineal with privilege of change to other ancestral lines. The Kwakiutl are patrilineal with transfer of privileges to daughter’s son and privilege of change to other ancestral lines. Finally, the Coast Salish is patrilineal. Only the northern and some central tribes (including the Bella Bella) have matrilineal clans (also called moieties). These clans range from two to five variations per tribe (Boas 1982a [1940]: 376).

Marriage is exogamous on the north coast, but it is much more complicated. Tlingit moieties are Raven and Wolf (Eagle in the north) each with a number of clans that are further divided into lineages or house groups that have heraldic crests. Moiety membership arranges individuals into opposites that intermarried and performed social and ceremonial services for each other (De Laguna 1990: 212). Haida is divided into moieties that are Raven and Eagle. Their marriages are regularly bilateral cross-cousins (Blackman 1990: 254). The Bella Bella and Kwakiutl have exogamous marriages for obtaining new privileges and endogamous for retaining highly valued privileges within the family. Among nobility of the Coast Salish, marriage preference is to exogamous villages (Boas 1982a [1940]: 376).

The privileges of local units are based on the crests and traditions in the north and central coast. The Coast Salish privileges are based on family tradition of chief's family, but in the northern part of the Coast Salish, there are sporadically weak crests (Boas 1982a [1940]: 376). This may be a product of freed slaves returning from the north or migration of the crests from the north.

Statistical analyses indicate that the social structure did not affected site selection, as there was no significant difference in site selection in 5000 years. The social structure reviewed was based on ethnographic records and it is difficult to determine how far into the past each of the social variables extends. The review of these social structures provides a comprehensive ethnographic review in the hopes of gleaning information about the distant past.

Tlingit houses were rectangular with a low-pitched gable roof. The entry was an oval in the front of the house at the usual height of the winter snow. The four main posts were often carved and painted (de Laguna 1990: 207). Haida houses are made of red cedar timbers and planks. There are two basic forms: a seven beam roof and a four beam roof style. The larger houses included an excavated floor to increase the size of the house. In front of Haida houses are carved totem poles occasionally positioned to provide the entryway of the house through a hole in the stomach or mouth of something on the pole (Blackman 1990: 243). Bella Coola has two and six beam options with a gable roof. Some of the entryways were part of totem poles while others were simple rectangular openings. Wakashan has one and two beam house options with a gable roof. In the southern coast, there are shed-roof and gambrel-roof houses in addition to the gable roof style (Suttles 1990a: 6-7). The Chinookans of the lower Columbia River had oblong, gabled-roof, upright-cedar-plank houses. Some of these were single dwelling (Silverstein 1990: 537), while the northern house included an extended family, plus slaves, of 40 to 50 people (de Laguna 1990: 207). In terms of underwater archaeology, such substantial structures should be detectable geophysically due to subsurface disturbances.

The NWC art styles can also be divided into northern and southern style. The northern style uses formlines and adheres to composition rules. It is also called the classic style. The northern art styles have little variation on flat and two-dimensional designs within the tribal level, like boxes, while there was greater variation on large sculptures, like totems. In the south, creatures are less likely to interlock and they are generally less stylized than the north. There were greater degrees of variability among local groups and individuals (Ames and Maschner 1999: 224-226).

One of the earliest distinctions between north and south was the initial tool technologies. On the north coast, microblades were present very early (before 8800 cal BP) (Ames and Maschner 1999: 165). The southern areas had stemmed points and crescents similar to the continental interior (Carlson 1990: 61). By Middle Pacific Period (3500 to 2000 BP), there were north-south distinctions in art styles, including whale bone clubs, cranial deformation, and labret wears (Ames and Maschner 1999: 170). The Middle Pacific Period also includes common practices of house and town organization.

4.4. Development of NWC Cultures

The NWC cultures are characterized by an economic focus on salmon, the ability to store food for long periods of time, winter villages, large shell middens, complex uses for cedar, and a complex social organization. The question is how and when did these characteristics develop? Essentially this question is a “chicken or egg” type question. The options for what causes development can be broken into three aspects: (1) storage, (2) environment, and (3) control through elites. Most researchers focus on one or two of these aspects.

Storage is important because it provides a means to have food through the cold winter months. It applies mainly to stored salmon, but includes eulachon (oolichan) oil, berries, and other plant and animals that can be dried. Eulachon is a tiny fish that has so much oil it can be burned like a candle. Schalk (1977) noted that in the northern and inland riverine areas, salmon might only be available for a few days a year. On the Klukshu River in the southwest Yukon, half of the sockeye salmon run passed in 7.5 days and in a bad year, half go by in only 2.5 days (Ames and Maschner 1999: 116). This short-term abundance means that to be effective, people have to have the ability to collect and process a large number of salmon before they spoil. According to Schalk, it is the knowledge and technological ability to process and store salmon that allowed NWC cultures to develop. Schalk’s (1977) model builds on Kroeber’s (1939) interior riverine adaptation model. The ability to store salmon would have been developed in the interior prior to the migration to the coast. Burley (1980) cultivated Kroeber’s (1939) theories regarding procurement and storage developed upstream where the rivers narrow. Either the technology diffused or the people migrated downstream to the coast and then developed additional NWC culture attributes due to the coastal environment. Croes and Hackenberger (1988) develop Schalk’s model into an evolutionary mode in which they divide societies into those with and without large-scale storage. The pre-storage groups relied on shellfish in the winter months until they reached carrying capacity and subsequently developed storage techniques. This change in subsistence practices would have occurred during the Marpole period (2500 -1500 BP). Carlson (1998: 26) places the intensification of salmon use and developed of storage-based economy at approximately 7000 or more years ago.

Fladmark (1975) was a proponent of the environmental causes for the development of the NWC cultures. He proposed that the salmon resources were depressed during the LGM and early Holocene due to the glaciers covering the coasts. This meant that it was difficult for salmon could not spawn in the streams. After the glaciers melted, salmon migrated north. However, it was not until after 5000 BP, when the land and sea-level reached equilibrium, that there was a significant increase in the amount of available salmon. Fladmark (1975) linked winter villages and shell middens. Large salmon catches, processing and storage lead to people being able to stay in one spot longer and leading to the accumulation of shell middens in the winter months. This point has since been refuted as large shell middens predate the winter villages (Matson and Coupland 1995: 148).

Proponents of elite control propose that the developed NWC culture was able to develop into a ranked society because of control of resources by individuals and their ability to organize groups of people. Ames (1981) proposed that ranking appears between 3,000 and 2,000 years ago on the NWC. It developed from the interactions of subsistence specialization, environmental circumscription, and population growth. Coupland (1998) has postulated that communities first controlled and defended predictable resources, primarily salmon, as a corporate group. Resource defense and management (Moss 2011) is assisted by permanent settlements. Ownership leads to hereditary inequality and eventually the NWC cultures. Storage is important for the separation of stored good from the producers and thus creates inequality (Matson and Coupland 1995:149-150).

These three aspects (storage, environmental change, and elite control) are all concepts advanced by anthropologists to explain how and why the NWC cultures developed. It is unlikely it was any one of these alone that caused NWC cultural development. Earlier evidence continues to be found that demonstrate greater time depth for these different characteristics. Salmon has been found at Kilgii Gwaay in southern Haida Gwaii, which dates to 10,500 cal BP (9,400 ^{14}C years) (Fedje et al. 2005b: 195). Faunal remains from Chuck Lake, on Heceta Island, also support a broader economy (Ackerman et al. 1985: 122-4). Unfortunately, the archeological evidence for many cultural traits are perishable and are not identifiable in the archaeological record. Underwater archaeology has the potential for some of these perishable artifacts to survive.

Many researchers recognize a change in subsistence practices and site locations around 5000 cal BP (C. Ames et al. 2010, Fladmark 1975, 1979, Moss 1998). However, sea-level stabilized at or near modern level around this time. This may merely reflect site visibility. Conversely, sites that are older would be on paleo-coastlines and thus more difficult to locate (Baichtal and Carlson 2010, Fedje et al. 2004). C. Ames et al. (2010) specifically investigate if there is a technological change at 4850 cal BP from chipped stone to ground and polished stone, bone and antler tools. The authors conclude that the difference between chipped stone, ground stone, and faunal tools is associated with season and activity not the age of the sites. Additionally, 5000 cal BP is when the salmon streams were able to reach contemporary levels of productivity following deglaciation (Fladmark 1979). Though there is no one reason for the transition at 5000 cal BP, this date has been used by archeologists to mark the transition into the developmental phase and the development of the NWC cultures.

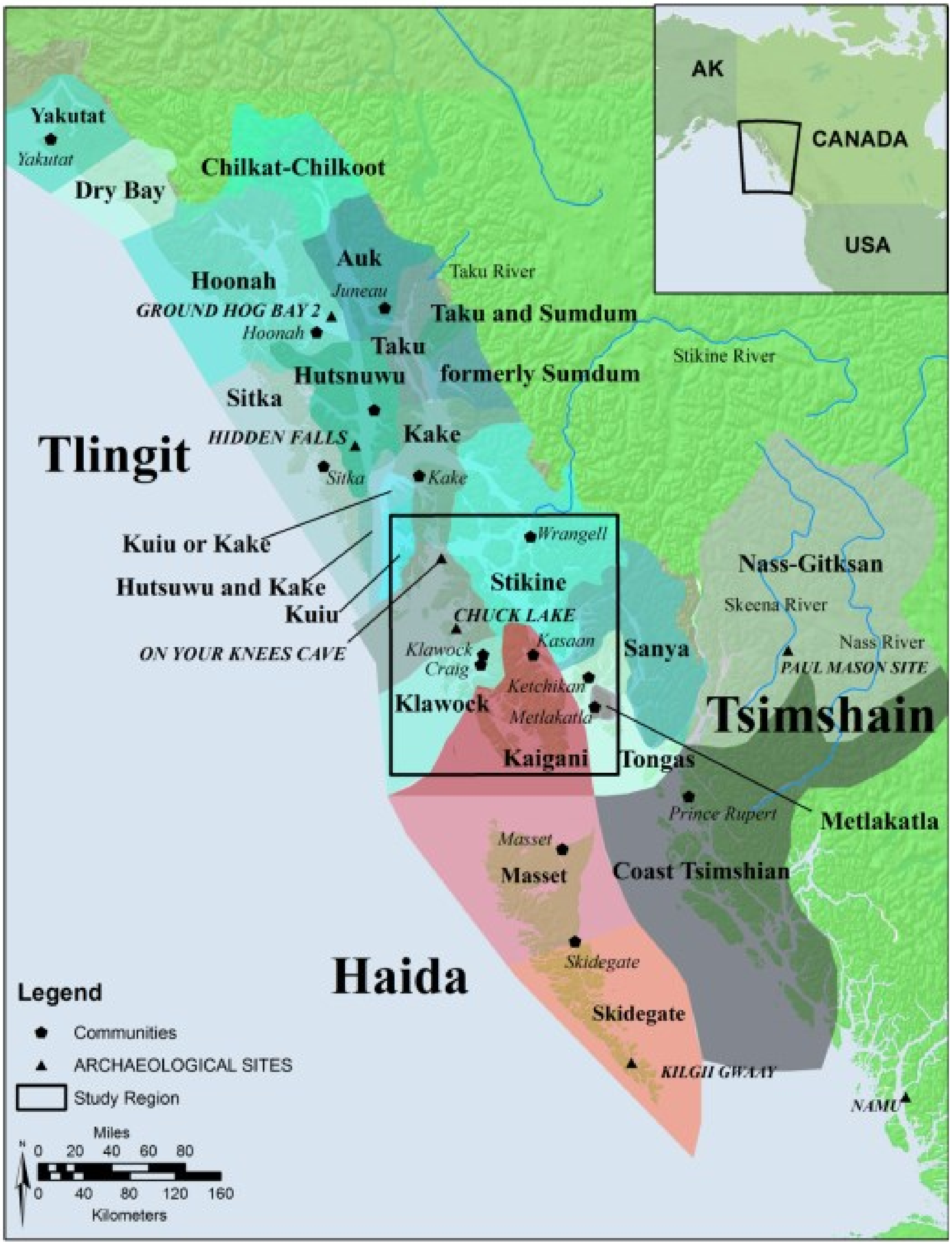


Figure 4-3: Northern NWC ethnographic groups

4.5. Northern NWC Ethnographic Groups

There are three ethnographic groups that are considered part of SE Alaska and are within the study region (Figure 4-3). The Tsimshian are mainly around the mouth of the Nass River on the mainland, but also have a reservation (the only one in Alaska) called Metlakatla on Annette Island south of Ketchikan Alaska. The Haida moved north into SE Alaska at some unknown point in the past and occupy the southern end of SE Alaska, including areas of POWI. The Tlingit have been in SE Alaska longer than the Haida, but for an unknown amount of time. They are present throughout the region, but mainly north of the Haida. The Eyak are also in SE Alaska but are north of the study region. The Tsimshian are east and south of the study region.

4.5.1. ***Tsimshian***

The Tsimshian are defined as a group based on language and common cultural traits. They live in northwest British Columbia (BC) along the Nass and Skeena rivers and at the reservation at Metlakatla, AK. There are four major divisions: the Nishja on the Nass River, the Gitksan on the Upper Skeena, the coast Tsimshian on the lower Skeena and coast, and the Southern Tsimshian on the coast and islands to the south (Halpin and Seguin 1990: 267). Coast Tsimshian and Nass-Gitksan form a language family. There may also be a third language or simply a separate dialect of Southern Tsimshian (Thompson and Kinkade 1990: 31-33).

Each local group traditionally occupied a single winter village, moving in the spring and summer to fishing villages or camps. The winter villages were usually located near available fresh water, a variety of plant and animal food resources, sheltered from strong winter winds, and preferably in a position providing defense against attack. Most activities required transportation by canoe, as it is time consuming to walk even short distances in the rainforest without cleared trails (Halpin and Seguin 1990: 269-271).

Tsimshian seasonal rounds are based on Coast and Southern Tsimshian historical accounts. When the river ice breaks up in the spring, the main activity was eulachon fishing on the Nass River. The fish were dried or processed into an oolichan oil (or grease). Their monopoly on the 'grease trade' made them very wealthy. May was for gathering and drying seaweed, usually for about a month. Herring spawn was caught in large quantities on grass, kelp, or branches suspended in the water and dried for later consumption. Men would fish off shore for halibut. women would cut them into filets for drying. Red cedar bark was collected for winter weaving. Hemlock, spruce, and lodge pole pine cambium (the layer inside the bark) was eaten contribution to the large number of culturally modified trees (CMTs). June was when sea gull eggs and oysters were gathered. Abalone was taken at the lowest tides of the spring. In the early summer, salmon begin to enter the streams and the Tsimshian move to salmon fishing camps, which were controlled by the corporate matrilineage group (or house) and managed by the chief. Throughout the summer, women were active gathering berries from house territories and then drying them or preserving them in grease. Early autumn was an intensive salmon harvesting period. Chum salmon, which were ideal for preservation because of low fat content, began to move into the rivers in the fall. Each house controlled several different fishing stations and had access to all five salmon species to provide insurance again famine due to a poor salmon run of any particular species (Halpin and Seguin 1990).

After the salmon were stored, hunting game became the major focus. Regularly hunted game included deer, elk, seal, sea lions, sea otter, mountain goats, mountain sheep, bear, porcupine, raccoons, eagles, marmots, caribou, moose, mountain lion, hares, lynx, swans, geese, ducks, and other waterfowl. In the winter months, people remained mainly in the village. Shellfish were gathered including cockles, several varieties of clams, and mussels. Women wove and men carved during the winter, which was also an important time for rituals and ceremonials events including potlatches (Halpin and Seguin 1990: 269-271). The winter villages, fishing camps (summer), and seaweed collecting camps (spring) should be visible archaeologically if they were occupied for a number of seasons and/or for the entire season.

Winter houses were constructed of massive red cedar timbers. Houses averaged 15 by 17 meters (50 by 55 feet). Thick upright planks on the four sides were grooved to fit horizontal planks, just outside the corner posts. Some people took their house planks to their spring and summer camps. The doors were either rectangular or oval and were at the gable end facing the beach. Some doors were cut into totem poles at the front of the house. The house names were inherited like crests. There were excavated pits for the central fireplace in the center of the house (Halpin and Seguin 1990: 271).

Basketry had two main techniques that were important to the Tsimshian, plaiting (which is a type of checker pattern), and twining. Men made wood working objects such as storage boxes, chests, the northern type of canoe, woodworking tools, and fishing and hunting gear (Halpin and Seguin 1990: 273-4).

Tsimshian have a four clan structure consisting of Killer Whale, Wolf, Eagle, and Raven with a few variations (such as the Gitksan having Fireweed in place of Killer Whale). The basic social unit of the Tsimshian society was a corporate matrilineage called a 'house'. The 'house' owned fishing, hunting, and gathering territories and localities that were controlled by the house chief. Crests are images and symbols of privileges that were owned by a house and ceremonially displayed. Crests were represented on architectural features (totem poles, house entrance poles, house posts, house front painting, beams, rafters, and ceremonial entrance), costume features (robes and head dresses), feast dishes, and ladles. They were used during the potlatches. The village chief was the highest-ranking house chief within the village, but the role of 'chief' only was recognized in the Coast and Southern Tsimshian (Halpin and Seguin 1990: 274 -6).

The first European contact was likely at the village of Kitkatla in 1787 by Captain Charles Duncan in the vessel *Princess Royal* and James Colnett in the *Prince of Wales* (Halpin and Seguin 1990: 281). After the Hudson's Bay Company moved Fort (later Port) Simpson to its present location, north of Prince Rupert in 1834, nine groups moved to the area of the fort. William Duncan reported there were approximately 2,300 Indians living in 140 houses around the fort in 1857. The majority of the published literature about the Tsimshian refers to the Port Simpson people (Halpin and Seguin 1990: 267-9). It is thought that the Tsimshian were not significantly impacted by the fur traders, but that missionaries had a significant impact on their culture. An Anglican preacher, William Duncan, led a group of converts to a new village on Venn Passage in 1862 and later to New Metlakatla on Annette Island in Alaska in 1887. Metlakatla is the only reservation in Alaska (Dunn and Booth 1990). By 1873, the Tsimshian that remained at Fort Simpson were Christianized and resembled 'White men' (Halpin and Seguin 1990: 281).

4.5.2. ***Haida***

Haida refers to a group distinguished by their unique langue. It is a language isolate, not part of a known language family that has considerable dialectal diversity. The three major surviving dialect clusters are Kaigani in SE Alaska, Masset in northern Haida Gwaii, and Skidegate in southern Haida Gwaii (Figure 4-3) (Blackman 1990, Langdon 1977: 105, Thompson and Kinkade 1990: 31).

At the time of European contact, the Haida lived in "towns" or villages composed of one or more matrilineal groups. By this time, the Haida had expanded into SE Alaska from the south, but it is unclear when this happened. From 1850 to 1860, Swanton and Newcombe recorded 126 habitation sites that were occupied by Haida people. Twenty of these were winter villages, the others were resource procurement camps. Haida selected winter village sites based on several criteria including: natural protection from storms and enemies, proximity to halibut banks and shellfish resources, availability of drinking water, and adequate beachfront for landing canoes. Houses were built facing the beach nested against the treeline. Ninstints, Kloo, Cumshewa, Chaatl, and Kasaan are winter villages that contained two rows of houses. Above the storm tidemark was a cluster of totem poles including those containing the dead (Blackman 1990: 241).

The Kaigani had a larger inventory of economically useful plants and animals in SE Alaska than on Haida Gwaii. SE Alaska is slightly more protected from storms than Haida Gwaii, but has colder winters and warmer summers. However, Haida Gwaii has more abundant halibut and chum salmon and better quality red cedar (Blackman 1990: 241). Halibut was quantitatively the most important fish. They were caught offshore using a V-shaped hook with line and octopus was a preferred bait. The Masset people in the 1970s identified chum salmon as the most important winter food. The Haida caught sockeye, coho, pink, and chum salmon in intertidal water in traps set in weirs in streams or with harpoons. The Haida also hunted seals, porpoises, sea lions, fur seal, sea otters, deer, beaver (in Alaska), and caribou (on Haida Gwaii). They also utilized stranded whales and numerous plants and marine invertebrates were collected.

The seasonal cycle varied locally based on available species, and summer was a time of intensive food gathering and processing. Generally, April included hunting birds and collecting their eggs and by late May to early June, people started to harvest sockeye from streams. September was favored for halibut and October also included hunting ducks and geese and trapping bears and martens. Before the end of November, the chums were smoked and transported back to the winter villages where people remained until the spring. Shellfish was eaten daily and was in the public domain, available to all. Higher valued resources, such as salmon and many berries were owned and controlled by lineages (Blackman 1990: 244-245).

Trade was an important aspect of the Haida economy. The Haida traded canoes, slaves, and shell for copper, Chilkat blankets, and moose and caribou hides with the Tlingit. The Haida traded canoes, seaweed, and dried halibut for eulachon grease, dried eulachons, and soapberries with the Tsimshian. Trade was conducted between chiefs of equivalent moieties or clans by establishing a bond of brotherhood. The Haida were also known to raid some of the southern NWC tribes for slaves (Blackman 1990: 246).

There were two basic types of Haida houses, and both were constructed of red cedar timbers and planks and were similar in finished form. Type A has seven roof beams. Six beams projected several feet beyond the front. One beam (the ridge pole) spanned the center of the house and was installed in two segments. This created an opening in the middle for a smoke hole. This type of house was the most common in central Haida Gwaii but was not found in Kaigani villages. Type B had only four roof beams that did not project outside the house. However, by the late nineteenth century, Type A was the most popular with few Type B houses found. A carved totem pole normally stood against the house façade, often with the bottom of the pole providing the entrance to the house. Houses were named, but may have more than one name based on the crests of the house owner, his economic resources or largesse, events that occurred during house construction, or physical features of the house (Blackman 1990: 242-4, Langdon 1977: 107).

Haida society was divided into two moieties, Raven and Eagle. Each clan has several lineages or families. Haida lineages differ from Tlingit lineages in that there are no relations between the clans. They are completely fissioned. The Haida lineages trace their origins to several supernatural women of the Raven and Eagle moieties. The Eagle moiety might have been of foreign origin, possibly Tsimshian people. The lineages were named often with reference to the group's origin, special property, or quality. Some lineages, especially those that migrated to SE Alaska, were divided into sub-lineages. These can be conceptualized as houses and likely reflect a Tlingit influence. The lineages controlled both real and incorporeal property including salmon spawning streams, lakes, trapping sites, patches of edible plants (cinquefoil, fireweed, high-bush and bog cranberry, and crabapple), stands of cedar trees, bird rookeries, and stretches of coastline. It has been suggested the lineages also owned halibut banks, but in the 1970s the Masset Haida clarified that neither the halibut banks nor the sea were aboriginally lineage properties. Incorporeal property included a repository of names (personal, canoe, fish-trap, house, and spoon names), dances, songs, stories, and crest figures. The lineages were controlled by a hereditary chief who was the trustee of lineage properties. For multi-lineage towns, the highest authority was the "town master" or "town mother" which was a title held by the highest ranking lineage chief (Blackman 1990: 248-51, Swanton 1905: 100).

The Haida practiced a class system. Titles were handed down at potlatches to children of high-ranking lineages by their parents. People who did not have potlatches held in their benefit were not high-ranked and did not succeed as well as high-ranked individuals in economic endeavors. Slaves were war captives and their offspring. Ceremonies were directly related to rank in Haida society (Blackman 1990: 252).

The first recorded contact with Europeans was in 1774 by Juan Perez at Langara Island on Haida Gwaii and on Dall Island in Alaska. European and American mariners traded extensively with the Haida throughout the late eighteenth and early nineteenth centuries. The Haida traded sea otter pelts for manufactured goods. Potato cultivation was introduced by traders. By 1825, the Haida were growing large quantities of potatoes and trading them with the Coast Tsimshian and later the Hudson's Bay Company. The Haida were regarded as skilled traders and were able to increase the price they received for their pelts. It is unclear the full effect that the European traders had on the Haida, but introduced diseases significantly decreased the population. The last traditional house and frontal totem-pole raising occurred in the winter of 1881 (Blackman 1990: 255-7, Gibson 1992).

4.5.3. ***Tlingit***

The Tlingit share a common language and customs (de Laguna 1990: 203). Tlingit is a Na-Dené language. It is similar to Eyak and Athapaskan (Figure 4-3). Tlingit is a homogeneous language with only mild dialect diversity. The dialects of Tlingit are Gulf Coast, Inland, Northern, and Southern (Thompson and Kinkade 1990: 31). Recent research indicates that Ket, a Yeniseian language from central Siberia, is related to Tlingit and Eyak (Kari and Potter 2010).

There are three major groups of tribes (Figure 4-3): the Gulf Coast, the Northern Tlingit, and the Southern Tlingit. There also are inland Tlingit, including groups in the Yukon, but this review focuses specifically on the Coastal Tlingit. The Gulf Coast Tlingit include the Dry Bay and after contact the Yakutat. The Yakutat are a group of Eyak that joined the Dry Bay Tlingit. The Northern Tlingit include the Hoonah, the Chilkat-Chilkoot, Auk, Taku, Sumdum, Sitka, and Hutsnuwu. The Southern Tlingit include the Kake, Kuiu, Henya, Klawak, Stikine (or Wrangell), Tongass, and Sanya (or Cape Fox). The tribes (and in Figure 4-3) are local communities consisting of several clans united by propinquity and intermarriage. Tlingit society is organized in matrilineal clans of two exogamous moieties. The clans held the territorial rights, and the tribes lacked chiefs or councils (de Laguna 1990: 203-5, Langdon 1977: 63-4).

Tlingit tribes had at least one principal village that was occupied in the winter. In the summer, it was deserted when the families left for hunting and fishing camps. Additional settlements were formed when immigrant groups arrived or if an old village was being abandoned or divided due to disputes, war, or disease. The preference for village locations is within sheltered bays with a sandy beach from which there is a view of approaches with nearby salmon streams. Proximity of hunting areas, berry patches, clam beds, fresh water, good timber, or special resources (such as halibut deeps, sealing grounds, or trails to the interior) also was important factors in site selection. Within the village, houses were arranged in a row facing the water. In front of the houses were canoes under mats, fish racks, garbage disposal areas, and totem poles. The graveyard was usually at the end of the row of houses or on an island opposite the settlement. Behind the houses were smokehouses, caches, steam bath huts, and women's menstruation and childbirth huts (de Laguna 1990: 206-7).

Seasonal rounds varied not only geographically, but different families might choose to follow different pursuits thus providing a more reliable and diverse resource base. Generally, the spring included hunting and trapping bear, marten, mink, beaver, sea otter, fur seal; catching halibut in deep water; collecting shellfish, seaweed, and herring spawn; and, gathering eulachon and processing it for oil. The first Chinook salmon runs began in April and May and much of the summer was spent catching and curing salmon. In addition to collecting berries, some Tlingit were occupied with harbor seal hunting, warfare, and slave raids to the south. The fall was a time for sea otter hunting, but catching salmon, smoking it, and picking the last of the berries were often more important. From collecting at the salmon streams, many people went straight to hunting because the animals were fattest at that time of year. By middle October, many families were established in their winter villages. The winter months were the time for ceremonies, trading trips into the interior, and craft work (de Laguna 1990: 206, Oberg 1973).

Tlingit houses were rectangular with low-pitched gable roofs. They accommodated around 40 to 50 people, including approximately six families. The center was excavated and planked to form a central fire pit. There were one or more wide wooden platforms, the highest of which were used as family sleeping areas. These sleeping areas were partitioned with wood screens, mats, or boxes. Under the platforms in dark holes was where some girls spent their puberty confinement or accused people were imprisoned until they confessed. Steam baths were also under the floor accessed by a trapdoor near the fire. The front entrance was an oval set above the usual winter snow level. The only other opening was a smoke hole with a screen that could be tilted against the wind. Wall planks were either vertical or horizontal. The four main house posts were carved and painted with totemic and ancestral figures. Houses, their posts, and totem poles were named, and were owned by the lineage or clan houses. The houses built in a hurry were made of spruce or cedars bark (de Laguna 1990: 207, Oberg 1973).

Because of the limited distribution of red cedar, most Tlingit primarily made their canoes from large spruce and paddles from yellow cedar. The Southern Tlingit had access to red cedar and Tlingits preferred Haida canoes for their size. They were involved in intertribal trade with Eyak, Tsimshian, Haida, and subarctic Athapaskan tribes. Trade was usually between “partners” who were members of the same moiety but from different or between “brothers-in-law” who were members of opposite moieties, or between “fathers- and sons-in-law”. Clan leaders owned the trails into the interior. They forbade direct contact between ‘Whites’ and interior Athapaskan (de Laguna 1990: 208-9).

Tlingit oral history indicates that clans migrated northward from the Tsimshian peninsula and that later other clans moved down the Skeena, Nass, Stikine, and Taku Rivers at a time when they were blocked by glacial ice (de Laguna 1990: 206, Langdon 1977: 67). “Human occupation of the Tlingit coast could have begun 10,000 years ago” (de Laguna 1990: 206). In the eighteenth century, the Tlingit were expanding into the Gulf Coast of Alaska, possibly due to the displacement of Southern

Table 4-4: Tlingit tribes adopting corporate structure (from de Laguna 1990: 225)

Historic Identity	**Location in 1980**	**Village Corporation**
Yakutat	Yakutat	Yak-tak Corporation
Hoonah	Hoonah	Huna Totem Corporation
Chilkat	Klukwan and Haines	Klukwan Corporation
Auk	Juneau	Goldbelt Corporation
Taku		
Sitka	Sitka	Shee-Atika Corporation
Hutsnuwu	Angoon	Hootznoowoo, Inc.
Sumdum	Juneau	
Kake	Kake	Kake Tribal Corporation
Kuiu		
Klawak	Kalwock	Klawock Heenya Shaan-Seet, Inc.
Henya	Craig	
Stikine	Wrangell	
Tongass	Ketchikan	Cape Fox Corporation
Sanya		

Tlingit groups from the Haida's northward migration into SE Alaska. The Northern Tlingit territories likely were occupied between AD 1200 and 1700 when the glaciers were smaller than they are now, but archaeological remains have not been discovered.

Tlingit social, political, and economic organizations were based around the two moieties: Raven and Wolf (sometime Eagle in the north). Each moiety included approximately 30 clans that were further subdivided into lineages or house groups. Memberships in all three groups were matrilineal. Moieties never met and were not social groups. they simply arranged people into opposites. These opposites were required to perform important social and ceremonial services (Boas 1982a [1940]: 376). The Henya had an Eagle clan that was outside the other two moieties. Tlingit clans and houses possessed territories and the rights to: all game, fish, berries, timber, drinking water, and trade routes; house sites in the winter village; and, totemic crests, decorations of houses, heirloom objects, and personal names. The chiefs were trustees and administrators of these properties (de Laguna 1990: 212-3, Oberg 1973).

European contact is first recorded in 1741 by the Russian explorer Alexei Chirkov. The Russians lost two boats in the encounter. Later, there was Bruno de Hezeta in 1775 from Spain who explored Klawak, Sitka, and Hoonah territory and as a result of this contact, infected the Sitka Tlingit with smallpox. Many Russian, British, and American vessels visited the Tlingit during this period. In 1799, Aleksandr Baranov established a fort at Sitka, which was captured by the Tlingit in 1802. In 1804, the Russians reclaimed the area and established Novo-Arkangel'sk (New Archangel), later Sitka. In 1808, this became the headquarters of the Russian-American Company. Alaska was purchased from the Russians in 1867, despite Tlingit demands that the Russians did not own Alaska. In 1971, the Tlingit and Alaska Haida formed the Sealaska Regional Corporation and village corporations in 10 villages (Table 4-4), under the provisions of the Alaska Native Claims Settlement Act. This reinvigorated a revival in Tlingit culture. Since 1970, Tlingit art (singing, dancing, and wood carving) has flourished along with potlatches and other traditional practices (de Laguna 1990: 223-226, Gibson 1992, Worl 1990).

4.6. Site Location Descriptions

In addition to the general descriptions of where Native people lived in SE Alaska prior to the time of Euro-American contact, a few quotes illustrate the factors underlying the selection of winter village locations. These are the types of sites that would be the most visible archeologically, especially house structures with excavated pits similar to the ethnographic plank houses.

Meares (1790: 109), an English ship captain, noted that Nootka was located in a protected harbor or bay. This does not indicate the location of their fresh water source. On June 28, 1788, Meares (1790: 146) notes that the village of Wiscanaish moved from close to the sea to the inner port. The next day they came across another group that is identified as being under Wicanaish's domain. Their village located along an open stretch of coast (1790: 152). When he entered the Strait of Juan de Fuca, Meares' saw villages on high banks close to the sea (1790: 157). "On the main land there are large and populous villages, well watered by rivulets, where great numbers of salmon are taken, which, when prepared properly, constitutes a principal part of their winter's food" (Mears 1790: 172).

Mary Gormly (1971: 163) says that the Tlingits of Bucareli Bay had their houses in defendable positions, usually on steep and rugged hills that were approached by a ladder. Moss and Erlandson (1992) discuss this archaeologically. Forts are seen in the Late Period and Ethnographic period as warfare became more predominant.

De Laguna worked with the Angoon Tlingit investigating both archaeology and ethnography. She states:

> "Most of the village sites were small flats, cramped between the beach and the steep hillside, and where space permitted the houses were ranged in a line just above the water. Sites for settlements were chosen more for a good landing beach for canoes then for convenient access by trail to inland hunting or trapping grounds. Summer villages and camps might be far up the bays near the salmon streams, but for the winter villages of permanent houses the

> people prized a view of the more open water across which the canoes of their friends or their enemies might be seen approaching" (de Laguna 1960: 30).

Archaeologically, Moss (1992: 7) describes sites being located in proximity to food sources and on banks or mouths of salmon streams. These would be the summer camps not the winter villages. These site location descriptions, in addition to the ones from the main text, provide a means of creating the archaeological site high potential model.

More generally, Easton (1993: 3) states

> "If we accept the assumption that most coastally adapted populations live close to the existing shoreline of the day, as they do today and have in the documented past, then rising RSL [relative sea-levels] would inundate evidence of ancient shoreline occupations".

These descriptions were qualitatively incorporated into the weighting process. This includes increasing the weight to coastlines that demonstrate moderate sinuosity to locate the bays where people would have preferred to live. Higher weights were assigned to streams and lakes for inland fishing grounds and possible routes into the interior. These locations are incorporated into the decisions regarding the weight of variables within the models. It is a basic assumption of this research that ancient habitation sites in SE Alaska would have been near the coast.

5. The Land-Use Model

An archaeological land-use model is designed with the intention of locating high potential areas for the occurrence of areas where past people would have exploited resources and the environment. The majority of the inputs into these models are environmental (slope, aspect, and distance from fresh water). Other variables are more subjective, such as distance from resource patches or between known archaeological sites (because the locations are incomplete). The time depth of the model must be incorporated into its development. Many models and maps are created utilizing the modern land surface, despite knowledge of temporal variability of the environment. Because the focus of this research is from 10,500 to 16,000 cal BP, resource patches are difficult to identify and locate and consequently they are not applicable variables for model development in this case. However, land sea-level relationships can be reconstructed to appropriate temporal intervals, or “time slices”, using modern bathymetry and sea-level history. Since the majority of the resources exploited by people along the northern NWC were maritime resources, the coastline is an appropriate approximation

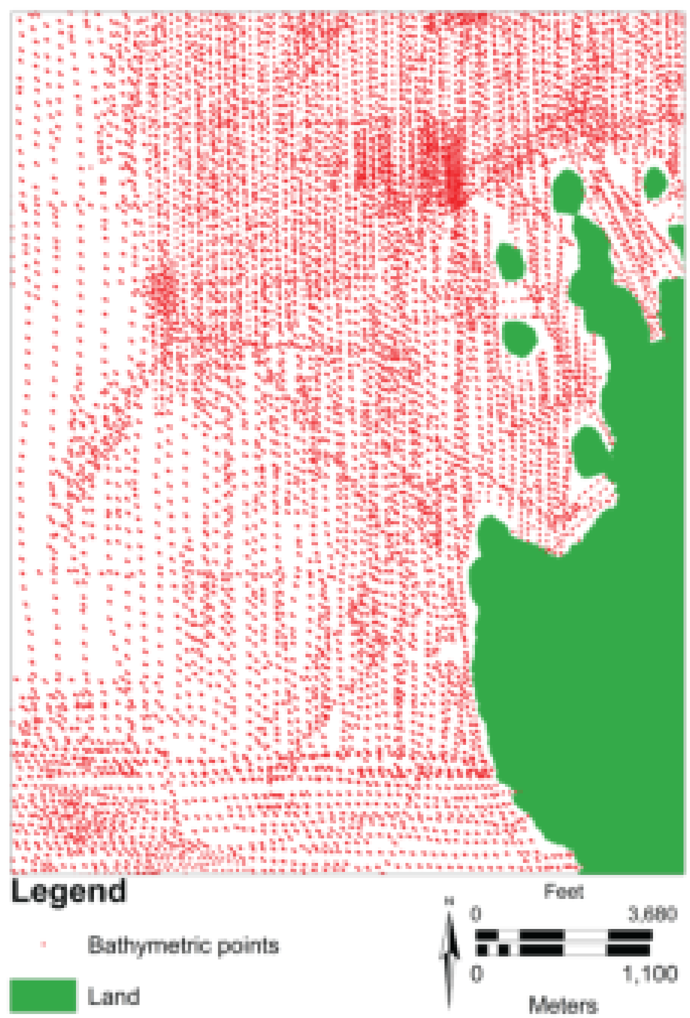


Figure 5-1: Distribution of data points included in the bathymetry DEM

for resource locations. The data sources used to create the paleo-landscapes and the models are discussed below, followed by the method for creating the models.

5.1. Data

The vector (point, line, and polygon) data were downloaded from the Alaska State Geo-Spatial Data Clearinghouse (ASGDC). This includes hydrology (including rivers and lakes), communities, modern glacial extent, and coastlines. These data sets were used for visualization and data exploration. The geology maps for the region were also downloaded as vector data from ASGDC. This was polygon data of Gehrels and Bergs' 1982 map of the exposed geology of southeastern Alaska. These were used to characterize the geology of the land within the survey areas (see 3.7 Project Study Area – Shakan Bay). The Canadian data was downloaded from GeoBase. GeoBase mainly provided hydrology shape files and topographic maps. (Topographic maps were no longer needed with ArcGIS 10, because they are provided as a streaming data layer.)

NOAA nautical charts were downloaded from the NOAA website. These were used to test the accuracy of the DEM (digital elevation model) produced for this project, to analyze bottom composition, and for data exploration. From the USGS (United States Geological Survey) publications website, the shape files for Carrara and colleagues (2003) publication were downloaded. These files were used by Yadeeh Sawyer, a UNM Biology graduate student, to create a Last Glacial Maximum extent for southeast Alaska. Raw GIS files were also provided by the Tongass National Forest courtesy of James Baichtal. These data was used mainly for exploration and mapping purposes, not for data analysis.

5.1.1. *Bathymetry and DEM*

Bathymetry is the topography of the seafloor. Unlike land features, there are few sources to downloaded compiled elevation models of the seafloor. Initially, a one arc second grid file was obtained from the NOAA website. This file later proved to have too many data errors to be useful for analysis. Data was downloaded from the hydrology section of the NOAA website. This included sounding data from early surveys, multibeam sonar surveys, and other surveys within the region (Appendix A**:** Bathymetry Metadata). The geographic extent of the study region was used to limit the search.

All of the data were downloaded as xyz point files (ASCII). These files were processed using a python script (Appendix B: Python Scripts and Geoprocessing Steps - Converting xyz and bag files to ArcGIS points) that converted the data to point shape files in UTM Zone 8 North. The steps included converting the files to comma-delimited files, adding a header (“Lat, Long, Z”), generating an XY extent, then converting the XY extent into a shape file, and finally converting the NAD83 shape file into UTM Zone 8 North. There were 710 files in total, 365 were in UTM Zone 8N originally. After all of the files were in the same format, they were merged in ArcGIS 10.0.

Other bathymetry data were purchased with NSF (OPP #0703980) funding from Scientific Fishers Inc. (SciFish Inc.) in Anchorage, Alaska. This included bathymetry points and

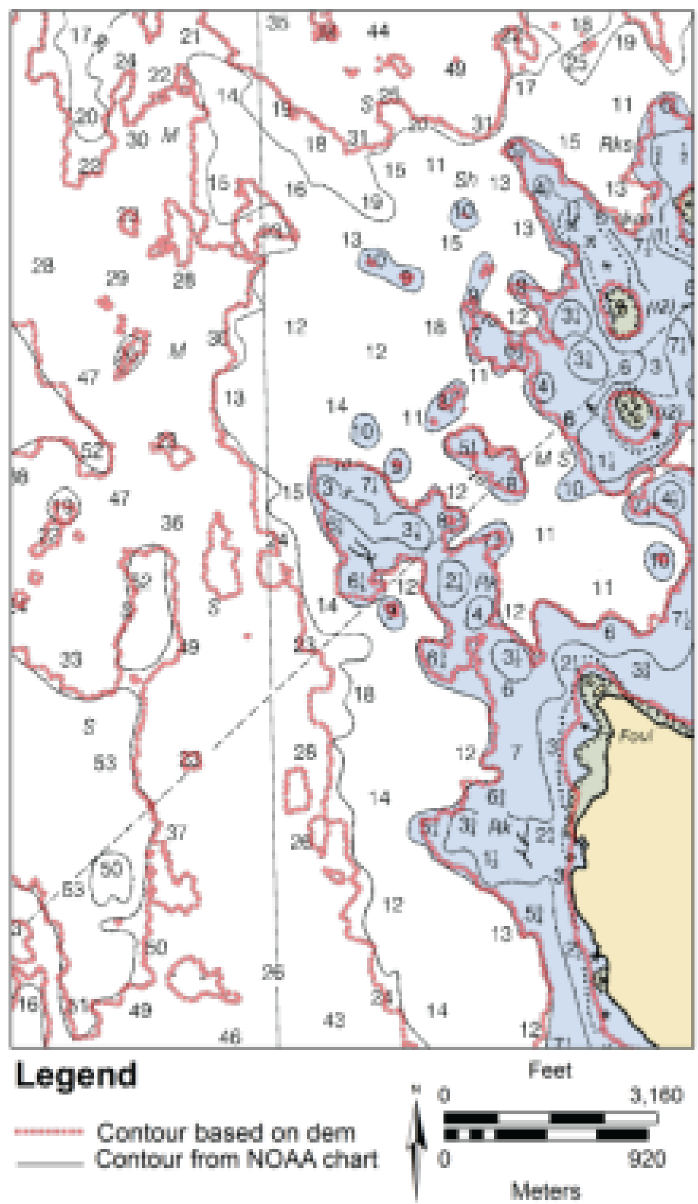


Figure 5-2: DEM generated for this project over NOAA chart with matching contour lines (solid are NOAA, dotted are DEM).

coastal points. The coastline of this data was actually at 9 meters elevation. The NOAA data were merged in ArcGIS with the coastal and bathymetry data from SciFish Inc. to form the final bathymetry data used to generate the DEM.

The land topography was downloaded from the USGS website using Earthexplorer. The NED (National Elevation Dataset, Gesch et al. 2002) was used. This has a resolution of 1-arc second in the study region. These DEMs were merged to form a single land surface for the study region with a resolution of 25 meters. Initially, this raster image was added together using spatial analyst math, but because these data only were added to cells with zero value, there was significant distortion near the coasts at the junction of these two raster images. In addition, the 9-meter vertical elevation of the coastline in the bathymetry file meant that any data below this elevation in the DEM was excluded. This meant there was a data gap between 0 and 9 meters elevation. The DEM was converted to points at 25-meter intervals (horizontally) to avoid this issue.

To create the final seamless DEM including both the bathymetry and the land topography, the point files from the bathymetry and the land were merged to form a large (over 40 million point) data file (Figure 5-1). This file was then converted to a raster using Inverse Weighted Distance (IWD) in ArcGIS's 3D Analyst at 5 m resolution. A minimum of 4 points were used per cell with a variable search radius and a power of 1. The final DEM has elevations ranging from -5,234 to 1,980 meters.

The DEM was tested using multiple methods. First, the data were compared to NOAA charts for the region (Figure 5-2). The contour lines used by NOAA (10, 25, and 50 fathoms) were converted to meters (18.29, 45.72, and 91.44 m) to aid visual comparison between the NOAA charts and the DEM. Generally, the contour lines [NOAA solid line (black). DEM dotted line (red), Figure 6] match between the two data sets. The differences between the contour lines are in places where there are no NOAA data. Although the DEM and NOAA charts are generally consistent, this could suggests that the larger dataset used to compile the DEM may be of higher resolution.

A Spline DEM (ArcGIS 10.0 - 3D analyst tool) was generated at 5 m resolution. Figure 5-3A is the Spline DEM using the same color ramp as Figure 5-3B. Figure 5-3C was generated by subtracting the Spline DEM from the IDW DEM. Land was added as a semi-transparent green for reference. The dark areas are places at which the DEMs differed. Although the southwest location lies beyond the continental shelf and has little data, it was included because it fell within the rectangular shape of the study region. Other than for a few smaller anomalies, the two DEM are very similar. Because the two DEMs correlate spatially in the study area, the IDW DEM was determined to be adequate for this study.

Figure 5-4 represents the difference between the multibeam data collected in May 2012. The multibeam data was subtracted from the DEM using raster math. The multibeam and the DEM have some variability (mean 5.24, standard deviation 27.24) between their interpretations of the seafloor. The maximum variability is 29 m. The multibeam values appear to be below the DEM in the south-southeast and above the DEM through the majority of the area. This discrepancy corresponds,

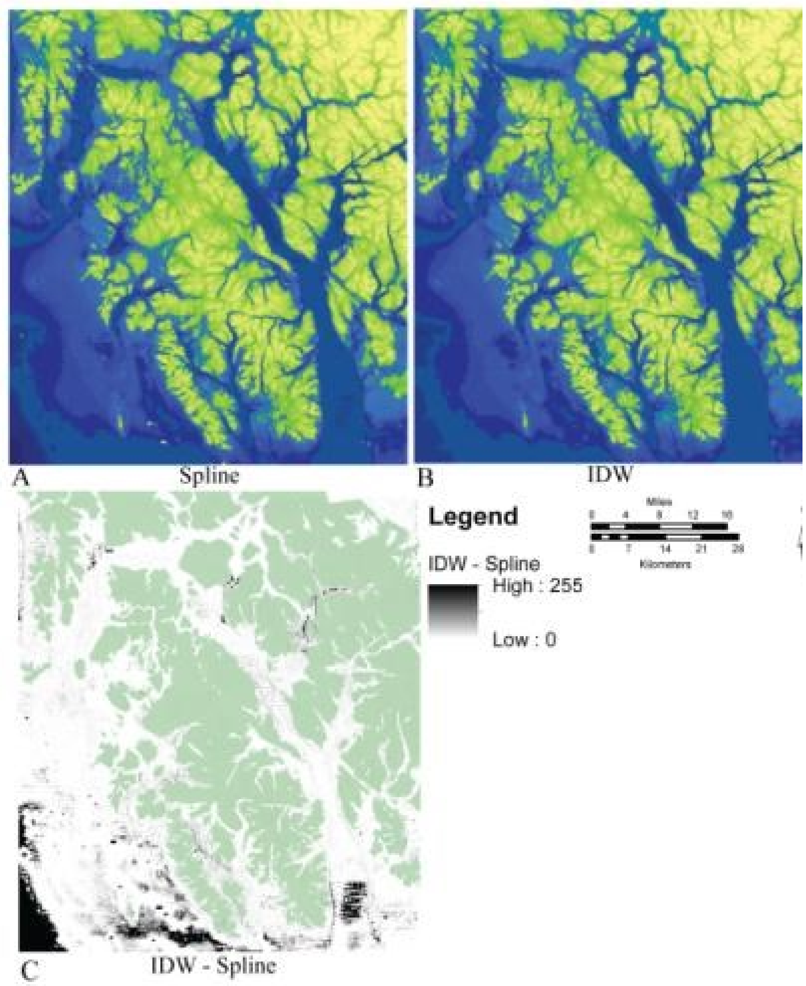


Figure 5-3: Comparison of Spline and IDW DEM methods. A) Spline DEM. B) IDW DEM. C) IDW minus Spline DEMs with land. Comparison was conducted between the IDW and a Spline version of the DEM to determine if there would be a significant difference in results between the IDW and a Spline version of the DEM.

partially, to when the surveys were conducted. Hence, a possible explanation is that there is an error in the tidal corrections or the velocity of sound corrections. This can be corrected using different post-processing methods and more careful collection.

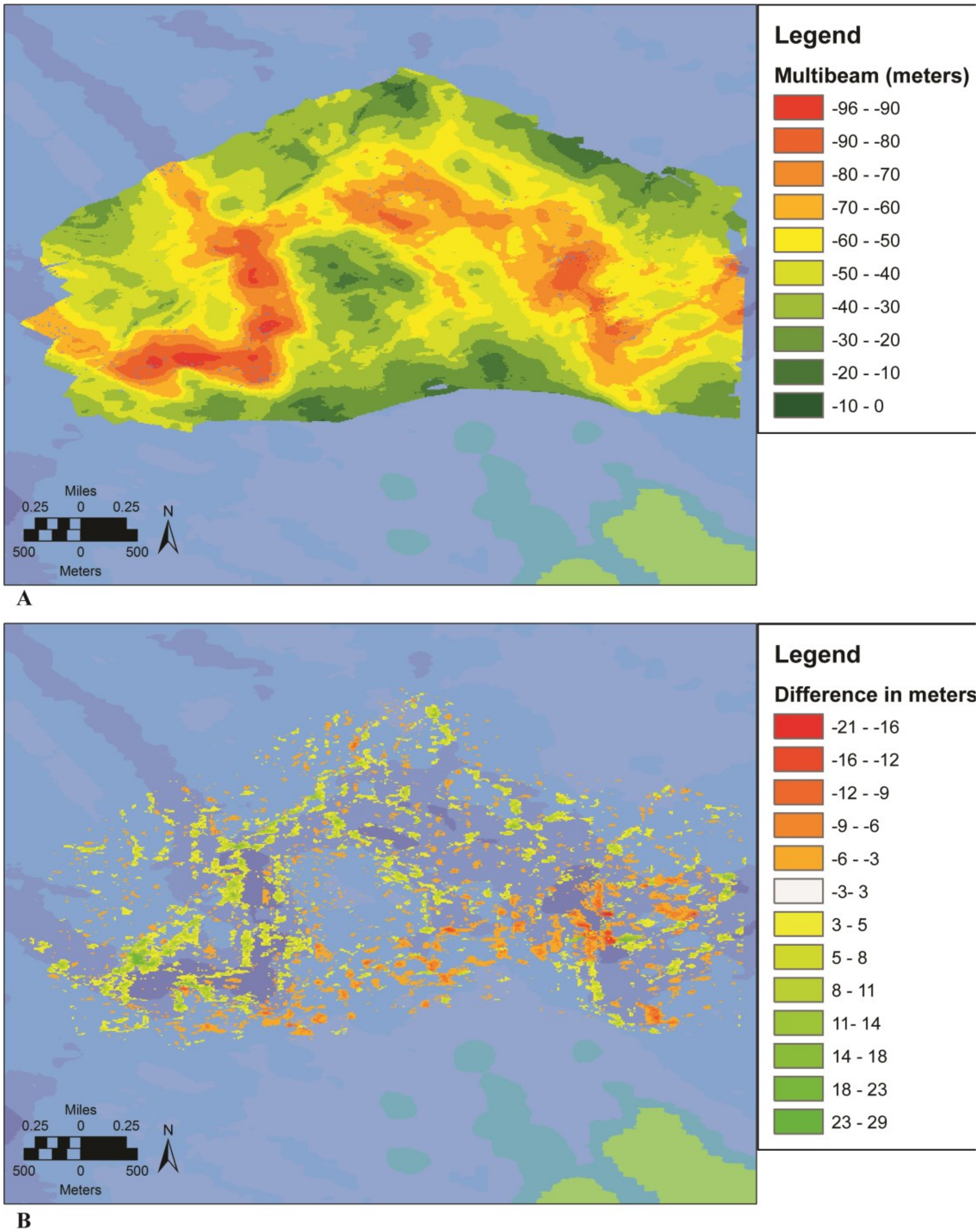


Figure 5-4: Multibeam. A) Multibeam data collected for Shakan Bay in 2012. B) Difference between DEM and multibeam at 10 m resolution.

5.1.2. ***Archaeological Site Data***

In total, there are 7,447 archaeological sites in the project's database (Figure 5-6). These data were provided by the Alaska SHPO and BC Archaeology Branch in January 2009. These sites range from the northern half of Vancouver Island (50° 3.3' N) to just north of Juneau, Alaska (58° 53.8' N). The BC data followed forest district boundaries and includes Haida Gwaii, North Island-Central Coast, and North Coast Forest. The Alaskan data encompass everything south of Juneau in Southeast Alaska.

The descriptive information for many of the archaeological sites is limited, but locational information is nearly always present. Only 254 of the sites in the Alaskan database include radiocarbon dates. Some additional radiocarbon data were obtained from published sources and the Canadian Archaeological Radiocarbon Database (canadianarchaeology.ca).

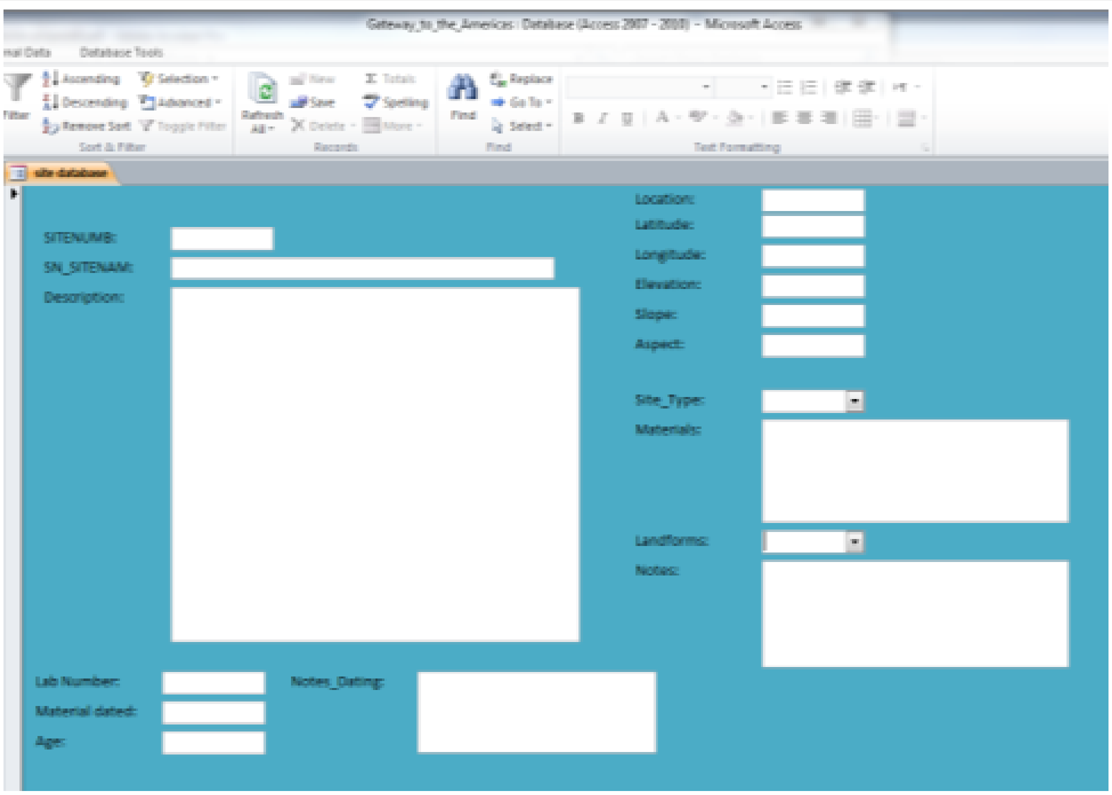


Figure 5-5: Archaeological site database, form view.

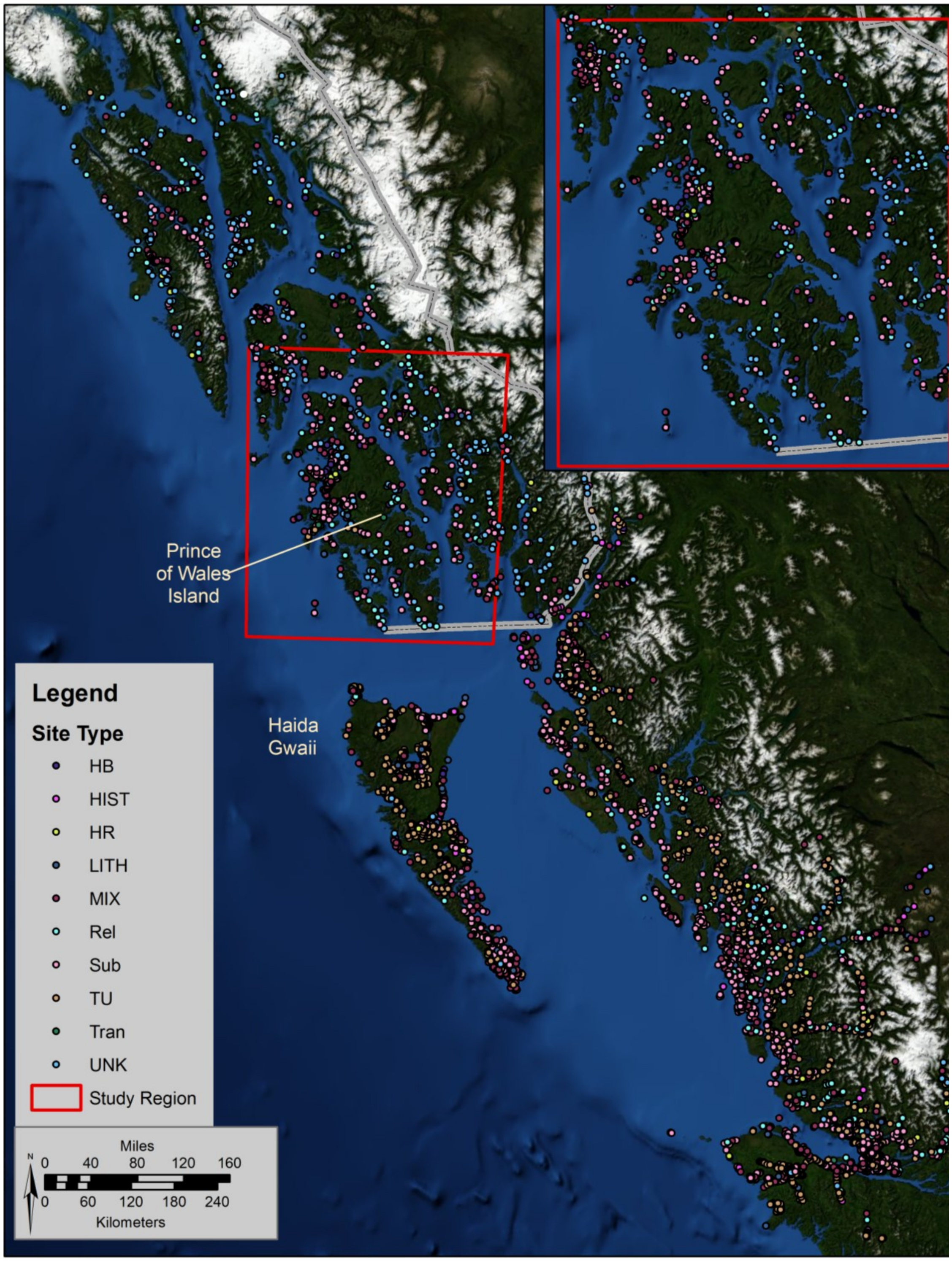


Figure 5-6: Map of archaeological sites in database (see Table 5-1 for site types)

The database was set up to incorporate information from the BC Archaeology Branch and AK SHPO archaeological databases. Figure 5-5 is the form view of the database. The data provided by these agencies completed the following fields: the site number [‘SITNUMB’], site name [‘SN_SITENAM’], ‘Description’, ‘Material dated’, ‘Age’, ‘Latitude’, and ‘Longitude’ fields. ArcGIS 9.3 was used to calculate the ‘Elevation’, ‘Slope’, and ‘Aspect’. ‘Site_Type’, ‘Materials’, and ‘Landforms’ were derived from the information contained in other relevant fields. The BC data include the site number, name, temporary number, locational information (including latitude and longitude, and accuracy), typology (describes the site type and location), a feature description, and a date field. Typology and feature description were used to create the ‘Site_Type’, ‘materials’, and ‘Landforms’ fields for the BC data. The Alaska data included site name, number, a description, location description, locational information, and a date field. The description, location description, and location information were used to create the ‘Site_Type’, ‘materials’, and ‘Landforms’ fields for the Alaskan data.

All archaeological site types found in SE Alaska were incorporated in the modeling process and statistical analysis. In total, there are 1077 known archaeological sites within the study region.

Table 5-1 and Figure 5-7 have the ten identified site types and their frequency in the study region. Assuming a sample population requirement of 20, statistically, there are enough sites in each category for statistically valid analysis for each site type except for lithic, human remains, traditional use, and historic. Site types that would not be useful for the modeling process are traditional use, historic, and human remains. Religious sites may be useful if petroglyphs or pictographs could be identified with the ROV, but the locations are likely not useful for modeling. To ensure that archaeological site locations are not randomly located on the landscape, statistics for each variable were calculated for the archaeological site database and for 1000 randomly generated locations.

Table 5-1: Frequency of archaeological site types within study region

Site Type		**Frequency**
Subsistence	Sub	449
Mixed	MIX	323
Religious	Rel	102
Habitation	HB	66
Unknown	UNK	56
Transportation	Tran	34
Lithic	LITH	19
Human Remains	HR	15
Traditional Use	TU	12
Historic	HIST	1

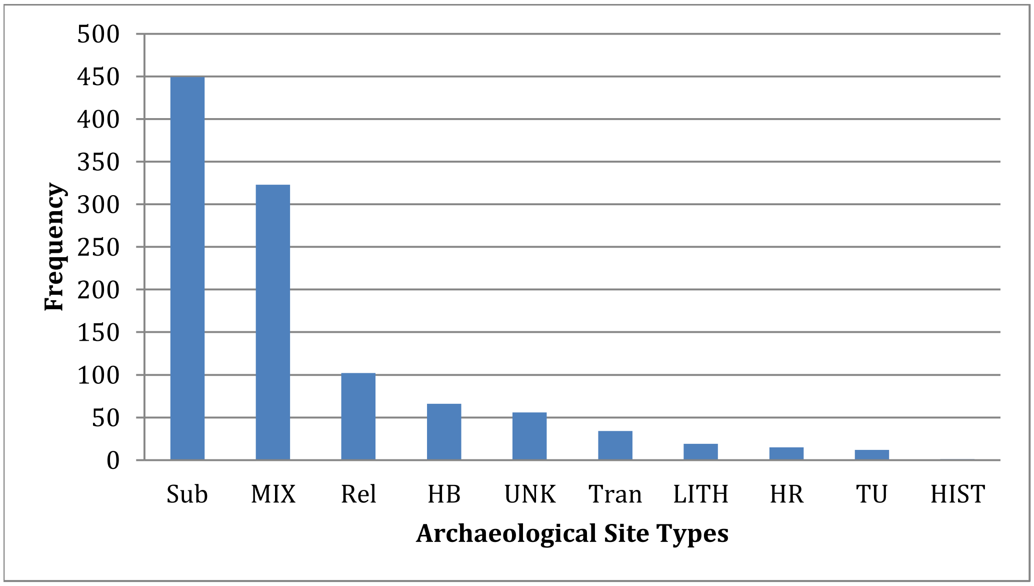


Figure 5-7: Histogram of Archaeological Site Types

5.2. The Three Stages of the Model

The archaeological high potential model was developed in three stages (Figure 5-8). Stage 1 is the GIS and includes gathering data, formatting it, and incorporating it into an ArcGIS database. Stage 2 can be divided into two types of products. Intermediate products are the raster datasets derived from the Stage 1 data. These include slope, aspect, coastal sinuosity, and the distance from coast to fresh water and other archaeological sites. The final products are weighted to develop overlays that depict the high potential areas. The third stage of the model was testing. It was conducted in two ways. The first (stage 3a) was statistical testing (cross-validation using Kvamme's Gain, high/low clustering or Getis-Ord General-G, and spatial autocorrelation with Moran's I). Stage 3a or the statistical validation, is discussed in detail in section 6 (Analysis of Model). The second testing method (stage 3b) was field testing using marine geophysical survey. The survey included multibeam sonar, side-scan sonar, sub-bottom profilier, an ROV (remotely operated vehicle), and a sediment sampling unit (Van Veen grab sampler). The results of the marine geophysical survey are presented in section 7 (Field Testing Results). The model incorporates an iterative process where model values are adjusted to reflect testing results and then retested.

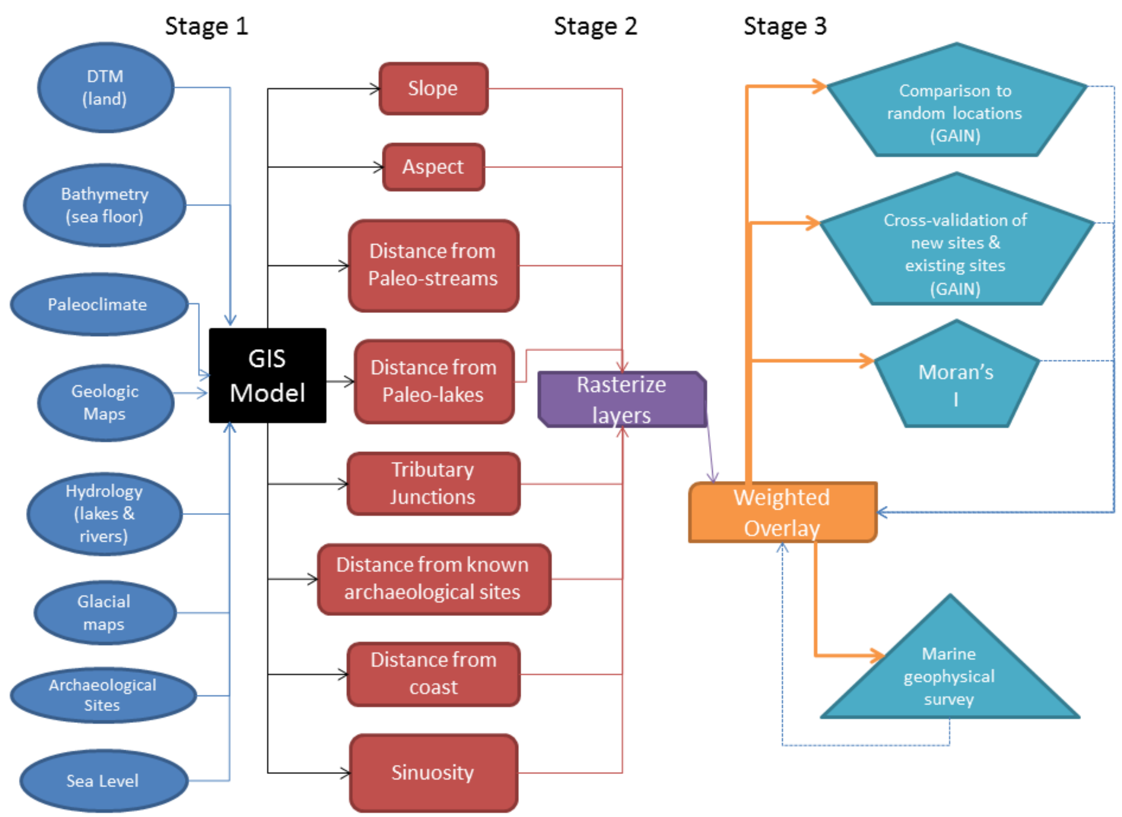


Figure 5-8: Flow chart of three stages for developing the model

For the study region, models were generated for sixteen 500 cal BP year intervals spanning the late Pleistocene and early Holocene (between 10,000 to 16,000 cal BP). The land - sea level relationships were spatially depicted using a 0 m elevation to represent the modern coastline. The DEM was created at 5 m. Intermediate products, such as slope, aspect, and buffers of the polygon features, were created at 10 m. The final product was also created at 10 m. Two other regions were defined and models were generated for modern sea-level or 0 m elevation to test the resolution. Two other areas or regions were used to test the resolution of the model, a 5 m and a 50 m resolution.

The first region is referred to as 'small' and is a rectangular area covering the NW of POWI. The area was selected to include portions of the study area, Shakan Bay, the Gulf of Esquibel, which were geophysically surveyed in 2010 and 2012, and adjacent terrestrial areas were surveyed in the summer of 2012 by UNM graduate students Mark Williams and William Taylor. The DEM for this region was generated at 1 m resolution. The intermediate and final results for this area are in 5 m resolution.

The second region was significantly larger. it represents the entire extent of the archaeological database and DEM collected for this project. It is referred to as 'NWC' and covers an area north of Vancouver Island, BC to Juneau, Alaska (Figure 4-1). The DEM was generated at 30 m resolution and the intermediate and final results are at 50 m resolution.

5.2.1. ***The Danish Model***

The Danish Model (Benjamin 2010) for submerged ancient site discovery (discussed in 2.4.1 Danish Model) has six phases of application. Phase I defines the general background for the region including archaeology, geography, geology, and geomorphology. This phase was conducted through independent study classes and independent research. Phase II is ethnographic background and historic research based in part on interviews in 2007 (CU Seed Grant) by the PI (E. James Dixon). Monteleone did an independent study course reviewing the ethnographic literature for the region. Phase III is the evaluation of maps, charts, satellite data, and aerial analysis and plotting locations of known archaeological sites. For this research, the development of the high potential model was determined to be practical and feasible based on these criteria. Phase IV is observation of potential survey locations which is the geophysical survey conducted to test the model. Phase V is marking of theoretical sites with GPS and diving to investigate. As our survey areas were too deep, an ROV and Van Veen grab sampler were used. Phase VI is post-fieldwork analysis. This is the statistical evaluation of the model and the interpretation of results. This project specifically focuses on Phases III through VI.

5.2.2. ***Stage 1 – Inputs for the Model***

There are eight inputs in stage 1 of the model. The DTM (digital terrain model) or land and bathymetry were developed from point data (see 5.1.1 Bathymetry and DEM). Archaeological site data were compiled for the northern NWC (see Appendix F: Site Location Statistics). Paleoclimate was used as an input in developing the hydrology (lakes and rivers). Geologic maps, glacial maps, and paleoclimate were used as limiting factors to determine if each area could have been habitable from 10,000 to 17,000 cal BP. Suites of topologic and hydrologic analyses were used to predict where streams and lakes might have existed prior to inundation by the ocean. All of these data were gathered into an ArcGIS database and used to create the stage 2 products.

5.2.2.1. *Water*

Andrew Wickert, a graduate student at the University of Colorado, Bolder created the streams variables in a GRASS 7 GIS script. Drainage paths were calculated from the IDW DEM using an improved, highly efficient least-cost-path search (Metz et al. 2011) in GRASS GIS 7 (GRASS Development Team 2012). Flow accumulation was calculated using a constant value for precipitation minus evapotranspiration of 4×10^{-5} mm/s, characteristic of the region based on the TraCE-21K paleoclimate model (He 2011, Liu 2009). A 0.1 m^3/s discharge threshold was used to define streams. This value was based on records from gauging stations in SE Alaska was used to define the headwaters of streams using CUASHI Hydrodesktop.

Possible lake locations were generated in a two-step process. First, depressions were identified in ArcGIS 10.0 with the basin fill algorithm (Spatial Analyst Toolbox). This algorithm typically is used to fill pits caused by data errors in the DEM, but also fills enclosed depressions that may have been lake basins. Hence, what are referred to as lakes are actually depressions in the landscape that could have been lakes, marshes, peat bogs, or simply depressions. The second step removed small areas that were not feasible as lakes from the basin fill output. An area of 200 m^2 was selected. This was an arbitrary value to remove small errors in the file outputted by basin fill.

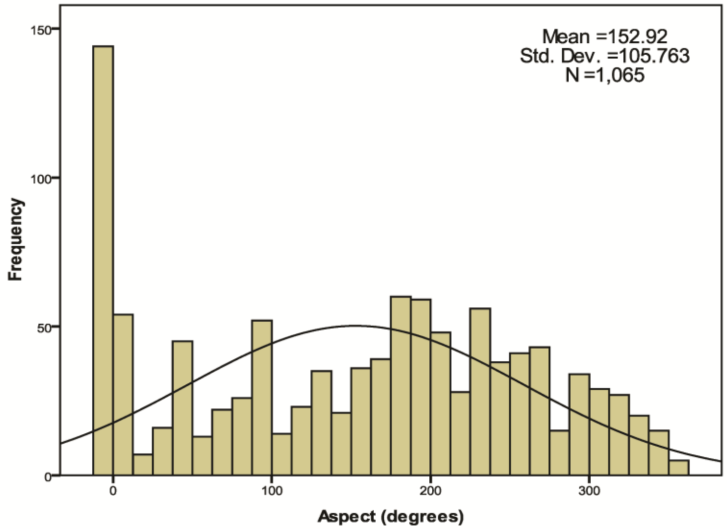
For each time slice, the stream file was clipped to the paleoshorelines from the original stream file. The shorelines were defined as the 1 m contour of the DEM for each time slice. Stream files had the lakes polygon locations removed so that the streamline file would intersect the polygon lake file and create a tributary at the lake-stream interface. Tributaries were calculated as the intersection of streams with other streams, lakes, and the coastline.

5.2.3. *Stage 2 – Model Outputs*

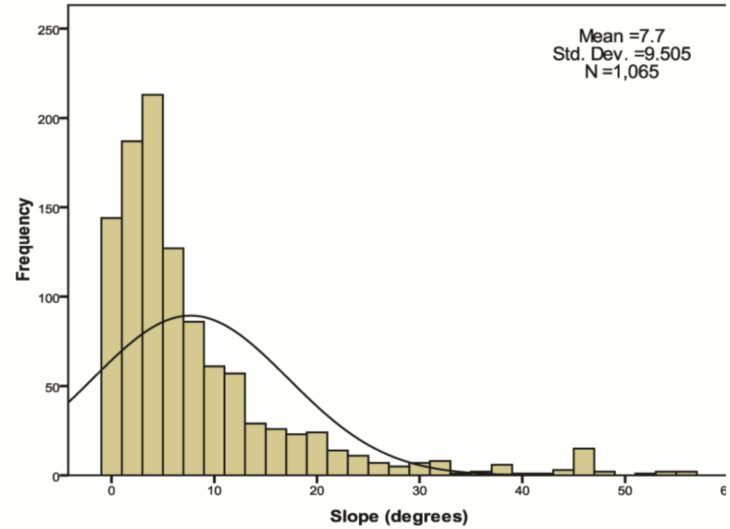
The data collected for stage 1 were analyzed and converted into rasters, with buffers, to form intermediate products. These rasters were then weighted together to form a series of final products.

5.2.3.1. *Intermediate Products*

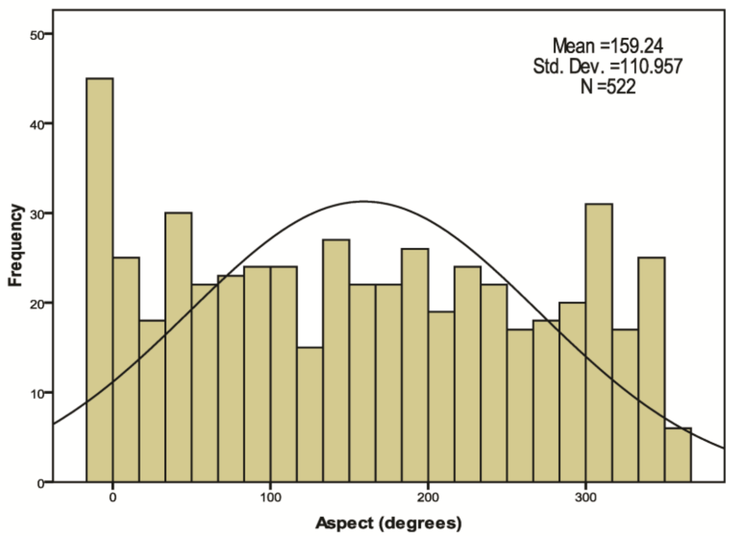
Each of the intermediate variables is a raster file at 10 m resolution. These included slope, aspect, distance from paleo-streams, distance from paleo-lakes, distance from tributary junctions, distance from archaeological sites, distance from paleo-coast, and coastal sinuosity. All of the variables, except distance from archaeological sites, were derived from the DEM generated for this project. All of the “distance from” variables use multiple buffers to delineate the ranked value that was used in the final products.



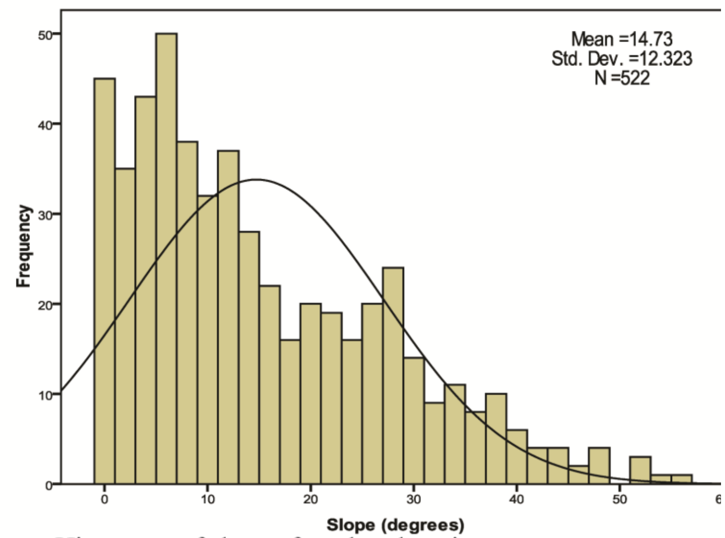
Histogram of aspect of known sites



Histogram of slope of known sites



Histogram of aspect of random locations



Histogram of slope of random locations

Figure 5-9: Histograms of slope and aspect for archaeological sites and random locations with distribution curves.

Table 5-2: Example of ranking of variables (based on Maschner 1992)

	Degrees	Value	
Slope	0- 2 °	5	
	2-5 °	4	
	5-10 °	3	
	10-20 °	2	
	20 °+	1	
Aspect	130°-275°	2	W, SW, S, SE
	276°-129°	1	E, NE, N, NW

Slope and aspect were generated using ArcGIS 10.0's Spatial Analyst. The best resolution for computing slope and aspect was found to be 10 m. This was done for each temporal interval. Then each time slice, slope or aspect was reclassified based on the ranked values in Table 5-2. These values were developed based on Maschner (1992) and from statistical analysis of archaeological site locations preformed specifically for this project. For archaeological sites within the study region, the mean slope is 7.7º and a median slope of 4.0º. The mean aspect is 153º and the median aspect is 168º (Figure 5-9). Random locations have a mean aspect of 160º, a median aspect of 157º, a mean slope of 14.7º, and a median slope of 11.5º. Because the means and medians appeared similar, paired sample t-tests (Table 5-3) were run in SPSS 17.0. Slope has a p-value for less than 0.00 (using a 95% confidence interval) and thus the null hypothesis that the mean for site location and random locations are the same can be rejected. This suggests that people chose to live, or use the landscape in such a way to create sites, on flat areas, on average less than 7.7º.

Aspect has a p-value of 0.745. Thus, the null hypothesis that the mean aspect for site location and random locations are the same cannot be rejected (at the 95% confidence interval or alpha of 0.05). Aspect has been weighted low in the models because of the random nature of this variable. This is in contrast to Maschner (1992) who found a southern aspect to be an important variable in site location utilizing regression analyses. Because the aspect is the statistically the same between known sites and random location, no inference can be gleamed from the aspect.

Table 5-3: Results of paired sample t-test for slope and aspect between archaeological site locations and random locations

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Slope	6.732	15.603	.682	5.392	8.073	9.867	522	.000
Aspect	-2.115	148.827	6.508	-14.899	10.670	-.325	522	.745

Using the concept of home range, distance from known archaeological sites is used as a variable to increase the weight for areas known to contain sites. Distance from known archaeological sites was buffered and ranked at distances of 100, 500, 1000, and 5000 m. The highest weight was given to the 100 m bin. Twenty-five percent of the sites in the study area are within 70 m of another site (Figure 5-10 and Appendix F: Site Location Statistics) and 50% of the sites are within 416 m. Random site locations are usually more than 2000 m away from known sites (Figure 5-11). The average distance between the random points (from each other) is 3371 m and the median distance is 3165 m. This means that either people chose to live in the same environment as other people at different times, i.e. around the same site locations, or they chose to live and use the land nearby.

Streams and lakes were generated for each time slice in stage 1. Archaeological site potential around water was ranked from 1 (lowest) to 5 (highest) in consecutive buffer rings at 100, 500, 1000, 2000, and 3000 m. The 500 m buffer was ranked higher than the 100 m buffer for lakes based on statistical analysis of the distance from archaeological sites (Appendix F: Site Location Statistics). The median distance from sites to fresh (drinking) water sources is 418 m. The sites that are further from water could be petroglyphs, pictographs, or specific resource patches or other types of sites such as caves or lithic sources that do not necessarily require water resources. As water sources are depicted as line with little thickness in GIS, the flood plan and actual size of the water source is unclear. This likely increased the weight of distance from water sources to almost 500 m from known sites, on average. People usually live ‘near’ water, not necessarily on top of it.

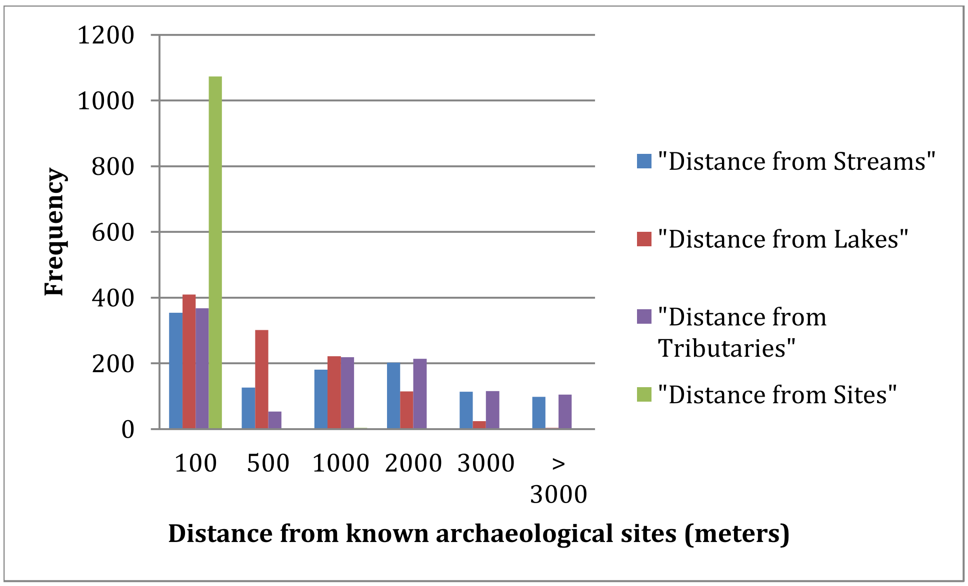


Figure 5-10: Histogram of archaeological site location statistics

The steps to convert the archaeological sites, streams, lakes, and tributary junctions into raster files were the same (Appendix B**:** Python Scripts and Geoprocessing Steps - B.6 Buffer variables (except sinuosity)). The multi-buffer tool would not work. Hence, each buffer distance was created as a separate file and finally combined together. First, the buffer rings were run, and then converted to a raster. The raster was then converted into an integer raster from a floating point raster. Then the integer raster was reclassified, so that the value of the raster was the rank applied to that buffer for that file type (stream, lake, etc.). The rasters where then added together, two at a time, until all of the buffer-rasters are combined into a single output.

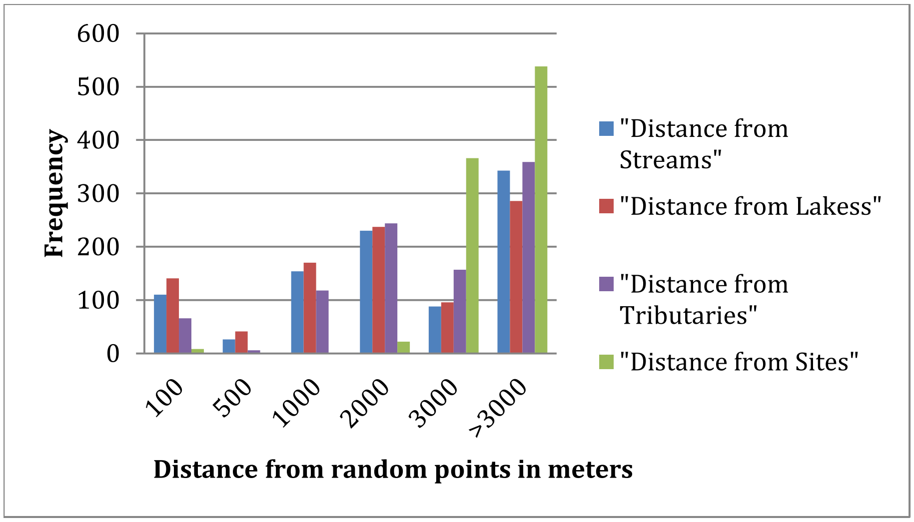


Figure 5-11: Histogram of random location statistics

5.2.3.2. *Coasts and Coastal Sinuosity*

Coastlines are perhaps the most important resource procurement areas for the NWC. In historic and proto-historic times, ethnographic accounts indicate that the largest native settlements were located in sheltered bays or harbors chosen for a good canoe landing beach (de Laguna 1960: 30, Mears 1790: 109). For the winter villages containing permanent houses "the people prized a view of the more open water across which the canoes of their friends or their enemies might be seen approaching" (de Laguna 1960: 30). The summer fishing camps could be located further up bays at salmon streams (de Laguna 1960, Moss 1992: 7). Thus, it is not just the proximity to the coast, but the shape of coast and character of the off shore environment that is important. Mackie and Sumpter (2005) utilize shoreline intricacy (like sinuosity) to analyze site distribution patterns on Haida Gwaii.

The coastline was reconstructed at 500 cal BP intervals based on the sea-level curve using a contour line at 1 m from the DEM. This contour line was assumed to approximate the paleocoastline. The coastal sinuosity python script was then applied to the paleocoastlines. The mean distance of recorded archaeological sites from the coast is 676 m. However, 50% of the sites are less than 182 m from the coast and 75% are less than 550 m from the shore. Like fresh water sources, people do not choose to live on the water but next to it, hence within 500 m is a reasonable distance to walk to and from the beach. It also provides safety from larger storm surges.

This analysis measured coastal sinuosity using adjacent 3 km diameter circles along the reconstructed coast using a python 2.6 script (Appendix B**:** Python Scripts and Geoprocessing Steps - B.5 Sinuosity). The shoreline was clipped to the 3 km (diameter) buffer at each point along the coast (with a maximum distance of 25 m between points). For each clipped shoreline length, the distance along the coast was calculated. The first and last points for each length of shoreline were used to calculate the linear or Euclidean distance using Pythagorean Theorem. The sinuosity of each length of shoreline was then calculated as the distance along the coast divided by the Euclidean distance. Finally, the mean value for all the lengths of shoreline within the 3 km buffer was calculated. The mean sinuosity value was then used for each point along the coast. The values range from linear (1) to sinuous (values greater than 5). The mean sinuosity value for the modern coast is 8.65. Figure 5-12 shows the coastal sinuosity for Shakan Bay at 13,000 cal BP.

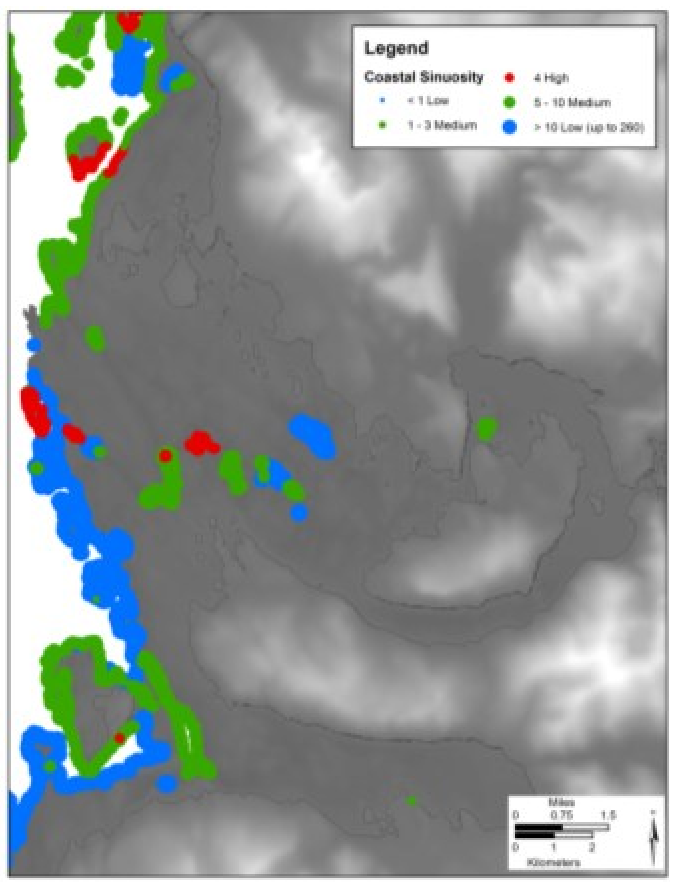


Figure 5-12: Coastal sinuosity of Shakan Bay Area at 13.000 cal BP

A proximity analysis was run to determine the distance between the location of the recorded archaeological sites and coastal sinuosity values. The mean coastal sinuosity near archaeological sites is 6.26. A paired t-test was run between all of the coastal sinuosity values and coastal sinuosity values nearest to archaeological sites. The sinuosity values are close to a normal distribution;

hence, a t-test is valid for the comparison. The null hypothesis is that the mean of the coastal sinuosity and the mean of the coastal sinuosity values nearest to archaeology are the same at a 95% confidence interval. The p-value for the paired t-test is 0.003, which demonstrates that the two sinuosity values are different. The null hypothesis can be rejected. The average or mean coastal sinuosity in the region is 8.65, but archaeological sites are 6.26. This suggests that people may have selected less complex coastlines for land-use and subsistence purposes for the last 5000 years. The coastal sinuosity values for the region were classified into high, medium, and low (Table 5-4) based on the proximity analysis from archaeological sites to coastal sinuosity. Distance from the paleoshoreline was combined with the coastal sinuosity variable to form a single ranked variable within the model. The high, medium, and low ranks were then buffered in 100, 500, 1000, and 2000 m groups (See Table 5-5 for the ranked values.)

Table 5-4: Coastal complexity ranks in relation to the location of recorded sites

Value	Rank
< 1	Low
1 - 3	Medium
4	High
5 - 10	Medium
> 10	Low

5.2.3.3. *Final Products*

For each time slice, nine raster files (Figure 5-13) were combined using ArcGIS Spatial Analyst's Weighted Overlay. The final weights of the model ranged from 0 to 4. Weight results1a, 2, 3, and 5a also included a value -1 in all time slices (Appendix C: Maps of Weighted Overlays). High potential was assessed based on distribution of results and determined to be values 3 and 4 (Figure 5-14A and C).Value 3 was moderately high potential and value 4 is high potential. In total thirteen models were created per time-slice (Table 5-5). The first five weighted overlays were named as a number and then using similar values including those for archaeological sites, as a number with an "a", ex weight 4a. All of the weighted overlays were run in an ArcGIS

10.0 model. All of the final maps are in Appendix C: Maps of Weighted Overlays. Each model is evaluated logically below.

For the first five models (weight 1 through 5), each were run and then a similar model was created with a percentage of the total weight diverted to archaeological sites. This was conducted to determine if the known archaeological sites influenced the model results significant. The known archaeological site database does not include any archaeological sites that are currently submerged on the continental shelf. This means that all models that include the known archaeological site data have variables that weight the modern landscape higher than the submerged landscape. As models that included archaeological sites produced high gain values (Appendix E: Kvamme's Gain) and were viewed as more useful models, weights 6 through 8 include archaeological sites and do not have a similar set of weighted values run without archaeological sites.

Weight 1 was very evenly distributed between the water variables (Table 5-5) with no weight for tributary junctions or for archaeological sites. There was an error with the weighted overlay, 20% of the weight was added to archaeological sites and 0% for lakes. This was corrected manually several times but still is present in the final model. It created a model that was very useful for the iterative process. As such, weight 1 was heavily skewed towards archaeological sites but still picked up the major water features. Weight 1a did not have the same error as Weight 1. Hence, lakes were weighted at 18% and archaeological sites were weighted at 5%. The water features were more heavily identified than with weight 1.

Weight 2 was similar to weight 1a, but included tributaries at 10%. Weight was taken from slope, streams, and lakes for tributaries. Weight 2a was very similar to weight 2, but also included archaeological sites at 5%. The weight was taken from distance from coasts. There is more moderately high potential areas in weight 2a than in weight 2, 10.27% value 3 in weight 2a and 6.89% value 3 in weight 2 (Appendix C: Maps of Weighted Overlays - C.4 Weighted Overlay 2).

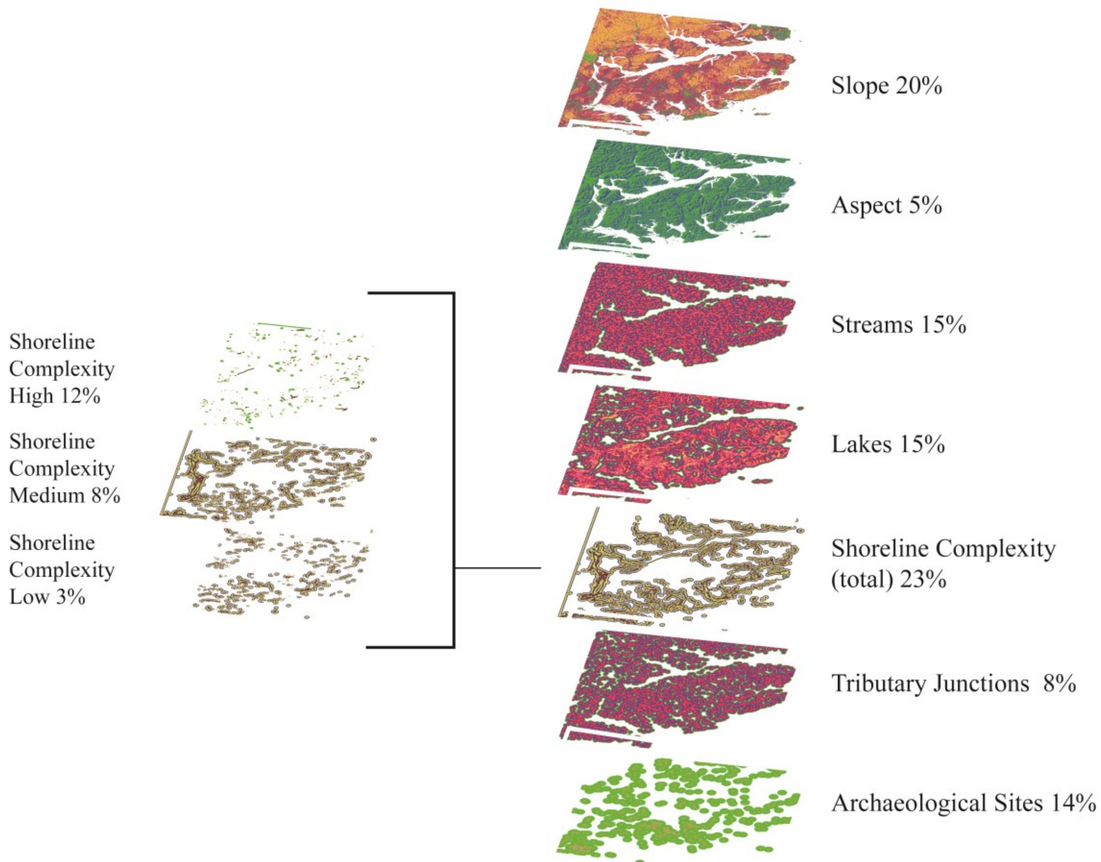


Figure 5-13: Stacked image of rasters used in final weighted model (13,000 cal BP).

Weight 3 attributes more weight to water features, including 15% for tributaries and 20% each for streams and lakes. This gives a total of 55% for fresh water variables. Weight 3 has more high potential than the other models. Weight 3 has 0.4% of value 4 in the total model area, while the next highest is 0.22% of the total model area for weight 4. Weight 3a has less emphasis on water features by 5%, which was reallocated to archaeological sites. Weight 3a has less high potential (.013% of the total model area) than Weight 3 (0.4% of the total model area) (Appendix C: Maps of Weighted Overlays - C.6 Weighted Overlay 3).

Weight 4 is heavily weighted towards slope (40%). The other weights are evenly distributed between the other variables, though streams are weighted very low at 10%. The high potential areas of weight 4 are well distributed along water features and include more value 4 high potential than the other models (17.6% of the total model area). Weight 4a decreased slope by 5% and increases the weight of archaeological sites by the same amount. There are significantly less high potential areas compared to weight 4, and 17.6 % of the total model area is high potential for weight 4 while 9.7% of the total model area is high potential for weight 4a.

Weight 5 emphasizes fresh water features giving them a total of 60% of the variables. Slope has only 10% of the total distributed weight. Weight 5 has little total high potential, 3.34% of total model area. There is limited value 4 or high potential areas (0.004% of the total model area) in this result. Weight 5a is similar to weight 5, but has slightly more total high potential (3.69 % of the entire model area), but less value 4 (0.000% of the total model area). The 5% reallocated to archaeological sites was removed from tributary junctions.

After reviewing the time slices of these 10 weighted overlays, archaeological sites were seen to be underrepresented. Weight 6 was then created with 30% of the total weight allocated to distance from archaeological sites. Slope was still significantly represented. Water features had reduced weight. This model produces circles of high potential around the known archaeological sites and is not useful in identifying other areas to look for archaeological sites. (Appendix C: Maps of Weighted Overlays -C.12 Weighted Overlay 6).

Based on visual inspections of the time slice maps, weights 1 (including the 20% weight mistakenly allocated to distance from archaeological sites) was the best overall map for documented archaeological site distribution. Weight 4 was the best overall map for water and coastal features, these features co-occurred with high potential areas. The average of the weights for these two models was averaged to create weight 7.

Finally, a combination of weight 1, 4, and 7 was created. This is the final weight map used for the region. It incorporates archaeological sites, water features, and coastlines very well, these features co-occurred with high potential areas. Figure 5-13 shows the intermediate raster layers for weight 8 including the distribution of the weights. Figure 5-14 shows the results for weight 8 for 13,000 cal BP and the combined final model.

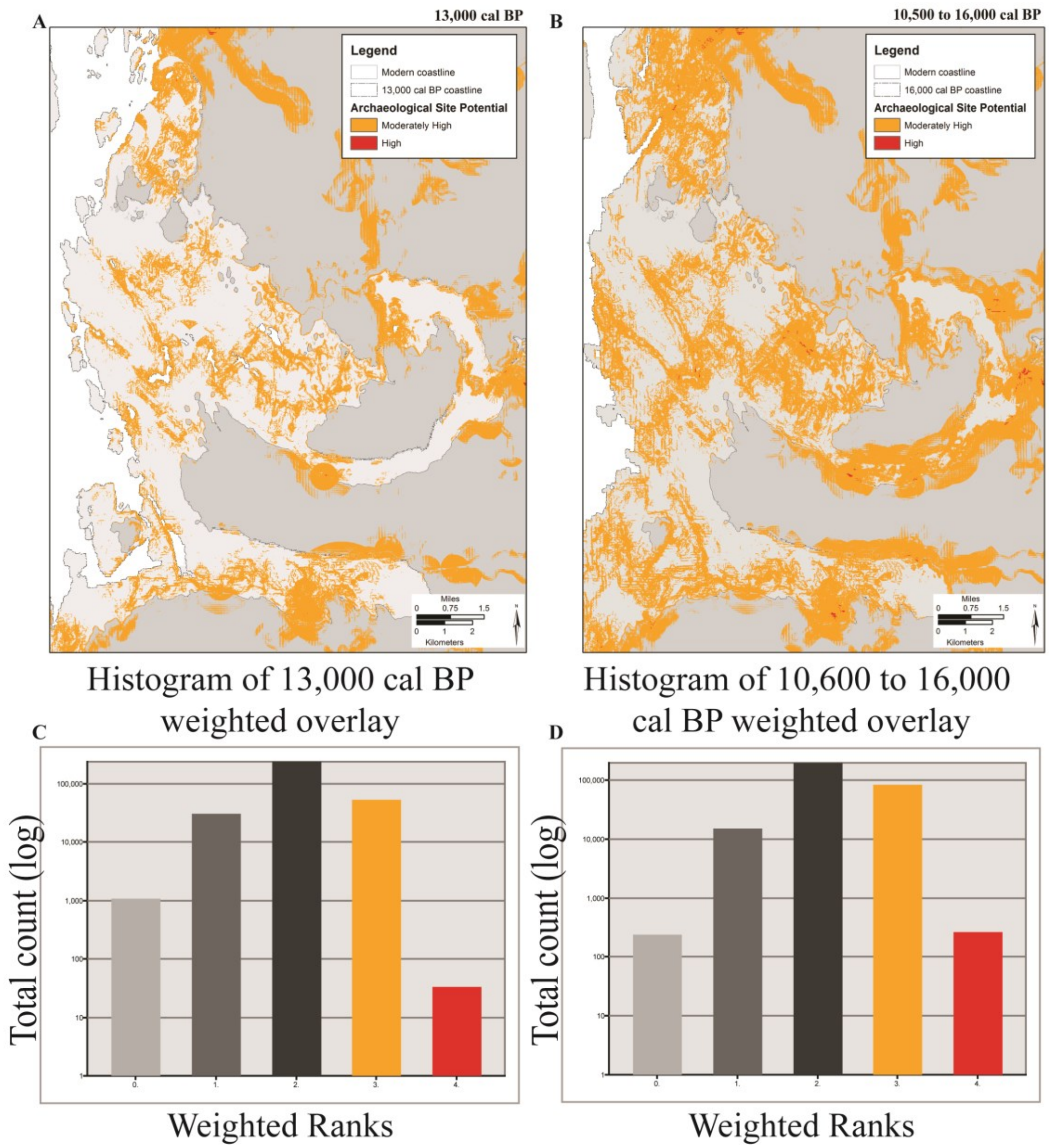


Figure 5-14: Model results. A) Map of Shakan Bay at 13,000 cal BP as an example of a time slice of the final model (weight 8). B) Map of Shakan Bay with the model results showing final high potential model. C) Histogram of final model results for 13,000 cal BP. D) Histogram of model results for all time slices combined. The histograms show the full values of the weighted overlay.

5.3. Conclusion

Modeling resulted in the production of 234 maps (15 time slices, different extents, and 13 different weight maps). The weight 8 model is viewed as the final model for each time slice. These individual time slices were combined to create a composite high potential model using 'mosaic to new raster' ArcGIS 10.0. This produced a final model that covered the entire study area from 10,500 to 16,000 cal BP. The resultant ranks ranged from 0 to 4 (Figure 5-14 B and D). Moderately high potential and high potential was determined to be the same as the individual time slices, values 3 and 4 respectively. This final model accurately incorporates the coasts, lakes, rivers, and archaeological sites in high potential areas.

As the research progress, the iterative process will incorporate new information from statistical analysis and marine geophysical surveys will be reincorporated into stages 1 and 2. This iterative process will continue to refine the model and guide further underwater research along the NWC coast, which may be applicable to other regions as well.

Table 5-5: Weighted overlay variables and weights for all models. (Values in red were actual weights while the proposed weights are in brackets beside). The final weight (weight 8) is highlighted in grey.

Variable	Degrees		Value	Weight 1	Weight 1a	Weight 2	Weight 2a	Weight 3	Weight 3a	Weight 4	Weight 4a	Weight 5	Weight 5a	Weight 6	Weight 7	Weight 8
Slope	0 -– 2		5	25	25	25	23	25	25	40	35	10	10	20	30	20
	2.001 -– 5		4													
	5.001 -– 10		3													
	10.001 - 20		2													
	20.001 +		1													
Aspect	130 -– 275		2	10	10	10	10	10	10	5	5	5	5	10	5	5
	275.001 -129.999		1													
	meters															
Distance from streams	100		4	25	22	17	17	20	17	10	10	20	20	12	20	15
	500		5													
	1000		3													
	2000		2													
	3000		1													
Distance from lakes	100		4	(20)0	18	18	17	20	18	17	17	25	25	13	10	15
	500		5													
	1000		3													
	2000		2													
	3000		1													
Distance from coast	H	100	5	10	10	10	9	5	5	9	9	12	12	5	9	12
	H	500	4													
	H	1000	3													
	H	2000	2													
	H	3000	1													
	M	100	5	6	6	6	6	3	3	6	6	8	8	3	6	8
	M	500	4													

	M M M	1000 2000 3000	3 2 1													
	L L L L L	100 500 1000 2000 3000	5 4 3 2 1	4	4	4	3	2	2	3	3	5	5	2	3	3
Distance from tributary		100 500 1000 2000 3000	5 4 3 2 1	0	0	10	10	15	15	10	10	15	10	5	5	8
Distance from archaeology sites		100 500 1000 5000	3 4 2 1	(0)20	5	0	5	0	5	0	5	0	5	30	12	14

6. Analysis of Model

High potential land-use models need to be tested using a variety of methods to ensure their success. This model has been tested statistically and in the field. Statistical tests include cross-validation using Kvamme's gain, high/low clustering or Getis-Ord General-G, and a spatial autocorrelation using Moran's I. Statistics were calculated for models 1, 4, and 7, a relatively small area within the SE Alaska study area, and the NWC. Random points were used in the statistical test to indicate if the archaeological site statistics were causes by random chance. There is no indication that archaeological sites are randomly distributed; these are utilized for comparative purposes only.

6.1. Kvamme's Gain

This statistic specifically tests the predictability of the model. The result is a value between -1 and 1 that is the ratio of the number of sites (new, old, or random points) within the area to the percent of the predicted area from the total area. If the results are negative or less than 0.5, the model is not predictive. If it is negatively predictive (result below 0), areas that are not high potential could and likely have archaeological sites. If the value is between 0 and 0.5, it means that it is close to equally likely that archaeological sites are in the high potential area or the low potential area. When the gain value is over 0.5, it means that more than 50% of the archaeological sites are likely within the high potential areas (Kvamme 1988b, Mink et al. 2006).

For the application of Kvamme's gain to this model, the modern landscape was used. This is because the majority of archaeological sites in the database are on the modern coastline, and postdate sea-levels stabilization around 6000 – 5000 cal BP. A population of 1000 random locations were generated within the study area and tested against the 1007 archaeological site database (known sites) for the study region. Additionally ten sites identified by Williams and Taylor during surveys in June 2012 (2012 survey). Finally, for the NWC extent, the entire site database was utilized (all sites). Gain values were calculated for model results 3 (moderate-high potential), 4 (high potential), and 3 and 4 combined (all high potential). The gain statistic was calculated for all weighted overlays using the modern landscape (Appendix E: Kvamme's Gain). The values for weighted overlay 1, 4, 7, and 8 are in Table 6-1.

Table 6-1: Gain statistics for modern landscapes for weights 1, 4, 7, and 8 of the study area

Model	Data Set	Gain Statistic	Predictive Utility (gain)
Weight 1			
3	Known sites	0.9618	Positive
	2012 survey	0.9367	Positive
	Random locations	0.1624	None
4	Known sites	0.9978	Positive
	2012 survey	-	None
	Random locations	0.8874	Positive
3+4	Known sites	0.9644	Positive
	2012 survey	0.9364	Positive
	Random locations	0.1866	None
Weight 4			
3	Known sites	0.5402	Positive
	2012 survey	0.5831	Positive
	Random locations	0.1907	None
4	Known sites	0.7356	Positive
	2012 survey	-	
	Random locations	0.4820	None
3+4	Known sites	0.5571	Positive
	2012 survey	0.5604	Positive
	Random locations	0.2135	None
Weight 7			
3	Known sites	0.8245	Positive
	2012 survey	0.7249	Positive
	Random locations	0.1693	None
4	Known sites	0.9938	Positive
	2012 survey	-	None
	Random locations	0.5852	Positive
3+4	Known sites	0.8414	Positive
	2012 survey	0.7239	Positive
	Random locations	0.1726	None

Weight 8			
3	Known sites	0.9446	Positive
	2012 survey	0.9053	Positive
	Random locations	0.2270	None
4	Known sites	0.9967	Positive
	2012 survey	-	None
	Random locations	0.8542	Positive
3+4	Known sites	0.9479	Positive
	2012 survey	0.9049	Positive
	Random locations	0.2401	None

When tested against the known archaeological site locations all four weights produced positive gain values. The random locations produced negative gain values for the moderately high potential and the combined high potential (values 3 and 4). The random locations produced high positive values for high potential sites (value 4). This is likely because of the small area of high potential compared to the entire model, less than 0.5% for each model. The 2012 survey locations produced positive gain values for moderately high (value 3) and combined high (values 3 and 4) archaeological site potential areas. No sites were identified in the high (value 4) archaeological site potential areas. This may be because the gain statistic was calculated using the modern landscape (the model was not generated for time slices above modern sea-level, 5,000 to 10,600 cal BP) as all of these sites are expected to date between 6,000 cal BP and 10,600 cal BP (Williams 2012 personal communication). The modern landscape is appropriate for the known sites because the majority of these sites are dated to after sea-level was established at near or at its modern levels.

Table 6-2: Gain values for the known archaeological sites in the small DEM area

Model	**Data Set**	**Gain Statistic**	**Predictive Utility (gain)**
Weight 1			
3	Known sites	0.9752	Positive
	2012 survey	0.9730	Positive
	Random locations	0.9507	Positive
4	Known sites	0.9996	Positive
	2012 survey	-	None
	Random locations	0.9946	Positive
3+4	Known sites	0.9815	Positive
	2012 survey	0.9728	Positive
	Random locations	0.9529	Positive
Weight 4			
3	Known sites	0.9500	Positive
	2012 survey	0.9439	Positive
	Random locations	0.9497	Positive
4	Known sites	0.9553	Positive
	2012 survey	-	None
	Random locations	0.9111	Positive
3+4	Known sites	0.6250	Positive
	2012 survey	0.5223	Positive
	Random locations	0.5993	Positive
Weight 7			
3	Known sites	0.9724	Positive
	2012 survey	0.9729	Positive
	Random locations	0.9196	Positive
4	Known sites	0.9985	Positive
	2012 survey	-	None
	Random locations	-	None
3+4	Known sites	0.9668	Positive
	2012 survey	0.9653	Positive
	Random locations	0.9498	Positive
Weight 8			
3	Known sites	0.9724	Positive
	2012 survey	0.9729	Positive
	Random locations	0.9196	Positive
4	Known sites	0.9993	Positive
	2012 survey	-	None
	Random locations	-	None

3+4	Known sites	0.9732	Positive
	2012 survey	0.9729	Positive
	Random locations	0.9196	Positive

Table 6-3: Gain values for the known archaeological sites in the NWC area

Model	**Data Set**	**Gain Statistic**	**Predictive Utility (gain)**
Weight 1			
3	Known sites	0.9372	Positive
	All Sites	0.9338	Positive
	Random locations	0.9233	Positive
4	Known sites	0.9959	Positive
	All Sites	0.9962	Positive
	Random locations	0.9972	Positive
3+4	Known sites	0.9391	Positive
	All Sites	0.9361	Positive
	Random locations	0.9275	Positive
Weight 4			
3	Known sites	0.4668	None
	All Sites	0.3650	None
	Random locations	0.0182	None
4	Known sites	0.4984	None
	All Sites	0.5776	Positive
	Random locations	-1.6129	Negative
3+4	Known sites	0.4681	None
	All Sites	0.3772	None
	Random locations	-0.0062	Negative
Weight 7			
3	Known sites	0.7316	Positive
	All Sites	0.6965	Positive
	Random locations	-0.0312	Negative
4	Known sites	0.9650	Positive
	All Sites	0.9663	Positive
	Random locations	#DIV/0!	None
3+4	Known sites	0.7392	Positive
	All Sites	0.7067	Positive
	Random locations	-0.0357	Negative
Weight 8			

3	Known sites	0.9054	Positive
	All Sites	0.8884	Positive
	Random locations	-0.0826	Negative
4	Known sites	0.9904	Positive
	All Sites	0.9919	Positive
	Random locations	#DIV/0!	None
3+4	Known sites	0.9065	Positive
	All Sites	0.8903	Positive
	Random locations	-0.0841	Negative

Table 6-2 and Table 6-3 illustrate the gain values for the small DEM and NWC areas, at the modified resolutions of 5 m and 50 m. Decreasing and increasing cell size inflates the gain value. The gain values for the random locations are as high as the gains for site locations. This indicates that the high grain values are a mathematical results and do not indicate that there is high predictability from the model. The small DEM has almost entirely positive result for all three data sets and all four weights. Most of these are over 90%. These results indicate more information is needed than simply gain values to interpret model results. For the NWC, random locations do have negative gain values and no gain, but so do the known sites and the "all site" database. This resolution issue is likely the result of the archaeological site data that results from sites being not necessarily located exactly where the point recorded in the database and the increased bias at different resolutions.

6.2. Getis-Ord General-G

The General G statistic tests the amount of clustering in both high and low values. It is different from Moran's I because it incorporates the high and low values. The null hypothesis is that there is no spatial clustering in the data. The null hypothesis can be rejected when the p-value returned by this tool is small and statistically significant (at a 95% confidence interval). If the null hypothesis is rejected, then the sign of the z-score becomes important. The z-score is a standard score, which indicates how many standard deviations, and observation is above or below the mean. If the z-score value is positive, the observed General G value is larger than the expected. This indicates that high values for the model are clustered. If the z-score value is negative, the observed General G value is smaller than the expected, indicating that low values are clustered (ArcGIS 10 – Getis-Ord G Works).

Getis-Ord General-G is a tool in the Spatial Statistic Toolbox for ESRI's ArcGIS10. It requires a vector input. The models were created as raster files. Before converting the model, with values ranging from 0 to 4, to polygons, values from 0 to 2 were removed in order to simplify the polygons and decrease the size of the data. The only input for this tool is the polygon of the model.

It was not possible to run this process because of errors usually related to memory. Although the computer had ample memory, the problem was the size of the input file was too large to process. In an effort to address this difficulty, several variations were attempted for the conceptualization of spatial relationships (inverse weighted distance, and distance bands) and for distance method (Euclidean and Manhattan). These processes were attempted several times including statistical package R via GRASS. The polygon files were too large to be loaded into R. This package holds all of the files in memory for processing.

Finally, a smaller area of the model was extracted. The area corresponds to the "small area" that was processed at 5 m resolution. The Getis-Ord General-G still did not process. Because of the similarities between Getis-Ord General-G and Moran's I, only Moran's I was run for the model. Moran's I also investigates spatial autocorrelation or clustering, but does not include variability in values. The General-G statistic seems redundant since there are only two values (3 and 4) in the model. Both processes were attempted because of recommendations by Getis and Ord (1992) and Kohler and Parker (1986). Possibly, in the future, this process could be successfully processed when program limitations are changed.

6.3. Moran's I

Like Getis-Ord's General-G, Moran's I tests spatial autocorrelation. The hypothesis is that there is no spatial correlation in the data. The difference between the two tools is how the z-score is analyzed. The Global Moran's I or spatial autocorrelation tool, measures spatial autocorrelation based on feature locations and feature values simultaneously. Given a set of features and an associated attribute (value 3 or 4), the tool evaluates whether the pattern expressed is clustered, dispersed, or random. It computes the mean and variance for the model value. Then, for each value, it subtracts the mean, creating a deviation from the mean. Deviation values for all neighboring features (features within the specified distance band, for example) are multiplied together to create a cross-product (ArcGIS10 Help – Spatial Autocorrelation Works).

Moran’s I is a tool in the Spatial Statistic Toolbox in ESRI’s ArcGIS10. The same polygon features created for Gets-Ord’s General-G were utilized. The same memory error problem occurred when the entire study area was utilized. The results for weighted overlay 8 are in Table 6-4 while the results for weighted overlays 1, 4, 7, and 8 are in Appendix D: Moran’s I Statistics. Due to the computational time and similarity in results, Moran’s I was only computed for these weighted results. Moran’s I was calculated at 250, 500, 1000, 1500, 2000, and 3000 m bands. There are some missing values for the 3000 m band. This is the same “memory error” that was encountered at the larger scale and is likely due to the complexity of the polygons compared at 3000 m. The results indicate that the models are clustered.

For all values less than 3000m, and some 3000 m results, there are values that do not have any neighbors. The tool parameters clearly state that all features must have a neighbor to be valid (ArcGIS10 help – Spatial Autocorrelation). Getis and Ord (1992) do not include this as a requirement for I statistics. The need for 3000 m distance band indicates that the data is not as clustered as the results indicated since some polygons did not have any neighbors within 2000 m (Figure 6-1).

The results for the Moran’s I statistic ranges from -1 to 1. For Weight 8, the values range from 0.14 to 0.89. The lower values are associated with the larger neighborhoods (3000 m) and the higher values with the smaller neighborhoods (250 m). The smaller neighborhoods have locations that do not have neighbors and are thus insignificant values. All of the results are positive and show some clustering. The z-scores for all of the results are very high, over 100, which indicates the results are significant at 5% alpha.

The p-values are all less than 0.000. This means the results are significant and the hypothesis that these is less than a 1% likelihood that the results are random.

The results are clustered likely because the environmental variables that they are mirroring are clustered. Though the Moran's I statistic was suggested to be a test of a predictive model, these results are more descriptive. They are not directly useful for testing the model results. The Moran's I statistic indicates that the model is clustered, which is expected from fresh water and coastally focused variables.

In relation to the use of archaeological sites to predict site locations, weighted overlay 4 does not include archaeological sites but has similar Moran's I values to those calculated for weighted overlays 1, 7, and 8. Therefore, the archaeological sites are not causing the clustered results.

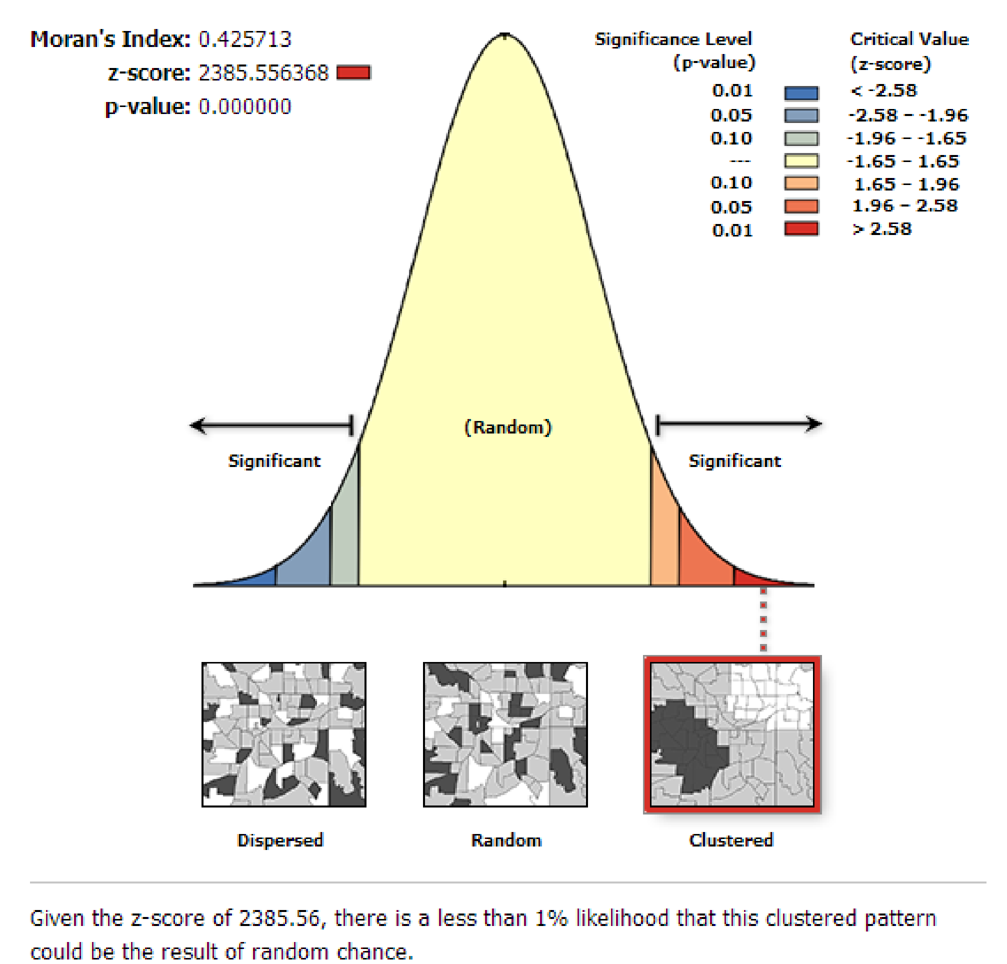


Figure 6-1: Results from Moran's I, all of the results are similar.

Table 6-4: Moran's I results for weighted overlay 8 for each time slice

		Weight 8					
		250	**500**	**1000**	**1500**	**2000**	**3000**
Y00_0	Moran's Index:	0.818106	0.730169	0.587001	0.498113	0.438805	0.362278
	Expected Index:	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003
	Variance:	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
	z-score:	1040.760916	1315.206433	1458.460503	1480.737921	1481.564403	1474.812907
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	2014	193	25	9	3	2
Y10_5	Moran's Index:	0.733922	0.648605	0.502842	0.419804	0.371121	0.312221
	Expected Index:	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003
	Variance:	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
	z-score:	870.939043	1105.541548	1195.291939	1187.864178	1180.418647	1178.637245
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	1506	179	33	15	6	2
Y11_0	Moran's Index:	0.742288	0.659308	0.542125	0.462736	0.409625	0.340383
	Expected Index:	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003
	Variance:	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
	z-score:	968.228810	1222.148692	1390.054495	1424.382967	1435.653997	1447.151749
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	2150	189	23	4	3	2
Y11_5	Moran's Index:	0.680467	0.550002	0.414312	0.344482	0.301841	0.249670
	Expected Index:	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003
	Variance:	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
	z-score:	907.144208	1053.938211	1115.886806	1120.121245	1120.390151	1126.434118
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	1925	163	20	10	4	2

		Weight 8					
		250	**500**	**1000**	**1500**	**2000**	**3000**
Y12_0	Moran's Index:	0.668636	0.549446	0.413450	0.340492	0.296600	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	961.828908	1149.008877	1239.183340	1253.599306	1263.521708	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2317	192	23	8	5	
Y12_5	Moran's Index:	0.659785	0.522660	0.382458	0.312143	0.269608	0.216912
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	909.899123	1044.950043	1100.763364	1110.776327	1117.338758	1122.101476
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	2739	226	25	8	1	0
Y13_0	Moran's Index:	0.630409	0.505819	0.371728	0.301790	0.260415	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	961.591421	1130.612820	1207.911629	1217.810628	1226.922023	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2656	199	17	7	2	
Y13_5	Moran's Index:	0.629983	0.501996	0.366861	0.298465	0.257210	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	970.121405	1134.919476	1209.043688	1223.168941	1232.009293	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2761	210	31	12	3	

		Weight 8					
		250	500	1000	1500	2000	3000
Y14_0	Moran's Index:	0.600764	0.478083	0.345392	0.279779	0.240143	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	931.709149	1088.741817	1147.453770	1156.296720	1160.349085	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2764	222	25	11	5	
Y14_5	Moran's Index:	0.614003	0.477480	0.343356	0.276109	0.236867	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	952.241184	1089.721334	1145.124768	1146.765602	1150.656237	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2782	218	23	5	2	
Y15_0	Moran's Index:	0.540919	0.386281	0.262517	0.209025	0.177942	0.141673
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	832.099836	878.932070	874.548219	865.369841	859.631378	858.379118
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	2357	190	29	14	7	1
Y15_5	Moran's Index:	0.596976	0.473856	0.346652	0.279655	0.239036	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	939.049894	1102.239070	1184.935378	1195.216419	1198.728763	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2992	253	32	16	9	

		Weight 8					
		250	500	1000	1500	2000	3000
Y16_0	Moran's Index:	0.562400	0.422667	0.300526	0.242034	0.205834	0.162127
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	887.053348	985.164629	1030.013304	1036.971714	1034.561242	1029.697119
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	2867	218	37	17	10	2
Deep	Moran's Index:	0.762542	0.655531	0.505108	0.407540	0.345512	0.270985
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	1272.3613350	1615.2846960	1849.2963840	1897.4340260	1917.9429820	1949.0280990
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	4087	286	27	8	3	1
Small Area	Moran's Index:	0.552503	0.402185	0.288936	0.230005	0.195688	0.154757
	Expected Index:	-0.000004	-0.000004	-0.000004	-0.000004	-0.000004	-0.000004
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	1152.4099370	1292.8717750	1397.9342450	1397.8431490	1378.5467090	1391.0499270
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	177	27	3	0	0	
NWC	Moran's Index:	too small for study area	too small for study area	0.627539	0.510169	0.443053	0.367534
	Expected Index:			-0.000003	-0.000003	-0.000003	-0.000003
	Variance:			0.000001	0.000001	0.000001	0.000001
	z-score:			868.345945	873.020919	871.802103	874.800708
	p-value:			0.000000	0.000000	0.000000	0.000000
	no neighbors			761	239	132	46

6.4. Conclusion

Kvamme's Gain indicates that the weighted overlay 8 is slightly predictive. Because the modeling process is iterative, the goal of future work will be to increase this value. The lack of neighbors for some values makes the I statistic possibly invalid. The Moran's I values indicate that the models are weakly clustered, though this has a very high certainty. Some degree of clustering should be expected in archaeological sites based on the logistical collectors model by Binford (1980) and the ethnographic overview presented in section 4.5 (Northern NWC Ethnographic Groups). The clustering is also expected because environmental variables that are being modeled are cluster, such as the coast and rivers.

The model has been tested against archaeological sites that had not been recorded when the model values were originally generated as a result of a survey conducted by Williams and Taylor on Prince of Wales Island in June 2012. Further statistical testing of the site predictive models awaits new modules in GRASS GIS or better functionality in ArcGIS. An updated database of archaeological sites would also provide a more complete statistical test of the model.

7. Field Testing Results

There have been two opportunities to field test the high potential model as part of the Gateway to the Americas I and II projects. The first in June 2010 was a preliminary survey to demonstrate that the survey methods were adequate and appropriate for SE Alaska (Dixon and Monteleone 2011). A few anomalies were identified in the geophysical survey that helped focus a new NSF proposal for three years of research. The Gateway to the Americas II project received 10 days support of ship time for marine survey from 2012 to 2014. The primary goal for 2012 was collecting data to test the high potential model presented in this dissertation.

7.1. June 2010 Survey

The 2010 fieldwork was conducted between June 16-24, 2010, aboard the 86' (26.2 meter) *FV Crain*. The survey team consisted of Dr. E. James Dixon (PI), the author, and two technicians: Tim Bulman of InDepth Marine and Harry Castle of Aquasphere Surveyors Inc. The ship was crewed by Chris Beaudin, Posi Beaudin, Gus Beaudin, and first mate James Bacon. Three survey locales were investigated: Keku Strait, Shakan Bay, and the Gulf of Esquibel.

7.1.1. ***Survey Equipment***

The seafloor was imaged using a dual beam adjustable frequency Imagenex Model 872 Yellowfin side scan sonar and ground truthed using an ROV and a small Van Veen grab sampler. Trimble XRS DGPS with integrated (internal) coast guard beacon provided real time satellite corrections and sub-meter accuracy. The ROV had two video cameras, a wide and normal view, and external light sources.

Side-scan sonar uses pulses of sound emitted in a conical, or fan shape, direction towards the seafloor. The acoustic reflection of the seafloor is recorded as intensity on either side of the vessel. The Yellowfin can collect 1000 data points per side, there is one transducer per side that is tilted down at 20º. Three different frequencies are available: high, medium, and low. Higher frequencies provided better resolution but cover less area. For the Yellowfin, high frequency is 800 kHz with a beam width of 0.7º by 30º. This means that each time a pulse is emitted it is 0.7º wide and spread over 30º. The number of data points is then spread over the entire beam area per side. Medium frequency is 330 kHz with a beam width of 1.8º by 60º. Low frequency is 260 kHz with a beam width of 2.2º by 75º (Imagenex 2011). The medium setting was determined to be the most effective for survey purposes and provided 125 m of visibility on either side of the vessel.

The side-scan sonar was towed beside the vessel using "cannon ball" weights to keep the line and tow-fish (side scan unit) as vertical as possible and operating at appropriate depths beneath the surface. The exact location of the side-scan in relation to the vessel varied with speed, current, length of extended cable, and depth. The *F/V Crain* was unable to maneuver at the slow speeds required to operate the side-scan. The helmsman was required regularly to shift in and out of gear while trying to steer a straight path. The results were sinuous, rather than straight, paths with variations in the location of the side-scan in relation to the GPS receiver, and thus a loss of accuracy in identifying the location of anomalies. The side-scan did not have an attached transceiver to indicate its precise location. Thus, side-scan anomalies are several meters from their precise locations.

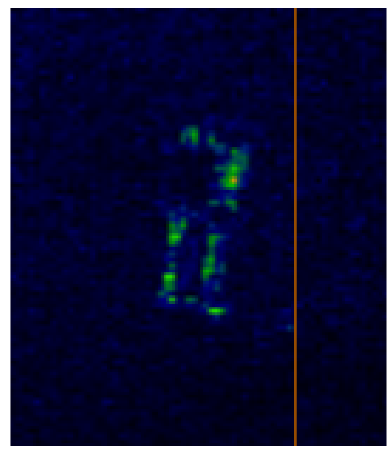


Figure 7-1: Rectangular anomaly from Keku Straight (approx 90 m depth).

An ROV or remotely operated vehicle can be equipped with a variety of equipment for research purposes. The ROV is controlled by a trained operator using a joystick in the cabin of the ship while observing on a monitor. The ROV used for this project was connected to the vessel via a tether cable that carries the video signals to the monitor. The video signals are recorded onto DVD similar to recording from a television. The technician controlling the ROV is able to move the ROV in all/any direction. In 2010, the compass was broken on the ROV, and as a result, there was no method in place for recording where the ROV was in relation to the vessel. The depth of the ROV was recorded. Because the *F/V Crain*, swings on its anchor while the ROV is deployed and it is necessary not to entangle the ROV in the anchor line or chain. The fine particulate matter and lack of light in the water column can result in poor visibility ROV exploration. Most of the ROV video provides views of the seafloor and objects such as rocks and wood on the ocean floor are clearly visible. The ROV is also equipped with a claw to grab samples. In 2010, this was attempted, and although the claw broke a wooden branch or sapling observed on the ocean floor, it successfully retrieved a sample of the wood.

7.1.2. ***Keku Strait***

In Keku Strait, the survey locale was selected based on coordinates from a local fisherman who reported recovering a ground slate point. The artifact was reportedly adhering to the mud on a shrimp pot that had been set at a depth of about 90 m (approximately 300 feet). He has lost the exact location where he recovered the point but provided bracketing coordinates for the submarine canyon where he had deployed his shrimp pot. During this initial survey, the optimum vessel speed was determined to be 1.2 knots. With the side scan sonar, the medium frequency (330 kHz) provided 125 meters of visibility per side for a total of 250 meters of seafloor visibility. Four transects were run, three on either edge of the submarine canyon and one across the canyon. One anomaly was identified. It was a small rectangular reflection. However, the location was too deep for the *FV Crain* to anchor, making it impossible to deploy the ROV or to use the Van Veen grab sampler. Extrapolation from the sea-level curve suggests this locale was inundated by rising sea-level about 13,400 cal years ago. There is no clear method to link the anomaly to the ground slate point. Ground slate was not utilized in this region until after 5,000 years ago (Ames and Maschner 1999). This suggests that the ground slate point was either not reported in the correct position or it may have been deposited by other mechanisms, such as lost overboard by early hunters or by a wounded (but not recovered) marine mammal (Dixon and Monteleone in press).

7.1.3. *Gulf of Esquibel*

In the past, the Gulf of Esquibel would have been a fresh water lake that was later flooded by rising seas. Based on contemporary bathymetry, the lowest topographic point along the basin's margins is c. -70 m (Baichtal and Carlson 2010). This is the probable point at which rising sea-level breached the Esquibel basin. A small locale in the SW of the area is interpreted to be an isthmus between Paleo-lake Esquibel and the Pacific Ocean. The southwest end of the Gulf of Esquibel was also surveyed (a total of nine survey lines were conducted). Four side-scan transects were conducted north to south, but these were difficult due to the current. Four side-scan lines were conducted east to west northeast of Steam Boat Bay where the breach point was suspected. These overlapping side-scan images were used to identify the breach point northeast of Steam Boat Bay during post-processing. Several rock outcrops observed in the side scan and ROV images appear to contain possible rock shelters. The ROV was deployed adjacent to two rock outcrops and the Van Veen grab sampled sediment adjacent to one of the rock outcrops. Grab samples were screened hydrologically for the presence of bone, shell, charcoal, lithic specimens, macrofossils, or cultural debris that may indicate cultural occupation. Although no definitive archaeological remains were identified, the outcrops were identified at potential targets for future multibeam survey and testing. This was the only location that the ROV and Van Veen were deployed in 2010.

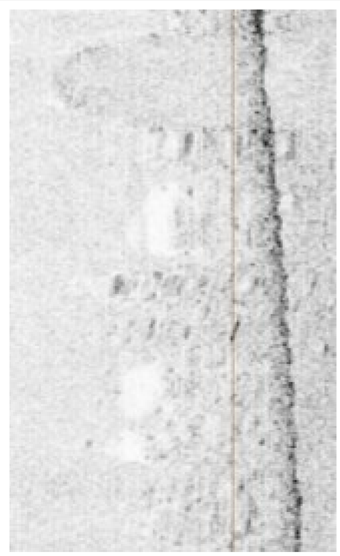


Figure 7-2:Shakan Bay Anomaly 1: two circular and one rectangular depression (white space).

7.1.4. *Shakan Bay*

On the northwest end of Prince of Wales Island, Shakan Bay was identified from the bathymetric data as a possible highly productive paleo-environment prior to 10,500 cal BP. It is sheltered from the Pacific Ocean by Kuiu Island to the west. Four transects were run from west to east. The current was from west to east and made it difficult to keep a straight transect from east to west, partially because of the slow speed required for the survey. Originally, five anomalies were identified (Figure 7-4) but subsequently number four could not be identified from the side-scan data.

Shakan Bay is a likely location to identify archaeological sites that are older than 11,500 or even 13,000 cal BP. The majority of the area was sub-aerial prior to sea level rising to a depth of 60 m or 12,500 cal BP. Though the coast extended further seaward in Sumner Strait, paleogeographic reconstruction suggests that rivers and lakes may have been favorable habitat to early settlers. Sumner Strait contained a large glacial lobe during the LGM, but the lobe is expected to have retreated to the north end of POWI by about15,000 cal BP (Carrara et al. 2003, 2007). This means there was deep water habitat available for fishing adjacent to Shakan Bay during the late Pleistocene and early Holocene.

7.1.4.1. *Shakan Bay Anomaly 1*

Anomaly 1 in Shakan Bay consists of two circular and one rectangular depression (Figure 7-2). This was located during analysis of survey line 00a. The Yellowfin software had to be reset. Hence, file number 00 was repeated. The shadows are seen as white space on a grey background, using the reverse grey color table. There are no dark or raised returns between the sonar and the shadows, which indicate they are depressions. The rectangular depression is approximately two meters wide and five meters long. The larger circle has a diameter of approximately three meters. The smaller circle, on the bottom of the image, has a diameter of 2.2 meters. The anomalies are in approximately 60 meters of water. This image is from the port side of the sidescan and the line on the right side of the image is the surface return. The sonar sends pulses of sound in all directions and records each return. The surface of the water occurs as a solid or dark line on each side (port and starboard) of the sonar image. The depth of an anomaly is calculated by adding the distances to port or starboard of the anomaly and the distance port of starboard of the surface return.

The circular and rectangular shaped depressions could be cache or storage pits or house depressions similar to those found in SE Alaska during the historic (PET-00126), proto-historic, and developmental phases (Twelve Mile Midden – PET – 00493, Kutsnoi

Habitation (Baby Bear Bay 2 – SIT- 00353). Twelve Mile Midden was occupied between 664 and 782 cal BP (660 ± 60 and 810 ± 60 ^{14}C years) (Beta-158919 and158918) and includes a depression measuring approximately 3.2 m long and 1.2 m wide, and 30 cm deep. Kutsnoi Habitation has a depression that is 2.35 m by 2 m and is 30 cm deep and dates to 1430 cal BP (Beta – 56342). Baby Bear Bay 5 has two oval depressions. one is 2.5 m by 3m and the other is 5 m square. There is also a rectangular depression, which is 2.5 m by 3m. The site dates between 940 and 1220 cal BP (Beta 56345, 56346). Depressions are common features through the archaeological record for SE Alaska. These three depressions could be cultural in origin based on comparison with similar recorded archeological features.

7.1.4.2. *Shakan Bay Anomaly 2*

Figure 7-3: Shakan Bay anomaly 2: two raised rectangular features

Anomaly two in Shakan Bay consists of two raised rectangular features (Figure 7-3). This anomaly is in line 00, across the top of the survey grid. The top rectangle is approximately 1 m wide by 4.5 m long. It is roughly 40 cm high. The lower rectangle is approximately 1 m wide and 9 m long. It is 40 cm high. It is unclear how much of the anomaly is below sediment and thus it is difficult to ascertain its true height. The area surrounding this anomaly is mainly flat sandy sea bottom. The anomaly is located at 120 m depth and is located on the starboard side of the sonar. The rectangular features appear to be man-made, but it is unclear what they are. They could be from nearby logging activities in the early 1900s. One suggestion was that it could be a log.

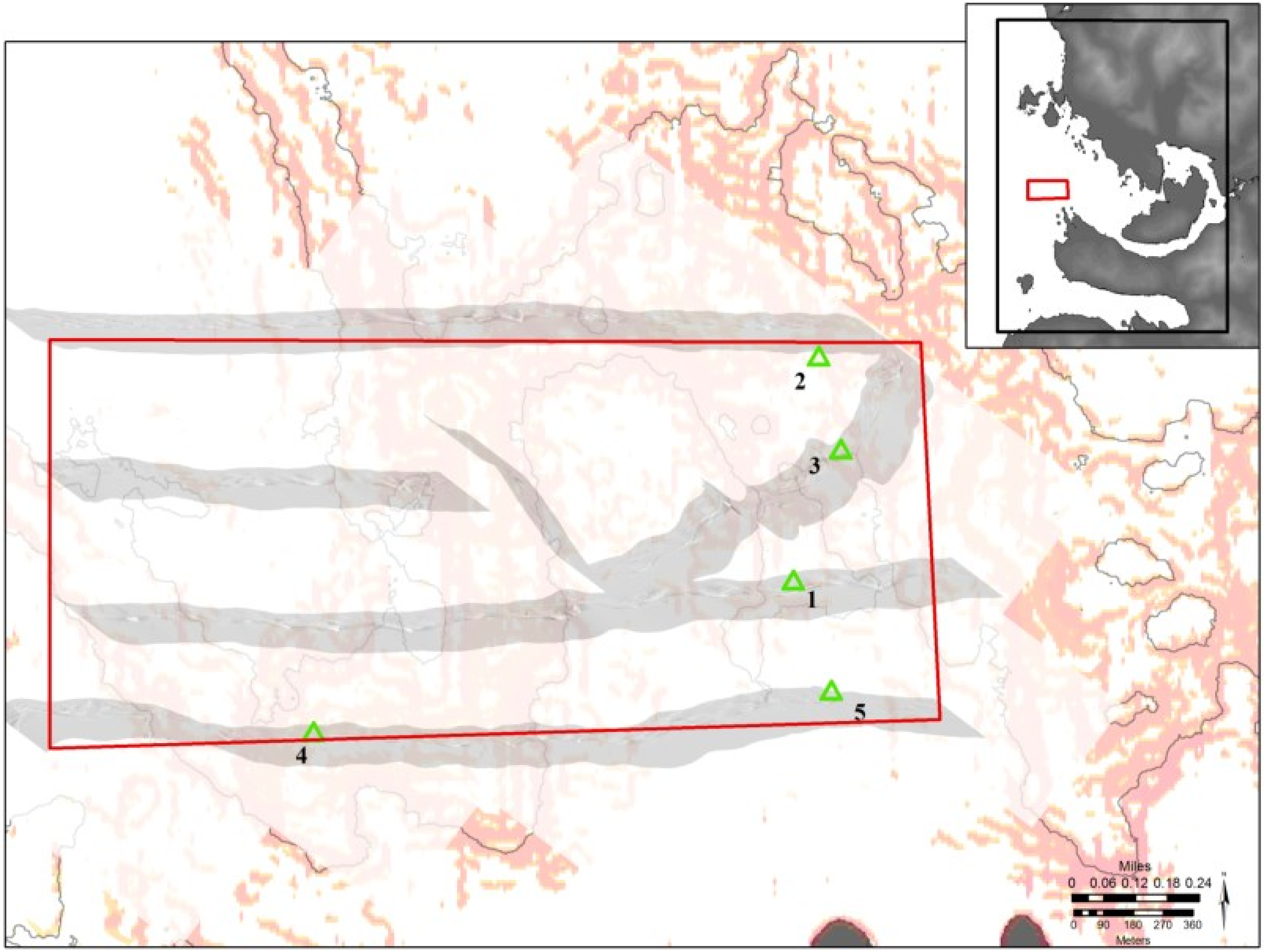


Figure 7-4: Map of Shakan Bay side-scan survey from June 2010 indicating anomaly locations. Modern coastline is in grey with the 52 meter coastline (line) and model (from May 2012 - red moderately-high potential and yellow high potential) in the background. The red box is the survey area indicated on the inset.

Below: Naukati Creek Village (CRG-123). Six stone fish weirs of low mounds of rocks at the mouths of a series of small inets from 19m to 127 m long. Dates to 2240 ± 50 RCYBP. (Richard Campbell 1988)

Above: East Kaikli Trap (CRG-269). A single lobed trap extending out from the grass margin on a rocky point. The trap is 7.5m across the base, and extends out 4.1m. The structure is 1.8m wide and is 0.20-0.35m high. It is constructed of boulders 25-50cm in diameter. The entire structure is above mean high tide.

Above: Warm Chuck Stone Trap (CRG-369). This is a series of at least five looping stone wall which form a complex stone fish trap. The structure is primarily in the middle to lower intertidal zone however additional stone walls appear to exist in the extreme low tidal zone.

Left: Wolf Creek (PET-123).

Figure 7-5: Images of stone weirs from SE Alaska from Doug Reger including East Kaikli Trap (CRG-269), Naukati Creek Village (CRG-123), Warm Chuck Sone Trap (CRG-369), and Wolf Creek (PET-123). (Site information from the SHPO database and Smith 2012).

7.1.4.3. *Shakan Bay Anomaly 3*

Anomaly three in Shakan Bay was interpreted from the side scan records as several stone semi-circular raised features and two circular depressions (Figure 8-6) semi-circles are between 20 and 40 cm high and 3.5 to 4 m wide. There are seven or eight of these semi-circular features near two depressions. The depressions are approximately 2.5 m in diameters. The depth below sea level is 52 m and the anomalies are located on the starboard side of the ship. It is unclear what the two depressions are, but one suggestion is that they are fresh water vents or similar karstic features.

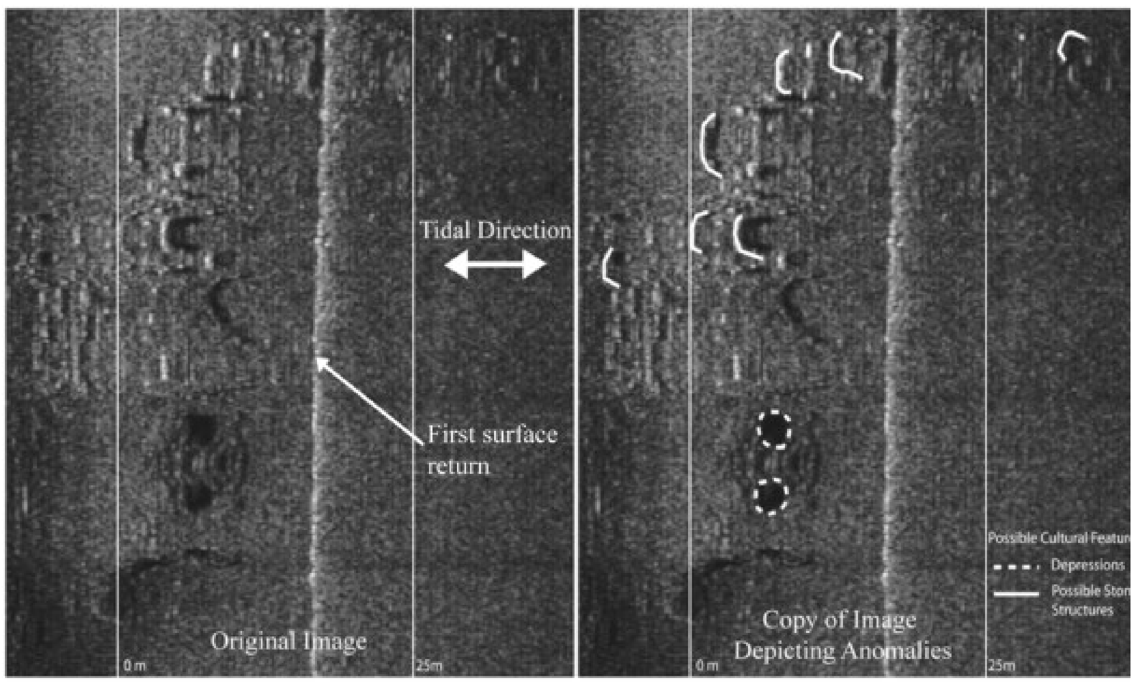


Figure 7-6: Shakan Anomaly 3: raised semi-circular features and two depressions. Image on the left is the original sonar and on the right is the sonar image with the anomalies depicted in white.

One hypothesis to explain the semi-circular features is that they are possibly intertidal fish weirs. Smith (2012:10) identified five types of fishing structures in SE Alaska: baskets (0.8%), stone (45.5%), wood stake (48%), basket and stake (0.3%), and stone and stake (5.4%). The percentages provided are for the number of recorded fishing structures in SE Alaska with a total of 369. The stone and stone with stakes weirs combine to create the largest category of fishing structures. Similarities can also be drawn between these semi-circular anomalies and a number of sites in SE Alaska including CRG-123, CRG-269, CRG 369, and PET 125 (Figure 7-5). Figure 7-7 incorporates an artist's reconstruction of the landscape when the potential fishing weir was exposed as dry land, using IVS3D Fledermaus. At a depth of 52 m, the region would have been an intertidal estuary. This landscape would have existed approximately 12, 300 cal BP, based on the sea-level curve. If the semicircular features were fish weirs, they would be the oldest fish weirs in North America. Ancient fish weirs are found throughout SE Alaska and the oldest weirs are approximately 5000 – 6000 cal BP (Smith 2011) .Older structures likely exist but have not yet been identified. This location was investigated during the May 2012 field season.

Figure 7-7: Reconstruction of the location of the potential weir and depressions on the landscape (sea-level is at 52 m with a 1 meter gap for tide).

7.1.4.4. *Shakan Bay Anomaly 4*

Shakan Bay anomaly 4 was originally described as two rectangular features and three small circular features. However, during further analysis of the side-scan data, these anomalies have not been identified, but are possibly visible in the 2012 multibeam data.

7.1.4.5. *Shakan Bay Anomaly 5 - Shipwreck*

Shakan Bay anomaly 5 is a shipwreck (Figure 7-8) at approximately 35 m of water. The vessel has the bow or stern detached, so it is in two parts. The main part of the anomaly is approximately 6 m wide and 35 m long. The anomaly is 1 to 1.5 m above the seafloor. Figure 7-8 depicts both the raised anomaly in grey and the shadow in white behind the two pieces of the possible wreck.

Figure 7-8: Shakan anomaly 5: shipwreck. Likely the Restless lost in 1910

The Restless is a Yawl vessel that sank February 10, 1910 between Shipley Bay and Shakan. It was stranded when the anchor line broke. Her last port was Wrangell. The vessel was reported to be trapping on Baranof Island when she sank. The vessel is of little value (financially or regarding cargo) and there are currently no other details regarding the vessel. Anomaly 5 in Shakan Bay is around 2.7 km (1.7 miles) from the reported location of the Restless. This reported location is a point that was put on a map based on survivor’s descriptions of where the vessel sank and consequently it is not precise. The anomaly could be the Restless.

7.2. May 2012 Survey

Field work was conducted from May 21 – 31, 2012 with the 86’ *F/V Crain* and the 36’ *R/V Antonie*. The *R/V Antonie* is a fiberglass gillnetter. The *F/V Crain* was utilized as a platform for deploying the ROV and Van Veen sampling, screening, and crew accommodations during the survey. The *R/V Antonie* was used for surveying using multibeam sonar and sub-bottom profiling. A Geometric G-882 magnetometer was available but was not utilized in 2012. The magnetometer was not functioning due to a software issue for the majority of the field season.

The archaeological team consisted of E. James Dixon (PI), Forest Haven, and the author. Forest Haven is Tsimshian from Metlakatla. She is an undergraduate student at the University of Alaska Southeast and was the intern selected by Sealaska Heritage Foundation to participate in the 2012 season. The technicians consisted of Tim Bulman of InDepth Marine, Harry Castle of Aquasphere Surveyors Inc., and Rick Hollar of AUS Diving. The crew of the *F/V Crain* was Chris Beaudin, Conrad Beaudin, and Stacie Murray. Tony D'Aoust is the owner and captain of the *R/V Antonie*.

Two areas were surveyed during the 2012 survey: Shakan Bay and the Gulf of Esquibel. The Gulf of Esquibel data will not be discussed here because it is not a test location for the dissertation. An area of 13.8 km^2 was surveyed in Shakan Bay from May 23 through May 26. The multibeam sonar unit and the *R/V Antonie* arrived on May 23 and surveyed May 24 through 26. Two new locations were identified during this survey, Shakan 6-add and 7. The sub-bottom profiler was operational on May 25th, but clean and useful data were only collected on May 26th in Shakan Bay. The sub-bottom profiler was used for the remainder of the survey in the Gulf of Esquibel. It provided excellent data after it had been calibrated. As a result, there is limited sub-bottom data for Shakan Bay.

The locations of both the *F/V Crain* and *R/V* Antonie were recorded by Hemisphere V100 GPS dual antenna systems. These tracked the position and heading providing differential or DGPS for the survey. They were also calibrated to record the pitch, roll, and heave of the vessels.

7.2.1. ***Multibeam Sonar***

Swath or multibeam echo sounders were designed to determine the depth of water and the topography of the seabed. Units use a broad fan-shaped sonar pulse from a transducer to create a swath across a track (perpendicular to the vessel) that records a small alongtrack (the forward movement). Like most geophysical units, the computer software then calculates a two way travel time for the acoustic pulses utilizing a bottom detection algorithm. The speed of sound in water must be calculated for each survey to ensure accuracy. This is conducted using a velocity probe (Kongsberg 2006).

The multibeam sonar used was the Kongsberg EM 3002 multibeam echo sounder. The survey was recorded in both Hypack 2011 (hydrologic processing software) and

Seafloor information system (SIS) from Kongsberg Maritime. The multibeam was attached to the hull of the *R/V Antonie*. The beam width used was 60º per side for a total of 120º of the seafloor. This means that the area of the seafloor recorded and the resolution of the data changed with the depth. A single 300 kHz sonar head with 254 beams was utilized. A velocity probe from Kongsberg was operated that connected directly with the Hypack software to correct for the speed of sound through the water. The velocity probe was deployed each day and whenever a new survey location was started. Differential GPS (D-GPS) was utilized to establish locational accuracy. The EM 3002 uses beamformed signal amplitudes, which mean the beams are combined in such a way that signals at some angles experience constructive interference while others experience destructive interference. The vertical or depth resolution is 1 cm and seafloor resolution can be 5 cm, which was unfortunately not utilized during this survey do to the large area covered.

The EM 3002 includes pitch, roll, and heave stabilization, and also records yaw. Pitch is the surge or longitudinal or front/back motion of the vessel. Roll is the sway or lateral or side-to-side motion of the vessel. Heave is the vertical or up-down motion of the ship. Yaw is the rotation of the vessel. A series of test lines were run to determine average values for pitch, roll, and heave. These test lines were over a flat location and a steep location to record how the ship responded. These values then were inputted into the Hypack software for immediate correction. The SIS dataset was not corrected. The Hypack data were used for analysis. Further post-processing to correct the heave, pitch, yaw, and roll were conducted by Rick Hollar. “Originally, the software removed a long-term average of the heave from the soundings but I [Rick] found that not removing that average gave better results” (Hollar 2012 personal communications). Tides in Shakan Bay vary by several meters. Tides were corrected using the predicted tides from the published tide tables for the Shakan Bay Entrance location (Station ID 9450982).

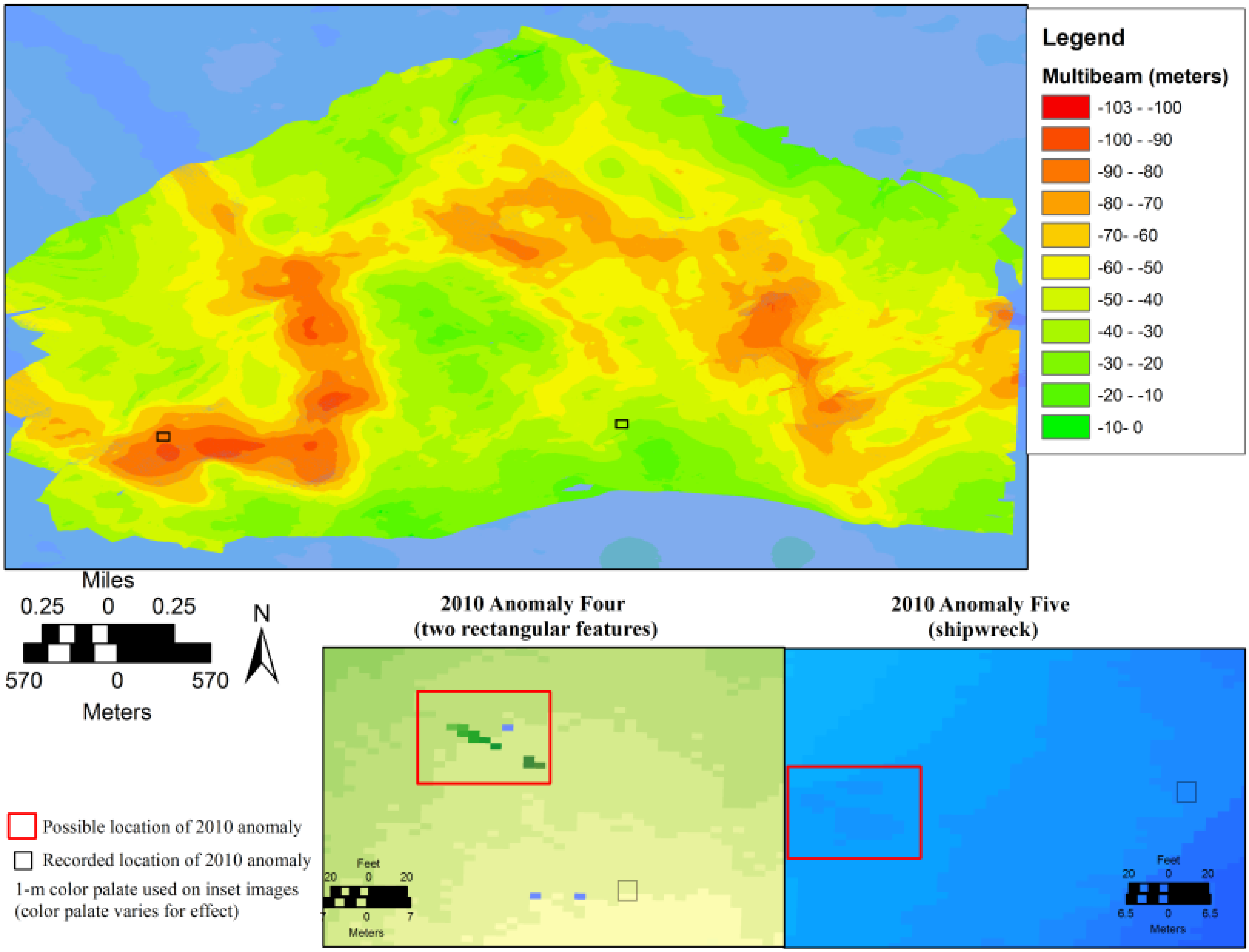


Figure 7-9: Multibeam results at 1-m resolution (with 5-m color palate) and identifying two of the 2010 anomalies (with1-m color palate)

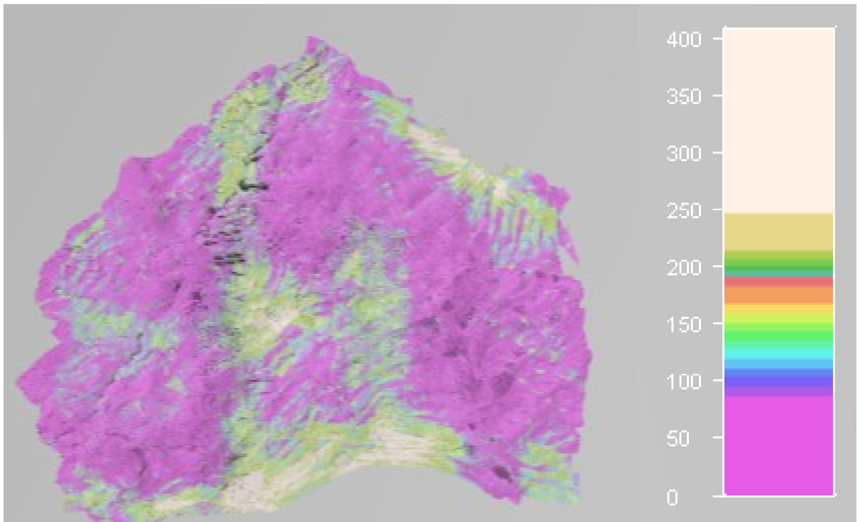


Figure 7-10: Density of multibeam points per $1m^2$.

The Hypack data were exported as xyz data by Rick Hollar and inputted into IVS3D Fledermaus. Using the DMagic tool, the data were combined into a "pure file magic" or pfm file. The pfm format allows the user to edit points to identify errors and problems with overlapping data. The data were exported at 0.25, 0.5, and 1 m. Due to the variability in point spacing, the 1 m option was chosen for better detail. A combined uncertainty bathymetry estimator (CUBE) was utilized during the generation of the pfm that created uncertainty estimates for the beam points and removes files that are outside normal parameters. Normal parameters are set at 5% variation in depth. Minimal other post-processing was conducted.

The data were very coarse (Figure 7-10). Points are much further apart than was intended for the survey. In the 2013 survey, the beam angle will be narrowed based on depth to maintain a constant resolution of less than 0.5 m. Currently, some of the data points are greater than 1 m apart. The 1 m resolution is only possible because a 100% overlap was achieved during most of the survey. Some small blue spots, or data holes are visible on the 1-m (Figure 7-9) and 10-m (Figure 5-4A) multibeam results. This exists when there is less than one multibeam return for a 1-m area. No new anomalies have been identified during post-processing of the data, but anomalies four and five from the 2010 survey are depicted in the bottom of Figure 7-9. The anomalies identified in the side-scan have not been identified in the multibeam data. Shakan Bay anomaly five, the shipwreck, has poor coverage.

7.2.2. ***Sub-bottom Profiler***

Sub-bottom profilers use the same premise as multibeam sonar, but it is a lower frequency and only a single beam. The lower frequency acts like ground penetrating radar and provides a two-way sound profile of the sub-seafloor. The profile depicts the density differences between strata and it can identify man-made cultural objects or disturbances such as buried structures or stratigraphic anomalies.

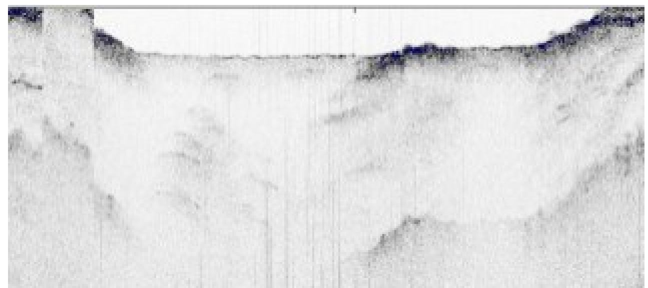


Figure 7-11: Sub-bottom from Shakan Bay indicate possible river channel.

The sub-bottom profiler used in 2012 was an Edgetech 3200 – SB-216S. The frequency range on this unit is 2 – 16 kHz. The vertical resolution is between 6 and 10 cm and it can penetrate from 6 to 80 m depending on the density of the material. The sub-bottom data were recorded using Edgetech software. This was routed through the Hypack multiple beam recording system for GPS location. The Hypack software would often lose the connection to the GPS and would need to be restarted. Each time Hypack was restarted, the settings on the Edgetech software returned to their factory settings (including time). The Edgetech software, Discovery Sub-Bottom, recorded everything in .jsf format, which is unique to Edgetech. This software had the ability to convert to .xtf, which is a universal format, but IVS3D does not utilize either format of sub-bottom data. IVS3D required SEG-Y files and the extension for FM Midwater. The sub-bottom data was analyzed in the Edgetech software and has not been referenced to the multibeam or previous side-scan data.

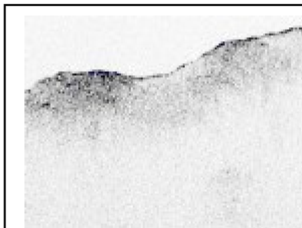


Figure 7-12: Sub-bottom image from Shakan Bay.

The sub-bottom profiles indicate that there is little surface sediment in the region, except in specific areas. Figure 7-12 is a profile from Shakan Bay. The dark returns indicate the lack of sediment or a hard surface return. In the middle is a dip with no, or less of, a hard return. This is an anomaly and could be natural or man-made. It is possibly likely made by a starfish burrowing into the seafloor or is a sediment filled paleo-river channel.

Figure 7-11 is another sub-bottom profile from Shakan Bay. In the center of the image is a rippled surface with no hard return. This is possibly a river channel. To the right of the possible river channel is a hard return and then a small area without a hard return. This could be an alternative channel or a feature, either natural or cultural. This image also includes echoes or multiples of the surface that are seen in the deeper (lower) sections of the profile.

These are the only significant anomalies identified in the sub-bottom data from Shakan Bay. A problem with the sub-bottom data can be that the sonar beam is very wide depending on depth, similar to the problem with the multibeam resolution. This means that a large area is included in the profile, often more than one meter for depths greater than 60 m. Both anomalies are at 20 meters depth and are high resolution. The most significant problem with the sub-bottom was the inability to capture it for the first two days of multibeam survey in Shakan Bay.

7.2.3. ***ROV***

The remotely operated vehicle (ROV) that was used in 2012 was similar to the one used in 2010, but it only had one camera. It was the Sea Eye Marine Falcon. This unit is rated to 300 m depth. It has a high resolution color camera with 180º tilt and three variable intensity LED lights totaling 6400 Lumens. The arm has a three finger gripping function.

A total of 19 hours, 59 minutes, and 6 seconds were recorded of ROV imaging. This does not include time diving the unit or submerging for most dives. Essentially, the time recorded equates to bottom time. Some of the test dives were not recorded. In Shakan Bay, a total of 6 hours, 16 minutes, and 57 seconds were recorded. Hypack 2011 and acoustic sensors were used to track the location of the ROV while submerged. A sensor was placed in the water slightly stern of mid-ship on the starboard side. This connected to the DGPS that was on top of the *F/V Crain* to record ROV location.

Four areas of Shakan Bay were investigated with the ROV: anomalies from the 2010 survey numbered one, two, and three and a high potential area referred to as 6-add. The first location was 6-add. This location was not surveyed in 2010, but was where *the Crain* was anchored on the night of May 23 and was adjacent to a high potential area based on the model. The seafloor was a new site and it took a while to become accustomed to the variability, shell density, and rocks visible. A small black basalt rock was brought up by the ROV at this location. It looked very luminous in the light of the ROV. It was not modified. Nothing of note was identified during this test dive.

Survey locale ‘Shakan one’ was the area containing the two circular and one rectangular depressions. At this location, the ROV found many small pits formed by starfish. A large piece of bark resting on the bottom was collected using the mechanical arm of the ROV. The pits identified from the 2010 side-scan survey could not be identified. Shakan two was the long raised rectangular feature. The ROV recorded a rock field with no defined pattern. There appeared to be some possible alignments of rocks at points, but nothing definitively cultural could be identified. Shakan three was the potential weir feature and depressions. A small cluster of rocks was identified; however, it is questionable if they were in alignment. A piece of a stick was picked up by the ROV from this location (Figure 7-13), but only a small portion of the stick survived surfacing. It broke after it had been grasped by the mechanical arm as it traveled through the water column to the surface.

An attempt has been made to mosaic sections of the ROV video to make a plan view. Unfortunately, the particulate matter visible in all frames and the changing angles of view make this very difficult. The images are blurry and it was necessary for the technician regularly to raise the camera to “look” where he was driving the ROV. This means the seafloor was not visible or only minimally visible for considerable lengths of time. In addition, the view of the seafloor would vary based on how the ROV moved vertically and

Figure 7-13: ROV image of stick picked up at Shakan Bay anomaly three.

horizontally. These factors made it difficult, if not impossible, to stitch these images together. Finally, the view from the ROV was as short as 18 inches at some times. Because the ROV needed to be close to the seafloor for it to be visible, the actual area visible on the seafloor was limited.

7.2.4. ***Recovered Ecofacts***

In addition to items that were recovered by the ROV, a Van Veen grab sampler was used to collect bottom sediments to physically test for the possible occurrence of artifacts and/or ecofacts. One artifact and 60 ecofacts were recovered, 45 of which are from Shakan Bay. The Van Veen was deployed in three different locations in Shakan Bay (and one location in the Gulf of Esquibel). These sample locations were anomalies 3 (stone semi-circular features and circular depressions) and newly identified locations Shakan Bay 6-add and 7.

The Van Veen Grab Sampler is a lightweight sampler designed to sample soft sediment. There are two sizes, small and large. Only the small size was available for the 2012 survey (the same one used in 2010). It has a sampling volume of 24 liters and can sample up to 150-200 lbs. of sediment. It weighs 40 lbs. and could penetrate the sediment up to 10 inches. Most of the time, it takes much smaller samples because of its inability to penetrate more consolidated sediment and cannot penetrate the full 10 inches. Additionally, the jaws of the device do no close if a cobble is caught between them resulting in "blanks" or no sediments to screen.

The small Van Veen was deployed from the *F/V Crain* via a hydraulic winch. It was dropped as quickly as possible and then brought up slowly. The sediment was then dumped into a sled-like plastic bin. The bin was slowly poured onto metal screens. The bin was then rinsed with sea water over the scree to capture any adhering sediment. The sediment was then wet screened using seawater. Two graduated screen sizes were used for each sample: one-half inch and one-quarter inch. Items of interest such as wood, conifer cones, and odd shaped rocks were put in plastic bags for later analysis. Sea water was added to all organic remains to maintain the salinity and moisture levels.

Each Van Veen sample had a GPS location taken with a hand-held Garmin eTrex GPS. Some of the Van Veen samples were also recorded using the acoustic sensors for the ROV. Notes were taken describing the character of the sediments and ecofacts in each sample. Each item or sample collected from the screen had a photo taken with a scale, the date, GPS number, and the name of the person who photographed it was logged. All of this information was also recorded on the plastic bag. A sample card with the same information, on acid-free paper, was filled in and placed in the plastic bag.

Figure 7-14:Cut wood from VV25-20 at Shakan Bay Anomaly three

Once the ecofacts and samples were returned to the archeology lab at the Maxwell Museum and put into Rubbermaid containers, the salinity was tested and slowly reduced to tap water or neutral salinity. The original seawater was determined to be 38 ppt with a specific gravity of 1.028. Seawater is usually between 28.5 and 35 ppt or 1.021 and 1.026. Tap water is usually 6 ppt or 1.004. A Coralife Deep Six Hydrometer was used to test the salinity of the original seawater, clean salinized water, and water in which the ecofacts had been soaking. Instant Ocean sea salt was used to create mixtures of decreasing salinity. The salinity was reduced by 2 ppt once every two to three weeks, until it reached 14 ppt or 1.010. At the lower salinity, the ecofacts were allowed to soak for one month before the water was changed. At the last salinity, 6 ppt or 1.004, the water was replaced a second time and the ecofacts were allowed to soak for a full month in each solution. To ensure the ecofacts did not dry out during soaking, all items were completely submerged and the Rubbermaid lid was secured. After the salinity was 6 ppt or 1.004, the water was drained from each container and the ecofacts were allowed to slowly dry (the lids were left ajar to minimize their exposure to dry Albuquerque air). Before the desalination process began, each ecofact was weighed, measured, and photographed in the lab.

Samples were taken from two locations near Shakan Bay anomaly three. In total, the Van Veen was deployed 35 times. only 20 of these contained sediment. The matrix was a silty-mud with rocks, rock fragments, and shell. Ecofacts that were recovered include bark, coniferous cones, a number of quartz and shale rocks, wood, a bulk sample including sediment, and a bulk sample of material remaining after screening. One sample, VV25-20 (Van Veen, May 25, sample number 20) included a small piece of cut wood (Figure 7-14). A sample of the cut wood was submitted for radiocarbon dating. The date was determined to be modern (CURL-15805). It is suspected that all or most of the ecofacts recovered are modern.

Four samples were taken at Shakan Bay 6-add. The matrix was muddy sand mixed with shell and some small rocks. No ecofacts or sediment samples were recovered from this location. It is likely any possible archaeological material is deeper in the sediments than the Van Veen will penetrate. A new sampling system will be implemented for the 2013 field season that has the ability to penetrate deeper and control sampling locations more precisely.

Shakan seven was identified by examination of the multibeam data collected the previous day that suggested the presence of a series of potential paleo-beaches. It was also a high potential location on the model. A total of 50 samples were brought up and only one of these was empty. Three locations were sampled within the area. The matrix was a silty-sand with rocks, shell, and shell-hash. The ecofacts recovered include bark, wood, coniferous cones, shale, and irregularly shaped rocks. Some of the bits of wood were rounded, but none of them showed definitive signs of cultural modification (Figure 7-15). The rounding was likely naturally caused by weathering and water erosion.

7.3. Summary

The composition of the seafloor was somewhat surprising. There was a significant amount of modern bark, coniferous cones, branches, and even logs. There were small pieces of wood and other organic materials on top of the sediments. The seafloor was silty with rock outcrops. The rock outcrops appear to have been scoured, likely by past glaciations. The silty areas were teaming with small sea life including numerous starfish. These starfish created small burrows or beds that could be interpreted to be small pits or depressions on geophysical results.

Figure 7-15: Piece of rounded wood recovered from Shakan Bay seven (VV-26-06).

The study region is vast, with large areas of open-ocean. Many areas of open-ocean will be dangerous and difficult to survey due to environmental conditions and the size of the survey vessels. This research is possible because of advancements in marine geophysics, geolocation, GIS software, and available GIS data. The majority of the model and the processing have required a "supercomputer" and new and continuously improving computer technology.

The large area requires the ability to collect and process larger sediment samples than the Van Veen sampler can provide. Conducting over 50 Van Veen samples in a single day could be equated, in sediment volume, to 50 shovels, which is not enough material. Additional field testing is essential to determining the outcome of the archaeological site high potential model. New methods have been developed using a suction dredge system attached to the ROV to increase sample size and precision on the sea floor. This will also allow the testing of sediments that are not currently on the surface. With the new technological improvements, it is expected an archaeological site will be located during the 2013 field season. If ship time and weather permitted, using this new sampling unit in Shakan Bay would likely produce archaeological sites.

In addition to the improved sampling, the precision and accuracy of the multibeam will be improved for the 2013 season. The overall area surveyed will need to decrease, but the beam angle will be narrowed to improve precision to less than 1 m. This is expected to delineate areas to be tested using the new ROV assisted sampling system.

8. Archaeology: Pre-9,000 BP Archaeological Sites on the Northern NWC

As of 2012, there are fifteen reliably dated archaeological sites on the northern NWC pre-9,000 cal BP (Table 8-1). These sites are mainly from times of lower sea-level and were not coastal sites. Some of the sites are on raised beach terraces from when sea-level was higher than modern (10,600 to 5730 cal BP, 9400 to 5000 ^{14}C years). These are the known site database that the archaeological high potential model is trying to expand. These are sites that are in the published literature. More sites exist in the archaeological site database from this period, but there is nodetailed description for them. Table 8-1 has the oldest component for each of the pre-9,000 cal BP sites in geographic order from north to south. Sites with dates prior to 9,000 cal BP were selected for several reasons. First, Baichtal and Carlson (2010) say that by 9,000 cal BP northwestern POWI was an ‘interaction corridor’. Secondly, 9,000 cal BP is over 1000 years after sea-level stabilized in the region. Hence, sites from this period should be visible. Finally, Fedje and Mackie (2005:158) identify the Kingii Complex starts at 8900 cal BP.

Table 8-1: Average calibrated ^{14}C dates for sites older than 9000 cal BP (Lee 2007: 32, 46)

Region	**Site**	**Component**	**Mean of Calibrated Age Ranges**
SE Alaska	Ground Hog Bay 2	Lower	11,528
	Hidden Falls[1]		10,157
	49 PET 408 (On Your Knees Cave)	Human Remains[1]	10,207
		Bone Tool	12,129
	Chuck Lake	Loc 1 (midden)	9,204
Haida Gwaii	K1 Cave[1]		12,650
	Lyell Bay	East	9,906
		South	9,483
	Echo Bay[1]		9,916
	Richardson[1]		10,442
	Arrow Creek 2[1]		10,584
	Gaadu Din Cave 1[1]		12,683
	Gaadu Din Cave 2[1]		12,480
	Werner Bay		12,481
	Kilgii Gwaii[1]		10,570
BC Mainland	Namu (ElSx1)		11,049
[1] Average of several mean calibrated age ranges			

Figure 8-1: Map of Pre-9,000 cal BP archaeological sites from the northern NWC

8.1. SE Alaskan Sites

Four of the pre-9,000 cal BP sites are in southeastern Alaska: Ground Hog Bay 2, Hidden Falls, PET-408 or On Your Knees Cave (OYKC), and Chuck Lake.

8.1.1. *Ground Hog Bay 2 (11,528 cal BP)*

The site is west of Juneau in Glacier Bay National Park. It was located in the summer of 1965 (Ackerman 1968: 55). Ground Hog Bay 2 is located on a glacio-marine terrace 17-18 m above mean sea-level (amsl) on Chilkat Peninsula. Ground Hog Bay is protected from Icy Strait by an offshore reef and headlands to the northwest and southeast (Ackerman 1996: 424). The site is set back from the current beach, 34.5 m inland from high tide (Ackerman 1968: 55). Following local deglaciation (11,500 cal BP) (Ackerman 1968: 56), the terrace formed the edge of an ancient beach, sea deposited sand and gravels overlay the till surface. Glacio-marine sediments from elevated terraces on either side of Icy Strait were dated to 16,366 cal BP (13,420±130 (SI-2082)) and 13,511 cal BP (11,630±145 (SI-2113)) (Ackerman et al. 1979: 198). These provide maximum limiting dates for the GHB2 terrace.

Ackerman (1968) originally identified six components. Component I was the youngest. Component II has eight dates ranging from 4,645 cal BP (4155±95 (I-7056)) to 9916 cal BP (8880±125 (I-7057)) (Ackerman 1996: 426). Component III has three dates 10,259 cal BP (9130±130 (I-6304)), 10,406 cal BP (9220±80 (SI-2122)), and 11,528 cal BP (10,180±800 (WSU-412)) (Ackerman 1996: 426). Due to the large error associated with the last date, it is not regarded as a reliable basal date (Ackerman et al. 1979, Ackerman 1996). Components II and III were later seen as stratigraphically indistinguishable and combined as the lower component of the site (Ackerman 1996: 425-6). There is no mention of components V and VI.

The diagnostic artifact in the assemblage is a wedge-shaped, frontally fluted microblade core. Obsidian is thought to have been imported from Suemez Island or Mount Edziza in British Columbia (Ackerman 1968, Lee 2007). Bifacial fragments were also present. Two obsidian biface fragments came from the lowest part of the site. The lower component (II and III) also includes side scrapers. No hearth or evidence of structure was noted during excavation of the lower component, though there might have been some fire altered rock (Ackerman 1996: 428-9).

Ground Hog Bay 2 is outside the model area, but using pre-exiting data from the Tongass National Forest, the site has a slope of 3º and an aspect of 177º or south. The slope would be rank 4 and the aspect would be rank 2. It is in the mixed (MIX) category of archaeological site because it includes multiple types of materials and archaeological features. The modern coast is 140 m from the site, but the 11,500 cal BP sea-level was 18 m lower, which means the site was approximately 700 m from the coast (based on NOAA charts) when it was occupied. This means the distance from coast value would be a rank of 3. Both coasts are relatively straight and likely would have a low sinuosity value (i.e. in the low category). The site is approximately 300 m from a stream (value of 5). There are no lakes within 3000 m so the value would be 0. The junction of a stream and the modern coast is 300 m away, but the prehistoric coast would have been further (within 1000 m has a rank of 3). The nearest archaeological site is over 7 km away; the rank would be 0. Putting this math together using the same system as the weighted overlay function and weights as weight 8, the location where Ground Hog Bay 2 is located would have a weight of 2. This means it would not have been a high potential area. The sea-level curve for this region would be different from the west side of POWI and thus the variables would need to be reconstructed to create an accurate model for this location.

8.1.2. ***Hidden Falls (10,157 cal BP)***

The Hidden Falls site is approximately 8 m above sea-level (asl) on a point at the head of Kasnyku Bay on northeastern Baranof Island, northeast of Sitka. It was excavated in 1978 and 1979 (Davis 1989: 23, 27) and was discovered as a result of road construction for a fish hatchery.

Hidden Falls is a multicomponent, stratified site at which Davis identified three components. Component I is the oldest and the only one relevant to this research. Component I was found in stratigraphic unit (SU) I, which is a discontinuous paleaosol, and in units SU G, H1, H1a, and H2, which are Holocene ablation tills (Davis 1996: 416-7). A total of 14 radiocarbon dates were reported for Component I. Eleven dates are from SU I, and ten of these were on wood. The eleventh was on wood and is younger than the other dates 8,000 cal BP (7175±155, SI-3777). Three radiocarbon samples were from H2. Two of these were wood and one was charcoal. The wood dates range from 12,240 cal BP (10,345±95 (SI4360)) to 8,774 cal BP (7,900±90 ^{14}C years (SI4340)) and include three dates over 11,500 cal BP (10,000 ^{14}C years). Only four of the dates are stratigraphically younger 10,000 cal BP, including the diluted wood. The charcoal from H2 was reported a date of 10,157 cal BP (9060±230 (Beta-7440)). Davis combines the radiocarbon dates and dates from pollen cores from Muskeg Lake to determine that the occupation was around 10,800 cal BP (9,500 ^{14}C years).

The artifact assemblage consisted of a unifacial tool, microblades, split-cobble and split-pebble tools, choppers, hammer stones, a variety of scraping tools, gravers, an abrader, burins, and utilized flakes. A total of 612 lithic artifacts and debitage were recovered from component I in the two years of excavation. A biface fragment was recovered, but Davis (1996: 417) questions its provenance because it was associated with a tree stump removal. Obsidian was from both Mount Edziza in British Columbia and Suemez Island, Alaska.

Hidden Falls is also located too far north to be in the study area. This site is also a mixed site in the database because it has lithics, charcoal, a midden. Using the same data as Ground Hog Bay 2, the slope is 6º and the aspect is 64º or north by east by east (NEE). This means the slope rank is 3 and the aspect is a rank of 1. The modern coast is less than 70 m away, and the 10,000 cal BP coast was 12 m above modern sea-level. This means the coast was less than 100 m. The coastal distance and sinuosity rank is 5. The site is located in a bay on a peninsula and is high sinuosity. Fresh water (streams, lakes, and tributary junctions) are all less than 500 m away and are ranked 5 except tributaries, which is ranked 4. There is a site located 2.7 km away; therefore, the distance from site rank is 1. The nearest site is a 4000 cal BP year old weir. The overall weight would be 3, or moderately high potential.

8.1.3. ***49-PET-408 (On Your Knees Cave) (10,207 cal BP and 12,129 cal BP)***

Cavers located OYKC in 1993. The cave is located in the northwest area of POWI, near Point Protection. The cave is approximately 135 m amsl. It was not in a coastal setting (Dixon et al. 1997: 707). The cave has a total length of 70 m and consists of two passages: the Bear and Seal Passages. OYKC was used as a carnivore den throughout the late Pleistocene and the Holocene (Heaton and Grady 2003). The site was subject to a variety of depositional events including the accumulation of unsorted inorganic sediments that could have been deposited by glacial melting and landslide events. The cave contained brown bear *(Ursus arctos*) and black bear *(Ursus americanus*) remains dating to before the LGM and ringed seal (*Phoca hispida*) remains dating to the LGM. The vertebrate remains indicate that the region was an ice-free refugia and capable of supporting humans and animals during the LGM. OYKC has uncovered additional species records and is to defining vertebrate faunal history for POWI over the past 50,000 years. The paleontological work focused on the inside of the cave while the archaeology primarily focused around the cave entrance (Heaton and Grady 2003: 22-3).

In 1996, Timothy Heaton found part of a human pelvis. Excavations stopped immediately when human remains were recognized, complying with NAGPRA (North American Grave Protection and Repatriation Act). With tribal approval, the excavation continued. The OYKC human remains represent a man who died in his mid-twenties, based on the partial eruption of his wisdom teeth. The remains are comprised of a mandible in two pieces (including teeth except for incisors), a right pelvis, a cervical vertebrae, a lumbar vertebrae, three thoracic vertebrae, three ribs, three incisors, and one canine (Kemp et al. 2007: 606). The mandible dated to 11,283 cal BP (9730±60 (CAMS-29873)) and the pelvis dated to 10,260 cal BP (9880±50 (CAMS32038)) (Dixon et al. 1997: 703). The human remains had a ^{13}C value of -12.5%. This suggests a diet principally based on marine resources (Dixon et al. 1997:703). The calibrated values incorporate the marine correction for each bone using the marine reservoir correction of $\Delta R=495 \pm 24$ (Dixon personal communication) and Marine09 in Calib6.0.

The human remains are contemporary with the cultural occupation of the site. Three dates were run on charcoal: 9739 cal BP (8760±50 (CAMS-43991)), 10,377 cal BP (9210±50 (CAMS-43990)), and 10,330 cal BP (9150±50 (CAMS43989)). Also recovered from this cultural layer were obsidian microblades, bifaces, and other tools. These tools are consistent with the NWC Microblade tradition (Dixon 1999: 118-9).

The only artifact recovered near the human remains was a piece of mammal bone that was modified, possibly as a flint flaker. It exhibited similar staining and preservation as the human remains and is possibly associated with the human remains. This piece of a mammal bone dates to 12,129 cal BP (10300 ± 50 (CAMS42381)) (Dixon et al. 1997: 705-706).

OYKC is located within the study area, so the variables used in the model can be used to describe this site. It is also a mixed site as it contains human and faunal remains. As the model was only generated from 10,500 cal BP and older, the 10,500 and 12,000 cal BP models will each be discussed for this site. These results will then be compared to the visual inspection of the data from the Tongass National Forest used for Ground Hog Bay 2 and Hidden Falls. Unfortunately, OYKC is a limestone cave, which is a feature that this model does not intend to model.

Based on the data from the Tongass National Forest, the slope is 2º and the aspect is 304º. These have a rank of 5 for slope and 1 for aspect. There are no streams in the Tongass data near the site, but there are several within 500 m on the USGS topographic maps. The streams were ranked 5. There are no lakes; they are ranked 0. Using the USGS topographic map, there are tributaries joining streams to the coast within 500 m. These are then ranked 4. The coast is very straight, though the site is on a peninsula, so the sinuosity is low. On the modern coast, the site is 275 m away. At 10,000 cal BP, the sea-level was 12 meters above the modern coast; therefore, the site would be within 500 m. The 12,000 cal BP coast was 43 m below the modern coast. The site would be less than 500 m from the coast (496 m). The coastal distance rank would be 4. In the data provided by the state SHPO office for archaeological sites, the nearest site is a 9000 to 10,000 cal BP midden (three middens). The site name is EO #1 Area A, but this is not a published site. This site is 2.3 km from OYKC. However, in June 2012, Mark Williams identified a midden that is only 1.7 km from OYKC and the associated shell mound dates to approximately 10,000 cal BP. Either way the sites are more than 1 km and less than 5 km from the site and are thus ranked 1. The final weight for the site using the data available for the sites not within the study area, OYKC has a weight of 2 or low potential.

Using the 10,500 cal BP model data, the final weight is also 2. The slope is ranked 4. Aspect is ranked 2. Streams are ranked 0. Lakes are ranked 0; remember these are filled depressions and do not necessarily contain open water. The sinuosity is low and coastal distance is ranked 4. Tributaries are ranked 0. All sites are ranked 5 for distance to site because they are a site. Despite the different values, the rank is still the same as with the values from the Tongass National Forest data and USGS.

Using the 12,000 cal BP model, OYKC is also ranked 2. Slope is ranked 2. Aspect is ranked 1. Streams are ranked 2. Lakes are ranked 2. Tributaries are ranked 2. Sinuosity is low and ranked 3. Again, distance from sites is ranked 5. These higher rankings for streams and tributaries are due to the lower sea-level, more streams and tributaries that would have formed. Finally, the final model for the region, which encompasses 10,500 to 16,000 cal BP, has OYKC weighted as 3 or moderately high potential. So, despite the model not focusing on caves, the site is still identified by the model in the earlier periods.

8.1.4. ***Chuck Lake (9,204 cal BP)***

The site is located on Chuck Creek between Chuck Lake and Warm Chuck Inlet on Heceta Island, west of POWI. Ackerman (et al. 1985: 110-6) identified six localities. Localities 1 through 3 were subsurface tested, while localities 4 through 6 had artifacts collected from the surface and from disturbed areas. Localities 2 and 3 dated to around 5800 cal BP. Only Locality 1 will be discussed. Okada and Okada (1992) report on subsequent survey and excavation that included an area they designated Locality 1 south. They have no dates but report that the stratigraphy and artifacts were similar to Locality 1. Ackerman and colleagues (1985: 143) describe the site as a small temporary encampment, where ancient hunter-gatherers utilized both marine and terrestrial resources.

Locality 1 is a ridge that is 15-18 m amsl. Excavations were centered on an exposed area where road construction had exposed the site. Based on test pits and a trench, the midden refuse was a downslope deposit (Ackerman et al. 1985: 112). Three dates were submitted from Locality 1, two on charcoal and one on shell. Charcoal from the top of the midden dated to 8293 cal BP (7360±720 (WSU-3242)), charcoal from the bottom of the midden dated to 9,204 cal BP (8220±125 (WS-3241)). The shell was from within the midden and dated to 9112 cal BP (8180±130 (WSU-3243)) (Ackerman 1985: 144). Lee (2007: 37) notes that Ackerman does not apply a marine correction to the shell and assumes the 8293 cal BP (7360 ^{14}C years) date from the charcoal was too young. After applying a marine correction for marine reservoir effect, the midden shell date is 8396 cal BP (7580±130 ^{14}C years) and is in accordance with the charcoal from the top of the midden.

Chuck Lake Locality 1 provides shell and faunal remains, which are lacking for the other sites with a maximum date that is pre-9000 cal BP sites in SE Alaska. The invertebrate assemblage is dominated by butter clams (*Saxidomus giganteus*) and little neck clams (*Protohaca stamina*) (Ackerman et al. 1985: 118, Table 13). The faunal assemblage is mostly composed of unidentified fish (non-Salmonidae), birds, sea mammals, and different sized terrestrial mammals. Included in the list of identified mammals is rabbit, beaver, deer, seal, Northern sea lion, and Cormorant (Ackerman et al. 1985: 122-4: Table 16).

From the six localities, 610 lithic artifacts were recovered. The assemblage consisted of over 90% microblades and microblade cores. The other lithic tool technology was a cobble flake core industry (Ackerman et al. 1985: 126). Lee (2007: 38) determined that of the nine total microblade cores that Ackerman recovered, six were from locality 1. None of the microblades were made of obsidian, and obsidian only comprised 4% (22 items) in the chipped stone assemblage. Locality 1 South contained 328 lithic artifacts, mainly microblades and microblade cores, with three burins or microblade core performs (Yajima 1992: 9, Okada and Okada 1992).

Chuck Lake is located within the study area, but not within the designated time period. For comparative purposes, the 10,500 cal BP and data from the Tongass National Forest will be compared for this site. The site is also a mixed site. From the Tongass National Forest data, the site has a slope of 2º and an aspect of 79º. This means the slope has a rank of 5 and aspect has a rank of 1. The site is located on a lake, less than 100 m, which has a rank of 4. There is a stream and a tributary within 200 m. Streams are ranked 5, and tributaries are ranked 4. The modern coast is 900 m away and is sinuous. The 9,000 cal BP coast would have been closer to the site, but not necessary less than 500 m. The coast is ranked 3. The weighted result for this location is moderately high potential or a value of 3.

The 10,500 cal BP data, which is an elevation of 12 m above modern sea-level, was used, though the site was located around when the sea-level was around 10 m above modern sea-level. The slope was ranked 1. Aspect was ranked 2. Streams were ranked 3. Lakes were ranked 5. Tributaries were ranked 4. Sinuosity was lower and distance from the coast was ranked 2. Finally, distance from sites was ranked 5, as per usual. The weighted value was 3, or moderately high potential. The final weighted value, for the 10,500 to 16,000 cal BP model, was also moderately high potential.

8.2. British Columbia (BC)

Eleven of the pre-9,000 cal BP archaeological sites are from Haida Gwaii: K1 Cave, Echo Bay, Richardson, Lyell Bay (south and east), Arrow Creek 2, Gaadu Din Caves 1 and 2, Werner Bay, Collison Bay, and Kilgii Gwaii. The final site, Namu, is from the BC mainland. For the Haida Gwaii sites, the sources of the lithic materials recovered from these sites are local, unless otherwise specified (Fedje et al. 2005c). Finally, none of the BC sites were included in the model area. Several of the sites are not in the published database of sites, or at least they are not identified by name.

8.2.1. *K1 Cave (12,650 cal BP)*

Located at the head of a fjord on the west coast of Moresby Island, K1 cave is a solution cave in limestone (Ramsey et al. 2004: 105). Within the cave, bear (*Ursus americanus*) remains were recovered dating from 10,612 cal BP (9,376 ± 50 (CAMS-79488)) to 17507 cal BP (14,390 ± 70 (CAMS-75746)). CAMS-75746 was corrected for marine reservoir effect by -150 years based on the isotopic signature. The ^{13}C isotopic values for the bears support a terrestrial diet except for the oldest, which was a mixed marine-terrestrial signature (Ramsey et al. 2004: 107-108). The bases of two large, foliate points were recovered in association to these bear bones and may derive from bear hunting (Fedje et al. 2008). One point was recovered from a level overlain by sediments dated to 12,488 cal BP (10,510 ^{14}C years) and underlain by a date of 12,812 cal BP (10,960 ^{14}C years). The other point was bracketed by dates of 12,500 to 12622 cal BP (10,525 and 10,660 ^{14}C years). Based on the stem width and heavy lateral and basal grinding, it is likely that these points were end-socket hafted. Both projectile points were made from a creamy-white to yellowish-brown chert (Fedje et al. 2008: 20). This site was not listed in the BC archaeology branch database. An exact location is not known for this research and an estimate from published maps is not accurate enough to test the model. As this is a cave site, its location is not intentionally identified by the model.

8.2.2. *Echo Bay (9,916 cal BP)*

Located on the eastern shore of Moresby Island, the Echo Bay site is located in the intertidal and sub-tidal zone in a small bay near the mouth of Echo Harbour. The site was disturbed by burrowing mollusks and wave action, except for a small area rich with buried artifacts. Several hundred stone artifacts have been recovered (Fedje and Christensen 1999: 644) including culturally modified sea mammal found in association with dense concentrations of stone tools (Fedje 1997: 46). The bone was radiocarbon dated to 9,828 cal BP (9,270±100 (CAMS-14438)) (Fedje and Christensen 1999: 642: Table 2). A piece of wood was dated to 9,540 cal BP (8550±60 (CAMS-9977)) and a shell was dated to 10,381 cal BP (9640±70 (CAMS-9978)) after applying a 600-year reservoir correction (Fedje et al. 1996a: 134). The lithic artifacts recovered include several bifaces, two microblade cores, and two microblades, over 500 lithic artifacts were found (Fedje et al. 1996a: 145). The faunal remains from the site consist of sea otter, bear, and unidentified mammal (Fedje 1997: 46). This site was not listed in the BC archaeology branch database. An exact location is not known for this research and an estimate from published maps is not accurate enough to test the model. This intertidal site would likely have been identified by the model because it is along the shore associated, with the appropriate sea-level curve, and is in a bay that would have been a moderately sinuous coast.

8.2.3. *Richardson Island (10,442 cal BP)*

The site was located as a secondary deposit in the inter-tidal zone on the west side of Richardson Island in Darwin Sound. The primary deposit was located on a raised marine terrace 15-16 m amsl. Over four vertical meters of stratified deposits accumulated over 1000 years at this site, and more than fifty deposition events were identified, at least twenty of these contained evidence of human occupation (Fedje 2003: 31, McLaren and Smith 2008: 41). Fourteen radiocarbon dates were run on charcoal from the raised beach. The underlying diamicion dated to 10,943 cal BP (9590 ±50 ^{14}C years (CAMS-39877)). The site dates from 10,442 cal BP (9290±50 (CAMS-39875 & CANS-39876)) to 9477 cal BP (8490 ±70 (CAMS-16199)) (Fedje 2003: 33). A few grams of calcined bone, mainly of fish, were recovered. The lithic assemblage consists of over 8300 artifacts from the 1995 and 1997 excavation and over 5000 artifacts from the 2001 excavation. There are two components at the site: (1) a Kingii complex (10,500 to 10,250 cal BP (9300 to 9000 ^{14}C years)) and (2) a subsequent Early Moresby tradition occupation dating from 10,250 to 9600 cal BP (9000 to 8500 ^{14}C years) (Fedje 2003: 33).

Large foliate points with slight basal edge grinding and contracting stems, referred to as Xil points, were recovered including two complete points, eleven base fragments, several point tips, and a number of mid-sections. Thirteen Xil points date from 10,500 to 10,000 cal BP (9300 to 8900 ^{14}C years) (Fedje et al. 2008: 21). These are mainly in component one of the site, which lacks microblade technology. There was only one chopper or core tool found in this component (Fedje and Christensen 1999: 645).

Component two is characterized by Xilju points. These are small contracting stem points that date from 9900 to 9800 cal BP (8800 to 8700 ^{14}C years) (Fedje et al. 2008: 22). Microblades are abundant in all post-10,000 cal BP (8900 ^{14}C years) strata, both tabular and conical types. Bifaces decrease in abundance with time. The assemblage includes core scrapes, cobble choppers, and both unidirectional and multidirectional cores (Fedje and Christensen 1999: 645).

This site was not listed in the BC archaeology branch database. An exact location is not known for this research. An estimate from published maps is not accurate enough to test the model. The primary deposit likely would have been identified by the model because it was along the coast during the period of occupation.

8.2.4. ***Lyell Bay (9,906 East, 9,483 South)***

There are two sites in Lyell Bay that are relevant. They are described as east and south, likely in relation to the bay. The east site is located on a small rise surrounded by runoff channels with a small creek 10 m inland from the site. Fifteen stratigraphic units were identified. However, cultural material was present in layers 14 through 8. The site was not excavated to sterile sediments due to time constraints (Fedje et al. 2005c: 216). A total of 274 lithic artifacts were recovered including a biface fragment (Fedje and Christensen 1999: 646). Five radiocarbon dates were run on charcoal, the oldest of which was 9,906 cal BP (8810±60 (CAMS-33913)). The youngest is 5798 cal BP (5030±40 (CAMS-33910)) (Fedje et al. 2005c:217: Table 12.3).

The south site is located on a small alluvial fan and on an adjacent ridge on the south side of Lyell Bay. The landforms upon which the site is located are elevated above the early Holocene high sea-level position. Nineteen stratigraphic layers were identified on one side of the site (EU3) and fifteen on the other side of a small creek (EU6). The cultural material is present from layers 2 through 16, and these levels are characterized as alluvial fan deposits. Fedje and colleagues (2005c: 212) postulate that the gravel was deposited seasonally and that people were living on these surfaces. Seven charcoal samples were radiocarbon dated, from 9,483 cal BP (8450±60 (CAMS-33917)) to 7510 cal BP (6630±60 (CAMS-26255)) (Fedje et al. 2005c: 214: table 12.2). Microblades (157 blades) were recovered from the lowest layers, 610 lithic artifacts in total (Fedje and Christensen 1999: 646). The hearth feature in EU6 included a dense concentration of calcined bone, mainly herring (Fedje et al. 2005c: 216).

This site was not listed in the BC archaeology branch database. An exact location is not known for this research and an estimate from published maps is not accurate enough to test the model. As both sites are coastal during the period of occupation and are near a tributary and stream, they likely would have been identified by the model.

8.2.5. ***Werner Bay (12,481 cal BP)***

This is the only underwater site currently known on the northern NWC. It consists of a single possibly utilized flake that was recovered during marine survey in Werner Bay, next to

Matheson Inlet and Juan Perez Sound. The flake was found on a drowned delta flood plain at a depth of 53 m. There is a utilized edge of the flake, which is still sharp. Usewear analysis suggests the flake was used as a knife for cutting meat or soft vegetables. The site is dated to around 10,000 BP based on sea-level history. Radiocarbon dating of the barnacle attached to the flake returned 12,481 cal BP (10500 ± 40 ^{14}C years (CAMS50947)) (Fedje and Josenhans 2000: 101-102, Fedje 2000, Josenhans et al. 1997). This site was not listed in the BC archaeology branch database. An exact location is not known for this research and an estimate from published maps is not accurate enough to test the model. The location of this flake is harder to determine than the other sites and as such, it is unclear if this isolated flake would have been identified by the model.

8.2.6. *Arrow Creek (10,584 cal BP)*

There are two relevant sites on Arrow Creek. They are site 1 and 2. Site 1 is located on an alluvial fan along Arrow Creek I in Matheson Inlet, Juan Perez Sound. It is 200 m upstream from the river mouth and 15 to 17 meters amsl. It was first recorded by Hobler in 1976 (Fedje et al. 2005c: 217-8, Hobler 1978). Ten radiocarbon dates have been run on organics from this site. They range from 10,625 cal BP (9390±60 ^{14}C years) on an alder left (CAMS-8375) to 6540 cal BP (5650±70, 5650±90, CAMS-4112 and CAMS-4111). There were several radiocarbon dates that were older prior to marine reservoir correction (Fedje et al. 1996: 134: Table 1). Though the site is stratified, the only organic remains are some small amounts of charcoal (Fedje et al. 1996a: 140). Thirty-five lithic artifacts were recovered. There were no microblades or microblade cores found, but microlithic cores and blade-like flakes were recovered (Fedje et al. 1996b: 122).

Arrow Creek 2 was located by a Haida archaeologist, Captain Gold as a result of his discovery of stone tools on raised marine sediments. The site is at the head of the estuary near the modern tidal limit. It dates from 11,578 cal BP (9900±90 (CAMS-9968)) to 10,088 cal BP (9010±160 (CAMS-8377)) (Fedje et al. 1996a: 134: Table 1) and was inundated around 10,250 cal BP (9000 ^{14}C years) by rising sea-level (Fedje et al. 1996a: 138). There were 110 lithic artifacts and 2 features identified at the site. Only one diagnostic artifact was found, an exhausted conical agate microblade core. Other lithic artifacts include debitage and unifacially modified flake tools. The two features are a hearth and a low wall of cobbles that Fedje and colleagues (1996a: 139) suggest may have been an old fish trap. The wall is a combination of larger rocks with smaller cobbles positioned in spaces. It is approximately 40 cm high (Fedje et al. 1996b: 129).

Arrow Creek was in the BC archaeology branch database, unfortunately, it is not the same site as Fedje and Josenhans (2000) have mapped. Arrow Creek 2 was located previously and is possibly located in the database, though it is not named. The location has a slope of 1º and an aspect of 40º. Slope would be ranked 5. Aspect would be ranked 1. The site is just over 200 m from the coast, but would have been on the coast when occupied. The distance from coast rank is 5. The coast is moderately sinuous. The site is approximately 200 m from a stream and a tributary. This is based on data from the Canadian government and GeoBase. According to maps by Fedje and Josenhans 2000, the site is on the stream. This is an error that is very common is site locations and explains the need to have the highest potential for stream and lakes be the 500 m buffer not the 100 m buffer. Streams would be ranked 5. Tributaries would be ranked 4. The site is 600 m from a lake; lakes would be ranked 3. The site is 200 m from Arrow Creek 1 and 500 m from two different shell middens. The distance from site rank would be 4. This means the Arrow Creek 2 site location is high potential with a weighted value of 4.

8.2.7. ***Gaadu Din Caves (12,683 cal BP cave 1, 12,480 cal BP cave 2)***

Two caves have been located at Gaadu Din cave 1 and 2 on Burnaby Island. They are on the east coast of Moresby Island, and both have produced vertebrate faunal remains. Two large foliate points with contracting stems lacking significant edge grinding dating to approximately 11,500 cal BP were recovered from Gaadu Din Cave 1. These points are typologically classified as being intermediate between the Taan (found at K1 and Gaadu Din Cave 2) and Xil styles (found at Richardson Island) (Fedje et al. 2008: 21).

A complete spear point was recovered from Gaadu Din Cave 2. It was made from a yellowish-brown chert and was heavily ground on the lateral stem margins. The base is broad, rounded, and unground. It is similar to the spear point bases found in K1 cave and is stratigraphically associated with faunal remains dating to 11,922 cal BP (10,220 ^{14}C years) (Fedje et al. 2008: 20-21).

This site was not listed in the BC archaeology branch database. An exact location is not known for this research. An estimate from published maps is not accurate enough to test the model. As these are cave sites, these locations are not designed to be identified by the model.

8.2.8. ***Kilgii Gwaay (10,570 cal BP)***

This is an intertidal site located in a small embayment on the south side of Ellen Island at the southernmost tip of Haida Gwaii (Fedje 2003: 34, Fedje et al. 2001: 98). The site was identified in 1991 and 1500 lithic artifacts were collected from the surface. In 2000, the site was mapped and two 50 cm square test units were excavated. Stone tools, faunal remains, and waterlogged wood were recovered. A bone splinter was dated to 10,686 cal BP (9460±50 (CAMS70704)) (10,700 cal BP). Further work was conducted in 2001 and 2002 (Fedje 2003: 35).

Kilgii Gwaay was occupied from 10,625 to 10,675 cal BP (9450 to 9400 ^{14}C years), during which time sea-level was a few meters below modern sea-level. The site was flooded in 10,675 cal BP. The archaeological site extends one to three meters below modern high tide and is distributed in a horseshoe pattern around a former pond or lagoon. Marine transgressions have disturbed most of the site, but there is a small area of in situ archaeological deposits on the west side of the basin (Fedje et al. 2005c: 187).

A total of twenty-three radiocarbon dates have been run for Kilgii Gwaay. Twelve of the dates are from archaeological deposits, including nine from stratigraphically paired samples of shell and wood and two from wooden artifacts and one from a spirally fracture bear bone. Two dates are from the intertidal area, one date is from the underlying paleaosol (Fedje et al. 2005c: 195). From a total of 16 m^2 of excavation, there were thirty-nine vertebrate and 16 invertebrate taxa. Over 4,200 vertebrate specimens that included 13 taxa of fish, 6 of mammals, and 20 of birds were recovered. Fish are dominated by rockfish, dogfish, and lingcod while mammals are predominately bear, harbor seal, and sea otter. Eighty-four percent of the shellfish weight was California mussel. Approximately 4,000 lithic artifacts were recovered. The formal tools are unifacial including a small unifacial stemmed point. There was a single biface fragment (Fedje et al. 2005c: 196). Ninety bones "exhibiting evidence of human modification" (Fedje et al. 2005c: 197), and over 100 wooden artifacts (Fedje et al. 2005c: 198) including cordage and wooden tools (e.g. wedges and stakes or pegs) (Lee 2007: 60). The bone artifacts included three awls, a unilaterally barbed point, and a bone billet flaker (Fedje et al. 2001: 106). This site provides an important glimpse into the preservation potential of water saturated sites and evidence of well-developed and diverse maritime subsistence economy at this early time. Additionally, this site suggests that submerged archaeological sites can be found intact within the region even after marine transgressions.

This site was not listed in the BC archaeology branch database. An exact location is not known for this research. An estimate from published maps is not accurate enough to test the model. As this site is intertidal and along a moderately sinuous coast, it would likely have been identified as high potential by the model.

8.2.9. *Namu (11,049 cal BP)*

Namu is the only pre-9000 cal BP site on the BC mainland on the BC mainland of the northern NWC. Namu is considered by most researchers to be part of the central NWC (Carlson 1979), but Ames and Maschner (1999) note that it is a transitional location with aspects of both the central and northern NWC. It is a seasonally occupied fishing camp at the junction of the Burke Channel and Fitzhugh Sound. Hester and Nelson originally excavated it in 1969 and 1970. They uncovered an occupation sequence spanning 9000 years. Work in 1977 and 1978 extended the sequence back to 9700 BP (Carlson 1996: 83). Occupations have been divided into six periods, of which only the oldest (period 1) is relevant for this research. Period 1 has been further subdivided into three sub-periods: 1A from 11,480 to 10,160 cal BP (10,000 to 9000 ^{14}C years); 1B from 10,160 to 8900 cal BP (9000 to 8000 ^{14}C years); and, 1C from 8900 to 6800 cal BP (8000 to 6000 ^{14}C years) (Carlson 1996: 91). These are based on four radiocarbon dates older than 10,160 cal BP (9000 ^{14}C years) all from charcoal, 9600 cal BP (8570±90 (WAT-516)), 10,090 cal BP (9000±140 (WAT-519)), 10,232 cal BP (9140±200 (Gak-3244)), and 11,049 cal BP (9720±140 (Wat-452)) (Carlson

1996: 84: Table 1). The faunal remains are continuous from 6800 cal BP (6000 ^{14}C years) to present, but are rare before then. The remains are dominated by fish, specifically salmon (Cannon 1998).

The lithic assemblage includes both local and imported stones. Period 1A has 32 lithic artifacts that were recovered from test pits and the river mouth trench which include a unifacial chopper, a foliate biface, three biface knives, and three biface preforms. There are no microblades in period 1A. Period 1B has microblades, ground stone tools, many bifacial tools, and unifacial choppers. There are a total of 206 lithic artifacts from period 1B in the test pits and river mouth trench (Carlson 1996: 91).

Namu is one of the sites that are listed in the database from the BC archaeology branch. The values are based on environmental data from the Canadian government via GeoBase and USGS topographic maps. The site is mixed including a shell midden and human remains. The slope is 3º and the aspect is 279º. That means the slope is ranked 4 and the aspect is ranked 1. From the modern coast, the site is 87 m. The sea-level curve for mainland BC is different from for Haida Gwaii and SE Alaska; the modern coast will be used for the coastal distance. The coastline is moderately sinuous. The site is less than 500 m from a stream (Namu Creek), a lake, and two tributary junctions. Streams are ranked 5. Lakes are ranked 5. Tributaries are ranked 4. The site is approximately 800 m from the nearest known archaeological site, a shell midden. Distance from known sites is ranked 2. The site location is weighted to 3 or moderately high potential.

8.3. Site Summary

These fifteen sites provide a framework of the type of sites that might be encountered on the continental shelf of southeast Alaska. Raised marine terraces are producing newly identified sites associated with higher sea-levels at a time immediately postdating Pleistocene sea level rise. Similar terraces and caves on the continental shelf may also contain archaeological sites. These sites also provide a background for the types of artifacts that should be encountered. Although microblades may not be present prior to around 9000 cal BP, the presence of unifacial choppers and bifacial foliate points extends further back into time. Although these data are not conclusive, the sites reviewed here are in accord with

Fedje and Mackie's (2005) chronology with the Early Coastal Biface tradition followed by the NWC microblade tradition.

Of the fifteen sites, there are only locations for six of them in the archaeological site databases acquired for this research. The other nine sites were located more recently and were not in the BC archaeology branch database provided. An attempt was made to ascertain the parameters based on published maps, but the results were inconsistent. One site was high potential. Three (or four) of the sites were moderately high potential. Two (or one) site was low potential. The two low potential sites were Ground Hog Bay 2 and OYKC. OYKC is a cave, which is not a site type that is being modeled, but the overall or final model did have the location a moderately high. Ground Hog Bay 2 requires a different sea-level curve and thus the coastline and associated environmental variables cannot be accurately estimated. The high potential site was Arrow Creek 2, which is a lithic scatter on an inlet in southern Haida Gwaii. This is exactly the sites that are likely based on the model parameters. These six site support the use and effectiveness of the model.

9. Discussion

Archaeological site location modeling is an iterative process. This dissertation presents the third iteration of the model. The first iteration was a limited model focused on the edge of the continental shelf (-165 m) inferred to be the approximate LGM shoreline. It utilized modern hydrology and bathymetric features and the deeper areas were added by hand only in the study area. The second iteration investigated the region in 500 ^{14}C year time slices based on an earlier sea-level curve. As the research progressed, issues were identified with defining tributaries, the importance of coastal sinuosity, defining probable paleolakes, and the sea-level curve itself. Refinement of the sea-level curve resulted in the realization that the -70 m contour interval was actually the land-sea interface 12,800 cal BP rather than 10,300 cal BP (9997 ^{14}C years) as originally interpreted. The new sea-level curve is more realistic as evident from the fact that the old curve had a 70 m sea-level change in 500 ^{14}C years.

9.1. Geologic Interpretations of Shakan Bay

The multibeam and ROV survey of Shakan Bay identified new information about the geology for the bay and region. Along the western side of the surveyed area is a fault ridge, a large raised mound that is present as a linear feature in the multibeam data.

In addition, glacial grooves and lineation's are present on rocks identifying the direction of glacial movement and suggesting this area was overrun by glacial ice during the LGM. Based on the striations identified on the multibeam, glacial ice entered Shakan Bay from three different directions, one from the north, one from the southeast, and one from the south. These directions fit with glacial advances from the surrounding valley glaciers. Unfortunately, it is difficult to determine the sequence and timing of these advances. However, the extent of the striations and scour is limited and may indicate that parts of Shakan Bay may have been ice-free during the LGM.

Although not strictly archeological in nature, these data are an important contribution to the growing body of knowledge defining the Late Wisconsin and early Holocene paleoecology of the Alexander Archipelago. These new data may contribute to the refinement of LGM glaciation that suggests this area was completely ice-covered during the LGM (Carrara et al. 2003). The multibeam geologic information is an important contribution to interpreting the glacial history of the Tongass National Forest and will be instrumental in future glacial reconstructions for the region and specifically for Shakan Bay.

9.2. Model Resolution

Although the larger cell size of the NWC model had higher gain values, the overall predictability of the model is lower, due to its poor resolution. Resolution of the model and the inputs also partially is controlled by the computing power available. ArcGIS utilizes a maximum of 4 GB of RAM memory, despite more memory being available in the computer dedicated to this research. Hence, to compute the 5 m resolution model required selecting a smaller area and some of the Moran's I values could not be processed.

Ideally, the DEM would be created at 50 cm resolution and the model at 1 m resolution. This would mean that small archaeological features would be visible in the model. Unfortunately, the bathymetry and DEM for the region is not of sufficient resolution to produce a sub-meter continuous DEM. The 1 m resolution for the small DEM already incorporates significant extrapolation to generate, and thus it likely contains numerous errors. However, it is anticipated that greater resolution will be possible in the future and incorporated in future iterations of this model. This iteration of the model focuses on locations where resources were available for past people using environmental factors such as distance from fresh water and the amount of coastline and hence marine resource within the vicinity.

Multibeam data collection is the means to solve this problem and can be used to collect higher resolution bathymetric data. LiDAR imagery and metadata are also available for small areas of the Tongass National Forest. Combining high-resolution multibeam and LiDAR data would achieve sub-one meter resolution for DEM development and facilitate construction of a higher resolution model. The area covered by such a model would have to be limited, likely to the scale of a study area such as Shakan Bay, because of computing power and digital storage requirements.

Another issue of resolution is demonstrated by the geophysical survey results. The 2012 survey collected multibeam at a coarse resolution. Consequently, post-processing was not able to generate 1 m resolution modeling of the seafloor. This results in making archaeological sites more difficult to discern in the multibeam data. The 2013 field season will focus the multibeam's beams to increase the resolution. This will likely mean that less of an area will be surveyed, but the resolution will be detailed enough to identified possible archaeological features to test with the new ROV guided suction dredge.

9.3. Coastal Migration Hypothesis and the First Americans

This model has the potential to test and provide evidence for the coastal migration hypothesis. This hypothesis postulates that the NWC of the Americas was a possible route that the first Americas took when migrating to the New World (Dixon 1993, 1999, 2011b, 2013, Fladmark 1975, 1979, Gruhn 1994, Heusser 1960). It is hypothesized that these migrants would have used watercraft to travel along the coastal areas of the north Pacific rim that are now submerged by post-Pleistocene sea-level rise. This means the continental shelf of SE Alaska may contain archaeological sites from the earliest settlers in the Americas.

The 'ice-free corridor' proposed between the continental glaciers was not viable for human occupation until 13,000 cal BP (11,000 ^{14}C years). This has been corroborated by several independent researchers from different disciplines including archaeology, geology, and paleontology (Arnold 2006, Dixon 2011: 9, Mandryk et al. 2001, Wilson 1996). Evidence for the Atlantic coastal migration is still lacking genetic and linguistic support (Stanford and Bradley 2012). This leaves the coastal migration hypothesis as a leading hypothesis in explaining the first colonization of the Americas.

All major areas along the Pacific Coast of the Americas were occupied by at least 13,000 – 11,500 cal BP. These occupations are contemporary with Folsom and Clovis sites in the continental interior (Erlandson et al. 2008, Dixon 2011b). It has only been with the advancement in marine geophysical survey technologies that exploration of the continental shelf of the Americas has become a viable and economical archaeological endeavor. This research frontier requires the development of predictive modeling to help guide archeological exploration to test this hypothesis.

To locate the earliest archaeological sites on the continental shelf, one would expect to look at the deeper depths or the outer continental shelf. The outer continental shelf is a difficult location to survey due to logistics. Locales such as Shakan Bay are mainly sheltered from the Pacific Ocean and provide an example of the types of settings where this research is logistical feasible.

9.4. Implications for SE Alaska and Northern NWC

This research significantly advances knowledge of NWC archaeology by surveying an unexplored region: the continental shelf of SE Alaska. This research is a pioneering effort to expand the archaeological record of SE Alaska back in time and onto the continental shelf. Although no conclusive non-shipwreck archaeological sites have been located on the continental shelf, the iterative process of this research assures continued advances will be made. Incidentally, this research has identified the correct location of a shipwreck based on verbal description.

It is expected that archaeological sites will be identified on the continental shelf of SE Alaska with the two more years of funded research. The model has also been utilized by Mark Williams during intertidal and near coastal surveys. Mr. Williams was able to locate four new sites despite limited resources. The Tongass National Forest will be provided the GIS files for this research for their future survey planning.

9.5. Conclusion

This research cannot yet accept or reject the hypothesis that the archaeological record of Southeast Alaska extends to areas of the continental shelf that were submerged by post-Pleistocene sea-level rise beginning around 10,600 cal BP (9,400 ^{14}C years). However, this is a huge area and the high potential model developed for this dissertation has only been tested in a very limited area. Tests of the model thus far have indicated that the model is useful in predicting site locations. Of the six pre-9000 cal BP sites that could be tested against the model, five of the sites would have been predicted by the model and the sixth is very far north of the modeled area and in a different sea-level environment. This model is specific to sea-level and the NWC culture area. It has the ability to be adapted to other regions by changing the sea-level reconstructions and reassessing the weights for the input model to accommodate the culture history of the new region.

This research will continue for two more years as part of the Gateway to the Americas II project and through the iterative process inherent in this model, the author and research team will continue the effort to locate archaeological sites the continental shelf of Southeast Alaska. It is expected that archaeological sites will be located in 2013 with the new technology and methods developed from this dissertation.

This research has demonstrated the cost effectiveness and benefits of using a land-use model to identify high potential areas for archaeological sites before underwater archaeological survey. With the expense of underwater archaeology, the methods utilized will be useful for future large-scale underwater archaeological surveys. The model generated for this research has successfully been tested against known and new terrestrial archaeological sites. New underwater archaeological sites will be located.

Appendices

Appendix A: Bathymetry Metadata

The surveys listed below were all included in the bathymetry metadata. The available information for each survey varies, but ideally includes the survey ID, year the survey was conducted, the locality or location of the survey, and the field unit or vessel that conducted the survey. The 'Survey ID' field is hyperlinked to the survey data and metadata.

Results found in extent:
Upper-left: (-136.853, 57.143)
Lower-right: (-129.382, 54.362)

NOS Hydrographic Surveys without Digital Sounding Data: H10959 (2000)
Survey ID: H10959
Year: 2000
Locality: Northern Clarence Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys without Digital Sounding Data: F00344 (1990)
Survey ID: F00344
Year: 1990
Locality: Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys without Digital Sounding Data: F00298 (1987)
Survey ID: F00298
Year: 1987
Locality: Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys without Digital Sounding Data: H09404 (1973)
Survey ID: H09404
Year: 1973
Locality: McHenry Inlet and Approaches
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys without Digital Sounding Data: F00201 (1965)
Survey ID: F00201
Year: 1965
Locality: Castle Islands, Duncan Canal
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys without Digital Sounding Data: H08689 (1965)
Survey ID: H08689

Year: 1965
Locality: Boulder Point to Sumner Island
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys without Digital Sounding Data: H08861 (1965)
Survey ID: H08861
Year: 1965
Locality: Sumner Island to Point Barrie
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys without Digital Sounding Data: F00168 (1959)
Survey ID: F00168
Year: 1959
Locality: Zimovia Strait
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: F00164 (1958)
Survey ID: F00164
Year: 1958
Locality: WRANGELL NARROWS CH.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H08326A (1958)
Survey ID: H08326A
Year: 1958
Locality: Approach to Cannery Dock at Hydaburg, Alaska
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys without Digital Sounding Data: H08243 (1955)
Survey ID: H08243
Year: 1955
Locality: Shakan Bay
Field Unit: NOAA Ship LESTER JONES

NOS Hydrographic Surveys without Digital Sounding Data: F00126 (1954)
Survey ID: F00126
Year: 1954
Locality: SURF PT.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: F00115 (1953)
Survey ID: F00115
Year: 1953
Locality: Vicinity of San Bautista Island
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys without Digital Sounding Data: H08065B (1953)
Survey ID: H08065B
Year: 1953
Locality: South of Barrier Islands
Field Unit: NOAA Ship HODGSON

NOS Hydrographic Surveys without Digital Sounding Data: H08066 (1953)
Survey ID: H08066
Year: 1953
Locality: Barrier Islands
Field Unit: NOAA Ship HODGSON

NOS Hydrographic Surveys without Digital Sounding Data: H08101 (1953)
Survey ID: H08101
Year: 1953
Locality: Ward Cove
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys without Digital Sounding Data: H08102 (1953)
Survey ID: H08102
Year: 1953
Locality: 12 Mile Arm - Hollis Anchorage
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys without Digital Sounding Data: F00041 (1943)
Survey ID: F00041
Year: 1943
Locality: SITKA SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H06821 (1943)
Survey ID: H06821
Year: 1943
Locality: Wrangell Narrows
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H06822 (1943)
Survey ID: H06822
Year: 1943
Locality: Wrangell Narrows
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H06823 (1943)
Survey ID: H06823
Year: 1943
Locality: Wrangel Narrows

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H06824 (1943)
Survey ID: H06824
Year: 1943
Locality: Wrangell Narrows
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H06825 (1943)
Survey ID: H06825
Year: 1943
Locality: Wrangell Narrows
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H06826 (1943)
Survey ID: H06826
Year: 1943
Locality: Wrangell Narrows
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H06827 (1943)
Survey ID: H06827
Year: 1943
Locality: Wrangell Narrows
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04761A (1927)
Survey ID: H04761A
Year: 1927
Locality: VIEW COVE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04623A (1926)
Survey ID: H04623A
Year: 1926
Locality: CHATHAM STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04392B (1924)
Survey ID: H04392B
Year: 1924
Locality: PORT ALEXANDER
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04261B (1923)
Survey ID: H04261B

Year: 1923
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03932A (1917)
Survey ID: H03932A
Year: 1917
Locality: CAPE MUZON
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03819A (1916)
Survey ID: H03819A
Year: 1916
Locality: PRINCE OF WALES I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03692B (unknown)
Survey ID: H03692B
Year:
Locality: PRINCE OF WALES I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03709 (unknown)
Survey ID: H03709
Year:
Locality: APPROACHES TO NICHOLS PASSAGE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01621B (unknown)
Survey ID: H01621B
Year:
Locality: WARDS COVE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01738 (unknown)
Survey ID: H01738
Year:
Locality: ST. JOHN HBR.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04554 (unknown)
Survey ID: H04554
Year:
Locality: NECKER IS.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04517B (unknown)
Survey ID: H04517B
Year:
Locality: TABLE BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01619C (unknown)
Survey ID: H01619C
Year:
Locality: LT. HOUSE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04945 (unknown)
Survey ID: H04945
Year:
Locality: KEKU STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04623B (unknown)
Survey ID: H04623B
Year:
Locality: CHATHAM STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01649E (unknown)
Survey ID: H01649E
Year:
Locality: NEW KASAAN
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03783A (unknown)
Survey ID: H03783A
Year:
Locality: HASSLER HBR.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03687 (unknown)
Survey ID: H03687
Year:
Locality: KETCHIKAN TO CUTTER ROCKS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03544 (unknown)
Survey ID: H03544
Year:
Locality: DAVIDSON INLET

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02326 (unknown)
Survey ID: H02326
Year:
Locality: KLAWAK INLET
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03688A (unknown)
Survey ID: H03688A
Year:
Locality: CLARENCE STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H06357 (unknown)
Survey ID: H06357
Year:
Locality: NORTHERN APPROACH TO SITKA HARBOR
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01615A (unknown)
Survey ID: H01615A
Year:
Locality: TAMGAS HBR.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02331 (unknown)
Survey ID: H02331
Year:
Locality: CORDOVA BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04595 (unknown)
Survey ID: H04595
Year:
Locality: BARANOF I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02731 (unknown)
Survey ID: H02731
Year:
Locality: MOIRA SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02788E (unknown)
Survey ID: H02788E

Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04395 (unknown)
Survey ID: H04395
Year:
Locality: CAPE OMMANEY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02143 (unknown)
Survey ID: H02143
Year:
Locality: RAY ANCHORAGE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04429 (unknown)
Survey ID: H04429
Year:
Locality: HEALY BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04430 (unknown)
Survey ID: H04430
Year:
Locality: PT. LAUDER TO SLATE ISLETS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02821A (unknown)
Survey ID: H02821A
Year:
Locality: IT MINE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03921 (unknown)
Survey ID: H03921
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03541 (unknown)
Survey ID: H03541
Year:
Locality: ENTRANCE TO DIXON
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03904 (unknown)
Survey ID: H03904
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03812 (unknown)
Survey ID: H03812
Year:
Locality: PT. BAKER
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04270 (unknown)
Survey ID: H04270
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03547A (unknown)
Survey ID: H03547A
Year:
Locality: CRAIG
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04329 (unknown)
Survey ID: H04329
Year:
Locality: EL CAPITAN PASS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03909 (unknown)
Survey ID: H03909
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01649D (unknown)
Survey ID: H01649D
Year:
Locality: VALLENAR PT.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04764A (unknown)
Survey ID: H04764A
Year:
Locality: DEVILS ELBOW

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04210 (unknown)
Survey ID: H04210
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03785 (unknown)
Survey ID: H03785
Year:
Locality: Annette Bay
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01651B (unknown)
Survey ID: H01651B
Year:
Locality: REVILLAGIGEDO I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03791A (unknown)
Survey ID: H03791A
Year:
Locality: SHAKHAN BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01440A (unknown)
Survey ID: H01440A
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03911 (unknown)
Survey ID: H03911
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02788B (unknown)
Survey ID: H02788B
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02109 (unknown)
Survey ID: H02109

Year:
Locality: REVILLAGIGEDO CH.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03916 (unknown)
Survey ID: H03916
Year:
Locality: ST. ALBANS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03685 (unknown)
Survey ID: H03685
Year:
Locality: APPROACHES TO NICHOLS PASSAGE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02327 (unknown)
Survey ID: H02327
Year:
Locality: APPROACHES TO UNTERS BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01620A (unknown)
Survey ID: H01620A
Year:
Locality: PENNOCK I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02112 (unknown)
Survey ID: H02112
Year:
Locality: BEHM CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01893 (unknown)
Survey ID: H01893
Year:
Locality: HEAD OF PORTLAND CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01525B (unknown)
Survey ID: H01525B
Year:
Locality: WRANGELL STRAITS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03392 (unknown)
Survey ID: H03392
Year:
Locality: NAKAT HBR.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03915 (unknown)
Survey ID: H03915
Year:
Locality: EYE OPENNER
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03708 (unknown)
Survey ID: H03708
Year:
Locality: ANNETTE I. VICINITY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03712 (unknown)
Survey ID: H03712
Year:
Locality: FELICE STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01900 (unknown)
Survey ID: H01900
Year:
Locality: PORTLAND CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04440B (unknown)
Survey ID: H04440B
Year:
Locality: KASAAN BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04786 (unknown)
Survey ID: H04786
Year:
Locality: MCFARLAND IS.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03317 (unknown)
Survey ID: H03317
Year:
Locality: DECEMBER PT.

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04327 (unknown)
Survey ID: H04327
Year:
Locality: PORT ARMSTRONG
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02788A (unknown)
Survey ID: H02788A
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03934A (unknown)
Survey ID: H03934A
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03791 (unknown)
Survey ID: H03791
Year:
Locality: SHAKHAN BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02174 (unknown)
Survey ID: H02174
Year:
Locality: SITKA SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03941 (unknown)
Survey ID: H03941
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03993 (unknown)
Survey ID: H03993
Year:
Locality: CAPE FANSHAW
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01739 (unknown)
Survey ID: H01739

Year:
Locality: ETOLIN I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03212 (unknown)
Survey ID: H03212
Year:
Locality: GREEN PT.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03812A (unknown)
Survey ID: H03812A
Year:
Locality: EAST STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02788C (unknown)
Survey ID: H02788C
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01756 (unknown)
Survey ID: H01756
Year:
Locality: PORT MCARTHUR
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02145 (unknown)
Survey ID: H02145
Year:
Locality: SEALED PASSAGE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02149 (unknown)
Survey ID: H02149
Year:
Locality: BOCA DE QUADRA TRIBUTARIES
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01755A (unknown)
Survey ID: H01755A
Year:
Locality: PORT PROTECTION
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02334 (unknown)
Survey ID: H02334
Year:
Locality: BAY OF PILLARS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03939 (unknown)
Survey ID: H03939
Year:
Locality: Zimovia Strait
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03687A (unknown)
Survey ID: H03687A
Year:
Locality: CLARENCE STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02326A (unknown)
Survey ID: H02326A
Year:
Locality: SAN ALBERTO BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03990 (unknown)
Survey ID: H03990
Year:
Locality: DRY STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01737 (unknown)
Survey ID: H01737
Year:
Locality: WRANGELL STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03422 (unknown)
Survey ID: H03422
Year:
Locality: APPROACHES TO TLEVAL NARROWS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01512C (unknown)
Survey ID: H01512C
Year:
Locality: Unknown

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01808 (unknown)
Survey ID: H01808
Year:
Locality: DUNCAN CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02107 (unknown)
Survey ID: H02107
Year:
Locality: BEHM NARROWS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04037 (unknown)
Survey ID: H04037
Year:
Locality: PETERSBURG
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02084 (unknown)
Survey ID: H02084
Year:
Locality: CUSTOM HOUSE COVE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02668 (unknown)
Survey ID: H02668
Year:
Locality: CHATHAM STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03416A (unknown)
Survey ID: H03416A
Year:
Locality: ROSE INLET
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04766 (unknown)
Survey ID: H04766
Year:
Locality: BEACON I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04994 (unknown)
Survey ID: H04994

Year:
Locality: SUMNER STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02271 (unknown)
Survey ID: H02271
Year:
Locality: WRANGELL STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03784 (unknown)
Survey ID: H03784
Year:
Locality: REVILLAGIGEDO I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04250 (unknown)
Survey ID: H04250
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02336 (unknown)
Survey ID: H02336
Year:
Locality: HAGGATT BAY & GUT BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04253 (unknown)
Survey ID: H04253
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01621A (unknown)
Survey ID: H01621A
Year:
Locality: PENNOCK I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04763 (unknown)
Survey ID: H04763
Year:
Locality: PT. BARRIE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04443B (unknown)
Survey ID: H04443B
Year:
Locality: THOMAS BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01525A (unknown)
Survey ID: H01525A
Year:
Locality: HOWKAN STRAITS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03213 (unknown)
Survey ID: H03213
Year:
Locality: WOODY I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03718 (unknown)
Survey ID: H03718
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03208 (unknown)
Survey ID: H03208
Year:
Locality: FREDERICK SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01620C (unknown)
Survey ID: H01620C
Year:
Locality: PENNOCK I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02174A (unknown)
Survey ID: H02174A
Year:
Locality: SITKA SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01652A (unknown)
Survey ID: H01652A
Year:
Locality: TWELVE MILE ARM

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01512B (unknown)
Survey ID: H01512B
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04328 (unknown)
Survey ID: H04328
Year:
Locality: NEW PORT WALTER
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03938 (unknown)
Survey ID: H03938
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04839 (unknown)
Survey ID: H04839
Year:
Locality: CAPE EDGECUMBE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02177 (unknown)
Survey ID: H02177
Year:
Locality: SITKA HBR.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04763A (unknown)
Survey ID: H04763A
Year:
Locality: PT. BARRIE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01622 (unknown)
Survey ID: H01622
Year:
Locality: MARY I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03942 (unknown)
Survey ID: H03942

Year:
Locality: CLARENCE STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01439 (unknown)
Survey ID: H01439
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04190 (unknown)
Survey ID: H04190
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02174B (unknown)
Survey ID: H02174B
Year:
Locality: SITKA SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01757 (unknown)
Survey ID: H01757
Year:
Locality: KOSCUISKO I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04249 (unknown)
Survey ID: H04249
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01809 (unknown)
Survey ID: H01809
Year:
Locality: DUNCAN CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01749 (unknown)
Survey ID: H01749
Year:
Locality: SUMNER STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02319 (unknown)
Survey ID: H02319
Year:
Locality: KRUZOF I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03214 (unknown)
Survey ID: H03214
Year:
Locality: BURNT I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04762 (unknown)
Survey ID: H04762
Year:
Locality: MCFARLAND IS.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01650B (unknown)
Survey ID: H01650B
Year:
Locality: CHASINA ANCHORAGE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02788 (unknown)
Survey ID: H02788
Year:
Locality: HETTA INLET
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01895 (unknown)
Survey ID: H01895
Year:
Locality: PORTLAND CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01649B (unknown)
Survey ID: H01649B
Year:
Locality: MOIRA SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03793A (unknown)
Survey ID: H03793A
Year:
Locality: CLARENCE STRAIT

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03880A (unknown)
Survey ID: H03880A
Year:
Locality: BUCARELI BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01623B (unknown)
Survey ID: H01623B
Year:
Locality: FREDERICK SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03686A (unknown)
Survey ID: H03686A
Year:
Locality: CLARENCE STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03388 (unknown)
Survey ID: H03388
Year:
Locality: WEDGE I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02972 (unknown)
Survey ID: H02972
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01619B (unknown)
Survey ID: H01619B
Year:
Locality: MARY I. ANCHORAGE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03793 (unknown)
Survey ID: H03793
Year:
Locality: NARROW PT.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03523 (unknown)
Survey ID: H03523

Year:
Locality: BURNETT INLET
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01620B (unknown)
Survey ID: H01620B
Year:
Locality: REVILLAGIGEDO CH.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04955 (unknown)
Survey ID: H04955
Year:
Locality: WRANGELL NARROWS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03711 (unknown)
Survey ID: H03711
Year:
Locality: NICHOLS PASSAGE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01742 (unknown)
Survey ID: H01742
Year:
Locality: CLARENCE STRAIT & ADJACENT CHANNELS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01807 (unknown)
Survey ID: H01807
Year:
Locality: DUNCAN
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01754 (unknown)
Survey ID: H01754
Year:
Locality: SUMNER STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02111 (unknown)
Survey ID: H02111
Year:
Locality: REVILLAGIGEDO I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02176 (unknown)
Survey ID: H02176
Year:
Locality: APPROACHES TO SITKA HARBOR
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01892 (unknown)
Survey ID: H01892
Year:
Locality: PORTLAND CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01811 (unknown)
Survey ID: H01811
Year:
Locality: THOMAS BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03548 (unknown)
Survey ID: H03548
Year:
Locality: BUCARELI BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04037A (unknown)
Survey ID: H04037A
Year:
Locality: PETERSBURG
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03790 (unknown)
Survey ID: H03790
Year:
Locality: ENTRANCE TO BOCA DE QUADRA
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01626 (unknown)
Survey ID: H01626
Year:
Locality: PERIL STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02787 (unknown)
Survey ID: H02787
Year:
Locality: CORDOVA BAY

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04763B (unknown)
Survey ID: H04763B
Year:
Locality: CONCLUSION I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01623A (unknown)
Survey ID: H01623A
Year:
Locality: WRANGELL I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03700 (unknown)
Survey ID: H03700
Year:
Locality: APPROACHES TO FELICE STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03209 (unknown)
Survey ID: H03209
Year:
Locality: PETERSBURG
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04626B (unknown)
Survey ID: H04626B
Year:
Locality: CHATHAM STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01758 (unknown)
Survey ID: H01758
Year:
Locality: PRINCE OF WALES I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02797 (unknown)
Survey ID: H02797
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03323 (unknown)
Survey ID: H03323

Year:
Locality: SOUTHERN ENTRANCE TO TONGASS NARROWS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02814 (unknown)
Survey ID: H02814
Year:
Locality: SEAL BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02175 (unknown)
Survey ID: H02175
Year:
Locality: SITKA HBR.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01619A (unknown)
Survey ID: H01619A
Year:
Locality: DUKE PT.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03810A (unknown)
Survey ID: H03810A
Year:
Locality: CLARENCE STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04198 (unknown)
Survey ID: H04198
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02151 (unknown)
Survey ID: H02151
Year:
Locality: CHAPIN BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01615B (unknown)
Survey ID: H01615B
Year:
Locality: WRANGELL STRAITS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01618B (unknown)
Survey ID: H01618B
Year:
Locality: PORT TONGASS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02740 (unknown)
Survey ID: H02740
Year:
Locality: DOLOMI ANCHORAGE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02732A (unknown)
Survey ID: H02732A
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03903 (unknown)
Survey ID: H03903
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04996 (unknown)
Survey ID: H04996
Year:
Locality: SUMNER STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03914 (unknown)
Survey ID: H03914
Year:
Locality: BLAKE CH.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02302 (unknown)
Survey ID: H02302
Year:
Locality: SITKA SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02913 (unknown)
Survey ID: H02913
Year:
Locality: PRINCE OF WHALES I.

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01650A (unknown)
Survey ID: H01650A
Year:
Locality: NIBLACK ANCHORAGE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H05004 (unknown)
Survey ID: H05004
Year:
Locality: SUMNER STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03810 (unknown)
Survey ID: H03810
Year:
Locality: CLARENCE STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04392A (unknown)
Survey ID: H04392A
Year:
Locality: CAPE OMMANEY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02664 (unknown)
Survey ID: H02664
Year:
Locality: DAVIDSON INLET
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01617 (unknown)
Survey ID: H01617
Year:
Locality: PORT SIMPSON
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03989 (unknown)
Survey ID: H03989
Year:
Locality: WRANGELL NARROWS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01744 (unknown)
Survey ID: H01744

Year:
Locality: PRINCE OF WALES I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01806 (unknown)
Survey ID: H01806
Year:
Locality: DUNCAN
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01754A (unknown)
Survey ID: H01754A
Year:
Locality: SUMNER STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01899 (unknown)
Survey ID: H01899
Year:
Locality: PORTLAND CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04995 (unknown)
Survey ID: H04995
Year:
Locality: SUMNER STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03794 (unknown)
Survey ID: H03794
Year:
Locality: PT. HARRINGTON
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03811 (unknown)
Survey ID: H03811
Year:
Locality: LABOUCHERE BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03934 (unknown)
Survey ID: H03934
Year:
Locality: MEARES I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01810 (unknown)
Survey ID: H01810
Year:
Locality: BROWN COVE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01740 (unknown)
Survey ID: H01740
Year:
Locality: ETOLIN I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01652B (unknown)
Survey ID: H01652B
Year:
Locality: KARTA BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04440A (unknown)
Survey ID: H04440A
Year:
Locality: KASAAN BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04764 (unknown)
Survey ID: H04764
Year:
Locality: KEKU STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03910 (unknown)
Survey ID: H03910
Year:
Locality: SUMNER STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03419 (unknown)
Survey ID: H03419
Year:
Locality: SUKKWAN STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01745 (unknown)
Survey ID: H01745
Year:
Locality: PRINCE OF WALES I.

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02108 (unknown)
Survey ID: H02108
Year:
Locality: NEW EDDYSTONE IS.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04263 (unknown)
Survey ID: H04263
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03043 (unknown)
Survey ID: H03043
Year:
Locality: BARRIER IS.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02233 (unknown)
Survey ID: H02233
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02150 (unknown)
Survey ID: H02150
Year:
Locality: KIKU STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04199 (unknown)
Survey ID: H04199
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02110 (unknown)
Survey ID: H02110
Year:
Locality: BEHM CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01896 (unknown)
Survey ID: H01896

Year:
Locality: PORTLAND CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02270 (unknown)
Survey ID: H02270
Year:
Locality: DANGER PT.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04628 (unknown)
Survey ID: H04628
Year:
Locality: CAPE OMMANEY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04159 (unknown)
Survey ID: H04159
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02757B (unknown)
Survey ID: H02757B
Year:
Locality: MCKENZIE INLET
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04439A (unknown)
Survey ID: H04439A
Year:
Locality: KASAAN BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01813 (unknown)
Survey ID: H01813
Year:
Locality: FREDERICK SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01653A (unknown)
Survey ID: H01653A
Year:
Locality: TOLSTI BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02332 (unknown)
Survey ID: H02332
Year:
Locality: RED FISH BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04765 (unknown)
Survey ID: H04765
Year:
Locality: SUMMIT I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03991 (unknown)
Survey ID: H03991
Year:
Locality: MCDONALD I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03920 (unknown)
Survey ID: H03920
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01804 (unknown)
Survey ID: H01804
Year:
Locality: FREDERICK SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01755 (unknown)
Survey ID: H01755
Year:
Locality: PORT PROTECTION
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04960 (unknown)
Survey ID: H04960
Year:
Locality: FREDERICK SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03992 (unknown)
Survey ID: H03992
Year:
Locality: CAPA STRAIT LT.

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H05019 (unknown)
Survey ID: H05019
Year:
Locality: DUNCAN CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03946 (unknown)
Survey ID: H03946
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01512A (unknown)
Survey ID: H01512A
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03925 (unknown)
Survey ID: H03925
Year:
Locality: SNOW PASSAGE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03717 (unknown)
Survey ID: H03717
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04195 (unknown)
Survey ID: H04195
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03783 (unknown)
Survey ID: H03783
Year:
Locality: HAM I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04622B (unknown)
Survey ID: H04622B

Year:
Locality: DALL I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01651A (unknown)
Survey ID: H01651A
Year:
Locality: SOUTHERN ENTRANCE TO TONGASS NARROWS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03686 (unknown)
Survey ID: H03686
Year:
Locality: REVILLAGIGEDO CH.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01616 (unknown)
Survey ID: H01616
Year:
Locality: WRANGELL STRAITS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03935 (unknown)
Survey ID: H03935
Year:
Locality: ERNEST SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03316 (unknown)
Survey ID: H03316
Year:
Locality: SUMNER STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04102A (unknown)
Survey ID: H04102A
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03782 (unknown)
Survey ID: H03782
Year:
Locality: CUSTOM HOUSE COVE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03792 (unknown)
Survey ID: H03792
Year:
Locality: FELICE STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01649C (unknown)
Survey ID: H01649C
Year:
Locality: GUARD IS.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02821 (unknown)
Survey ID: H02821
Year:
Locality: KASAAN BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04514C (unknown)
Survey ID: H04514C
Year:
Locality: PORT ALEXANDER
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03221 (unknown)
Survey ID: H03221
Year:
Locality: EAST CLUMP
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01812 (unknown)
Survey ID: H01812
Year:
Locality: FARRAGUT BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01614 (unknown)
Survey ID: H01614
Year:
Locality: PORTLAND CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03222 (unknown)
Survey ID: H03222
Year:
Locality: LION PT.

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04316 (unknown)
Survey ID: H04316
Year:
Locality: THOMAS BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01649A (unknown)
Survey ID: H01649A
Year:
Locality: ENTRANCE TO DIXONS
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02144 (unknown)
Survey ID: H02144
Year:
Locality: DANGER PASSAGE VICINITY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03690 (unknown)
Survey ID: H03690
Year:
Locality: SUKKWAN STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02788D (unknown)
Survey ID: H02788D
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04780 (unknown)
Survey ID: H04780
Year:
Locality: SOUTHERN APPROACHES TO KAIGANI STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04196 (unknown)
Survey ID: H04196
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01753 (unknown)
Survey ID: H01753

Year:
Locality: SUMNER STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03814 (unknown)
Survey ID: H03814
Year:
Locality: DANGER PASSAGE VICINITY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03405 (unknown)
Survey ID: H03405
Year:
Locality: PT. BAKER
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02152 (unknown)
Survey ID: H02152
Year:
Locality: SECURITY BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03688 (unknown)
Survey ID: H03688
Year:
Locality: KETCHIKAN TO GUARD I.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04943 (unknown)
Survey ID: H04943
Year:
Locality: KEKU STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04961 (unknown)
Survey ID: H04961
Year:
Locality: FREDERICK SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02732 (unknown)
Survey ID: H02732
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04439B (unknown)
Survey ID: H04439B
Year:
Locality: KASAAN BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02856 (unknown)
Survey ID: H02856
Year:
Locality: KETCHIKON
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H05017 (unknown)
Survey ID: H05017
Year:
Locality: LEVEL IS.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04764B (unknown)
Survey ID: H04764B
Year:
Locality: KEKU STRAIT
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03913 (unknown)
Survey ID: H03913
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01622A (unknown)
Survey ID: H01622A
Year:
Locality: NICHOLS PASSAGE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02733 (unknown)
Survey ID: H02733
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03789A (unknown)
Survey ID: H03789A
Year:
Locality: CLARENCE STRAIT

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H06356 (unknown)
Survey ID: H06356
Year:
Locality: SOUTHERN APPROACHES TO SITKA HARBOR
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04262 (unknown)
Survey ID: H04262
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04772 (unknown)
Survey ID: H04772
Year:
Locality: SAN ALBERTO BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03309 (unknown)
Survey ID: H03309
Year:
Locality: KASAAN BAY
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03943 (unknown)
Survey ID: H03943
Year:
Locality: CHARLESTON
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01894 (unknown)
Survey ID: H01894
Year:
Locality: PORTLAND CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03786 (unknown)
Survey ID: H03786
Year:
Locality: Tamgas Harbor, Annette Island
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03389 (unknown)
Survey ID: H03389

Year:
Locality: MOIRA SOUND
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04010 (unknown)
Survey ID: H04010
Year:
Locality: SEA OTTER HBR.
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03563 (unknown)
Survey ID: H03563
Year:
Locality: HIDDEN INLET
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01741 (unknown)
Survey ID: H01741
Year:
Locality: HIGHFIELD ANCHORAGE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03919 (unknown)
Survey ID: H03919
Year:
Locality: PT. BABBLER
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04197 (unknown)
Survey ID: H04197
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04514B (unknown)
Survey ID: H04514B
Year:
Locality: PORT CONCLUSION
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H02757A (unknown)
Survey ID: H02757A
Year:
Locality: LYMAN ANCHORAGE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03917 (unknown)
Survey ID: H03917
Year:
Locality: CAPE DECISION
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04761B (unknown)
Survey ID: H04761B
Year:
Locality: VIEW COVE
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H01653B (unknown)
Survey ID: H01653B
Year:
Locality: CLEVELAND PENISULA
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03962 (unknown)
Survey ID: H03962
Year:
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H04514D (unknown)
Survey ID: H04514D
Year:
Locality: PORT ALEXANDER
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03699 (unknown)
Survey ID: H03699
Year:
Locality: PORTLAND CANAL
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03046 (unknown)
Survey ID: H03046
Year:
Locality: BAR PT. TO ROSA REEF
Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03220 (unknown)
Survey ID: H03220
Year:
Locality: PT. HIGGINS

Field Unit:

NOS Hydrographic Surveys without Digital Sounding Data: H03781A (unknown)
Survey ID: H03781A
Year:
Locality: SEALED PASSAGE
Field Unit:

NOS Hydrographic Surveys with BAGs: H11660 (2007)
Survey ID: H11660
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H11124 (2004)
Survey ID: H11124
Year: 2004
Locality: Sitka
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with BAGs: H11574 (2007)
Survey ID: H11574
Year: 2007
Locality: Wet of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11335 (2004)
Survey ID: H11335
Year: 2004
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11586 (2007)
Survey ID: H11586
Year: 2007
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11123 (2004)
Survey ID: H11123
Year: 2004
Locality: Sitka
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with BAGs: H11571 (2007)
Survey ID: H11571

Year: 2007
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11369 (2004)
Survey ID: H11369
Year: 2004
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11575 (2007)
Survey ID: H11575
Year: 2007
Locality:
Field Unit:

NOS Hydrographic Surveys with BAGs: H11122 (2005)
Survey ID: H11122
Year: 2005
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11690 (2007)
Survey ID: H11690
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11470 (2005)
Survey ID: H11470
Year: 2005
Locality: Cape Decision
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: D00146 (2008)
Survey ID: D00146
Year: 2008
Locality: West of Prince Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H11404 (2005)
Survey ID: H11404
Year: 2005
Locality: Ernest Sound Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11866 (2008)
Survey ID: H11866
Year: 2008
Locality:
Field Unit:

NOS Hydrographic Surveys with BAGs: H11272 (2005)
Survey ID: H11272
Year: 2005
Locality: Southern Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11851 (2008)
Survey ID: H11851
Year: 2008
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11428 (2005)
Survey ID: H11428
Year: 2005
Locality: Approaches to Sitka
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H11846 (2008)
Survey ID: H11846
Year: 2008
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11469 (2005)
Survey ID: H11469
Year: 2005
Locality: Cape Decision
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11844 (2008)
Survey ID: H11844
Year: 2008
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11429 (2005)
Survey ID: H11429
Year: 2005
Locality: Approaches to Sitka

Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: D00145 (2008)
Survey ID: D00145
Year: 2008
Locality: West of Prince Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H11403 (2005)
Survey ID: H11403
Year: 2005
Locality: Ernest Sound Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: D00143 (2008)
Survey ID: D00143
Year: 2008
Locality: West of Prince Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H11135 (2005)
Survey ID: H11135
Year: 2005
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11993 (2008)
Survey ID: H11993
Year: 2008
Locality: Sukkwan Narrows
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11449 (2005)
Survey ID: H11449
Year: 2005
Locality: Wrangell Narrows
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11850 (2008)
Survey ID: H11850
Year: 2008
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11577 (2006)
Survey ID: H11577

Year: 2006
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11822 (2008)
Survey ID: H11822
Year: 2008
Locality: Ernest Sound
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11538 (2006)
Survey ID: H11538
Year: 2006
Locality: Approaches to Sitka
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H11852 (2008)
Survey ID: H11852
Year: 2008
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11540 (2006)
Survey ID: H11540
Year: 2006
Locality: Approaches to Sitka
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H11694 (2008)
Survey ID: H11694
Year: 2008
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11579 (2006)
Survey ID: H11579
Year: 2006
Locality: Keku Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H12000 (2008)
Survey ID: H12000
Year: 2008
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11128 (2006)
Survey ID: H11128
Year: 2006
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11845 (2008)
Survey ID: H11845
Year: 2008
Locality: Approaches to SItka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11706 (2007)
Survey ID: H11706
Year: 2007
Locality: Chatham Strait
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with BAGs: D00144 (2008)
Survey ID: D00144
Year: 2008
Locality: West of Prince Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H11677 (2007)
Survey ID: H11677
Year: 2007
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11867 (2008)
Survey ID: H11867
Year: 2008
Locality:
Field Unit:

NOS Hydrographic Surveys with BAGs: H11661 (2007)
Survey ID: H11661
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H11847 (2008)
Survey ID: H11847
Year: 2008
Locality: Approaches to Sitka

Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11659 (2007)
Survey ID: H11659
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H11849 (2008)
Survey ID: H11849
Year: 2008
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11679 (2007)
Survey ID: H11679
Year: 2007
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11917 (2008)
Survey ID: H11917
Year: 2008
Locality: Chatham Strait
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11570 (2007)
Survey ID: H11570
Year: 2007
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11126 (2009)
Survey ID: H11126
Year: 2009
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11572 (2007)
Survey ID: H11572
Year: 2007
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H12030 (2009)
Survey ID: H12030

Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11569 (2007)
Survey ID: H11569
Year: 2007
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11865 (2009)
Survey ID: H11865
Year: 2009
Locality:
Field Unit:

NOS Hydrographic Surveys with BAGs: H11692 (2007)
Survey ID: H11692
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11824 (2009)
Survey ID: H11824
Year: 2009
Locality: Ernest Sound
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11334 (2004)
Survey ID: H11334
Year: 2004
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H12028 (2009)
Survey ID: H12028
Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11130 (2004)
Survey ID: H11130
Year: 2004
Locality: Sitka Sound
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with BAGs: H12031 (2009)
Survey ID: H12031
Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11405 (2005)
Survey ID: H11405
Year: 2005
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11825 (2009)
Survey ID: H11825
Year: 2009
Locality: Ernest Sound
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11507 (2005)
Survey ID: H11507
Year: 2005
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H12034 (2009)
Survey ID: H12034
Year: 2009
Locality: Keku Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11270 (2005)
Survey ID: H11270
Year: 2005
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H12026 (2009)
Survey ID: H12026
Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11406 (2005)
Survey ID: H11406
Year: 2005
Locality: Ernest Sound and Eastern Passsage

Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11823 (2009)
Survey ID: H11823
Year: 2009
Locality: Ernest Sound
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11578 (2006)
Survey ID: H11578
Year: 2006
Locality: Keku Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H12027 (2009)
Survey ID: H12027
Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11127 (2006)
Survey ID: H11127
Year: 2006
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H12029 (2009)
Survey ID: H12029
Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11447 (2006)
Survey ID: H11447
Year: 2006
Locality: Wrangell Narrows
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H12032 (2009)
Survey ID: H12032
Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11699 (2007)
Survey ID: H11699

Year: 2007
Locality: Chatham Strait
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with BAGs: H12035 (2009)
Survey ID: H12035
Year: 2009
Locality: Kekuy Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H11707 (2007)
Survey ID: H11707
Year: 2007
Locality: Chatham Strait
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with BAGs: H12224 (2010)
Survey ID: H12224
Year: 2010
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11662 (2007)
Survey ID: H11662
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H12063 (2010)
Survey ID: H12063
Year: 2010
Locality: Chatham Strait
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11691 (2007)
Survey ID: H11691
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: RAINIER Launch 2122

NOS Hydrographic Surveys with BAGs: H12177 (2010)
Survey ID: H12177
Year: 2010
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11678 (2007)
Survey ID: H11678
Year: 2007
Locality: Approaches to sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H12175 (2010)
Survey ID: H12175
Year: 2010
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11509 (2005)
Survey ID: H11509
Year: 2005
Locality: Ernest Sound and Eastern Passge
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H12064 (2010)
Survey ID: H12064
Year: 2010
Locality: Chatham Strait
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11271 (2005)
Survey ID: H11271
Year: 2005
Locality: Approaches to sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H12183 (2010)
Survey ID: H12183
Year: 2010
Locality: Chatham Strait
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11364 (2005)
Survey ID: H11364
Year: 2005
Locality: Cape Decision
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H12185 (2010)
Survey ID: H12185
Year: 2010
Locality: Chatham Strait

Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11448 (2006)
Survey ID: H11448
Year: 2006
Locality: Wrangell Narrows
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with BAGs: H12176 (2010)
Survey ID: H12176
Year: 2010
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11663 (2007)
Survey ID: H11663
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H11818 (2010)
Survey ID: H11818
Year: 2010
Locality: Chatham Strait
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11708 (2007)
Survey ID: H11708
Year: 2007
Locality: Chatham Strait
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with BAGs: H12178 (2010)
Survey ID: H12178
Year: 2010
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11362 (2004)
Survey ID: H11362
Year: 2004
Locality: Cape Decision
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11427 (2005)
Survey ID: H11427

Year: 2005
Locality: Approaches to Sitka
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H11539 (2006)
Survey ID: H11539
Year: 2006
Locality: Approaches to SItka
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with BAGs: H11508 (2005)
Survey ID: H11508
Year: 2005
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11727 (2007)
Survey ID: H11727
Year: 2007
Locality: Keku strait
Field Unit: Beechcraft King Air 90

NOS Hydrographic Surveys with BAGs: H11573 (2007)
Survey ID: H11573
Year: 2007
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with BAGs: H11688 (2007)
Survey ID: H11688
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11818 (2010)
Survey ID: H11818
Year: 2010
Locality: Chatham Strait
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H12063 (2010)
Survey ID: H12063
Year: 2010
Locality: Chatham Strait
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H12064 (2010)
Survey ID: H12064
Year: 2010
Locality: Chatham Strait
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H12175 (2010)
Survey ID: H12175
Year: 2010
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H12176 (2010)
Survey ID: H12176
Year: 2010
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H12177 (2010)
Survey ID: H12177
Year: 2010
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H12178 (2010)
Survey ID: H12178
Year: 2010
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H12183 (2010)
Survey ID: H12183
Year: 2010
Locality: Chatham Strait
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H12185 (2010)
Survey ID: H12185
Year: 2010
Locality: Chatham Strait
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H12224 (2010)
Survey ID: H12224
Year: 2010
Locality: Behm Canal

Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11126 (2009)
Survey ID: H11126
Year: 2009
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11823 (2009)
Survey ID: H11823
Year: 2009
Locality: Ernest Sound
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11824 (2009)
Survey ID: H11824
Year: 2009
Locality: Ernest Sound
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11825 (2009)
Survey ID: H11825
Year: 2009
Locality: Ernest Sound
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11865 (2009)
Survey ID: H11865
Year: 2009
Locality:
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H12026 (2009)
Survey ID: H12026
Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H12027 (2009)
Survey ID: H12027
Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H12028 (2009)
Survey ID: H12028

Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H12029 (2009)
Survey ID: H12029
Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H12030 (2009)
Survey ID: H12030
Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H12031 (2009)
Survey ID: H12031
Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H12032 (2009)
Survey ID: H12032
Year: 2009
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H12034 (2009)
Survey ID: H12034
Year: 2009
Locality: Keku Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H12035 (2009)
Survey ID: H12035
Year: 2009
Locality: Kekuy Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: D00143 (2008)
Survey ID: D00143
Year: 2008
Locality: West of Prince Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with Digital Sounding Data: D00144 (2008)
Survey ID: D00144
Year: 2008
Locality: West of Prince Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with Digital Sounding Data: D00145 (2008)
Survey ID: D00145
Year: 2008
Locality: West of Prince Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with Digital Sounding Data: D00146 (2008)
Survey ID: D00146
Year: 2008
Locality: West of Prince Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with Digital Sounding Data: H11694 (2008)
Survey ID: H11694
Year: 2008
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11822 (2008)
Survey ID: H11822
Year: 2008
Locality: Ernest Sound
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11844 (2008)
Survey ID: H11844
Year: 2008
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11845 (2008)
Survey ID: H11845
Year: 2008
Locality: Approaches to SItka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11846 (2008)
Survey ID: H11846
Year: 2008
Locality: Approaches to Sitka

Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11847 (2008)
Survey ID: H11847
Year: 2008
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11849 (2008)
Survey ID: H11849
Year: 2008
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11850 (2008)
Survey ID: H11850
Year: 2008
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11851 (2008)
Survey ID: H11851
Year: 2008
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11852 (2008)
Survey ID: H11852
Year: 2008
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11866 (2008)
Survey ID: H11866
Year: 2008
Locality:
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H11867 (2008)
Survey ID: H11867
Year: 2008
Locality:
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H11917 (2008)
Survey ID: H11917

Year: 2008
Locality: Chatham Strait
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11993 (2008)
Survey ID: H11993
Year: 2008
Locality: Sukkwan Narrows
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H12000 (2008)
Survey ID: H12000
Year: 2008
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11569 (2007)
Survey ID: H11569
Year: 2007
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11570 (2007)
Survey ID: H11570
Year: 2007
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11571 (2007)
Survey ID: H11571
Year: 2007
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11572 (2007)
Survey ID: H11572
Year: 2007
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11573 (2007)
Survey ID: H11573
Year: 2007
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11574 (2007)
Survey ID: H11574
Year: 2007
Locality: Wet of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11575 (2007)
Survey ID: H11575
Year: 2007
Locality:
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H11586 (2007)
Survey ID: H11586
Year: 2007
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11659 (2007)
Survey ID: H11659
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with Digital Sounding Data: H11660 (2007)
Survey ID: H11660
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with Digital Sounding Data: H11661 (2007)
Survey ID: H11661
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with Digital Sounding Data: H11662 (2007)
Survey ID: H11662
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with Digital Sounding Data: H11663 (2007)
Survey ID: H11663
Year: 2007
Locality: West of Prince of Wales Island

Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with Digital Sounding Data: H11677 (2007)
Survey ID: H11677
Year: 2007
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11678 (2007)
Survey ID: H11678
Year: 2007
Locality: Approaches to sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11679 (2007)
Survey ID: H11679
Year: 2007
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11688 (2007)
Survey ID: H11688
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11690 (2007)
Survey ID: H11690
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11691 (2007)
Survey ID: H11691
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: RAINIER Launch 2122

NOS Hydrographic Surveys with Digital Sounding Data: H11692 (2007)
Survey ID: H11692
Year: 2007
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11699 (2007)
Survey ID: H11699

Year: 2007
Locality: Chatham Strait
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with Digital Sounding Data: H11706 (2007)
Survey ID: H11706
Year: 2007
Locality: Chatham Strait
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with Digital Sounding Data: H11707 (2007)
Survey ID: H11707
Year: 2007
Locality: Chatham Strait
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with Digital Sounding Data: H11708 (2007)
Survey ID: H11708
Year: 2007
Locality: Chatham Strait
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with Digital Sounding Data: H11727 (2007)
Survey ID: H11727
Year: 2007
Locality: Keku strait
Field Unit: Beechcraft King Air 90

NOS Hydrographic Surveys with Digital Sounding Data: H11127 (2006)
Survey ID: H11127
Year: 2006
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11128 (2006)
Survey ID: H11128
Year: 2006
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11447 (2006)
Survey ID: H11447
Year: 2006
Locality: Wrangell Narrows
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11448 (2006)
Survey ID: H11448
Year: 2006
Locality: Wrangell Narrows
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11538 (2006)
Survey ID: H11538
Year: 2006
Locality: Approaches to Sitka
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with Digital Sounding Data: H11539 (2006)
Survey ID: H11539
Year: 2006
Locality: Approaches to SItka
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with Digital Sounding Data: H11540 (2006)
Survey ID: H11540
Year: 2006
Locality: Approaches to Sitka
Field Unit: deHavilland Bombardier DASH 8-200

NOS Hydrographic Surveys with Digital Sounding Data: H11577 (2006)
Survey ID: H11577
Year: 2006
Locality: West of Prince of Wales Island
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11578 (2006)
Survey ID: H11578
Year: 2006
Locality: Keku Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11579 (2006)
Survey ID: H11579
Year: 2006
Locality: Keku Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11122 (2005)
Survey ID: H11122
Year: 2005
Locality: Approaches to Sitka

Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11135 (2005)
Survey ID: H11135
Year: 2005
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11270 (2005)
Survey ID: H11270
Year: 2005
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11271 (2005)
Survey ID: H11271
Year: 2005
Locality: Approaches to sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11272 (2005)
Survey ID: H11272
Year: 2005
Locality: Southern Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11364 (2005)
Survey ID: H11364
Year: 2005
Locality: Cape Decision
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11403 (2005)
Survey ID: H11403
Year: 2005
Locality: Ernest Sound Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11404 (2005)
Survey ID: H11404
Year: 2005
Locality: Ernest Sound Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11405 (2005)
Survey ID: H11405

Year: 2005
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11406 (2005)
Survey ID: H11406
Year: 2005
Locality: Ernest Sound and Eastern Passsage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11449 (2005)
Survey ID: H11449
Year: 2005
Locality: Wrangell Narrows
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11469 (2005)
Survey ID: H11469
Year: 2005
Locality: Cape Decision
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11470 (2005)
Survey ID: H11470
Year: 2005
Locality: Cape Decision
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11507 (2005)
Survey ID: H11507
Year: 2005
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11508 (2005)
Survey ID: H11508
Year: 2005
Locality: Ernest Sound and Eastern Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11509 (2005)
Survey ID: H11509
Year: 2005
Locality: Ernest Sound and Eastern Passge
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: F00497 (2004)
Survey ID: F00497
Year: 2004
Locality: Wrangell Narrows
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11114 (2004)
Survey ID: H11114
Year: 2004
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11118 (2004)
Survey ID: H11118
Year: 2004
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11119 (2004)
Survey ID: H11119
Year: 2004
Locality: Approaches to Sitka
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11123 (2004)
Survey ID: H11123
Year: 2004
Locality: Sitka
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with Digital Sounding Data: H11124 (2004)
Survey ID: H11124
Year: 2004
Locality: Sitka
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with Digital Sounding Data: H11130 (2004)
Survey ID: H11130
Year: 2004
Locality: Sitka Sound
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with Digital Sounding Data: H11334 (2004)
Survey ID: H11334
Year: 2004
Locality: Behm Canal

Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11335 (2004)
Survey ID: H11335
Year: 2004
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11354 (2004)
Survey ID: H11354
Year: 2004
Locality: Sitka Sound
Field Unit: Beechcraft King Air 90 (N91S)

NOS Hydrographic Surveys with Digital Sounding Data: H11362 (2004)
Survey ID: H11362
Year: 2004
Locality: Cape Decision
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11369 (2004)
Survey ID: H11369
Year: 2004
Locality: Behm Canal
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H11117 (2003)
Survey ID: H11117
Year: 2003
Locality: Sitka Sound
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11120 (2003)
Survey ID: H11120
Year: 2003
Locality: Sitka Sound
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11134 (2003)
Survey ID: H11134
Year: 2003
Locality: Sitka Sound
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11236 (2003)
Survey ID: H11236

Year: 2003
Locality: Kasaan Bay
Field Unit: LUNA SEA

NOS Hydrographic Surveys with Digital Sounding Data: H11237 (2003)
Survey ID: H11237
Year: 2003
Locality: Twelve Mile Arm
Field Unit: LUNA SEA

NOS Hydrographic Surveys with Digital Sounding Data: H11238 (2003)
Survey ID: H11238
Year: 2003
Locality: Kasaan Bay
Field Unit: LUNA SEA

NOS Hydrographic Surveys with Digital Sounding Data: H11239 (2003)
Survey ID: H11239
Year: 2003
Locality: Kasaan Bay
Field Unit: LUNA SEA

NOS Hydrographic Surveys with Digital Sounding Data: H11240 (2003)
Survey ID: H11240
Year: 2003
Locality: Kasaan Bay
Field Unit: LUNA SEA

NOS Hydrographic Surveys with Digital Sounding Data: H11097 (2002)
Survey ID: H11097
Year: 2002
Locality: Kasaan Bay
Field Unit: LUNA SEA

NOS Hydrographic Surveys with Digital Sounding Data: H11098 (2002)
Survey ID: H11098
Year: 2002
Locality: Kasaan Bay
Field Unit: ROYAL FISH

NOS Hydrographic Surveys with Digital Sounding Data: H11099 (2002)
Survey ID: H11099
Year: 2002
Locality: Twelve Mile Arm
Field Unit: LUNA SEA

NOS Hydrographic Surveys with Digital Sounding Data: H11121 (2002)
Survey ID: H11121
Year: 2002
Locality: Sitka Sound
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11160 (2002)
Survey ID: H11160
Year: 2002
Locality: Kasaan Bay
Field Unit: LUNA SEA

NOS Hydrographic Surveys with Digital Sounding Data: H11161 (2002)
Survey ID: H11161
Year: 2002
Locality: Northern Clarence Strait
Field Unit: R/V MINOTAUR

NOS Hydrographic Surveys with Digital Sounding Data: H11162 (2002)
Survey ID: H11162
Year: 2002
Locality: Northern Clarence Strait
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with Digital Sounding Data: H11163 (2002)
Survey ID: H11163
Year: 2002
Locality: Northern Clarence Strait
Field Unit: R/V MISTRAL

NOS Hydrographic Surveys with Digital Sounding Data: H11164 (2002)
Survey ID: H11164
Year: 2002
Locality: Northern Clarence Strait
Field Unit: R/V DAVIDSON

NOS Hydrographic Surveys with Digital Sounding Data: H11165 (2002)
Survey ID: H11165
Year: 2002
Locality: Northern Clarence Strait
Field Unit: R/V QUICKSILVER

NOS Hydrographic Surveys with Digital Sounding Data: H10951 (2001)
Survey ID: H10951
Year: 2001
Locality: Clarence Strait

Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11048 (2001)
Survey ID: H11048
Year: 2001
Locality: Zimovia Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11049 (2001)
Survey ID: H11049
Year: 2001
Locality: Zimovia Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11050 (2001)
Survey ID: H11050
Year: 2001
Locality: Zimovia Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11051 (2001)
Survey ID: H11051
Year: 2001
Locality: Zimovia Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11052 (2001)
Survey ID: H11052
Year: 2001
Locality: Zimovia Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11053 (2001)
Survey ID: H11053
Year: 2001
Locality: Zimovia Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H11058 (2001)
Survey ID: H11058
Year: 2001
Locality: Clarence Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10949 (2000)
Survey ID: H10949

Year: 2000
Locality: Northern Clarence Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10950 (2000)
Survey ID: H10950
Year: 2000
Locality: Northern Clarence Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10967 (2000)
Survey ID: H10967
Year: 2000
Locality: Tongass Narrows
Field Unit: DUCER

NOS Hydrographic Surveys with Digital Sounding Data: H10987 (2000)
Survey ID: H10987
Year: 2000
Locality: Tongass Narrows
Field Unit: DUCER

NOS Hydrographic Surveys with Digital Sounding Data: H10988 (2000)
Survey ID: H10988
Year: 2000
Locality: Tongass Narrows
Field Unit: DUCER

NOS Hydrographic Surveys with Digital Sounding Data: H11009 (2000)
Survey ID: H11009
Year: 2000
Locality: Tongass Narrows
Field Unit: DUCER

NOS Hydrographic Surveys with Digital Sounding Data: H10818 (1998)
Survey ID: H10818
Year: 1998
Locality: Sumner Strait
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10751 (1997)
Survey ID: H10751
Year: 1997
Locality: Frederick Sound
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10677 (1996)
Survey ID: H10677
Year: 1996
Locality: Southern Stephens Passage
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10678 (1996)
Survey ID: H10678
Year: 1996
Locality: Southern Stephens Passage
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10679 (1996)
Survey ID: H10679
Year: 1996
Locality: Southern Stephens Passage
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10295 (1989)
Survey ID: H10295
Year: 1989
Locality: Frederick Sound
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10296 (1989)
Survey ID: H10296
Year: 1989
Locality: Frederick Sound
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10297 (1989)
Survey ID: H10297
Year: 1989
Locality: Frederick Sound
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10265 (1988)
Survey ID: H10265
Year: 1988
Locality: Frederick Sound
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10269 (1988)
Survey ID: H10269
Year: 1988
Locality: Frederick Sound

Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10272 (1988)
Survey ID: H10272
Year: 1988
Locality: Frederick Sound
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10288 (1988)
Survey ID: H10288
Year: 1988
Locality: Frederick Sound
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10289 (1988)
Survey ID: H10289
Year: 1988
Locality: Frederick Sound
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10256 (1987)
Survey ID: H10256
Year: 1987
Locality: Frederick Sound
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: F00263 (1984)
Survey ID: F00263
Year: 1984
Locality: Tongass Narrows
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10133 (1984)
Survey ID: H10133
Year: 1984
Locality: Walker Cove
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H10154 (1984)
Survey ID: H10154
Year: 1984
Locality: Hassler Pass to Shrimp Bay
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10155 (1984)
Survey ID: H10155

Year: 1984
Locality: Hassler Pass to Bailey Bay
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10159 (1984)
Survey ID: H10159
Year: 1984
Locality: Behm Narrows to Anchor Pass
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10160 (1984)
Survey ID: H10160
Year: 1984
Locality: Bell Arm and Anchor Pass
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10163 (1984)
Survey ID: H10163
Year: 1984
Locality: Claude Point to Point Whaley
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: F00251 (1983)
Survey ID: F00251
Year: 1983
Locality: Ward Cove
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10085 (1983)
Survey ID: H10085
Year: 1983
Locality: Rowan Bay to Washington Bay
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H10115 (1983)
Survey ID: H10115
Year: 1983
Locality: Ofshore - Point Higgins to Helm Bay
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10118 (1983)
Survey ID: H10118
Year: 1983
Locality: Offshore - Naha Bay to Port Stewart
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10121 (1983)
Survey ID: H10121
Year: 1983
Locality: Convenient Cove and Vicinity
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H09976 (1982)
Survey ID: H09976
Year: 1982
Locality: Point Ellis to Rowan Bay
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H10047 (1982)
Survey ID: H10047
Year: 1982
Locality: Smeaton Bay and Approaches
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10048 (1982)
Survey ID: H10048
Year: 1982
Locality: Smeaton Bay
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10050 (1982)
Survey ID: H10050
Year: 1982
Locality: Bay of Pillars
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H10051 (1982)
Survey ID: H10051
Year: 1982
Locality: Approaches to Boca de Quadra
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10055 (1982)
Survey ID: H10055
Year: 1982
Locality: Quadra Point to Badger Bay
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10057 (1982)
Survey ID: H10057
Year: 1982
Locality: Vixen Bay and Mink Bay

Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10063 (1982)
Survey ID: H10063
Year: 1982
Locality: Marten Arm and Vicinity
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10064 (1982)
Survey ID: H10064
Year: 1982
Locality: Six Miles Northeast of Bactrian Point
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H10065 (1982)
Survey ID: H10065
Year: 1982
Locality: Head of Boca De Quadra
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H09977 (1981)
Survey ID: H09977
Year: 1981
Locality: Rowan Bay
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: F00228 (1980)
Survey ID: F00228
Year: 1980
Locality: Ketchikan Harbor
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H08945 (1978)
Survey ID: H08945
Year: 1978
Locality: Whale Passage
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H09754 (1978)
Survey ID: H09754
Year: 1978
Locality: Lake Bay and Approaches
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H09756 (1978)
Survey ID: H09756

Year: 1978
Locality: Coffman Cove to Beck Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H09757 (1978)
Survey ID: H09757
Year: 1978
Locality: Vicinity of Rose Island
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H09791 (1978)
Survey ID: H09791
Year: 1978
Locality: Petersburg
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09792 (1978)
Survey ID: H09792
Year: 1978
Locality: Mountain Point to Northern Entrance
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09795 (1978)
Survey ID: H09795
Year: 1978
Locality: North Point to Mountain Point
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09729 (1977)
Survey ID: H09729
Year: 1977
Locality: Midway Rock to Point Humbug
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09572 (1976)
Survey ID: H09572
Year: 1976
Locality: Point Howe (Mitkof Island) to Baht Harbor (Zarembo Island)
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09650 (1976)
Survey ID: H09650
Year: 1976
Locality: Vank Island and Vicinity
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09651 (1976)
Survey ID: H09651
Year: 1976
Locality: Sokolof Island to Woronofski Island
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09652 (1976)
Survey ID: H09652
Year: 1976
Locality: Blind Slough to Dry Strait
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09653 (1976)
Survey ID: H09653
Year: 1976
Locality: Rynda Island and Vicinity
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09571 (1975)
Survey ID: H09571
Year: 1975
Locality: Vichnefski Rock to Point Alexander
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09483 (1974)
Survey ID: H09483
Year: 1974
Locality: Indian Point to Towers Arm
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09146 (1973)
Survey ID: H09146
Year: 1973
Locality: Vicinity of Percy Island and Hotspur Island
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H09331 (1973)
Survey ID: H09331
Year: 1973
Locality: Sealed Passage
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H09370 (1973)
Survey ID: H09370
Year: 1973
Locality: Vegas Islands to Ryus Bay

Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09401 (1973)
Survey ID: H09401
Year: 1973
Locality: Rocky Bay
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H09402 (1973)
Survey ID: H09402
Year: 1973
Locality: Mosman Inlet and Vicinity
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H09403 (1973)
Survey ID: H09403
Year: 1973
Locality: Burnett Inlet
Field Unit: NOAA Ship RAINIER (S221)

NOS Hydrographic Surveys with Digital Sounding Data: H09268 (1972)
Survey ID: H09268
Year: 1972
Locality: Mitchell Point to Point Saint John
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09269 (1972)
Survey ID: H09269
Year: 1972
Locality: West Shore of Zarembo Island
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09285 (1972)
Survey ID: H09285
Year: 1972
Locality: Onslow Point to Etolin Island
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H09286 (1972)
Survey ID: H09286
Year: 1972
Locality: Peterson Island to Brownson Island
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H09287 (1972)
Survey ID: H09287

Year: 1972
Locality: Vixen Inlet to Union Point
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H09288 (1972)
Survey ID: H09288
Year: 1972
Locality: Union Point to Brownson Island
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H09309 (1972)
Survey ID: H09309
Year: 1972
Locality: San Alberto Bay and Klawock Inlet
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H09330 (1972)
Survey ID: H09330
Year: 1972
Locality: Off Nichols Passage and Felice Strait
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H09332 (1972)
Survey ID: H09332
Year: 1972
Locality: Vicinity of Woewodski Island
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09333 (1972)
Survey ID: H09333
Year: 1972
Locality: Vicinity of Big Castle Island
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09343 (1972)
Survey ID: H09343
Year: 1972
Locality: High Castle Island to Indian Point
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H08946 (1971)
Survey ID: H08946
Year: 1971
Locality: Whale Passage
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H09191 (1971)
Survey ID: H09191
Year: 1971
Locality: Union Bay
Field Unit: USC&GS Ship PATHFINDER

NOS Hydrographic Surveys with Digital Sounding Data: H09192 (1971)
Survey ID: H09192
Year: 1971
Locality: Dewey Anchorage and Vicinity
Field Unit: USC&GS Ship PATHFINDER

NOS Hydrographic Surveys with Digital Sounding Data: H09193 (1971)
Survey ID: H09193
Year: 1971
Locality: Ratz Harbor
Field Unit: USC&GS Ship PATHFINDER

NOS Hydrographic Surveys with Digital Sounding Data: H09194 (1971)
Survey ID: H09194
Year: 1971
Locality: Ernest Point to Ratz Point
Field Unit: USC&GS Ship PATHFINDER

NOS Hydrographic Surveys with Digital Sounding Data: H09213 (1971)
Survey ID: H09213
Year: 1971
Locality: Threemile Arm to Seclusion Harbor
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09214 (1971)
Survey ID: H09214
Year: 1971
Locality: Vicinity of Conclusion Island
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09215 (1971)
Survey ID: H09215
Year: 1971
Locality: Sumner Strait
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09216 (1971)
Survey ID: H09216
Year: 1971
Locality: Red Bay and Approaches

Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09217 (1971)
Survey ID: H09217
Year: 1971
Locality: Point Barrie to Totem Bay
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09218 (1971)
Survey ID: H09218
Year: 1971
Locality: Totem Bay and Approaches
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09219 (1971)
Survey ID: H09219
Year: 1971
Locality: Douglas Bay and Approaches
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09220 (1971)
Survey ID: H09220
Year: 1971
Locality: Pine Point to Mitchell Point
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09221 (1971)
Survey ID: H09221
Year: 1971
Locality: Kah Sheets Bay and Approaches
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09222 (1971)
Survey ID: H09222
Year: 1971
Locality: Red Bay Entrance
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09223 (1971)
Survey ID: H09223
Year: 1971
Locality: Off Red Bay to Point Baker
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H08960 (1970)
Survey ID: H08960

Year: 1970
Locality: Saginaw Bay
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08961 (1970)
Survey ID: H08961
Year: 1970
Locality: Vicinity of Cornwallis Pt. to Payne I.
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H09000 (1970)
Survey ID: H09000
Year: 1970
Locality: Point Macartney to Kake
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H09101 (1970)
Survey ID: H09101
Year: 1970
Locality: Alvin Bay to Conclusion Island
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09157 (1970)
Survey ID: H09157
Year: 1970
Locality: Vicinity of Hid Reef
Field Unit: USC&GS Ship MCARTHUR

NOS Hydrographic Surveys with Digital Sounding Data: H09158 (1970)
Survey ID: H09158
Year: 1970
Locality: Point Camden to Big John Bay
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09159 (1970)
Survey ID: H09159
Year: 1970
Locality: High Island to Horseshoe Island
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09160 (1970)
Survey ID: H09160
Year: 1970
Locality: Point Barrie to South End of Rocky Pass
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09161 (1970)
Survey ID: H09161
Year: 1970
Locality: South End of Rocky Pass
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09182 (1970)
Survey ID: H09182
Year: 1970
Locality: Smuggler Cove to Copper Point
Field Unit: USC&GS Ship MCARTHUR

NOS Hydrographic Surveys with Digital Sounding Data: H09184 (1970)
Survey ID: H09184
Year: 1970
Locality: Vicinity of Point Davison
Field Unit: USC&GS Ship MCARTHUR

NOS Hydrographic Surveys with Digital Sounding Data: H09039 (1969)
Survey ID: H09039
Year: 1969
Locality: Hamilton Bay and Vicinity
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09066 (1969)
Survey ID: H09066
Year: 1969
Locality: Nichols Passage
Field Unit: USC&GS Ship MCARTHUR

NOS Hydrographic Surveys with Digital Sounding Data: H09069 (1969)
Survey ID: H09069
Year: 1969
Locality: Vicinity of Bostwick Inlet
Field Unit: NOAA Ship MACARTHUR

NOS Hydrographic Surveys with Digital Sounding Data: H09070 (1969)
Survey ID: H09070
Year: 1969
Locality: Nichols Passage
Field Unit: NOAA Ship MACARTHUR

NOS Hydrographic Surveys with Digital Sounding Data: H09078 (1969)
Survey ID: H09078
Year: 1969
Locality: South of High Island

Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09079 (1969)
Survey ID: H09079
Year: 1969
Locality: Vicinity of Summit Island
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09080 (1969)
Survey ID: H09080
Year: 1969
Locality: Devils Elbow to Summit Island
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09081 (1969)
Survey ID: H09081
Year: 1969
Locality: Eagle Island to Devil's Elbow
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09082 (1969)
Survey ID: H09082
Year: 1969
Locality: Port Camden
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09083 (1969)
Survey ID: H09083
Year: 1969
Locality: Port Camden
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09084 (1969)
Survey ID: H09084
Year: 1969
Locality: Thorne Bay
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09085 (1969)
Survey ID: H09085
Year: 1969
Locality: Tolstoi Bay and Vicinity
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09091 (1969)
Survey ID: H09091

Year: 1969
Locality: Tolstoi Point to Niblack Point
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H09092 (1969)
Survey ID: H09092
Year: 1969
Locality: Narrow Point to Tolstoi Island
Field Unit: NOAA Ship FAIRWEATHER (S220)

NOS Hydrographic Surveys with Digital Sounding Data: H08658 (1968)
Survey ID: H08658
Year: 1968
Locality: Kake to Hamilton Island
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08948 (1968)
Survey ID: H08948
Year: 1968
Locality: Lyman Anchorage
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H09040 (1968)
Survey ID: H09040
Year: 1968
Locality: Vicinity of Keku Islands
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09041 (1968)
Survey ID: H09041
Year: 1968
Locality: Point Camden to Hound Island
Field Unit: NOAA Ship DAVIDSON (S331)

NOS Hydrographic Surveys with Digital Sounding Data: H09062 (1968)
Survey ID: H09062
Year: 1968
Locality: Grindall Island to Lyman Anchorage
Field Unit: USC&GS Ship PATHFINDER

NOS Hydrographic Surveys with Digital Sounding Data: H08801 (1967)
Survey ID: H08801
Year: 1967
Locality: Tongass Narrows
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08947 (1967)
Survey ID: H08947
Year: 1967
Locality: Grindall and Street Islands
Field Unit: NOAA Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08906 (1966)
Survey ID: H08906
Year: 1966
Locality: Duncal Canal
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08907 (1966)
Survey ID: H08907
Year: 1966
Locality: Vicinity of Pt. Macartney & Pinta Rocks
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08688 (1965)
Survey ID: H08688
Year: 1965
Locality: Reid Bay and Approaches
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08872 (1965)
Survey ID: H08872
Year: 1965
Locality: Vicinity of Pennock Island
Field Unit: USC&GS Ship BOWIE

NOS Hydrographic Surveys with Digital Sounding Data: H08798 (1964)
Survey ID: H08798
Year: 1964
Locality: Revillagigedo Channel
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08799 (1964)
Survey ID: H08799
Year: 1964
Locality: Thorne Arm - North Half
Field Unit: USC&GS Ship PATHFINDER

NOS Hydrographic Surveys with Digital Sounding Data: H08800 (1964)
Survey ID: H08800
Year: 1964
Locality: Tongass Narrows

Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08802 (1964)
Survey ID: H08802
Year: 1964
Locality: Tongass Narrows
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08533 (1963)
Survey ID: H08533
Year: 1963
Locality: Kasaan Bay
Field Unit: USC&GS Ship PATHFINDER

NOS Hydrographic Surveys with Digital Sounding Data: H08692 (1963)
Survey ID: H08692
Year: 1963
Locality: Osten Island to Rock Point
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08715 (1963)
Survey ID: H08715
Year: 1963
Locality: Vallenar Bay
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08716 (1963)
Survey ID: H08716
Year: 1963
Locality: Vicinity of Vallenar Point
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08755 (1963)
Survey ID: H08755
Year: 1963
Locality: Osten Island to Shelter Cove
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08756 (1963)
Survey ID: H08756
Year: 1963
Locality: North of Shelter Cove
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08757 (1963)
Survey ID: H08757

Year: 1963
Locality: Thorne Arm - South Half
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08758 (1963)
Survey ID: H08758
Year: 1963
Locality: Pennock Island to Bold Island
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08759 (1963)
Survey ID: H08759
Year: 1963
Locality: Vicinity of Bold Island
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08769 (1963)
Survey ID: H08769
Year: 1963
Locality: Kasaan Bay
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08770 (1963)
Survey ID: H08770
Year: 1963
Locality: Kasaan Bay
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08771 (1963)
Survey ID: H08771
Year: 1963
Locality: Kasaan Bay
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08640 (1962)
Survey ID: H08640
Year: 1962
Locality: Cholmondeley Sound, West Arm
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08641 (1962)
Survey ID: H08641
Year: 1962
Locality: Cholmondeley Sound, South Arm
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08653 (1962)
Survey ID: H08653
Year: 1962
Locality: Point Amelius to Boulder Point
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08654 (1962)
Survey ID: H08654
Year: 1962
Locality: Port Beauclerc
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08659 (1962)
Survey ID: H08659
Year: 1962
Locality: Cholmondeley Sound
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08660 (1962)
Survey ID: H08660
Year: 1962
Locality: Clover Bay
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08665 (1962)
Survey ID: H08665
Year: 1962
Locality: Vicinity of Windy Point and Chasina Point
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08666 (1962)
Survey ID: H08666
Year: 1962
Locality: Off Kasaan Bay
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08690 (1962)
Survey ID: H08690
Year: 1962
Locality: Northern Part
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08691 (1962)
Survey ID: H08691
Year: 1962
Locality: Vicinity of California Head

Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08604 (1961)
Survey ID: H08604
Year: 1961
Locality: Cape Decision to Cape Pole
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08605 (1961)
Survey ID: H08605
Year: 1961
Locality: Pt. St. Albans to Boulder Pt.
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08620 (1961)
Survey ID: H08620
Year: 1961
Locality: Wrangell Harbor
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08621 (1961)
Survey ID: H08621
Year: 1961
Locality: Approaches to Wrangell Harbor
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08622 (1961)
Survey ID: H08622
Year: 1961
Locality: Gravina Island
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08623 (1961)
Survey ID: H08623
Year: 1961
Locality: West Side of Gravina Island
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08624 (1961)
Survey ID: H08624
Year: 1961
Locality: Kitkun Bay and Dora Bay
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08112 (1960)
Survey ID: H08112

Year: 1960
Locality: Entrance to Sumner Strait
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08455 (1960)
Survey ID: H08455
Year: 1960
Locality: Vicinity of North Pass
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08517 (1960)
Survey ID: H08517
Year: 1960
Locality: Kake
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08531 (1960)
Survey ID: H08531
Year: 1960
Locality: Twelve Mile Arm (South)
Field Unit: USC&GS Ship PATHFINDER

NOS Hydrographic Surveys with Digital Sounding Data: H08532 (1960)
Survey ID: H08532
Year: 1960
Locality: Twelvemile Arm (South)
Field Unit: USC&GS Ship PATHFINDER

NOS Hydrographic Surveys with Digital Sounding Data: H08359 (1959)
Survey ID: H08359
Year: 1959
Locality: Devilfish Bay to Shakan Strait
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08466 (1959)
Survey ID: H08466
Year: 1959
Locality: Polk Inlet
Field Unit: USC&GS Ship PATHFINDER

NOS Hydrographic Surveys with Digital Sounding Data: H08467 (1959)
Survey ID: H08467
Year: 1959
Locality: Skowl Arm and McKenzie Inlet
Field Unit: USC&GS Ship PATHFINDER

NOS Hydrographic Surveys with Digital Sounding Data: H08501 (1959)
Survey ID: H08501
Year: 1959
Locality: Sawmill Cove
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08440 (1958)
Survey ID: H08440
Year: 1958
Locality: Moira Sound
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08441 (1958)
Survey ID: H08441
Year: 1958
Locality: North Arm, Moira Sound and Port Johnson
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08442 (1958)
Survey ID: H08442
Year: 1958
Locality: West of Gravina Island
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08443 (1958)
Survey ID: H08443
Year: 1958
Locality: Northwest Coast Heceta Island
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08444 (1958)
Survey ID: H08444
Year: 1958
Locality: Iphigenia Bay
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08456 (1958)
Survey ID: H08456
Year: 1958
Locality: Natzuhini Bay
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08457 (1958)
Survey ID: H08457
Year: 1958
Locality: Soda Bay

Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08458 (1958)
Survey ID: H08458
Year: 1958
Locality: Tlevak Narrows
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H07987 (1957)
Survey ID: H07987
Year: 1957
Locality: Brockman Island to Devilfish Bay
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H08038 (1957)
Survey ID: H08038
Year: 1957
Locality: Tahka Point to Kassan Islands
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08382 (1957)
Survey ID: H08382
Year: 1957
Locality: Kendrick Bay to Adams Point
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08383 (1957)
Survey ID: H08383
Year: 1957
Locality: Eastern Shore, Prince of Wales Island
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08384 (1957)
Survey ID: H08384
Year: 1957
Locality: Ingraham Bay and Part of Moira Sound
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08385 (1957)
Survey ID: H08385
Year: 1957
Locality: Moira Sound, Prince of Wales Island
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08391 (1957)
Survey ID: H08391

Year: 1957
Locality: Cap Island to Brockman Island
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08392 (1957)
Survey ID: H08392
Year: 1957
Locality: Karheen Passage
Field Unit: NOAA Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08393 (1957)
Survey ID: H08393
Year: 1957
Locality: Sea Otter Sound
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08286 (1956)
Survey ID: H08286
Year: 1956
Locality: Warren Channel
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08287 (1956)
Survey ID: H08287
Year: 1956
Locality: Davidson Inlet
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08288 (1956)
Survey ID: H08288
Year: 1956
Locality: Northern Part of Sea Otter Sound
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08289 (1956)
Survey ID: H08289
Year: 1956
Locality: Marble Passage
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08290 (1956)
Survey ID: H08290
Year: 1956
Locality: Tokeen Bay
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08325 (1956)
Survey ID: H08325
Year: 1956
Locality: North Side Sukkwan Island
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08326 (1956)
Survey ID: H08326
Year: 1956
Locality: Hydaburg Harbor
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08151 (1955)
Survey ID: H08151
Year: 1955
Locality: Shakan Bay
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08229 (1955)
Survey ID: H08229
Year: 1955
Locality: Klakas Inlet
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08230 (1955)
Survey ID: H08230
Year: 1955
Locality: Approaches to Hetta Inlet
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08231 (1955)
Survey ID: H08231
Year: 1955
Locality: Eek Point to Corbin Point
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08232 (1955)
Survey ID: H08232
Year: 1955
Locality: Jumbo Island to Gould Island
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08244 (1955)
Survey ID: H08244
Year: 1955
Locality: Off Kosciusko Island

Field Unit: NOAA Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08245 (1955)
Survey ID: H08245
Year: 1955
Locality: Shipley Bay
Field Unit: NOAA Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08067 (1954)
Survey ID: H08067
Year: 1954
Locality: Vicinity Ship Islands to Hunter Point
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08125 (1954)
Survey ID: H08125
Year: 1954
Locality: Hessa Inlet and Approaches
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08126 (1954)
Survey ID: H08126
Year: 1954
Locality: Tah Bay
Field Unit: NOAA Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08127 (1954)
Survey ID: H08127
Year: 1954
Locality: Hunter Bay, Klinkwan Cove, South Klakas Inlet and Ruth Bay
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08128 (1954)
Survey ID: H08128
Year: 1954
Locality: Ship Island Passage and Kassa Inlet
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08129 (1954)
Survey ID: H08129
Year: 1954
Locality: Klakas Inlet
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08130 (1954)
Survey ID: H08130

Year: 1954
Locality: East Shore Cordova Bay, Mabel Bay and Hassiah Inlet
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08131 (1954)
Survey ID: H08131
Year: 1954
Locality: Southeast Sukkwan Island
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08132 (1954)
Survey ID: H08132
Year: 1954
Locality: Nutkwa and Keete Inlet
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08133 (1954)
Survey ID: H08133
Year: 1954
Locality: Nutkwa Inlet
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08134 (1954)
Survey ID: H08134
Year: 1954
Locality: Central and Northern Parts
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08148 (1954)
Survey ID: H08148
Year: 1954
Locality: Wrangell
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08149 (1954)
Survey ID: H08149
Year: 1954
Locality: Port Protection to Strait Island
Field Unit: USC&GS Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08150 (1954)
Survey ID: H08150
Year: 1954
Locality: Northwest Coast of Prince of Wales Island
Field Unit: NOAA Ship LESTER JONES

NOS Hydrographic Surveys with Digital Sounding Data: H08036 (1953)
Survey ID: H08036
Year: 1953
Locality: South End
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08037 (1953)
Survey ID: H08037
Year: 1953
Locality: Ahtun Point to Naukati Bay
Field Unit: USC&GS Ship PATTON

NOS Hydrographic Surveys with Digital Sounding Data: H08064 (1953)
Survey ID: H08064
Year: 1953
Locality: Southern Part. (Cordova Bay)
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H08065A (1953)
Survey ID: H08065A
Year: 1953
Locality: South of Barrier Islands
Field Unit: USC&GS Ship HODGSON

NOS Hydrographic Surveys with Digital Sounding Data: H07869 (1951)
Survey ID: H07869
Year: 1951
Locality: WARD COVE
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H07787 (1949)
Survey ID: H07787
Year: 1949
Locality: NAKWASINA SOUND
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H07789 (1949)
Survey ID: H07789
Year: 1949
Locality: KRESTOF SOUND
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H07189 (1947)
Survey ID: H07189
Year: 1947
Locality: SILVER BAY

Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H07190 (1947)
Survey ID: H07190
Year: 1947
Locality: DEEP INLET
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H07191 (1947)
Survey ID: H07191
Year: 1947
Locality: DARANOF I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H07193 (1947)
Survey ID: H07193
Year: 1947
Locality: BIORKA CH.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H07095 (1946)
Survey ID: H07095
Year: 1946
Locality: EDNA BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H07098 (1946)
Survey ID: H07098
Year: 1946
Locality: EDNA BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H07096 (1945)
Survey ID: H07096
Year: 1945
Locality: BARANOF I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H07097 (1945)
Survey ID: H07097
Year: 1945
Locality: BIORKA I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H07163 (1945)
Survey ID: H07163

Year: 1945
Locality: SITKA HBR.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06947 (1943)
Survey ID: H06947
Year: 1943
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06948 (1943)
Survey ID: H06948
Year: 1943
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06764 (1942)
Survey ID: H06764
Year: 1942
Locality: STARRIGAVAN BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06795 (1942)
Survey ID: H06795
Year: 1942
Locality: PORT ARMSTRONG
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06655 (1941)
Survey ID: H06655
Year: 1941
Locality: BIORKA REEF
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06666 (1941)
Survey ID: H06666
Year: 1941
Locality: SITKA SOUND
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06667 (1941)
Survey ID: H06667
Year: 1941
Locality: SITKA SOUND
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06743 (1941)
Survey ID: H06743
Year: 1941
Locality: CAPE EDGECUMBE
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06351 (1938)
Survey ID: H06351
Year: 1938
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06352 (1938)
Survey ID: H06352
Year: 1938
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06353 (1938)
Survey ID: H06353
Year: 1938
Locality: APPROACHES TO SITKA HARBOR
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06354 (1938)
Survey ID: H06354
Year: 1938
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06355 (1938)
Survey ID: H06355
Year: 1938
Locality: APPROACHES TO SITKA HARBOR
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06358 (1938)
Survey ID: H06358
Year: 1938
Locality: W. OF SUMNER STRAIT
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06282 (1937)
Survey ID: H06282
Year: 1937
Locality: Unknown

Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06283 (1937)
Survey ID: H06283
Year: 1937
Locality: WARREN CH.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06284 (1937)
Survey ID: H06284
Year: 1937
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H06285 (1937)
Survey ID: H06285
Year: 1937
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05236 (1933)
Survey ID: H05236
Year: 1933
Locality: BLACK ROCK
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05267 (1933)
Survey ID: H05267
Year: 1933
Locality: REVILLAGEDO CH.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05281 (1933)
Survey ID: H05281
Year: 1933
Locality: KELP I. TO HASSLER REEF
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05360 (1933)
Survey ID: H05360
Year: 1933
Locality: LINCOLN CH.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05372 (1933)
Survey ID: H05372

Year: 1933
Locality: FILLMORE I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05384 (1933)
Survey ID: H05384
Year: 1933
Locality: MINK BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05385 (1933)
Survey ID: H05385
Year: 1933
Locality: LORD IS. & NAKAT BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05386 (1933)
Survey ID: H05386
Year: 1933
Locality: ENTRANCE TO DIXON
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05387 (1933)
Survey ID: H05387
Year: 1933
Locality: TREE PT.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05388 (1933)
Survey ID: H05388
Year: 1933
Locality: ENTRANCE TO DIXON
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05389 (1933)
Survey ID: H05389
Year: 1933
Locality: QUADRA PT.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05205 (1932)
Survey ID: H05205
Year: 1932
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05244 (1932)
Survey ID: H05244
Year: 1932
Locality: TWIN I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05263 (1932)
Survey ID: H05263
Year: 1932
Locality: DIXON ENT.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05268 (1932)
Survey ID: H05268
Year: 1932
Locality: BARREN I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05105 (1931)
Survey ID: H05105
Year: 1931
Locality: NEETS BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05137 (1931)
Survey ID: H05137
Year: 1931
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05144 (1931)
Survey ID: H05144
Year: 1931
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05145 (1931)
Survey ID: H05145
Year: 1931
Locality: RUDYERD BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05150 (1931)
Survey ID: H05150
Year: 1931
Locality: CHANNEL I.

Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05174 (1931)
Survey ID: H05174
Year: 1931
Locality: BEHM CANAL
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05175 (1931)
Survey ID: H05175
Year: 1931
Locality: MANZANITA BAY AND RUDYERD BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05176 (1931)
Survey ID: H05176
Year: 1931
Locality: RUDYERD I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05185 (1931)
Survey ID: H05185
Year: 1931
Locality: WALKER COVE VICINITY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05060 (1930)
Survey ID: H05060
Year: 1930
Locality: GUARD I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05061 (1930)
Survey ID: H05061
Year: 1930
Locality: BACK I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05079 (1930)
Survey ID: H05079
Year: 1930
Locality: NAHA BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05102 (1930)
Survey ID: H05102

Year: 1930
Locality: YES BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05103 (1930)
Survey ID: H05103
Year: 1930
Locality: BLIND PASS
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H05106 (1930)
Survey ID: H05106
Year: 1930
Locality: BEHM CANAL
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04842 (1928)
Survey ID: H04842
Year: 1928
Locality: CAPE EDGECUMBE
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04843 (1928)
Survey ID: H04843
Year: 1928
Locality: W. OF KRUZOF I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04773 (1927)
Survey ID: H04773
Year: 1927
Locality: URSUA CH.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04774 (1927)
Survey ID: H04774
Year: 1927
Locality: PRINCE OF WALES I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04594 (1926)
Survey ID: H04594
Year: 1926
Locality: SUEMEZ I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04622A (1926)
Survey ID: H04622A
Year: 1926
Locality: DALL I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04624 (1926)
Survey ID: H04624
Year: 1926
Locality: PORT LUCY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04625 (1926)
Survey ID: H04625
Year: 1926
Locality: PORT HERBERT
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04626A (1926)
Survey ID: H04626A
Year: 1926
Locality: YEBENKOF BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04627 (1926)
Survey ID: H04627
Year: 1926
Locality: RED BLUFF BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03692 (1925)
Survey ID: H03692
Year: 1925
Locality: MEARES PASSAGE
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03692A (1925)
Survey ID: H03692A
Year: 1925
Locality: MEARES PASSAGE
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04514A (1925)
Survey ID: H04514A
Year: 1925
Locality: PORT CONCLUSION

Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04515 (1925)
Survey ID: H04515
Year: 1925
Locality: SPANISH IS.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04516 (1925)
Survey ID: H04516
Year: 1925
Locality: CORONATION I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04517A (1925)
Survey ID: H04517A
Year: 1925
Locality: TABLE BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04528 (1925)
Survey ID: H04528
Year: 1925
Locality: BARANOF I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04530 (1925)
Survey ID: H04530
Year: 1925
Locality: BARANOF I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04534 (1925)
Survey ID: H04534
Year: 1925
Locality: PRINCE OF WALES I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04535 (1925)
Survey ID: H04535
Year: 1925
Locality: PRINCE OF WALES I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04536 (1925)
Survey ID: H04536

Year: 1925
Locality: CAPE MUZON
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04431 (1924)
Survey ID: H04431
Year: 1924
Locality: UPPER GREAT ARM & SMALL ARM
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04432 (1924)
Survey ID: H04432
Year: 1924
Locality: PUFFIN PT.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04441 (1924)
Survey ID: H04441
Year: 1924
Locality: LOY I. TO HEAD
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04443A (1924)
Survey ID: H04443A
Year: 1924
Locality: THOMAS BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04261A (1923)
Survey ID: H04261A
Year: 1923
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04325 (1923)
Survey ID: H04325
Year: 1923
Locality: CORONATION I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04326 (1923)
Survey ID: H04326
Year: 1923
Locality: CORONATION I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04330 (1923)
Survey ID: H04330
Year: 1923
Locality: EL CAPITAN PASS
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04331 (1923)
Survey ID: H04331
Year: 1923
Locality: HAZY IS.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04251 (1922)
Survey ID: H04251
Year: 1922
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04252 (1922)
Survey ID: H04252
Year: 1922
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04254 (1922)
Survey ID: H04254
Year: 1922
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04259 (1922)
Survey ID: H04259
Year: 1922
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04260 (1922)
Survey ID: H04260
Year: 1922
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04264 (1922)
Survey ID: H04264
Year: 1922
Locality: Unknown

Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04271 (1922)
Survey ID: H04271
Year: 1922
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04272 (1922)
Survey ID: H04272
Year: 1922
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04273 (1922)
Survey ID: H04273
Year: 1922
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04274 (1922)
Survey ID: H04274
Year: 1922
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04188 (1921)
Survey ID: H04188
Year: 1921
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04200 (1921)
Survey ID: H04200
Year: 1921
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04203 (1921)
Survey ID: H04203
Year: 1921
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04204 (1921)
Survey ID: H04204

Year: 1921
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04208A (1921)
Survey ID: H04208A
Year: 1921
Locality: DALL I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04208B (1921)
Survey ID: H04208B
Year: 1921
Locality: BAKER IS.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04209 (1921)
Survey ID: H04209
Year: 1921
Locality: GULF OF ESQUIBEL
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03819B (1920)
Survey ID: H03819B
Year: 1920
Locality: DALL I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04158 (1920)
Survey ID: H04158
Year: 1920
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04160 (1920)
Survey ID: H04160
Year: 1920
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04161 (1920)
Survey ID: H04161
Year: 1920
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04191 (1920)
Survey ID: H04191
Year: 1920
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04192 (1920)
Survey ID: H04192
Year: 1920
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H04009 (1917)
Survey ID: H04009
Year: 1917
Locality: GOOSENECK HBR.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03912 (1916)
Survey ID: H03912
Year: 1916
Locality: KASHEVAROF PASSAGE
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03930 (1916)
Survey ID: H03930
Year: 1916
Locality: PORT BAGAN
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03931 (1916)
Survey ID: H03931
Year: 1916
Locality: FORRESTER I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03932 (1916)
Survey ID: H03932
Year: 1916
Locality: CAPE MUZON
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03933 (1916)
Survey ID: H03933
Year: 1916
Locality: DALL I.

Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03940 (1916)
Survey ID: H03940
Year: 1916
Locality: Unknown
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03781 (1915)
Survey ID: H03781
Year: 1915
Locality: SEALED PASSAGE
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03787 (1915)
Survey ID: H03787
Year: 1915
Locality: SEALED PASSAGE
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03789 (1915)
Survey ID: H03789
Year: 1915
Locality: LORD ROCK
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03795 (1915)
Survey ID: H03795
Year: 1915
Locality: PORTILLO CH.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03818 (1915)
Survey ID: H03818
Year: 1915
Locality: PORT REAL MARINA
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03880 (1915)
Survey ID: H03880
Year: 1915
Locality: BUCARELI BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03666 (1914)
Survey ID: H03666

Year: 1914
Locality: PRINCE OF WALES I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03678 (1914)
Survey ID: H03678
Year: 1914
Locality: APPROACHES TO TROCADERO BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03679 (1914)
Survey ID: H03679
Year: 1914
Locality: PRINCE OF WALES I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03680 (1914)
Survey ID: H03680
Year: 1914
Locality: PRINCE OF WALES I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03691 (1914)
Survey ID: H03691
Year: 1914
Locality: SUKKWAN STRAIT
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03710 (1914)
Survey ID: H03710
Year: 1914
Locality: Port Chester, Annette Island Southeast Alaska
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03416 (1913)
Survey ID: H03416
Year: 1913
Locality: PRINCE OF WALES PASSAGE
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03539 (1913)
Survey ID: H03539
Year: 1913
Locality: APPROACHES TO CHRISTOVAL CHANNEL
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03540 (1913)
Survey ID: H03540
Year: 1913
Locality: APPROACHES TO BOCAS DE FINAS
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03547 (1913)
Survey ID: H03547
Year: 1913
Locality: PRINCE OF WALES I.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03390 (1912)
Survey ID: H03390
Year: 1912
Locality: GARDNER'S BAY & KENDRICK BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03417 (1912)
Survey ID: H03417
Year: 1912
Locality: TLEVAK STRAIT
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03427 (1912)
Survey ID: H03427
Year: 1912
Locality: ULLOA CH.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03042 (1909)
Survey ID: H03042
Year: 1909
Locality: ENTRANCE TO DIXON
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H03042A (1909)
Survey ID: H03042A
Year: 1909
Locality: ENTRANCE TO CORDOVA BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H02665 (1903)
Survey ID: H02665
Year: 1903
Locality: SITKA SOUND

Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H02333 (1897)
Survey ID: H02333
Year: 1897
Locality: FREDERICK STRAIT
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H02241 (1895)
Survey ID: H02241
Year: 1895
Locality: CHALK BAY
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H02142 (1892)
Survey ID: H02142
Year: 1892
Locality: REVILLAGIGEDO CH.
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H01891 (1889)
Survey ID: H01891
Year: 1889
Locality: PORTLAND CANAL
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H01996 (1889)
Survey ID: H01996
Year: 1889
Locality: FREDERICK SOUND
Field Unit:

NOS Hydrographic Surveys with Digital Sounding Data: H01618A (1883)
Survey ID: H01618A
Year: 1883
Locality: CAPE FOX TO BOLD I.
Field Unit:

Appendix B: Python Scripts and Geoprocessing Steps

B.1 Converting xyz and bag files to ArcGIS points

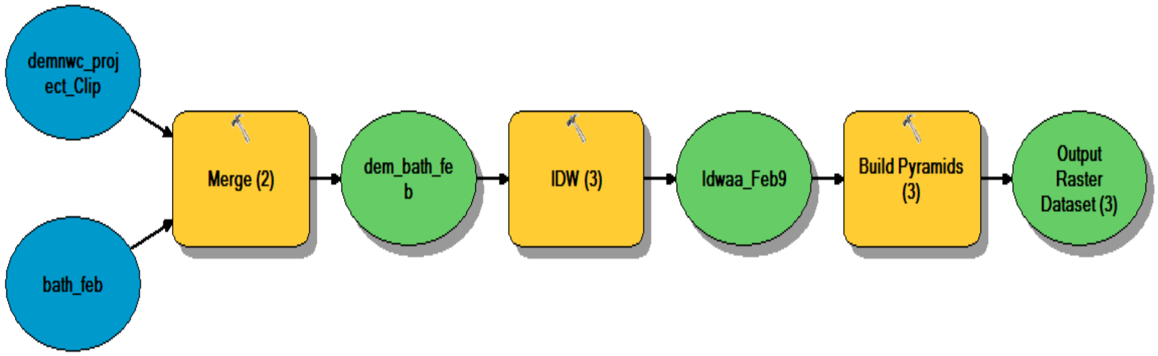
F:\Gateway to the Americas\bathpts\script\final.pyw

```
import arcpy, os, sys, csv

try:
    for filename in os.listdir(r"R:/bathpts/csvxyz/"):

        basename, extension = filename.split('.')

        if extension == "CSV":

            output = open(r"R:/bathpts/post/" + filename,  'w')
            infile = open(r"R:/bathpts/csvxyz/" + filename, 'r')

            output.write("Long, Lat, Z")
            output.write('\n')
            for line in infile:
                output.write(line)

            output.close()
            infile.close()

    cnt = 1
    for Event in os.listdir(r"R:/bathpts/post/"):
        basenameEv, extension = Event.split('.')

        Layer_Name = cnt
        Eventout = r"R:/bathpts/shape/" + basenameEv + ".shp"
        EventoutU = r"R:/bathpts/shapeUTM/" + basenameEv + ".shp"

        arcpy.MakeXYEventLayer_management((r"R:/bathpts/post/" + Event), "long", "lat",
        Layer_Name,
        "GEOGCS['GCS_North_American_1983',DATUM['D_North_American_1983',SPHEROID['GRS_1980',63781
        37.0,298.257222101]],PRIMEM['Greenwich',0.0],UNIT['Degree',0.0174532925199433]];-400
        -400 1000000000;-100000 10000;-100000
        10000;8.98315284119521E-09;0.001;0.001;IsHighPrecision", "Z")
        arcpy.FeatureToPoint_management(Layer_Name, Eventout, "CENTROID")
        arcpy.Project_management(Eventout, EventoutU,
        "PROJCS['WGS_1984_UTM_Zone_8N',GEOGCS['GCS_WGS_1984',DATUM['D_WGS_1984',SPHEROID['WGS_198
        4',6378137.0,298.257223563]],PRIMEM['Greenwich',0.0],UNIT['Degree',0.0174532925199433]],P
        ROJECTION['Transverse_Mercator'],PARAMETER['False_Easting',500000.0],PARAMETER['False_Nor
        thing',0.0],PARAMETER['Central_Meridian',-135.0],PARAMETER['Scale_Factor',0.9996],PARAMET
        ER['Latitude_Of_Origin',0.0],UNIT['Meter',1.0]]", "NAD_1983_To_WGS_1984_3",
        "GEOGCS['GCS_North_American_1983',DATUM['D_North_American_1983',SPHEROID['GRS_1980',63781
        37.0,298.257222101]],PRIMEM['Greenwich',0.0],UNIT['Degree',0.0174532925199433]]")

        print cnt
        cnt = cnt + 1
except:
    print "xyz finished"


    for filenameU in os.listdir(r"R:/bathpts/csvbag/"):

        basenameU, extensionU = filenameU.split('.')
```

F:\Gateway to the Americas\bathpts\script\final.pyw

```
        if extensionU == "CSV":

            outputU = open(r"R:/bathpts/postU/" + filenameU,  'w')
            infileU = open(r"R:/bathpts/csvbag/" + filenameU, 'r')

            outputU.write("Long, Lat, Z")
            outputU.write('\n')
            for lineU in infileU:
                outputU.write(line)

            outputU.close()
            infileU.close()

cntU = 1
for EventU in os.listdir(r"R:/bathpts/postU/"):
    basenameEvU, extensionU = EventU.split('.')

    Layer_NameU = cntU
    EventoutU = r"R:/bathpts/shapeUTM/" + basenameEvU + ".shp"

    arcpy.MakeXYEventLayer_management((r"R:/bathpts/postU/" + EventU), "long", "lat",
    Layer_NameU,
    "PROJCS['WGS_1984_UTM_Zone_8N',GEOGCS['GCS_WGS_1984',DATUM['D_WGS_1984',SPHEROID['WGS_1984',6
    378137.0,298.257223563]],PRIMEM['Greenwich',0.0],UNIT['Degree',0.0174532925199433]],PROJECTIO
    N['Transverse_Mercator'],PARAMETER['False_Easting',500000.0],PARAMETER['False_Northing',0.0],
    PARAMETER['Central_Meridian',-135.0],PARAMETER['Scale_Factor',0.9996],PARAMETER['Latitude_Of_
    Origin',0.0],UNIT['Meter',1.0]];-5120900 -9998100 10000;-100000 10000;-100000
    10000;0.001;0.001;0.001;IsHighPrecision", "Z")
    arcpy.FeatureToPoint_management(Layer_NameU, EventoutU, "CENTROID")
    print cntU
    cntU = cntU + 1
```

B.2 Merge bathymetry and terrestrial point files and create DEM



B.3 Slice IDW DEM into 500 calendar years and extract land

R:\python scripts\sea_level_Nov28_2012CLEAN.pyw

```
# ---------------------------------------------------------------------------
# sea_level_Nov28_2012.pyw.py
# Created on: 2012-11-28 16:55:28.00000
#   (generated by ArcGIS/ModelBuilder)
# Description:
# ---------------------------------------------------------------------------

# Import arcpy module
import arcpy

# Check out any necessary licenses
arcpy.CheckOutExtension("3D")
arcpy.CheckOutExtension("spatial")

# Local variables:
y10_5 = "2"
y11_0 = "-10"
y11_5 = "-18"
y12_0 = "-43"
y12_5 = "-60"
y13_0 = "-75"
y13_5 = "-86"
y14_0 = "-98"
y14_5 = "-109"
y15_0 = "-131"
y15_5 = "-131"
y16_0 = "-143"
DEM_tif = "R:\\Nov2012\\DEM2.tif"
DEM_int_tif = "R:\\Nov2012\\DEM_int.tif"
Y10_5_DEM_tif = "R:\\Nov2012\\Y10_5_DEM.tif"
Y11_0_DEM_tif = "R:\\Nov2012\\Y11_0_DEM.tif"
Y11_5_DEM_tif = "R:\\Nov2012\\Y11_5_DEM.tif"
Y12_0_DEM_tif = "R:\\Nov2012\\Y12_0_DEM.tif"
Y12_5_DEM_tif = "R:\\Nov2012\\Y12_5_DEM.tif"
Y13_0_DEM_tif = "R:\\Nov2012\\Y13_0_DEM.tif"
Y13_5_DEM_tif = "R:\\Nov2012\\Y13_5_DEM.tif"
Y14_0_DEM_tif = "R:\\Nov2012\\Y14_0_DEM.tif"
Y14_5_DEM_tif = "R:\\Nov2012\\Y14_5_DEM.tif"
Y15_0_DEM_tif = "R:\\Nov2012\\Y15_0_DEM.tif"
Y15_5_DEM_tif = "R:\\Nov2012\\Y15_5_DEM.tif"
Y16_0_DEM_tif = "R:\\Nov2012\\Y16_0_DEM.tif"
Y10_5_DEMEXT_tif = "R:\\Nov2012\\Y10_5_DEMEXT.tif"
Y11_0_DEMEXT_tif = "R:\\Nov2012\\Y11_0_DEMEXT.tif"
Y11_5_DEMEXT_tif = "R:\\Nov2012\\Y11_5_DEMEXT.tif"
Y12_0_DEMEXT_tif = "R:\\Nov2012\\Y12_0_DEMEXT.tif"
Y12_5_DEMEXT_tif = "R:\\Nov2012\\Y12_5_DEMEXT.tif"
Y13_0_DEMEXT_tif = "R:\\Nov2012\\Y13_0_DEMEXT.tif"
Y13_5_DEMEXT_tif = "R:\\Nov2012\\Y13_5_DEMEXT.tif"
Y14_0_DEMEXT_tif = "R:\\Nov2012\\Y14_0_DEMEXT.tif"
Y14_5_DEMEXT_tif = "R:\\Nov2012\\Y14_5_DEMEXT.tif"
Y15_0_DEMEXT_tif = "R:\\Nov2012\\Y15_0_DEMEXT.tif"
Y15_5_DEMEXT_tif = "R:\\Nov2012\\Y15_5_DEMEXT.tif"
Y16_0_DEMEXT_tif = "R:\\Nov2012\\Y16_0_DEMEXT.tif"
```

```
# Process: Int
arcpy.Int_3d(DEM_tif, DEM_int_tif)

# Process: Plus (12)
arcpy.Plus_3d(DEM_int_tif, y11_0, Y11_0_DEM_tif)

# Process: Extract by Attributes (12)
arcpy.gp.ExtractByAttributes_sa(Y11_0_DEM_tif, "VALUE >= 0", Y11_0_DEMEXT_tif)

# Process: Plus (13)
arcpy.Plus_3d(DEM_int_tif, v11, Y11_5_DEM_tif)

# Process: Extract by Attributes (13)
arcpy.gp.ExtractByAttributes_sa(Y11_5_DEM_tif, "VALUE >= 0", Y11_5_DEMEXT_tif)

# Process: Plus (14)
arcpy.Plus_3d(DEM_int_tif, v12, Y12_0_DEM_tif)

# Process: Extract by Attributes (14)
arcpy.gp.ExtractByAttributes_sa(Y12_0_DEM_tif, "VALUE >= 0", Y12_0_DEMEXT_tif)

# Process: Plus (15)
arcpy.Plus_3d(DEM_int_tif, v10, Y12_5_DEM_tif)

# Process: Extract by Attributes (15)
arcpy.gp.ExtractByAttributes_sa(Y12_5_DEM_tif, "VALUE >= 0", Y12_5_DEMEXT_tif)

# Process: Plus (16)
arcpy.Plus_3d(DEM_int_tif, v70, Y13_0_DEM_tif)

# Process: Extract by Attributes (16)
arcpy.gp.ExtractByAttributes_sa(Y13_0_DEM_tif, "VALUE >= 0", Y13_0_DEMEXT_tif)

# Process: Plus (17)
arcpy.Plus_3d(DEM_int_tif, v83, Y13_5_DEM_tif)

# Process: Extract by Attributes (17)
arcpy.gp.ExtractByAttributes_sa(Y13_5_DEM_tif, "VALUE >= 0", Y13_5_DEMEXT_tif)

# Process: Plus (18)
arcpy.Plus_3d(DEM_int_tif, v100, Y14_0_DEM_tif)

# Process: Extract by Attributes (18)
arcpy.gp.ExtractByAttributes_sa(Y14_0_DEM_tif, "VALUE >= 0", Y14_0_DEMEXT_tif)

# Process: Plus (19)
arcpy.Plus_3d(DEM_int_tif, v106, Y14_5_DEM_tif)

# Process: Extract by Attributes (19)
arcpy.gp.ExtractByAttributes_sa(Y14_5_DEM_tif, "VALUE >= 0", Y14_5_DEMEXT_tif)

# Process: Plus (21)
arcpy.Plus_3d(DEM_int_tif, v130, Y15_5_DEM_tif)
```

```
# Process: Extract by Attributes (21)
arcpy.gp.ExtractByAttributes_sa(Y15_5_DEM_tif, "VALUE >= 0", Y15_5_DEMEXT_tif)

# Process: Plus (22)
arcpy.Plus_3d(DEM_int_tif, v145, Y16_0_DEM_tif)

# Process: Extract by Attributes (22)
arcpy.gp.ExtractByAttributes_sa(Y16_0_DEM_tif, "VALUE >= 0", Y16_0_DEMEXT_tif)
```

B.4 From IDW DEM, shoreline, slope, aspect, lakes, streams, and tributaries (and reclassified slope and aspect)

R:\python scripts\variables_Dec5_2012_2.pyw

```
import arcpy, os
import arcpy.sa
from os import path
import arcpy.conversion
import arcpy.analysis

arcpy.env.workspace = "R:\\Dec2012\\"
arcpy.env.overwriteoutput = 1


# Check out any necessary licenses
arcpy.CheckOutExtension("3D")
arcpy.CheckOutExtension("spatial")

try:
    for filename in os.listdir("R:\\Dec2012\\new\\"):
        basename, extension = path.splitext(filename)

        if extension == '.tif':
            year = basename[0:6]
            base = basename[6:]
            if base == 'DEMEXT':

                DEMInt = "R:\\Dec2012\\" + year + "DEMInt"
                Int = arcpy.sa.Int("R:\\Dec2012\\new\\" + filename)
                Int.save(DEMInt)
## lakes
                fill = "R:\\Dec2012\\" + year + "fill"
                fill_d = "R:\\Dec2012\\" + year + "fill_d"
                lakes = "R:\\Dec2012\\" + year + "lakes"
                lakesP = "R:\\Dec2012\\" + year + "lakes" + ".shp"

                Fills = arcpy.sa.Fill(DEMInt,"#")
                Fills.save(fill)

                Minus = arcpy.sa.Minus(fill,DEMInt)
                Minus.save(fill_d)

                lake = arcpy.sa.Reclassify(fill_d,"VALUE","3 2000 1; 0 2 NODATA","NODATA")
                lake.save(lakes)

                arcpy.conversion.RasterToPolygon(lakes,lakesP,"SIMPLIFY","VALUE")

##slope
                Slope = "R:\\Dec2012\\" + year + "Slope"
                SlopeR = "R:\\Dec2012\\" + year + "SlopeR"

            ##Process: Slope
                tempEnvironment0 = arcpy.env.cellSize
                arcpy.env.cellSize = "10"
                tempEnvironment1 = arcpy.env.mask
                arcpy.env.mask = ""
                arcpy.Slope_3d("R:\\Dec2012\\" + filename, Slope, "DEGREE", "1")
                arcpy.env.cellSize = tempEnvironment0
```

```
                arcpy.env.mask = tempEnvironment1

            # Process: Rlassify
                SRec = arcpy.sa.Reclassify(Slope, "Value", "0 2 1;2.0000100000000001 5
                2;5.0000999999999998 10 3;10.0001 20 4;20.0001 90 5;NODATA 0", "NODATA")
                SRec.save(SlopeR)

##aspect
                Aspect = "R:\\Dec2012\\" + year + "Aspect"
                AspectR = "R:\\Dec2012\\" + year + "AspectR"

            ##Process: Aspect
                tempEnvironment0 = arcpy.env.cellSize
                arcpy.env.cellSize = "10"
                tempEnvironment1 = arcpy.env.mask
                arcpy.env.mask = ""
                arcpy.Aspect_3d("R:\\Dec2012\\" + filename, Aspect)
                arcpy.env.cellSize = tempEnvironment0
                arcpy.env.mask = tempEnvironment1


                # Process: Rlassify (2)
                ARec = arcpy.sa.Reclassify(Aspect, "Value", "-1 130 2;130.09999999999999
                275.89999999999998 1;276 360 2;NODATA 0", "NODATA")
                ARec.save(AspectR)

#shore
                ShoreRec = "R:\\Dec2012\\" + year + "ShoreRec" + ".tif"
                Shore = "R:\\Dec2012\\" + year + "shore" + ".shp"

                ShRec = arcpy.sa.Reclassify(DEMInt,"Value","1 3000 1;0 NODATA","NODATA")
                ShRec.save(ShoreRec)
                arcpy.RasterToPolygon_conversion(ShoreRec, Shore, "SIMPLIFY","VALUE")

#stream & trib
                StreamRaw = "R:\\Dec2012\\stream_raw.shp\\"
                StreamF = "R:\\Dec2012\\" + year + "streamF" + ".shp"
                tribS = "R:\\Dec2012\\" + year + "tribS" + ".shp"
                tribC = "R:\\Dec2012\\" + year + "tribC" + ".shp"
                trib1 = "R:\\Dec2012\\" + year + "trib1" + ".shp"
                Stream = "R:\\Dec2012\\" + year + "stream" + ".shp"
                tribL = "R:\\Dec2012\\" + year + "tribL" + ".shp"
                trib = "R:\\Dec2012\\" + year + "trib" + ".shp"

                arcpy.analysis.Clip(StreamRaw, Shore, StreamF)

                arcpy.analysis.Intersect(StreamF,tribS, "ALL","#","POINT")
                TCin = (StreamF, Shore)
                arcpy.analysis.Intersect(TCin,tribC, "ALL","#","POINT")
                tribin = (tribS,tribC)
                arcpy.Merge_management(tribin, trib1)

                arcpy.analysis.Erase(StreamF, lakesP, Stream, "#")
                TLin = (Stream,lakesP)
```

```
                arcpy.analysis.Intersect(TLin,tribL, "ALL","#","POINT")
                Trbin2 = (tribL, tribl)
                arcpy.Merge_management(Trbin2, trib)

                print year

except Exception as ErrorDesc:
    Errors = "TRUE"
    print(ErrorDesc.message)
```

B.5 Sinuosity

R:\python scripts\sinuosity_Dec18_WORKS (2).pyw

```
import arcpy, os, math
import arcpy.sa
import arcpy.analysis
from os import path
import math, numpy

# Check out any necessary licenses
arcpy.CheckOutExtension("3D")
arcpy.CheckOutExtension("spatial")

##try:
for filename in os.listdir("C:\\Kelly\\"):
    basename, extension = path.splitext(filename)


    if extension == '.shp':
        year = basename[0:6]
        base = basename[6:]

        if base == 'shore':
            ShoreL = "C:\\Kelly\\" + year + 'ShoreL' + ".shp"
            ShoreP = "C:\\Kelly\\" + year + 'ShoreP' + ".shp"
            ShorePBuf = "C:\\Kelly\\" + year + 'ShPBuf' + ".shp"
            ShoreLD = "C:\\Kelly\\" + year + 'ShoreLD' + ".shp"
            Land = "C:\\Kelly\\" + year + 'Land' + ".shp"
            Land_elm = "C:\\Kelly\\" + year + 'Land_elm' + ".shp"


            arcpy.RepairGeometry_management("C:\\Kelly\\" + filename,"DELETE_NULL")
            arcpy.Select_analysis("C:\\Kelly\\" + filename,Land,"GRIDCODE = 1")
            arcpy.EliminatePolygonPart_management(Land,Land_elm,"AREA","150 SquareMeters","0",
            "ANY")
            arcpy.PolygonToLine_management(Land_elm, ShoreL,"IDENTIFY_NEIGHBORS")
            arcpy.Densify_edit(ShoreL,"DISTANCE","25 Unknown","0.25 Unknown","25")
            arcpy.FeatureVerticesToPoints_management(ShoreL, ShoreP,"ALL")
            arcpy.analysis.Buffer(ShoreP, ShorePBuf,"1.5 Kilometers","FULL","ROUND","NONE","#")
            arcpy.PolygonToLine_management(Land_elm, ShoreLD,"IDENTIFY_NEIGHBORS")

            arcpy.AddField_management(ShorePBuf,"Sin","DOUBLE", 0, 0)
            arcpy.AddField_management(ShoreP,"Sin","DOUBLE", 0, 0)

            cur = arcpy.UpdateCursor(ShorePBuf)

            for row in cur:
                ShoreRow = "C:\\Kelly\\" + year + 'ShRow' + ".shp"
                ft = row.Shape
                arcpy.analysis.Clip(ShoreLD, ft, ShoreRow)

                curS = arcpy.SearchCursor(ShoreRow)
                for Srow in curS:
                    desc = arcpy.Describe(ShoreRow)
                    shapefieldname = desc.ShapeFieldName

                    partnum = 0
```

R:\python scripts\sinuosity_Dec18_WORKS (2).pyw

```
                feat = Srow.getValue(shapefieldname)
                Xarray = []
                Yarray = []
                x = 0.0000

                xi = numpy.array ([x])

                for pnt in feat.getPart(partnum):
                    LD = 0
                    LT = 0

                    LD += feat.length



                    Xarray.append(pnt.X)
                    Yarray.append(pnt.Y)

                    FX = Xarray[0]
                    FY = Yarray[0]
                    LX = Xarray[-1]
                    LY = Yarray[-1]

                    LT = math.sqrt((LX-FX)**2 + (LY-FY)**2)
                    if LT == 0:
                        LT = LD
                    else:
                        LT = LT
                    x = LD/LT
                    xi = numpy.append(xi,[x])
                    numpy.resize(xi, (1, partnum))

                    del LD
                    del LT
                    del FX, FY, LX, LY
                    partnum += 1
                del Srow
            numpy.delete(xi, 0)

            del curS
            Sinu =0
            Sinu = numpy.mean(xi)
            row.Sin = Sinu
            cur.updateRow(row)


            arcpy.Delete_management(ShoreRow)
            del feat, Sinu
            del row, shapefieldname
            del pnt, ft, Xarray, Yarray
            del x, xi, partnum, desc
        del cur

        print year
```

-2-

Then the ShPBuf is ‘joined’ with the ShoreP, using the ‘original FID’ field. Next, the ‘sin’ field is copied (as’ Sin_1’) using field calculator.

B.6 Buffer variables (except sinuosity)

R:\python scripts\buffer_variables_Dec9_2012.pyw

```
import arcpy, os, math
import arcpy.sa
import arcpy.analysis
from os import path

# Check out any necessary licenses
arcpy.CheckOutExtension("3D")
arcpy.CheckOutExtension("spatial")

try:
    for filename in os.listdir("R:\\Dec2012\\test\\"):
        basename, extension = path.splitext(filename)


        if extension == '.shp':
            year = basename[0:6]
            base = basename[6:]

            if base == 'stream':
                StreamBuf1 = "R:\\Dec2012\\test\\" + year + 'StBuf1' + ".shp"
                StreamBuf5 = "R:\\Dec2012\\test\\" + year + 'StBuf5' + ".shp"
                StreamBuf10 = "R:\\Dec2012\\test\\" + year + 'StBuf10' + ".shp"
                StreamBuf20 = "R:\\Dec2012\\test\\" + year + 'StBuf20' + ".shp"
                StreamBuf30 = "R:\\Dec2012\\test\\" + year + 'StBuf30' + ".shp"
                StreamBPoly = "R:\\Dec2012\\test\\" + year + 'StPol1'
                StreamBPoly = "R:\\Dec2012\\test\\" + year + 'StPol5'
                StreamBPoly = "R:\\Dec2012\\test\\" + year + 'StPol10'
                StreamBPoly = "R:\\Dec2012\\test\\" + year + 'StPol20'
                StreamBPoly = "R:\\Dec2012\\test\\" + year + 'StPol30'
                StreamI1 = "R:\\Dec2012\\test\\" + year + 'StI1'
                StreamI5 = "R:\\Dec2012\\test\\" + year + 'StI5'
                StreamI10 = "R:\\Dec2012\\test\\" + year + 'StI10'
                StreamI20 = "R:\\Dec2012\\test\\" + year + 'StI20'
                StreamI30 = "R:\\Dec2012\\test\\" + year + 'StI30'
                StreamRec1 = "R:\\Dec2012\\test\\" + year + 'StRec1'
                StreamRec2 = "R:\\Dec2012\\test\\" + year + 'StRec2'
                StreamRec3 = "R:\\Dec2012\\test\\" + year + 'StRec3'
                StreamRec4 = "R:\\Dec2012\\test\\" + year + 'StRec4'
                StreamRec5 = "R:\\Dec2012\\test\\" + year + 'StRec5'
                Stream1 = "R:\\Dec2012\\test\\" + year + 'Stream1'
                Stream2 = "R:\\Dec2012\\test\\" + year + 'Stream2'
                Stream3 = "R:\\Dec2012\\test\\" + year + 'Stream3'
                Stream4 = "R:\\Dec2012\\test\\" + year + 'Stream4'

                #100m
                arcpy.analysis.Buffer("R:\\Dec2012\\test\\" + filename, StreamBuf1, "100 Meters"
                , "FULL", "ROUND", "NONE", "")
                arcpy.PolygonToRaster_conversion(StreamBuf10, "BUFF_DIST", StreamBPoly1,
                "CELL_CENTER", "NONE", "10")
                StI1 = arcpy.sa.Int(StreamBPoly1)
                StI1.save(StreamI1)
                StRec1 = arcpy.sa.Reclassify(StreamI1, "VALUE", "100 4; NODATA 0", "NODATA")
                StRec1.save(StreamRec4)
                #500m
```

```
        arcpy.analysis.Buffer("R:\\Dec2012\\test\\" + filename, StreamBuf5, "500 Meters"
        , "FULL", "ROUND", "NONE", "")
        arcpy.PolygonToRaster_conversion(StreamBuf5, "BUFF_DIST", StreamBPoly5,
        "CELL_CENTER", "NONE", "10")
        StI5 = arcpy.sa.Int(StreamBPoly5)
        StI5.save(StreamI5)
        StRec5 = arcpy.sa.Reclassify(StreamI5, "VALUE", "500 5; NODATA 0", "NODATA")
        StRec5.save(StreamRec5)
        #1000m
        arcpy.analysis.Buffer("R:\\Dec2012\\test\\" + filename, StreamBuf10, "1000
        Meters", "FULL", "ROUND", "NONE", "")
        arcpy.PolygonToRaster_conversion(StreamBuf10, "BUFF_DIST", StreamBPoly10,
        "CELL_CENTER", "NONE", "10")
        StI10 = arcpy.sa.Int(StreamBPoly10)
        StI10.save(StreamI10)
        StRec10 = arcpy.sa.Reclassify(StreamI10, "VALUE", "1000 3; NODATA 0", "NODATA")
        StRec10.save(StreamRec3)
        #2000m
        arcpy.analysis.Buffer("R:\\Dec2012\\test\\" + filename, StreamBuf20, "2000
        Meters", "FULL", "ROUND", "NONE", "")
        arcpy.PolygonToRaster_conversion(StreamBuf20, "BUFF_DIST", StreamBPoly20,
        "CELL_CENTER", "NONE", "10")
        StI20 = arcpy.sa.Int(StreamBPoly20)
        StI20.save(StreamI20)
        StRec20 = arcpy.sa.Reclassify(StreamI20, "VALUE", "2000 2; NODATA 0", "NODATA")
        StRec20.save(StreamRec2)
        #3000m
        arcpy.analysis.Buffer("R:\\Dec2012\\test\\" + filename, StreamBuf30, "3000
        Meters", "FULL", "ROUND", "NONE", "")
        arcpy.PolygonToRaster_conversion(StreamBuf30, "BUFF_DIST", StreamBPoly30,
        "CELL_CENTER", "NONE", "10")
        StI30 = arcpy.sa.Int(StreamBPoly30)
        StI30.save(StreamI30)
        StRec30 = arcpy.sa.Reclassify(StreamI30, "VALUE", "3000 1; NODATA 0", "NODATA")
        StRec30.save(StreamRec1)

        St1 = arcpy.sa.Plus(StreamRec1, StreamRec2)
        St1.save(Stream1)
        St2 = arcpy.sa.Plus(StreamRec3, StreamRec4)
        St2.save(Stream2)
        St3 = arcpy.sa.Plus(Stream1, Stream2)
        St3.save(Stream3)
        St4 = arcpy.sa.Plus(StreamRec5, Stream3)
        St4.save(Stream4)


    if base == 'lake':
        lakeBuf1 = "R:\\Dec2012\\test\\" + year + 'LaBuf1' + ".shp"
        lakeBuf5 = "R:\\Dec2012\\test\\" + year + 'LaBuf5' + ".shp"
        lakeBuf10 = "R:\\Dec2012\\test\\" + year + 'LaBuf10' + ".shp"
        lakeBuf20 = "R:\\Dec2012\\test\\" + year + 'LaBuf20' + ".shp"
        lakeBuf30 = "R:\\Dec2012\\test\\" + year + 'LaBuf30' + ".shp"
        lakeBPoly = "R:\\Dec2012\\test\\" + year + 'LaPol1'
        lakeBPoly = "R:\\Dec2012\\test\\" + year + 'LaPol5'
```

```
lakeBPoly = "R:\\Dec2012\\test\\" + year + 'LaPol10'
lakeBPoly = "R:\\Dec2012\\test\\" + year + 'LaPol20'
lakeBPoly = "R:\\Dec2012\\test\\" + year + 'LaPol30'
lakeI1 = "R:\\Dec2012\\test\\" + year + 'LaI1'
lakeI5 = "R:\\Dec2012\\test\\" + year + 'LaI5'
lakeI10 = "R:\\Dec2012\\test\\" + year + 'LaI10'
lakeI20 = "R:\\Dec2012\\test\\" + year + 'LaI20'
lakeI30 = "R:\\Dec2012\\test\\" + year + 'LaI30'
lakeRec1 = "R:\\Dec2012\\test\\" + year + 'LaRec1'
lakeRec2 = "R:\\Dec2012\\test\\" + year + 'LaRec2'
lakeRec3 = "R:\\Dec2012\\test\\" + year + 'LaRec3'
lakeRec4 = "R:\\Dec2012\\test\\" + year + 'LaRec4'
lakeRec5 = "R:\\Dec2012\\test\\" + year + 'LaRec5'
lake1 = "R:\\Dec2012\\test\\" + year + 'lake1'
lake2 = "R:\\Dec2012\\test\\" + year + 'lake2'
lake3 = "R:\\Dec2012\\test\\" + year + 'lake3'
lake4 = "R:\\Dec2012\\test\\" + year + 'lake4'

#100m
arcpy.analysis.Buffer("R:\\Dec2012\\test\\" + filename, lakeBuf1, "100 Meters",
"FULL", "ROUND", "NONE", "")
arcpy.PolygonToRaLaer_conversion(lakeBuf10, "BUFF_DIST", lakeBPoly1,
"CELL_CENTER", "NONE", "10")
LaI1 = arcpy.sa.Int(lakeBPoly1)
LaI1.save(lakeI1)
LaRec1 = arcpy.sa.Reclassify(lakeI1, "VALUE", "100 4; NODATA 0", "NODATA")
LaRec1.save(lakeRec4)
#500m
arcpy.analysis.Buffer("R:\\Dec2012\\test\\" + filename, lakeBuf5, "500 Meters",
"FULL", "ROUND", "NONE", "")
arcpy.PolygonToRaLaer_conversion(lakeBuf5, "BUFF_DIST", lakeBPoly5,
"CELL_CENTER", "NONE", "10")
LaI5 = arcpy.sa.Int(lakeBPoly5)
LaI5.save(lakeI5)
LaRec5 = arcpy.sa.Reclassify(lakeI5, "VALUE", "500 5; NODATA 0", "NODATA")
LaRec5.save(lakeRec5)
#1000m
arcpy.analysis.Buffer("R:\\Dec2012\\test\\" + filename, lakeBuf10, "1000 Meters"
, "FULL", "ROUND", "NONE", "")
arcpy.PolygonToRaLaer_conversion(lakeBuf10, "BUFF_DIST", lakeBPoly10,
"CELL_CENTER", "NONE", "10")
LaI10 = arcpy.sa.Int(lakeBPoly10)
LaI10.save(lakeI10)
LaRec10 = arcpy.sa.Reclassify(lakeI10, "VALUE", "1000 3; NODATA 0", "NODATA")
LaRec10.save(lakeRec3)
#2000m
arcpy.analysis.Buffer("R:\\Dec2012\\test\\" + filename, lakeBuf20, "2000 Meters"
, "FULL", "ROUND", "NONE", "")
arcpy.PolygonToRaLaer_conversion(lakeBuf20, "BUFF_DIST", lakeBPoly20,
"CELL_CENTER", "NONE", "10")
LaI20 = arcpy.sa.Int(lakeBPoly20)
LaI20.save(lakeI20)
LaRec20 = arcpy.sa.Reclassify(lakeI20, "VALUE", "2000 2; NODATA 0", "NODATA")
LaRec20.save(lakeRec2)
```

```
        #3000m
        arcpy.analysis.Buffer("R:\\Dec2012\\test\\" + filename, lakeBuf30, "3000 Meters"
        , "FULL", "ROUND", "NONE", "")
        arcpy.PolygonToRaLaer_conversion(lakeBuf30, "BUFF_DIST", lakeBPoly30,
        "CELL_CENTER", "NONE", "10")
        LaI30 = arcpy.sa.Int(lakeBPoly30)
        LaI30.save(lakeI30)
        LaRec30 = arcpy.sa.Reclassify(lakeI30, "VALUE", "3000 1; NODATA 0", "NODATA")
        LaRec30.save(lakeRec1)

        La1 = arcpy.sa.Plus(lakeRec1, lakeRec2)
        La1.save(lake1)
        La2 = arcpy.sa.Plus(lakeRec3, lakeRec4)
        La2.save(lake2)
        La3 = arcpy.sa.Plus(lake1, lake2)
        La3.save(lake3)
        La4 = arcpy.sa.Plus(lakeRec5, lake3)
        La4.save(lake4)

    if base == 'trib':
        tribBuf1 = "R:\\Dec2012\\test\\" + year + 'TrBuf1' + ".shp"
        tribBuf5 = "R:\\Dec2012\\test\\" + year + 'TrBuf5' + ".shp"
        tribBuf10 = "R:\\Dec2012\\test\\" + year + 'TrBuf10' + ".shp"
        tribBuf20 = "R:\\Dec2012\\test\\" + year + 'TrBuf20' + ".shp"
        tribBuf30 = "R:\\Dec2012\\test\\" + year + 'TrBuf30' + ".shp"
        tribBPoly = "R:\\Dec2012\\test\\" + year + 'TrPol1'
        tribBPoly = "R:\\Dec2012\\test\\" + year + 'TrPol5'
        tribBPoly = "R:\\Dec2012\\test\\" + year + 'TrPol10'
        tribBPoly = "R:\\Dec2012\\test\\" + year + 'TrPol20'
        tribBPoly = "R:\\Dec2012\\test\\" + year + 'TrPol30'
        tribI1 = "R:\\Dec2012\\test\\" + year + 'TrI1'
        tribI5 = "R:\\Dec2012\\test\\" + year + 'TrI5'
        tribI10 = "R:\\Dec2012\\test\\" + year + 'TrI10'
        tribI20 = "R:\\Dec2012\\test\\" + year + 'TrI20'
        tribI30 = "R:\\Dec2012\\test\\" + year + 'TrI30'
        tribRec1 = "R:\\Dec2012\\test\\" + year + 'TrRec1'
        tribRec2 = "R:\\Dec2012\\test\\" + year + 'TrRec2'
        tribRec3 = "R:\\Dec2012\\test\\" + year + 'TrRec3'
        tribRec4 = "R:\\Dec2012\\test\\" + year + 'TrRec4'
        tribRec5 = "R:\\Dec2012\\test\\" + year + 'TrRec5'
        trib1 = "R:\\Dec2012\\test\\" + year + 'trib1'
        trib2 = "R:\\Dec2012\\test\\" + year + 'trib2'
        trib3 = "R:\\Dec2012\\test\\" + year + 'trib3'
        trib4 = "R:\\Dec2012\\test\\" + year + 'trib4'

        #100m
        arcpy.analysis.Buffer("R:\\Dec2012\\test\\" + filename, tribBuf1, "100 Meters",
        "FULL", "ROUND", "NONE", "")
        arcpy.PolygonToRaTrer_conversion(tribBuf10, "BUFF_DIST", tribBPoly1,
        "CELL_CENTER", "NONE", "10")
        TrI1 = arcpy.sa.Int(tribBPoly1)
        TrI1.save(tribI1)
        TrRec1 = arcpy.sa.RecTrssify(tribI1, "VALUE", "100 4; NODATA 0", "NODATA")
        TrRec1.save(tribRec4)
```

B.7 Buffer sinuosity (example with modern (y00_0) time slice)

R:\python scripts\buffer_sinuosity.pyw

```
import arcpy, os, math
import arcpy.sa
import arcpy.analysis
from os import path
import math, numpy

# Check out any necessary licenses
arcpy.CheckOutExtension("3D")
arcpy.CheckOutExtension("spatial")

for filename in os.listdir("R:\\Dec2012\\y00_0_\\"):
    basename, extension = path.splitext(filename)


    if extension == '.shp':
        year = basename[0:6]
        base = basename[6:]

        if base == 'ShoreP':

# Local variables:

SinBuffer100 = "R:\\Dec2012\\y00_0\\SinBuffer100.shp"
SinBuffer2000 = "R:\\Dec2012\\y00_0\\SinBuffer2000.shp"
SinBuffer3000 = "R:\\Dec2012\\y00_0\\SinBuffer3000.shp"
SinBuffer500 = "R:\\Dec2012\\y00_0\\SinBuffer500.shp"
SinBuffer1000 = "R:\\Dec2012\\y00_0\\SinBuffer1000.shp"
IntSin1 = "R:\\Dec2012\\y00_0\\IntSin1"
IntSinHigh3 = "R:\\Dec2012\\y00_0\\IntSinHigh3"
IntSinHigh4 = "R:\\Dec2012\\y00_0\\IntSinHigh4"
IntSinHigh5 = "R:\\Dec2012\\y00_0\\IntSinHigh5"
SinH1 = "R:\\Dec2012\\y00_0\\SinH1"
rSinH1 = "R:\\Dec2012\\y00_0\\rSinH1"
rSinH2 = "R:\\Dec2012\\y00_0\\rSinH2"
SinH2 = "R:\\Dec2012\\y00_0\\SinH2"
SinBuffer50_Polyg = "R:\\Dec2012\\y00_0\\SinBuffer50_Polyg.shp"
SinBuffer100_Polyg = "R:\\Dec2012\\y00_0\\SinBuffer100_Polyg.shp"
SinBuffer200_Polyg = "R:\\Dec2012\\y00_0\\SinBuffer200_Polyg.shp"
SinBuffer300_Polyg = "R:\\Dec2012\\y00_0\\SinBuffer300_Polyg.shp"
SinBuffer10_Polyg = "R:\\Dec2012\\y00_0\\SinBuffer10_Polyg.shp"
IntSin5 = "R:\\Dec2012\\y00_0\\IntSin5"
IntSin10 = "R:\\Dec2012\\y00_0\\IntSin10"
IntSin20 = "R:\\Dec2012\\y00_0\\IntSin20"
IntSin30 = "R:\\Dec2012\\y00_0\\IntSin30"
SinH3 = "R:\\Dec2012\\y00_0\\SinH3"
SinH4 = "R:\\Dec2012\\y00_0\\SinH4"
SinL2 = "R:\\Dec2012\\y00_0\\SinL2"
SinL1 = "R:\\Dec2012\\y00_0\\SinL1"
SinL3 = "R:\\Dec2012\\y00_0\\SinL3"
SinL4 = "R:\\Dec2012\\y00_0\\SinL4"
ESin1High = "R:\\Dec2012\\y00_0\\ESin1High"
ESin5High = "R:\\Dec2012\\y00_0\\ESin5High"
ESin10High = "R:\\Dec2012\\y00_0\\ESin10High"
ESin20High = "R:\\Dec2012\\y00_0\\ESin20High"
```

R:\python scripts\buffer_sinuosity.pyw

```
ESin20Low = "R:\\Dec2012\\y00_0\\ESin20Low"
ESin30High = "R:\\Dec2012\\y00_0\\ESin30High"
ESin30Low = "R:\\Dec2012\\y00_0\\ESin30Low"
ESin20Med = "R:\\Dec2012\\y00_0\\ESin20Med"
ESin30Med = "R:\\Dec2012\\y00_0\\ESin30Med"
ESin10Low = "R:\\Dec2012\\y00_0\\ESin10Low"
ESin10Med = "R:\\Dec2012\\y00_0\\ESin10Med"
ESin5Low = "R:\\Dec2012\\y00_0\\ESin5Low"
ESin5Med = "R:\\Dec2012\\y00_0\\ESin5Med"
ESin1Med = "R:\\Dec2012\\y00_0\\ESin1Med"
IntSinMed4 = "R:\\Dec2012\\y00_0\\IntSinMed4"
IntSinMed5 = "R:\\Dec2012\\y00_0\\IntSinMed5"
ESin1Low = "R:\\Dec2012\\y00_0\\ESin1Low"
IntSinLow5 = "R:\\Dec2012\\y00_0\\IntSinLow5"
IntSinLow4 = "R:\\Dec2012\\y00_0\\IntSinLow4"
IntSinMed3 = "R:\\Dec2012\\y00_0\\IntSinMed3"
IntSinLow3 = "R:\\Dec2012\\y00_0\\IntSinLow3"
SinM1 = "R:\\Dec2012\\y00_0\\SinM1"
rSinM2 = "R:\\Dec2012\\y00_0\\rSinM2"
rSinL2 = "R:\\Dec2012\\y00_0\\rSinL2"
rSinM1 = "R:\\Dec2012\\y00_0\\rSinM1"
rSinL1 = "R:\\Dec2012\\y00_0\\rSinL1"
SinM2 = "R:\\Dec2012\\y00_0\\SinM2"
SinM3 = "R:\\Dec2012\\y00_0\\SinM3"
SinM4 = "R:\\Dec2012\\y00_0\\SinM4"

# Process: Sin_Buffer (3)
arcpy.analysis.Buffer("R:\\Dec2012\\y00_0_\\" + filename, Sin_Buffer2000, "2000 Meters", "FULL",
 "ROUND", "NONE", "")

# Process: Polygon to Raster (4)
arcpy.PolygonToRaster_conversion(Sin_Buffer2000, "Sin_1", Sin_Buffer200_Polyg, "CELL_CENTER",
"NONE", "10")

# Process: Int (4)
arcpy.arcpy.sa.Int(Sin_Buffer200_Polyg, IntSin2)

# Process: Extract by Attributes
arcpy.sa.ExtractByAttributes(IntSin2, "\"VALUE\" < 1 OR \"VALUE\" >10", ESin2Low)

# Process: Reclassify (12)
arcpy.sa.Reclassify(ESin2Low, "Value", "0 2;10 300000 2;NODATA 0", rSinL2, "DATA")

# Process: Sin_Buffer (3)
arcpy.analysis.Buffer("R:\\Dec2012\\y00_0_\\" + filename, Sin_Buffer3000, "3000 Meters", "FULL",
 "ROUND", "NONE", "")

# Process: Polygon to Raster (4)
arcpy.PolygonToRaster_conversion(Sin_Buffer3000, "Sin_1", Sin_Buffer300_Polyg, "CELL_CENTER",
"NONE", "10")

# Process: Int (3)
arcpy.arcpy.sa.Int(Sin_Buffer300_Polyg, IntSin30)
```

R:\python scripts\buffer_sinuosity.pyw

```
# Process: Sin_Buffer (5)
arcpy.analysis.Buffer("R:\\Dec2012\\y00_0_\\" + filename, Sin_Buffer1000, "1000 Meters", "FULL",
 "ROUND", "NONE", "")

# Process: Polygon to Raster (3)
arcpy.PolygonToRaster_conversion(Sin_Buffer1000, "Sin_1", Sin_Buffer100_Polyg, "CELL_CENTER",
"NONE", "10")

# Process: Int (3)
arcpy.arcpy.sa.Int(Sin_Buffer100_Polyg, IntSin10)

# Process: Extract by Attributes (4)
arcpy.sa.ExtractByAttributes(IntSin10, "\"VALUE\" < 1 OR \"VALUE\" >10", ESin10Low)

# Process: Reclassify (10)
arcpy.sa.Reclassify(ESin10Low, "Value", "0 3;10 300000 3;NODATA 0", rSinL3, "DATA")

# Process: Sin_Buffer (4)
arcpy.analysis.Buffer("R:\\Dec2012\\y00_0_\\" + filename, SinBuffer500, "500 Meters", "FULL",
"ROUND", "NONE", "")

# Process: Polygon to Raster (2)
arcpy.PolygonToRaster_conversion(SinBuffer500, "Sin_1", SinBuffer50_Polyg, "CELL_CENTER", "NONE"
, "10")

# Process: Int (2)
arcpy.arcpy.sa.Int(SinBuffer50_Polyg, IntSin5)

# Process: Extract by Attributes (7)
arcpy.sa.ExtractByAttributes(IntSin5, "\"VALUE\" < 1 OR \"VALUE\" >10", ESin5Low)

# Process: Reclassify (8)
arcpy.sa.Reclassify(ESin5Low, "Value", "0 4;10 300000 4;NODATA 0", IntSinLow4, "DATA")

# Process: Sin_Buffer (2)
arcpy.analysis.Buffer("R:\\Dec2012\\y00_0_\\" + filename, SinBuffer100, "100 Meters", "FULL",
"ROUND", "NONE", "")

# Process: Polygon to Raster
arcpy.PolygonToRaster_conversion(SinBuffer100, "Sin_1", SinBuffer10_Polyg, "CELL_CENTER", "NONE"
, "10")

# Process: Int
arcpy.arcpy.sa.Int(SinBuffer10_Polyg, IntSin1)

# Process: Extract by Attributes (10)
arcpy.sa.ExtractByAttributes(IntSin1, "\"VALUE\" < 1 OR \"VALUE\" >10", ESin1Low)

# Process: Reclassify (6)
arcpy.sa.Reclassify(ESin1Low, "Value", "0 5;10 300000 5;NODATA 0", IntSinLow5, "DATA")


# Process: Extract by Attributes (10)
arcpy.sa.ExtractByAttributes(IntSin30, "\"VALUE\" < 1 OR \"VALUE\" >10", ESin30Low)
```

```
# Process: Reclassify (6)
arcpy.sa.Reclassify(ESin30Low, "Value", "0 1;10 300000 1;NODATA 0", IntSinLow1, "DATA")

# Process: Plus (8)
arcpy.sa.Plus(rSinL1, rSinL2, SinL2)

# Process: Plus (6)
arcpy.sa.Plus(IntSinLow3, IntSinLow4, SinL1)

# Process: Plus (4)
arcpy.sa.Plus(SinL2, SinL1, SinL3)

# Process: Plus (4)
arcpy.sa.Plus(SinL3, IntSinLow5, SinL4)

# Process: Extract by Attributes (2)
arcpy.sa.ExtractByAttributes(IntSin20, "\"VALUE\" =2 OR \"VALUE\" =3", ESin20High)

# Process: Reclassify (4)
arcpy.sa.Reclassify(ESin20High, "Value", "2 2;3 2;NODATA 0", rSinH2, "DATA")

# Process: Extract by Attributes (5)
arcpy.sa.ExtractByAttributes(IntSin10, "\"VALUE\" =4", ESin10High)

# Process: Reclassify (3)
arcpy.sa.Reclassify(ESin10High, "Value", "4 3;NODATA 0", rSinH3, "DATA")

# Process: Extract by Attributes (8)
arcpy.sa.ExtractByAttributes(IntSin5, "\"VALUE\" =4", ESin5High)

# Process: Reclassify (2)
arcpy.sa.Reclassify(ESin5High, "Value", "4 4;NODATA 0", IntSinHigh4, "DATA")

# Process: Extract by Attributes (11)
arcpy.sa.ExtractByAttributes(IntSin1, "\"VALUE\" =4", ESin1High)

# Process: Reclassify
arcpy.sa.Reclassify(ESin1High, "Value", "4 5;NODATA 0", IntSinHigh5, "DATA")

# Process: Extract by Attributes (11)
arcpy.sa.ExtractByAttributes(IntSin30, "\"VALUE\" =4", ESin30High)

# Process: Reclassify
arcpy.sa.Reclassify(ESin1High, "Value", "4 1;NODATA 0", IntSinHigh1, "DATA")

# Process: Plus (2)
arcpy.sa.Plus(rSinH1, rSinH2, SinH2)

# Process: Plus
arcpy.sa.Plus(IntSinHigh3, IntSinHigh4, SinH1)

# Process: Plus (3)
arcpy.sa.Plus(SinH2, SinH1, SinH3)
```

```
# Process: Plus (3)
arcpy.sa.Plus(SinH3, IntSinHigh5, SinH4)

# Process: Extract by Attributes (3)
arcpy.sa.ExtractByAttributes(IntSin30, "\Value\ >= 1 AND \Value\ <=3 OR \Value\ >=5 AND \Value\
<= 10", ESin30Med)

# Process: Extract by Attributes (3)
arcpy.sa.ExtractByAttributes(IntSin20, "\Value\ >= 1 AND \Value\ <=3 OR \Value\ >=5 AND \Value\
<= 10", ESin20Med)

# Process: Extract by Attributes (6)
arcpy.sa.ExtractByAttributes(IntSin10, "\Value\ >= 1 AND \Value\ <=3 OR \Value\ >=5 AND \Value\
<= 10", ESin10Med)

# Process: Extract by Attributes (9)
arcpy.sa.ExtractByAttributes(IntSin5, "\Value\ >= 1 AND \Value\ <=3 OR \Value\ >=5 AND \Value\
<= 10", ESin5Med)

# Process: Extract by Attributes (12)
arcpy.sa.ExtractByAttributes(IntSin1, "\Value\ >= 1 AND \Value\ <=3 OR \Value\ >=5 AND \Value\
<= 10", ESin1Med)

# Process: Reclassify (7)
arcpy.sa.Reclassify(ESin5Med, "Value", "1 3 4;5 10 4;NODATA 0", IntSinMed4, "DATA")

# Process: Reclassify (5)
arcpy.sa.Reclassify(ESin1Med, "Value", "1 3 5;5 10 5;NODATA 0", IntSinMed5, "DATA")

# Process: Reclassify (11)
arcpy.sa.Reclassify(ESin20Med, "Value", "1 3 2;5 10 2;NODATA 0", rSinM2, "DATA")

# Process: Reclassify (11)
arcpy.sa.Reclassify(ESin30Med, "Value", "1 3 1;5 10 1;NODATA 0", rSinM1, "DATA")

# Process: Reclassify (9)
arcpy.sa.Reclassify(ESin10Med, "Value", "1 3 3;5 10 3;NODATA 0", rSinM3, "DATA")

# Process: Plus (7)
arcpy.sa.Plus(rSinM1, rSinM2, SinM2)

# Process: Plus (5)
arcpy.sa.Plus(IntSinMed3, IntSinMed4, SinM1)

# Process: Plus (9)
arcpy.sa.Plus(SinM2, SinM1, SinM3)

# Process: Plus (9)
arcpy.sa.Plus(SinM3, IntSinMed5, SinM4)
```

B.8 Weighted Overlays


```
# ---------------------------------------------------------------------------
# WOy15_5_Jan16_2013.py
# Created on: 2013-01-16 16:04:18.00000
#   (generated by ArcGIS/ModelBuilder)
# Description:
# ---------------------------------------------------------------------------

# Import arcpy module
import arcpy

# Check out any necessary licenses
arcpy.CheckOutExtension("spatial")


# Local variables:
y15_5_sloper = "R:\\Dec2012\\y15_5\\y15_5_sloper"
y15_5_aspectr = "R:\\Dec2012\\y15_5\\y15_5_aspectr"
y15_5_Stream4_tif = "R:\\Dec2012\\y15_5\\y15_5_Stream4.tif"
y15_5_lake4_tif = "R:\\Dec2012\\y15_5\\y15_5_lake4.tif"
sinh4 = "R:\\Dec2012\\y15_5\\sinh4"
sinm4 = "R:\\Dec2012\\y15_5\\sinm4"
sinl4 = "R:\\Dec2012\\y15_5\\sinl4"
y15_5_trib4_tif = "R:\\Dec2012\\y15_5\\y15_5_trib4.tif"
sitesrecr_tif = "R:\\Dec2012\\sitesrecr.tif"
y15_5_sloper__2_ = "R:\\Dec2012\\y15_5\\y15_5_sloper"
y15_5_aspectr__2_ = "R:\\Dec2012\\y15_5\\y15_5_aspectr"
y15_5_Stream4_tif__2_ = "R:\\Dec2012\\y15_5\\y15_5_Stream4.tif"
y15_5_lake4_tif__2_ = "R:\\Dec2012\\y15_5\\y15_5_lake4.tif"
sinh4__2_ = "R:\\Dec2012\\y15_5\\sinh4"
sinm4__2_ = "R:\\Dec2012\\y15_5\\sinm4"
sinl4__2_ = "R:\\Dec2012\\y15_5\\sinl4"
y15_5_trib4_tif__2_ = "R:\\Dec2012\\y15_5\\y15_5_trib4.tif"
sitesrecr_tif__2_ = "R:\\Dec2012\\sitesrecr.tif"
y15_5_sloper__3_ = "R:\\Dec2012\\y15_5\\y15_5_sloper"
y15_5_aspectr__3_ = "R:\\Dec2012\\y15_5\\y15_5_aspectr"
y15_5_Stream4_tif__3_ = "R:\\Dec2012\\y15_5\\y15_5_Stream4.tif"
y15_5_lake4_tif__3_ = "R:\\Dec2012\\y15_5\\y15_5_lake4.tif"
sinh4__3_ = "R:\\Dec2012\\y15_5\\sinh4"
sinm4__3_ = "R:\\Dec2012\\y15_5\\sinm4"
sinl4__3_ = "R:\\Dec2012\\y15_5\\sinl4"
y15_5_trib4_tif__3_ = "R:\\Dec2012\\y15_5\\y15_5_trib4.tif"
sitesrecr_tif__3_ = "R:\\Dec2012\\sitesrecr.tif"
y15_5_sloper__4_ = "R:\\Dec2012\\y15_5\\y15_5_sloper"
y15_5_aspectr__4_ = "R:\\Dec2012\\y15_5\\y15_5_aspectr"
y15_5_Stream4_tif__4_ = "R:\\Dec2012\\y15_5\\y15_5_Stream4.tif"
y15_5_lake4_tif__4_ = "R:\\Dec2012\\y15_5\\y15_5_lake4.tif"
sinh4__4_ = "R:\\Dec2012\\y15_5\\sinh4"
sinm4__4_ = "R:\\Dec2012\\y15_5\\sinm4"
sinl4__4_ = "R:\\Dec2012\\y15_5\\sinl4"
y15_5_trib4_tif__4_ = "R:\\Dec2012\\y15_5\\y15_5_trib4.tif"
sitesrecr_tif__4_ = "R:\\Dec2012\\sitesrecr.tif"
y15_5_sloper__5_ = "R:\\Dec2012\\y15_5\\y15_5_sloper"
y15_5_aspectr__5_ = "R:\\Dec2012\\y15_5\\y15_5_aspectr"
y15_5_Stream4_tif__5_ = "R:\\Dec2012\\y15_5\\y15_5_Stream4.tif"
```

```
y15_5_lake4_tif__5_ = "R:\\Dec2012\\y15_5\\y15_5_lake4.tif"
sinh4__5_ = "R:\\Dec2012\\y15_5\\sinh4"
sinm4__5_ = "R:\\Dec2012\\y15_5\\sinm4"
sinl4__5_ = "R:\\Dec2012\\y15_5\\sinl4"
y15_5_trib4_tif__5_ = "R:\\Dec2012\\y15_5\\y15_5_trib4.tif"
sitesrecr_tif__5_ = "R:\\Dec2012\\sitesrecr.tif"
y15_5_sloper__6_ = "R:\\Dec2012\\y15_5\\y15_5_sloper"
y15_5_aspectr__6_ = "R:\\Dec2012\\y15_5\\y15_5_aspectr"
y15_5_Stream4_tif__6_ = "R:\\Dec2012\\y15_5\\y15_5_Stream4.tif"
y15_5_lake4_tif__6_ = "R:\\Dec2012\\y15_5\\y15_5_lake4.tif"
sinh4__6_ = "R:\\Dec2012\\y15_5\\sinh4"
sinm4__6_ = "R:\\Dec2012\\y15_5\\sinm4"
sinl4__6_ = "R:\\Dec2012\\y15_5\\sinl4"
y15_5_trib4_tif__6_ = "R:\\Dec2012\\y15_5\\y15_5_trib4.tif"
sitesrecr_tif__6_ = "R:\\Dec2012\\sitesrecr.tif"
y15_5_sloper__7_ = "R:\\Dec2012\\y15_5\\y15_5_sloper"
y15_5_aspectr__7_ = "R:\\Dec2012\\y15_5\\y15_5_aspectr"
y15_5_Stream4_tif__7_ = "R:\\Dec2012\\y15_5\\y15_5_Stream4.tif"
y15_5_lake4_tif__7_ = "R:\\Dec2012\\y15_5\\y15_5_lake4.tif"
sinh4__7_ = "R:\\Dec2012\\y15_5\\sinh4"
sinm4__7_ = "R:\\Dec2012\\y15_5\\sinm4"
sinl4__7_ = "R:\\Dec2012\\y15_5\\sinl4"
y15_5_trib4_tif__7_ = "R:\\Dec2012\\y15_5\\y15_5_trib4.tif"
sitesrecr_tif__7_ = "R:\\Dec2012\\sitesrecr.tif"
y15_5_sloper__8_ = "R:\\Dec2012\\y15_5\\y15_5_sloper"
y15_5_aspectr__8_ = "R:\\Dec2012\\y15_5\\y15_5_aspectr"
y15_5_Stream4_tif__8_ = "R:\\Dec2012\\y15_5\\y15_5_Stream4.tif"
y15_5_lake4_tif__8_ = "R:\\Dec2012\\y15_5\\y15_5_lake4.tif"
sinh4__8_ = "R:\\Dec2012\\y15_5\\sinh4"
sinm4__8_ = "R:\\Dec2012\\y15_5\\sinm4"
sinl4__8_ = "R:\\Dec2012\\y15_5\\sinl4"
y15_5_trib4_tif__8_ = "R:\\Dec2012\\y15_5\\y15_5_trib4.tif"
sitesrecr_tif__8_ = "R:\\Dec2012\\sitesrecr.tif"
y15_5_sloper__9_ = "R:\\Dec2012\\y15_5\\y15_5_sloper"
y15_5_aspectr__9_ = "R:\\Dec2012\\y15_5\\y15_5_aspectr"
y15_5_Stream4_tif__9_ = "R:\\Dec2012\\y15_5\\y15_5_Stream4.tif"
y15_5_lake4_tif__9_ = "R:\\Dec2012\\y15_5\\y15_5_lake4.tif"
sinh4__9_ = "R:\\Dec2012\\y15_5\\sinh4"
sinm4__9_ = "R:\\Dec2012\\y15_5\\sinm4"
sinl4__9_ = "R:\\Dec2012\\y15_5\\sinl4"
y15_5_trib4_tif__9_ = "R:\\Dec2012\\y15_5\\y15_5_trib4.tif"
sitesrecr_tif__9_ = "R:\\Dec2012\\sitesrecr.tif"
y15_5_sloper__10_ = "R:\\Dec2012\\y15_5\\y15_5_sloper"
y15_5_aspectr__10_ = "R:\\Dec2012\\y15_5\\y15_5_aspectr"
y15_5_Stream4_tif__10_ = "R:\\Dec2012\\y15_5\\y15_5_Stream4.tif"
y15_5_lake4_tif__10_ = "R:\\Dec2012\\y15_5\\y15_5_lake4.tif"
sinh4__10_ = "R:\\Dec2012\\y15_5\\sinh4"
sinm4__10_ = "R:\\Dec2012\\y15_5\\sinm4"
sinl4__10_ = "R:\\Dec2012\\y15_5\\sinl4"
y15_5_trib4_tif__10_ = "R:\\Dec2012\\y15_5\\y15_5_trib4.tif"
sitesrecr_tif__10_ = "R:\\Dec2012\\sitesrecr.tif"
y15_5_sloper__11_ = "R:\\Dec2012\\y15_5\\y15_5_sloper"
y15_5_aspectr__11_ = "R:\\Dec2012\\y15_5\\y15_5_aspectr"
y15_5_Stream4_tif__11_ = "R:\\Dec2012\\y15_5\\y15_5_Stream4.tif"
```

```
y15_5_lake4_tif__11_ = "R:\\Dec2012\\y15_5\\y15_5_lake4.tif"
sinh4__11_ = "R:\\Dec2012\\y15_5\\sinh4"
sinm4__11_ = "R:\\Dec2012\\y15_5\\sinm4"
sinl4__11_ = "R:\\Dec2012\\y15_5\\sinl4"
y15_5_trib4_tif__11_ = "R:\\Dec2012\\y15_5\\y15_5_trib4.tif"
sitesrecr_tif__11_ = "R:\\Dec2012\\sitesrecr.tif"
y15_5_sloper__12_ = "R:\\Dec2012\\y15_5\\y15_5_sloper"
y15_5_aspectr__12_ = "R:\\Dec2012\\y15_5\\y15_5_aspectr"
y15_5_Stream4_tif__12_ = "R:\\Dec2012\\y15_5\\y15_5_Stream4.tif"
y15_5_lake4_tif__12_ = "R:\\Dec2012\\y15_5\\y15_5_lake4.tif"
sinh4__12_ = "R:\\Dec2012\\y15_5\\sinh4"
sinm4__12_ = "R:\\Dec2012\\y15_5\\sinm4"
sinl4__12_ = "R:\\Dec2012\\y15_5\\sinl4"
y15_5_trib4_tif__12_ = "R:\\Dec2012\\y15_5\\y15_5_trib4.tif"
sitesrecr_tif__12_ = "R:\\Dec2012\\sitesrecr.tif"
y15_5_sloper__13_ = "R:\\Dec2012\\y15_5\\y15_5_sloper"
y15_5_aspectr__13_ = "R:\\Dec2012\\y15_5\\y15_5_aspectr"
y15_5_Stream4_tif__13_ = "R:\\Dec2012\\y15_5\\y15_5_Stream4.tif"
y15_5_lake4_tif__13_ = "R:\\Dec2012\\y15_5\\y15_5_lake4.tif"
sinh4__13_ = "R:\\Dec2012\\y15_5\\sinh4"
sinm4__13_ = "R:\\Dec2012\\y15_5\\sinm4"
sinl4__13_ = "R:\\Dec2012\\y15_5\\sinl4"
y15_5_trib4_tif__13_ = "R:\\Dec2012\\y15_5\\y15_5_trib4.tif"
sitesrecr_tif__13_ = "R:\\Dec2012\\sitesrecr.tif"
w1 = "R:\\Dec2012\\y15_5\\w1"
w1a = "R:\\Dec2012\\y15_5\\w1a"
w2 = "R:\\Dec2012\\y15_5\\w2"
w2a = "R:\\Dec2012\\y15_5\\w2a"
w3 = "R:\\Dec2012\\y15_5\\w3"
w3a = "R:\\Dec2012\\y15_5\\w3a"
w4 = "R:\\Dec2012\\y15_5\\w4"
w4a = "R:\\Dec2012\\y15_5\\w4a"
w5 = "R:\\Dec2012\\y15_5\\w5"
w5a = "R:\\Dec2012\\y15_5\\w5a"
w6 = "R:\\Dec2012\\y15_5\\w6"
w7 = "R:\\Dec2012\\y15_5\\w7"
w8 = "R:\\Dec2012\\y15_5\\w8"

# Process: Weighted Overlay
arcpy.gp.WeightedOverlay_sa("('R:\\Dec2012\\y15_5\\y15_5_sloper' 25 'VALUE' (0 0; 1 1; 2 2; 3
3; 4 4; 5 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_aspectr' 10 'VALUE' (0 0; 1 1; 2 2;NODATA
NODATA); 'R:\\Dec2012\\y15_5\\y15_5_Stream4.tif' 25 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_lake4.tif' 0 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinh4' 10 'VALUE' (0 0; 2 1; 6 3; 7 3; 8 4; 9 4; 13 5; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinm4' 6 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9
3; 10 4; 12 4; 13 5; 14 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinl4' 4 'VALUE' (0 0; 1 1; 2
1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 4; 14 5; 15 5;NODATA 0);
'R:\\Dec2012\\y15_5\\y15_5_trib4.tif' 0 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0);
'R:\\Dec2012\\sitesrecr.tif' 20 'VALUE' (0 0; 1 1; 3 2; 6 3; 7 4; 10 5;NODATA 0));0 5 1", w1)

# Process: Weighted Overlay (2)
arcpy.gp.WeightedOverlay_sa("('R:\\Dec2012\\y15_5\\y15_5_sloper' 25 'VALUE' (0 0; 1 1; 2 2; 3
3; 4 4; 5 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_aspectr' 10 'VALUE' (0 0; 1 1; 2 2;NODATA
NODATA); 'R:\\Dec2012\\y15_5\\y15_5_Stream4.tif' 22 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
```

```
5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_lake4.tif' 18 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinh4' 10 'VALUE' (0 0; 2 1; 6 3; 7 3; 8 4; 9 4; 13 5; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinm4' 6 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9
3; 10 4; 12 4; 13 5; 14 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinl4' 4 'VALUE' (0 0; 1 1; 2
1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 4; 14 5; 15 5;NODATA 0);
'R:\\Dec2012\\y15_5\\y15_5_trib4.tif' 0 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0);
'R:\\Dec2012\\sitesrecr.tif' 5 'VALUE' (0 0; 1 1; 3 2; 6 3; 7 4; 10 5;NODATA 0));0 5 1", w1a)

# Process: Weighted Overlay (3)
arcpy.gp.WeightedOverlay_sa("('R:\\Dec2012\\y15_5\\y15_5_sloper' 25 'VALUE' (0 0; 1 1; 2 2; 3
3; 4 4; 5 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_aspectr' 10 'VALUE' (0 0; 1 1; 2 2;NODATA
NODATA); 'R:\\Dec2012\\y15_5\\y15_5_Stream4.tif' 17 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_lake4.tif' 18 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinh4' 10 'VALUE' (0 0; 2 1; 6 3; 7 3; 8 4; 9 4; 13 5; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinm4' 6 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9
3; 10 4; 12 4; 13 5; 14 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinl4' 4 'VALUE' (0 0; 1 1; 2
1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 4; 14 5; 15 5;NODATA 0);
'R:\\Dec2012\\y15_5\\y15_5_trib4.tif' 10 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0);
'R:\\Dec2012\\sitesrecr.tif' 0 'VALUE' (0 0; 1 1; 3 2; 6 3; 7 4; 10 5;NODATA 0));0 5 1", w2)

# Process: Weighted Overlay (4)
arcpy.gp.WeightedOverlay_sa("('R:\\Dec2012\\y15_5\\y15_5_sloper' 23 'VALUE' (0 0; 1 1; 2 2; 3
3; 4 4; 5 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_aspectr' 10 'VALUE' (0 0; 1 1; 2 2;NODATA
NODATA); 'R:\\Dec2012\\y15_5\\y15_5_Stream4.tif' 17 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_lake4.tif' 17 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinh4' 9 'VALUE' (0 0; 2 1; 6 3; 7 3; 8 4; 9 4; 13 5; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinm4' 6 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9
3; 10 4; 12 4; 13 5; 14 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinl4' 3 'VALUE' (0 0; 1 1; 2
1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 4; 14 5; 15 5;NODATA 0);
'R:\\Dec2012\\y15_5\\y15_5_trib4.tif' 10 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0);
'R:\\Dec2012\\sitesrecr.tif' 5 'VALUE' (0 0; 1 1; 3 2; 6 3; 7 4; 10 5;NODATA 0));0 5 1", w2a)

# Process: Weighted Overlay (5)
arcpy.gp.WeightedOverlay_sa("('R:\\Dec2012\\y15_5\\y15_5_sloper' 25 'VALUE' (0 0; 1 1; 2 2; 3
3; 4 4; 5 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_aspectr' 10 'VALUE' (0 0; 1 1; 2 2;NODATA
NODATA); 'R:\\Dec2012\\y15_5\\y15_5_Stream4.tif' 20 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_lake4.tif' 20 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinh4' 5 'VALUE' (0 0; 2 1; 6 3; 7 3; 8 4; 9 4; 13 5; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinm4' 3 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9
3; 10 4; 12 4; 13 5; 14 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinl4' 2 'VALUE' (0 0; 1 1; 2
1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 4; 14 5; 15 5;NODATA 0);
'R:\\Dec2012\\y15_5\\y15_5_trib4.tif' 15 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0);
'R:\\Dec2012\\sitesrecr.tif' 0 'VALUE' (0 0; 1 1; 3 2; 6 3; 7 4; 10 5;NODATA 0));0 5 1", w3)

# Process: Weighted Overlay (6)
arcpy.gp.WeightedOverlay_sa("('R:\\Dec2012\\y15_5\\y15_5_sloper' 25 'VALUE' (0 0; 1 1; 2 2; 3
3; 4 4; 5 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_aspectr' 10 'VALUE' (0 0; 1 1; 2 2;NODATA
NODATA); 'R:\\Dec2012\\y15_5\\y15_5_Stream4.tif' 17 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_lake4.tif' 18 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinh4' 5 'VALUE' (0 0; 2 1; 6 3; 7 3; 8 4; 9 4; 13 5; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinm4' 3 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9
3; 10 4; 12 4; 13 5; 14 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinl4' 2 'VALUE' (0 0; 1 1; 2
1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 4; 14 5; 15 5;NODATA 0);
'R:\\Dec2012\\y15_5\\y15_5_trib4.tif' 15 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0);
```

```
'R:\\Dec2012\\sitesrecr.tif' 5 'VALUE' (0 0; 1 1; 3 2; 6 3; 7 4; 10 5;NODATA 0));0 5 1", w3a)

# Process: Weighted Overlay (7)
arcpy.gp.WeightedOverlay_sa("('R:\\Dec2012\\y15_5\\y15_5_sloper' 40 'VALUE' (0 0; 1 1; 2 2; 3 3; 4 4; 5 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_aspectr' 5 'VALUE' (0 0; 1 1; 2 2;NODATA NODATA); 'R:\\Dec2012\\y15_5\\y15_5_Stream4.tif' 10 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_lake4.tif' 17 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinh4' 9 'VALUE' (0 0; 2 1; 6 3; 7 3; 8 4; 9 4; 13 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinm4' 6 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 5; 14 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinl4' 3 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 4; 14 5; 15 5;NODATA 0);
'R:\\Dec2012\\y15_5\\y15_5_trib4.tif' 10 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0);
'R:\\Dec2012\\sitesrecr.tif' 0 'VALUE' (0 0; 1 1; 3 2; 6 3; 7 4; 10 5;NODATA 0));0 5 1", w4)

# Process: Weighted Overlay (8)
arcpy.gp.WeightedOverlay_sa("('R:\\Dec2012\\y15_5\\y15_5_sloper' 35 'VALUE' (0 0; 1 1; 2 2; 3 3; 4 4; 5 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_aspectr' 5 'VALUE' (0 0; 1 1; 2 2;NODATA NODATA); 'R:\\Dec2012\\y15_5\\y15_5_Stream4.tif' 10 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_lake4.tif' 17 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinh4' 9 'VALUE' (0 0; 2 1; 6 3; 7 3; 8 4; 9 4; 13 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinm4' 6 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 5; 14 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinl4' 3 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 4; 14 5; 15 5;NODATA 0);
'R:\\Dec2012\\y15_5\\y15_5_trib4.tif' 10 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0);
'R:\\Dec2012\\sitesrecr.tif' 5 'VALUE' (0 0; 1 1; 3 2; 6 3; 7 4; 10 5;NODATA 0));0 5 1", w4a)

# Process: Weighted Overlay (9)
arcpy.gp.WeightedOverlay_sa("('R:\\Dec2012\\y15_5\\y15_5_sloper' 10 'VALUE' (0 0; 1 1; 2 2; 3 3; 4 4; 5 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_aspectr' 5 'VALUE' (0 0; 1 1; 2 2;NODATA NODATA); 'R:\\Dec2012\\y15_5\\y15_5_Stream4.tif' 20 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_lake4.tif' 25 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinh4' 12 'VALUE' (0 0; 2 1; 6 3; 7 3; 8 4; 9 4; 13 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinm4' 8 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 5; 14 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinl4' 5 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 4; 14 5; 15 5;NODATA 0);
'R:\\Dec2012\\y15_5\\y15_5_trib4.tif' 15 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0);
'R:\\Dec2012\\sitesrecr.tif' 0 'VALUE' (0 0; 1 1; 3 2; 6 3; 7 4; 10 5;NODATA 0));0 5 1", w5)

# Process: Weighted Overlay (10)
arcpy.gp.WeightedOverlay_sa("('R:\\Dec2012\\y15_5\\y15_5_sloper' 10 'VALUE' (0 0; 1 1; 2 2; 3 3; 4 4; 5 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_aspectr' 5 'VALUE' (0 0; 1 1; 2 2;NODATA NODATA); 'R:\\Dec2012\\y15_5\\y15_5_Stream4.tif' 20 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_lake4.tif' 25 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinh4' 12 'VALUE' (0 0; 2 1; 6 3; 7 3; 8 4; 9 4; 13 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinm4' 8 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 5; 14 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinl4' 5 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 4; 14 5; 15 5;NODATA 0);
'R:\\Dec2012\\y15_5\\y15_5_trib4.tif' 10 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0);
'R:\\Dec2012\\sitesrecr.tif' 5 'VALUE' (0 0; 1 1; 3 2; 6 3; 7 4; 10 5;NODATA 0));0 5 1", w5a)

# Process: Weighted Overlay (11)
arcpy.gp.WeightedOverlay_sa("('R:\\Dec2012\\y15_5\\y15_5_sloper' 20 'VALUE' (0 0; 1 1; 2 2; 3 3; 4 4; 5 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_aspectr' 10 'VALUE' (0 0; 1 1; 2 2;NODATA NODATA); 'R:\\Dec2012\\y15_5\\y15_5_Stream4.tif' 12 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
```

```
5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_lake4.tif' 13 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinh4' 5 'VALUE' (0 0; 2 1; 6 3; 7 3; 8 4; 9 4; 13 5; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinm4' 3 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9
3; 10 4; 12 4; 13 5; 14 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinl4' 2 'VALUE' (0 0; 1 1; 2
1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 4; 14 5; 15 5;NODATA 0);
'R:\\Dec2012\\y15_5\\y15_5_trib4.tif' 5 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0);
'R:\\Dec2012\\sitesrecr.tif' 30 'VALUE' (0 0; 1 1; 3 2; 6 3; 7 4; 10 5;NODATA 0));0 5 1", w6)

# Process: Weighted Overlay (12)
arcpy.gp.WeightedOverlay_sa("('R:\\Dec2012\\y15_5\\y15_5_sloper' 30 'VALUE' (0 0; 1 1; 2 2; 3
3; 4 4; 5 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_aspectr' 5 'VALUE' (0 0; 1 1; 2 2;NODATA
NODATA); 'R:\\Dec2012\\y15_5\\y15_5_Stream4.tif' 20 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_lake4.tif' 10 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinh4' 9 'VALUE' (0 0; 2 1; 6 3; 7 3; 8 4; 9 4; 13 5; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinm4' 6 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9
3; 10 4; 12 4; 13 5; 14 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinl4' 3 'VALUE' (0 0; 1 1; 2
1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 4; 14 5; 15 5;NODATA 0);
'R:\\Dec2012\\y15_5\\y15_5_trib4.tif' 5 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0);
'R:\\Dec2012\\sitesrecr.tif' 12 'VALUE' (0 0; 1 1; 3 2; 6 3; 7 4; 10 5;NODATA 0));0 5 1", w7)

# Process: Weighted Overlay (13)
arcpy.gp.WeightedOverlay_sa("('R:\\Dec2012\\y15_5\\y15_5_sloper' 20 'VALUE' (0 0; 1 1; 2 2; 3
3; 4 4; 5 5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_aspectr' 5 'VALUE' (0 0; 1 1; 2 2;NODATA
NODATA); 'R:\\Dec2012\\y15_5\\y15_5_Stream4.tif' 15 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\y15_5_lake4.tif' 15 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinh4' 12 'VALUE' (0 0; 2 1; 6 3; 7 3; 8 4; 9 4; 13 5; 15
5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinm4' 8 'VALUE' (0 0; 1 1; 2 1; 3 2; 5 2; 6 2; 7 3; 8 3; 9
3; 10 4; 12 4; 13 5; 14 5; 15 5;NODATA 0); 'R:\\Dec2012\\y15_5\\sinl4' 3 'VALUE' (0 0; 1 1; 2
1; 3 2; 5 2; 6 2; 7 3; 8 3; 9 3; 10 4; 12 4; 13 4; 14 5; 15 5;NODATA 0);
'R:\\Dec2012\\y15_5\\y15_5_trib4.tif' 8 'Value' (0 0; 1 1; 3 2; 6 3; 11 4; 15 5;NODATA 0);
'R:\\Dec2012\\sitesrecr.tif' 14 'VALUE' (0 0; 1 1; 3 2; 6 3; 7 4; 10 5;NODATA 0));0 5 1", w8)
```

B.9 Convert Raster of overlays into polygons

R:\python scripts\raster to poly_Sm_dem.pyw

```
import arcpy
import arcpy.sa

# Check out any necessary licenses
arcpy.CheckOutExtension("spatial")

# Local variables:
W1 = "R:\\Dec2012\\sm_dem\\w1"
IntW1 = "R:\\Dec2012\\sm_dem\\Int_W1"
Ext_W1 = "R:\\Dec2012\\sm_dem\\Ext_W1"
PolyW1 = "R:\\Dec2012\\sm_dem\\Poly_W1.shp"

W1Int = arcpy.sa.Int(W1)
W1Int.save(IntW1)

# Process: Extract by Attributes
arcpy.gp.ExtractByAttributes_sa(W1, "\"Value\" > 2", Ext_W1)

#Process: Raster to Polyline
arcpy.RasterToPolygon_conversion(Ext_W1, PolyW1, "SIMPLIFY", "VALUE")

print "W1"

# Local variables:
wla = "R:\\Dec2012\\sm_dem\\wla"
Intwla = "R:\\Dec2012\\sm_dem\\Int_wla"
Ext_wla = "R:\\Dec2012\\sm_dem\\Ext_wla"
Polywla = "R:\\Dec2012\\sm_dem\\Poly_wla.shp"

wlaInt = arcpy.sa.Int(wla)
wlaInt.save(Intwla)

# Process: Extract by Attributes
arcpy.gp.ExtractByAttributes_sa(wla, "\"Value\" > 2", Ext_wla)

#Process: Raster to Polyline
arcpy.RasterToPolygon_conversion(Ext_wla, Polywla, "SIMPLIFY", "VALUE")

print "wla"

# Local variables:
w2 = "R:\\Dec2012\\sm_dem\\w2"
Intw2 = "R:\\Dec2012\\sm_dem\\Int_w2"
Ext_w2 = "R:\\Dec2012\\sm_dem\\Ext_w2"
Polyw2 = "R:\\Dec2012\\sm_dem\\Poly_w2.shp"

w2Int = arcpy.sa.Int(w2)
w2Int.save(Intw2)

# Process: Extract by Attributes
arcpy.gp.ExtractByAttributes_sa(w2, "\"Value\" > 2", Ext_w2)

#Process: Raster to Polyline
arcpy.RasterToPolygon_conversion(Ext_w2, Polyw2, "SIMPLIFY", "VALUE")
```

```
print "w2"

# Local variables:
w2a = "R:\\Dec2012\\sm_dem\\w2a"
Intw2a = "R:\\Dec2012\\sm_dem\\Int_w2a"
Ext_w2a = "R:\\Dec2012\\sm_dem\\Ext_w2a"
Polyw2a = "R:\\Dec2012\\sm_dem\\Poly_w2a.shp"

w2aInt = arcpy.sa.Int(w2a)
w2aInt.save(Intw2a)

# Process: Extract by Attributes
arcpy.gp.ExtractByAttributes_sa(w2a, "\"Value\" > 2", Ext_w2a)

#Process: Raster to Polyline
arcpy.RasterToPolygon_conversion(Ext_w2a, Polyw2a, "SIMPLIFY", "VALUE")

print "w2a"

# Local variables:
w3 = "R:\\Dec2012\\sm_dem\\w3"
Intw3 = "R:\\Dec2012\\sm_dem\\Int_w3"
Ext_w3 = "R:\\Dec2012\\sm_dem\\Ext_w3"
Polyw3 = "R:\\Dec2012\\sm_dem\\Poly_w3.shp"

w3Int = arcpy.sa.Int(w3)
w3Int.save(Intw3)

# Process: Extract by Attributes
arcpy.gp.ExtractByAttributes_sa(w3, "\"Value\" > 2", Ext_w3)

#Process: Raster to Polyline
arcpy.RasterToPolygon_conversion(Ext_w3, Polyw3, "SIMPLIFY", "VALUE")

print "w3"

# Local variables:
w3a = "R:\\Dec2012\\sm_dem\\w3a"
Intw3a = "R:\\Dec2012\\sm_dem\\Int_w3a"
Ext_w3a = "R:\\Dec2012\\sm_dem\\Ext_w3a"
Polyw3a = "R:\\Dec2012\\sm_dem\\Poly_w3a.shp"

w3aInt = arcpy.sa.Int(w3a)
w3aInt.save(Intw3a)

# Process: Extract by Attributes
arcpy.gp.ExtractByAttributes_sa(w3a, "\"Value\" > 2", Ext_w3a)

#Process: Raster to Polyline
arcpy.RasterToPolygon_conversion(Ext_w3a, Polyw3a, "SIMPLIFY", "VALUE")

print "w3a"
```

```
# Local variables:
w4 = "R:\\Dec2012\\sm_dem\\w4"
Intw4 = "R:\\Dec2012\\sm_dem\\Int_w4"
Ext_w4 = "R:\\Dec2012\\sm_dem\\Ext_w4"
Polyw4 = "R:\\Dec2012\\sm_dem\\Poly_w4.shp"

w4Int = arcpy.sa.Int(w4)
w4Int.save(Intw4)

# Process: Extract by Attributes
arcpy.gp.ExtractByAttributes_sa(w4, "\"Value\" > 2", Ext_w4)

#Process: Raster to Polyline
arcpy.RasterToPolygon_conversion(Ext_w4, Polyw4, "SIMPLIFY", "VALUE")

print "w4"

# Local variables:
w4a = "R:\\Dec2012\\sm_dem\\w4a"
Intw4a = "R:\\Dec2012\\sm_dem\\Int_w4a"
Ext_w4a = "R:\\Dec2012\\sm_dem\\Ext_w4a"
Polyw4a = "R:\\Dec2012\\sm_dem\\Poly_w4a.shp"

w4aInt = arcpy.sa.Int(w4a)
w4aInt.save(Intw4a)

# Process: Extract by Attributes
arcpy.gp.ExtractByAttributes_sa(w4a, "\"Value\" > 2", Ext_w4a)

#Process: Raster to Polyline
arcpy.RasterToPolygon_conversion(Ext_w4a, Polyw4a, "SIMPLIFY", "VALUE")

print "w4a"

# Local variables:
w5 = "R:\\Dec2012\\sm_dem\\w5"
Intw5 = "R:\\Dec2012\\sm_dem\\Int_w5"
Ext_w5 = "R:\\Dec2012\\sm_dem\\Ext_w5"
Polyw5 = "R:\\Dec2012\\sm_dem\\Poly_w5.shp"

w5Int = arcpy.sa.Int(w5)
w5Int.save(Intw5)

# Process: Extract by Attributes
arcpy.gp.ExtractByAttributes_sa(w5, "\"Value\" > 2", Ext_w5)

#Process: Raster to Polyline
arcpy.RasterToPolygon_conversion(Ext_w5, Polyw5, "SIMPLIFY", "VALUE")

print "w5"

# Local variables:
w5a = "R:\\Dec2012\\sm_dem\\w5a"
Intw5a = "R:\\Dec2012\\sm_dem\\Int_w5a"
```

```
Ext_w5a = "R:\\Dec2012\\sm_dem\\Ext_w5a"
Polyw5a = "R:\\Dec2012\\sm_dem\\Poly_w5a.shp"

w5aInt = arcpy.sa.Int(w5a)
w5aInt.save(Intw5a)

# Process: Extract by Attributes
arcpy.gp.ExtractByAttributes_sa(w5a, "\"Value\" > 2", Ext_w5a)

#Process: Raster to Polyline
arcpy.RasterToPolygon_conversion(Ext_w5a, Polyw5a, "SIMPLIFY", "VALUE")

print "w5a"

# Local variables:
w6 = "R:\\Dec2012\\sm_dem\\w6"
Intw6 = "R:\\Dec2012\\sm_dem\\Int_w6"
Ext_w6 = "R:\\Dec2012\\sm_dem\\Ext_w6"
Polyw6 = "R:\\Dec2012\\sm_dem\\Poly_w6.shp"

w6Int = arcpy.sa.Int(w6)
w6Int.save(Intw6)

# Process: Extract by Attributes
arcpy.gp.ExtractByAttributes_sa(w6, "\"Value\" > 2", Ext_w6)

#Process: Raster to Polyline
arcpy.RasterToPolygon_conversion(Ext_w6, Polyw6, "SIMPLIFY", "VALUE")

print "w6"

# Local variables:
w7 = "R:\\Dec2012\\sm_dem\\w7"
Intw7 = "R:\\Dec2012\\sm_dem\\Int_w7"
Ext_w7 = "R:\\Dec2012\\sm_dem\\Ext_w7"
Polyw7 = "R:\\Dec2012\\sm_dem\\Poly_w7.shp"

w7Int = arcpy.sa.Int(w7)
w7Int.save(Intw7)

# Process: Extract by Attributes
arcpy.gp.ExtractByAttributes_sa(w7, "\"Value\" > 2", Ext_w7)

#Process: Raster to Polyline
arcpy.RasterToPolygon_conversion(Ext_w7, Polyw7, "SIMPLIFY", "VALUE")

print "w7"

# Local variables:
w8 = "R:\\Dec2012\\sm_dem\\w8"
Intw8 = "R:\\Dec2012\\sm_dem\\Int_w8"
Ext_w8 = "R:\\Dec2012\\sm_dem\\Ext_w8"
Polyw8 = "R:\\Dec2012\\sm_dem\\Poly_w8.shp"
```

```
w8Int = arcpy.sa.Int(w8)
w8Int.save(Intw8)

# Process: Extract by Attributes
arcpy.gp.ExtractByAttributes_sa(w8, "\"Value\" > 2", Ext_w8)

#Process: Raster to Polyline
arcpy.RasterToPolygon_conversion(Ext_w8, Polyw8, "SIMPLIFY", "VALUE")

print "w8"
```

B.10 Moran's I (an example for 12,000 cal BP (y12_0) only displaying the first process (250 m nearest neighbor for weight 7)

R:\python scripts\example of moranI.pyw

```
# ---------------------------------------------------------------------------
# MoranI-Jan16.py
# Created on: 2013-01-24 15:52:40.00000
#   (generated by ArcDec2012/ModelBuilder)
# Description:
# ---------------------------------------------------------------------------

# Import arcpy module
import arcpy

# Set Geoprocessing environments
arcpy.env.scratchWorkspace = "R:\\model"
arcpy.env.snapRaster = ""
arcpy.env.extent = ""
arcpy.env.workspace = "R:\\model"


# Local variables:
poly_w1_shp = "R:\\Dec2012\\y12_0\\poly_w1.shp"
poly_w4_shp = "R:\\Dec2012\\y12_0\\poly_w4.shp"
poly_w7_shp = "R:\\Dec2012\\y12_0\\poly_w7.shp"
poly_w8_shp = "R:\\Dec2012\\y12_0\\poly_w8.shp"
try:
    # Process: Process  (2)
    tempEnvironment0 = arcpy.env.newPrecision
    arcpy.env.newPrecision = "SINGLE"
    tempEnvironment1 = arcpy.env.autoCommit
    arcpy.env.autoCommit = "1000"
    tempEnvironment2 = arcpy.env.XYResolution
    arcpy.env.XYResolution = ""
    tempEnvironment3 = arcpy.env.XYDomain
    arcpy.env.XYDomain = ""
    tempEnvironment4 = arcpy.env.scratchWorkspace
    arcpy.env.scratchWorkspace = "C:\Users\jdixon\Documents\ArcGIS\Default.gdb"
    tempEnvironment5 = arcpy.env.terrainMemoryUsage
    arcpy.env.terrainMemoryUsage = "false"
    tempEnvironment6 = arcpy.env.MTolerance
    arcpy.env.MTolerance = ""
    tempEnvironment7 = arcpy.env.compression
    arcpy.env.compression = "LZ77"
    tempEnvironment8 = arcpy.env.coincidentPoints
    arcpy.env.coincidentPoints = "MEAN"
    tempEnvironment9 = arcpy.env.randomGenerator
    arcpy.env.randomGenerator = "0 ACM599"
    tempEnvironment10 = arcpy.env.outputCoordinateSystem
    arcpy.env.outputCoordinateSystem = ""
    tempEnvironment11 = arcpy.env.rasterStatistics
    arcpy.env.rasterStatistics = "STATISTICS 1 1"
    tempEnvironment12 = arcpy.env.ZDomain
    arcpy.env.ZDomain = ""
    tempEnvironment13 = arcpy.env.snapRaster
    arcpy.env.snapRaster = ""
    tempEnvironment14 = arcpy.env.projectCompare
```

```
arcpy.env.projectCompare = "NONE"
tempEnvironment15 = arcpy.env.cartographicCoordinateSystem
arcpy.env.cartographicCoordinateSystem = ""
tempEnvironment16 = arcpy.env.configKeyword
arcpy.env.configKeyword = ""
tempEnvironment17 = arcpy.env.outputZFlag
arcpy.env.outputZFlag = "Same As Input"
tempEnvironment18 = arcpy.env.qualifiedFieldNames
arcpy.env.qualifiedFieldNames = "true"
tempEnvironment19 = arcpy.env.tileSize
arcpy.env.tileSize = "128 128"
tempEnvironment20 = arcpy.env.pyramid
arcpy.env.pyramid = "PYRAMIDS -1 NEAREST DEFAULT 75"
tempEnvironment21 = arcpy.env.referenceScale
arcpy.env.referenceScale = ""
tempEnvironment22 = arcpy.env.extent
arcpy.env.extent = ""
tempEnvironment23 = arcpy.env.XYTolerance
arcpy.env.XYTolerance = ""
tempEnvironment24 = arcpy.env.tinSaveVersion
arcpy.env.tinSaveVersion = "CURRENT"
tempEnvironment25 = arcpy.env.MDomain
arcpy.env.MDomain = ""
tempEnvironment26 = arcpy.env.spatialGrid1
arcpy.env.spatialGrid1 = "0"
tempEnvironment27 = arcpy.env.cellSize
arcpy.env.cellSize = "MAXOF"
tempEnvironment28 = arcpy.env.outputZValue
arcpy.env.outputZValue = ""
tempEnvironment29 = arcpy.env.outputMFlag
arcpy.env.outputMFlag = "Same As Input"
tempEnvironment30 = arcpy.env.geographicTransformations
arcpy.env.geographicTransformations = ""
tempEnvironment31 = arcpy.env.spatialGrid2
arcpy.env.spatialGrid2 = "0"
tempEnvironment32 = arcpy.env.ZResolution
arcpy.env.ZResolution = ""
tempEnvironment33 = arcpy.env.mask
arcpy.env.mask = ""
tempEnvironment34 = arcpy.env.spatialGrid3
arcpy.env.spatialGrid3 = "0"
tempEnvironment35 = arcpy.env.maintainSpatialIndex
arcpy.env.maintainSpatialIndex = "false"
tempEnvironment36 = arcpy.env.workspace
arcpy.env.workspace = "C:\Users\jdixon\Documents\ArcGIS\Default.gdb"
tempEnvironment37 = arcpy.env.MResolution
arcpy.env.MResolution = ""
tempEnvironment38 = arcpy.env.derivedPrecision
arcpy.env.derivedPrecision = "HIGHEST"
tempEnvironment39 = arcpy.env.ZTolerance
arcpy.env.ZTolerance = ""
arcpy.SpatialAutocorrelation_stats(poly_w7_shp, "GRIDCODE", "GENERATE_REPORT",
"INVERSE_DISTANCE", "EUCLIDEAN_DISTANCE", "NONE", "250", "")
arcpy.env.newPrecision = tempEnvironment0
```

```
    arcpy.env.autoCommit = tempEnvironment1
    arcpy.env.XYResolution = tempEnvironment2
    arcpy.env.XYDomain = tempEnvironment3
    arcpy.env.scratchWorkspace = tempEnvironment4
    arcpy.env.terrainMemoryUsage = tempEnvironment5
    arcpy.env.MTolerance = tempEnvironment6
    arcpy.env.compression = tempEnvironment7
    arcpy.env.coincidentPoints = tempEnvironment8
    arcpy.env.randomGenerator = tempEnvironment9
    arcpy.env.outputCoordinateSystem = tempEnvironment10
    arcpy.env.rasterStatistics = tempEnvironment11
    arcpy.env.ZDomain = tempEnvironment12
    arcpy.env.snapRaster = tempEnvironment13
    arcpy.env.projectCompare = tempEnvironment14
    arcpy.env.cartographicCoordinateSystem = tempEnvironment15
    arcpy.env.configKeyword = tempEnvironment16
    arcpy.env.outputZFlag = tempEnvironment17
    arcpy.env.qualifiedFieldNames = tempEnvironment18
    arcpy.env.tileSize = tempEnvironment19
    arcpy.env.pyramid = tempEnvironment20
    arcpy.env.referenceScale = tempEnvironment21
    arcpy.env.extent = tempEnvironment22
    arcpy.env.XYTolerance = tempEnvironment23
    arcpy.env.tinSaveVersion = tempEnvironment24
    arcpy.env.MDomain = tempEnvironment25
    arcpy.env.spatialGrid1 = tempEnvironment26
    arcpy.env.cellSize = tempEnvironment27
    arcpy.env.outputZValue = tempEnvironment28
    arcpy.env.outputMFlag = tempEnvironment29
    arcpy.env.geographicTransformations = tempEnvironment30
    arcpy.env.spatialGrid2 = tempEnvironment31
    arcpy.env.ZResolution = tempEnvironment32
    arcpy.env.mask = tempEnvironment33
    arcpy.env.spatialGrid3 = tempEnvironment34
    arcpy.env.maintainSpatialIndex = tempEnvironment35
    arcpy.env.workspace = tempEnvironment36
    arcpy.env.MResolution = tempEnvironment37
    arcpy.env.derivedPrecision = tempEnvironment38
    arcpy.env.ZTolerance = tempEnvironment39
    print arcpy.GetMessages()
except Exception as ErrorDesc:
    Errors = "TRUE"
    print(ErrorDesc.message)
```

B.11 Kvamme's Gain

1) In GRASS 6.4.2

2) "v.what. rast" is used to populate the statistics field in the shape file table

3) "r.stat" with (a) 'print area totals' and (c) 'print cell counts' selected. The file is outputted as a tab delineated text file

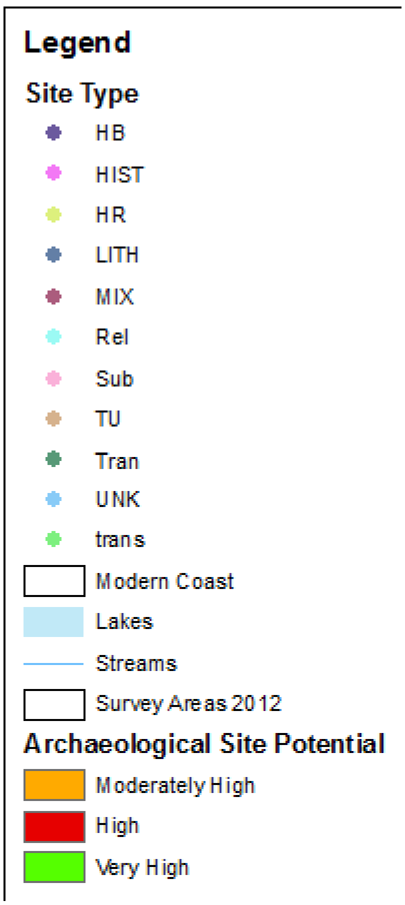
4) The shape files are exported using "db.out.ogr" as dbf files

5) The dbf files are imported as text files into SPSS 17.0

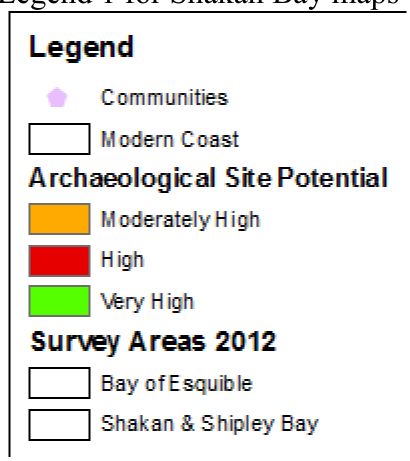
6) The final gain values are calculated in an excel spreadsheet (APPENDIX GAIN)

Appendix C: Maps of Weighted Overlays

Each map includes which weighted overlay it is of in the top left corner and which time-slice it is from in the top right corner. The maps are organized by weighted overlays and then time slice. First are maps of Shakan Bay, followed by maps of the entire region.

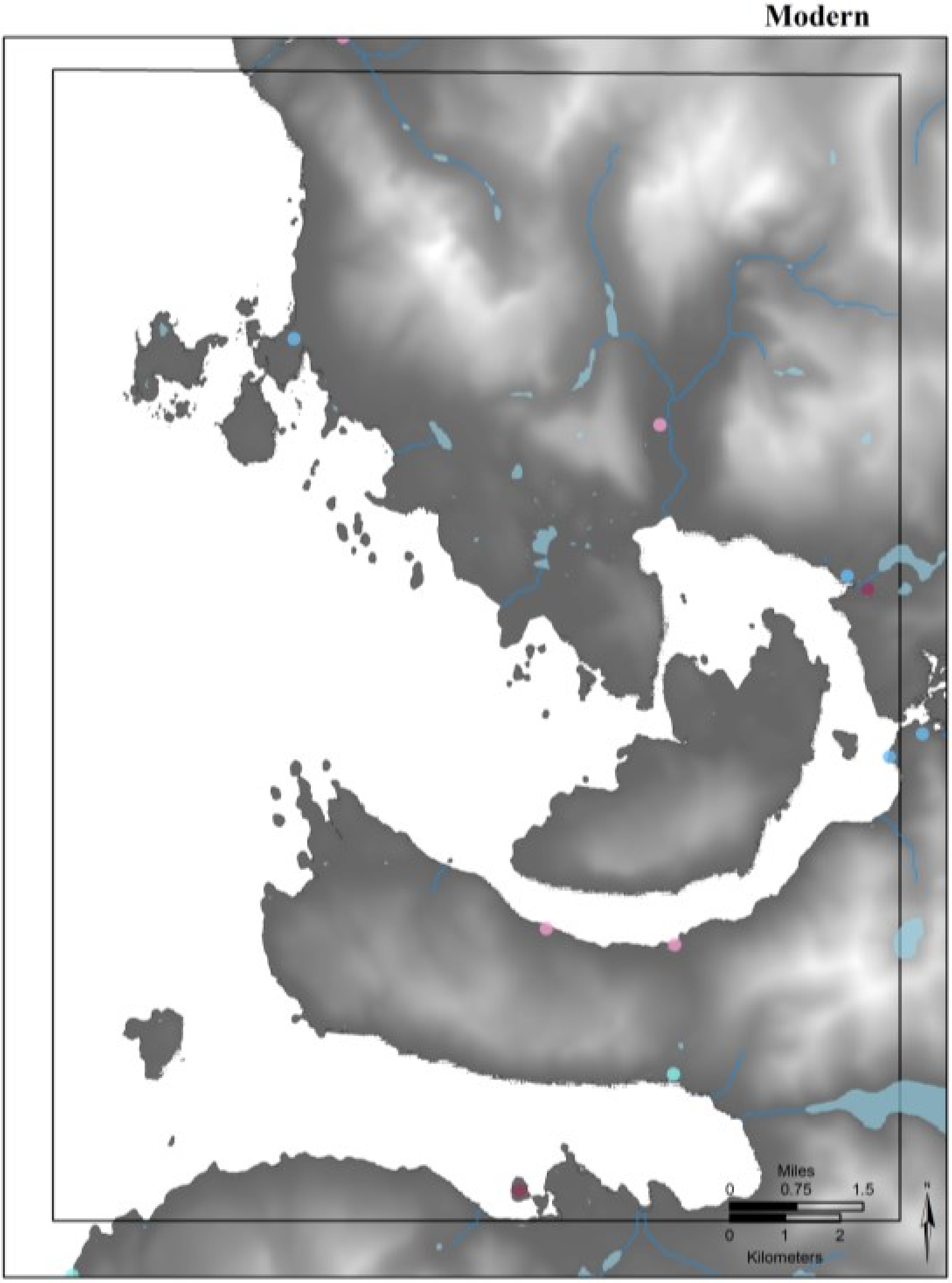


Legend 1 for Shakan Bay maps

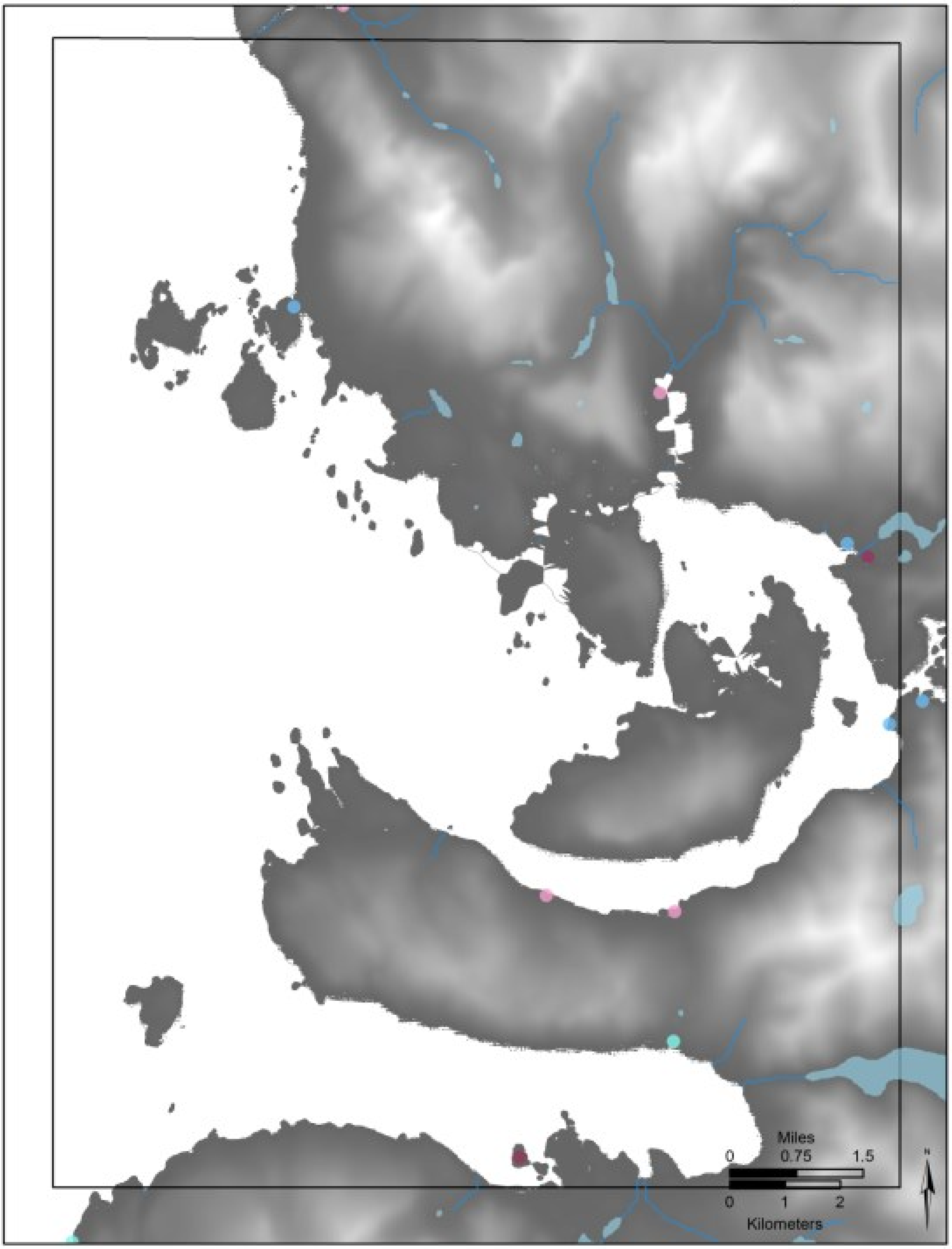


Legend 2 for regional maps

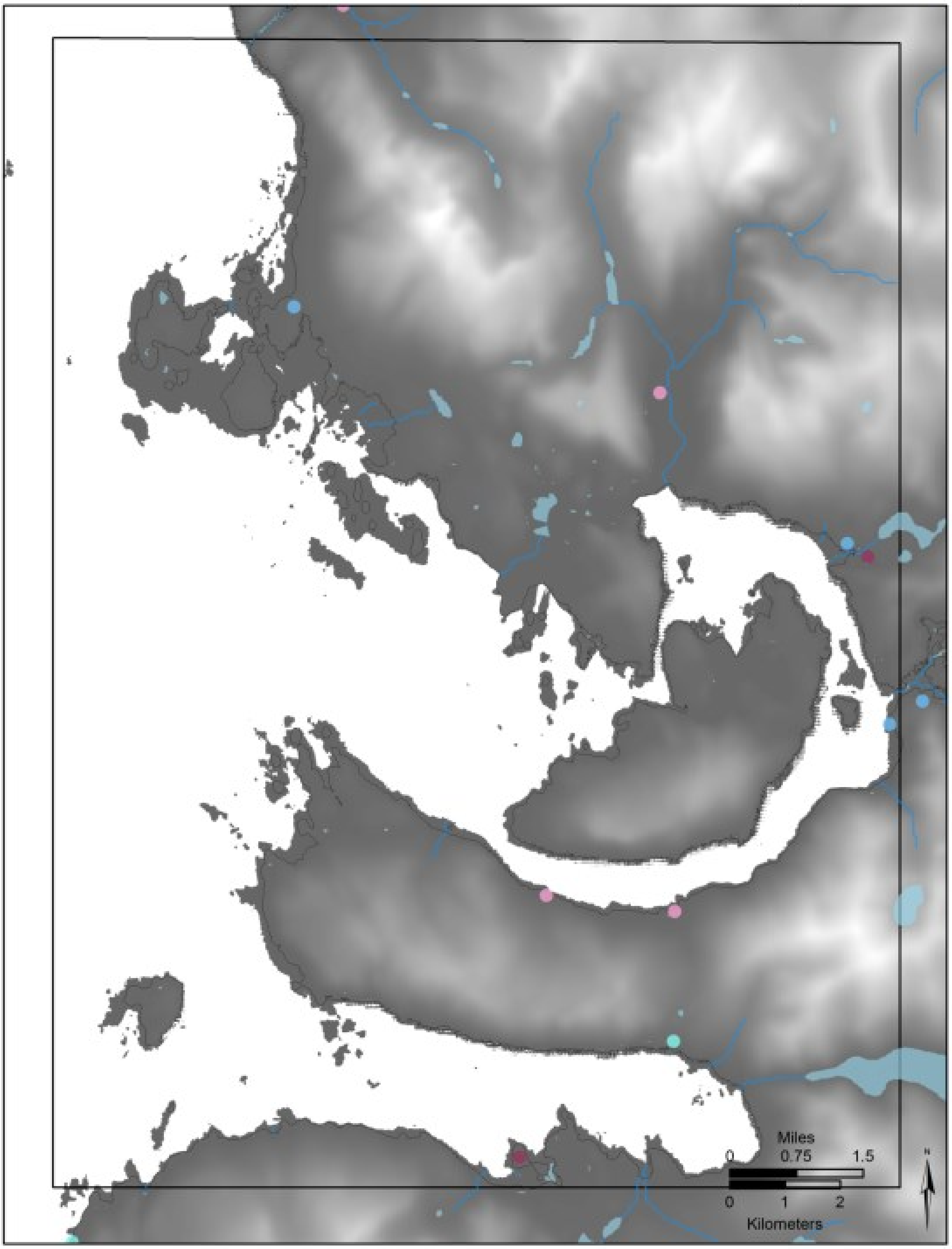
C.1 Maps of Shakan Bay showing streams, lakes, and paleolandscapes



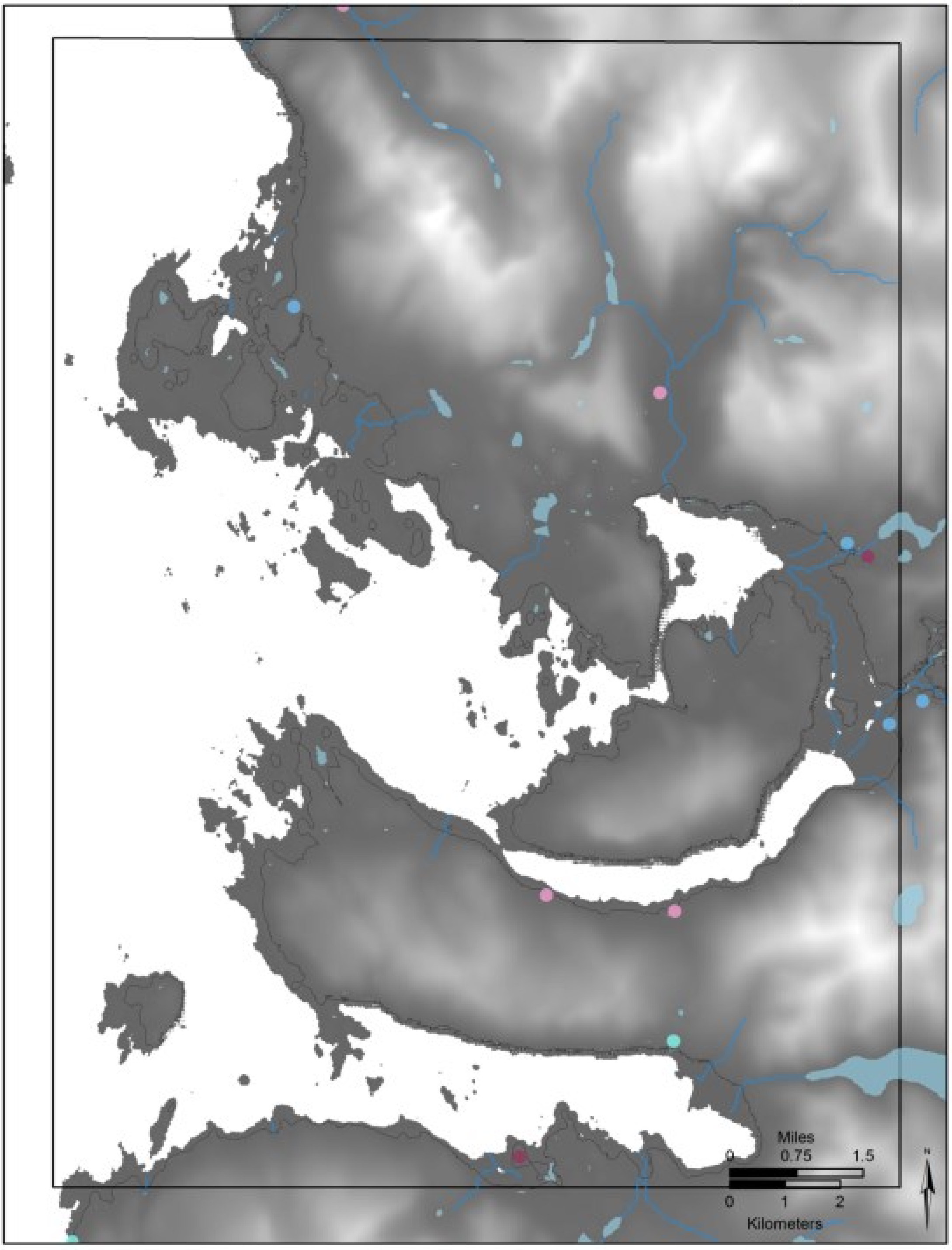
10,500 cal BP



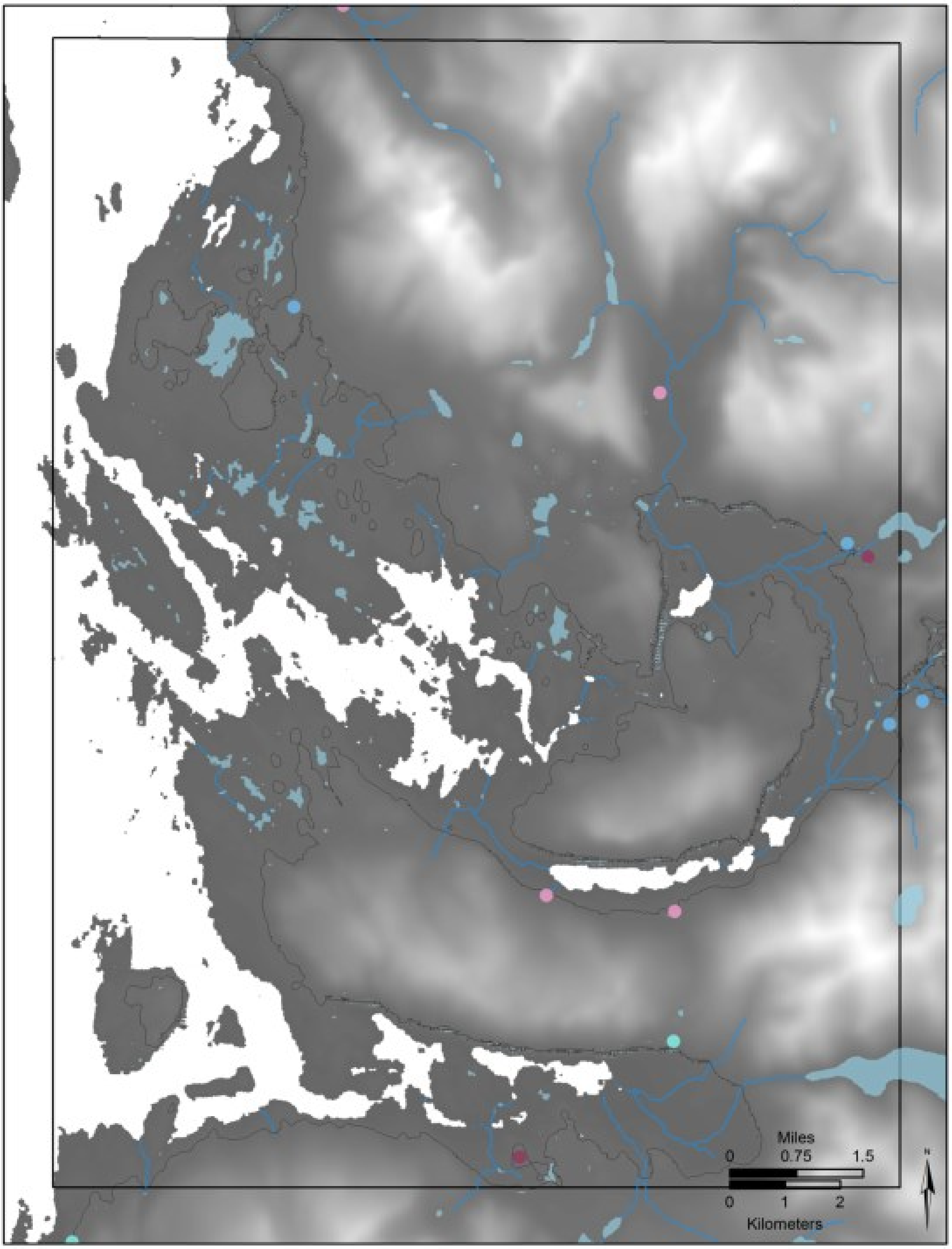
11,000 cal BP



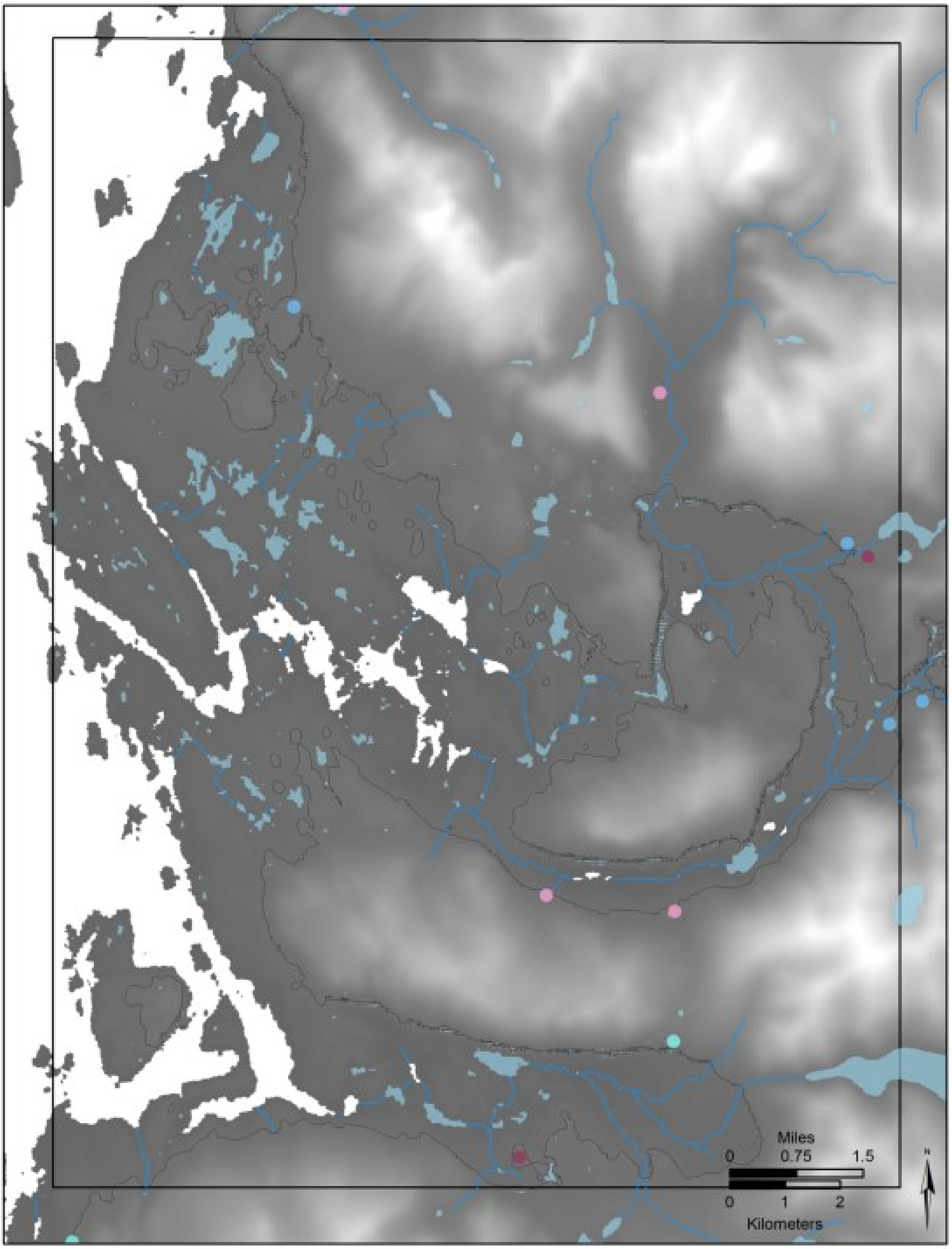
11,500 cal BP



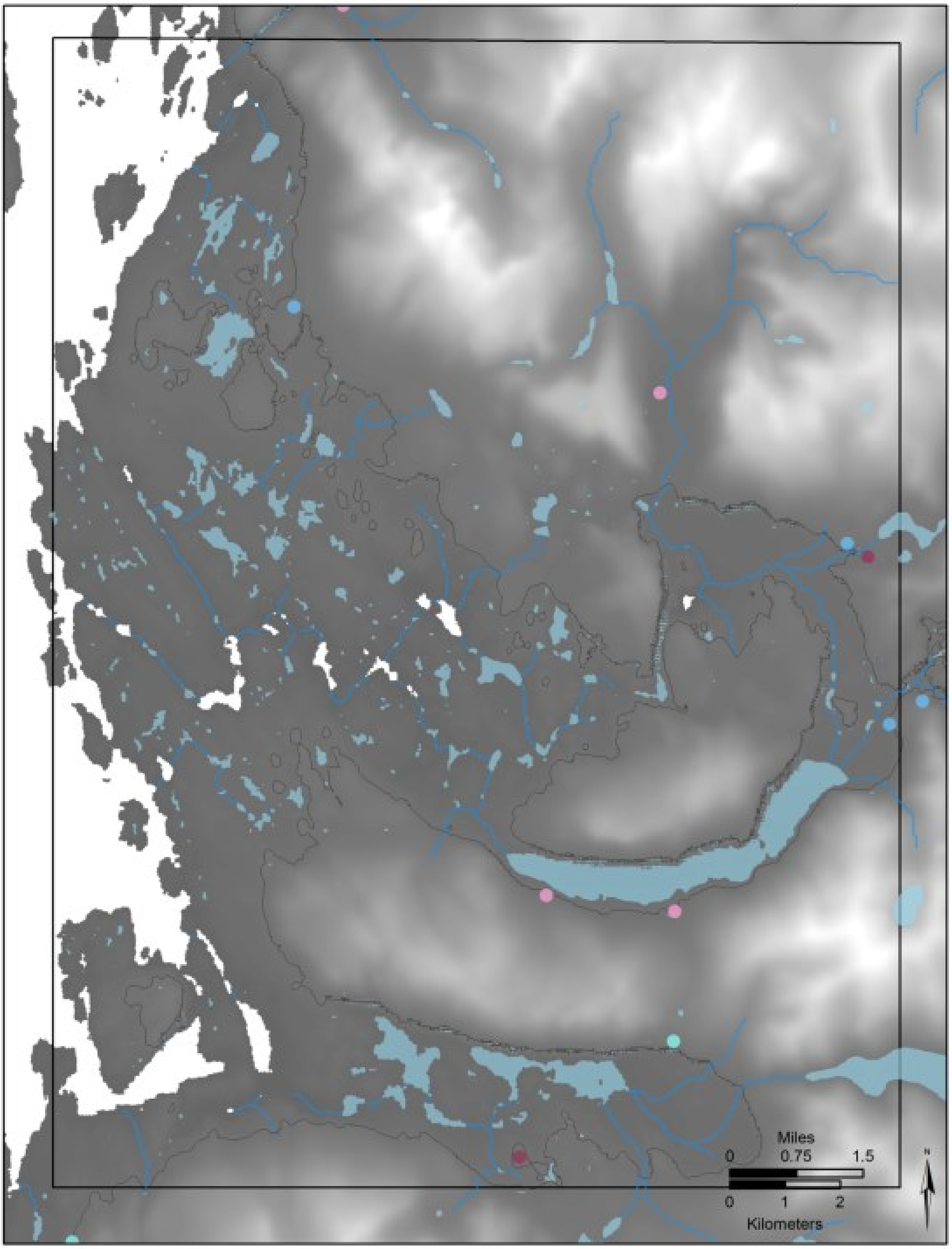
12,000 cal BP



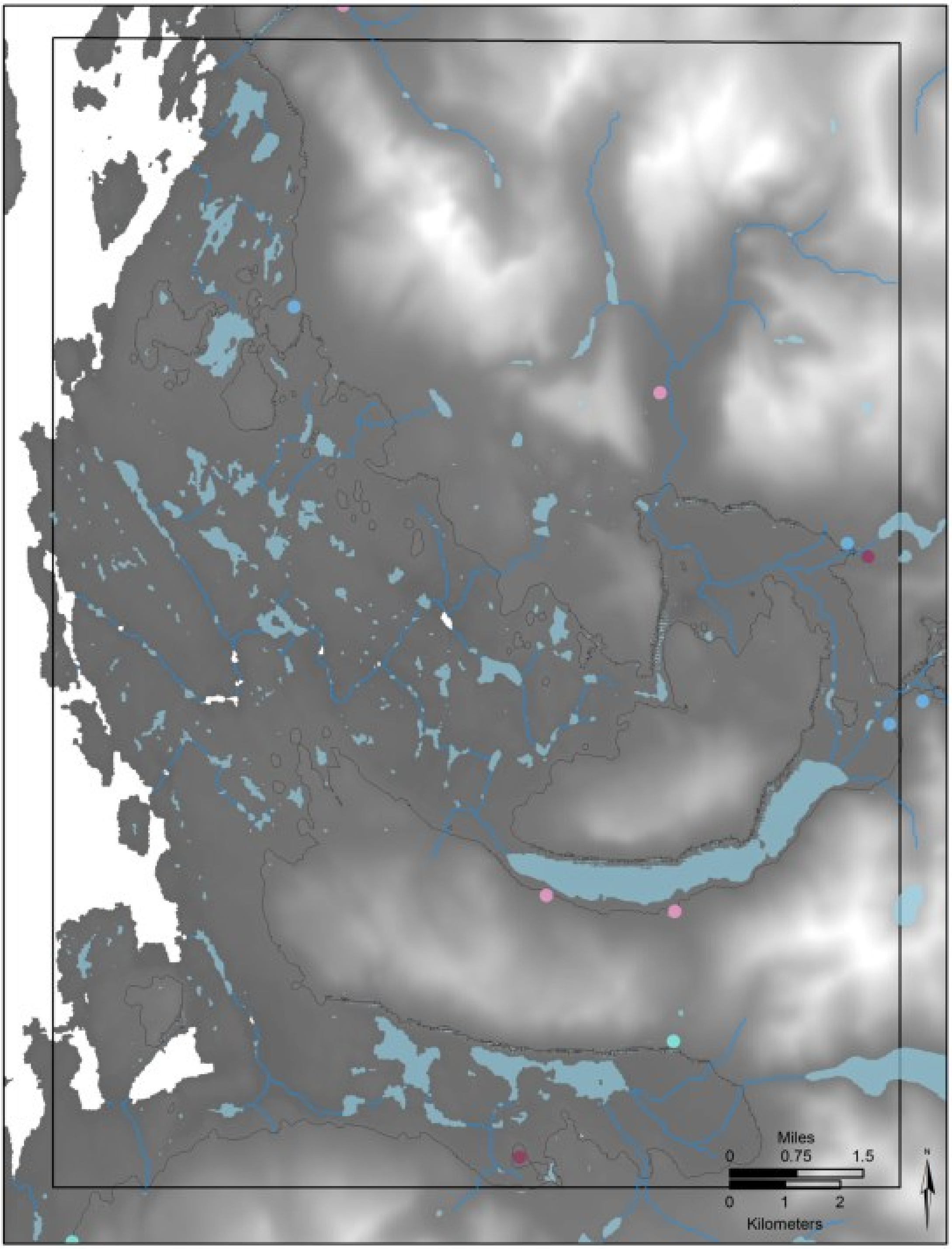
12,500 cal BP



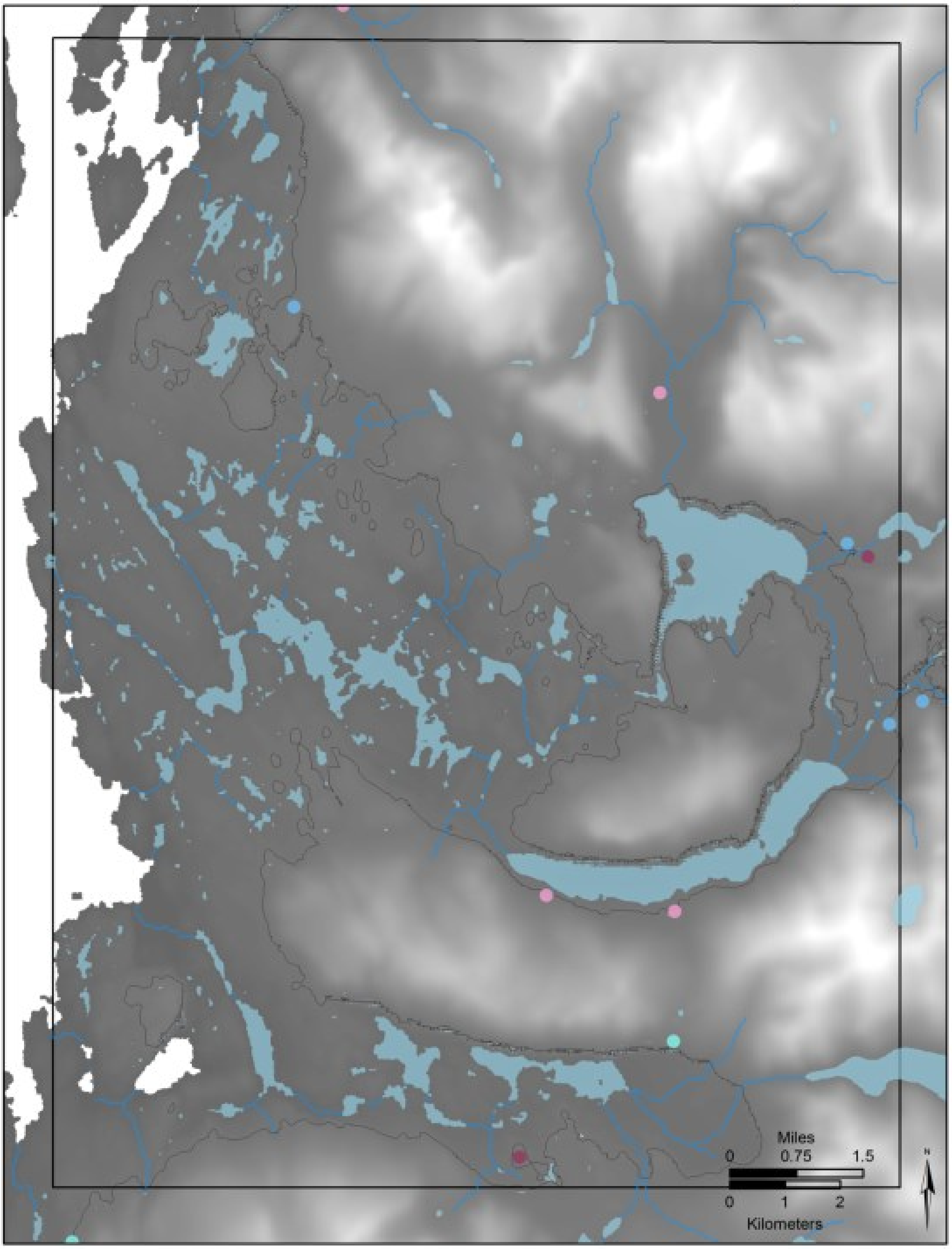
13,000 cal BP



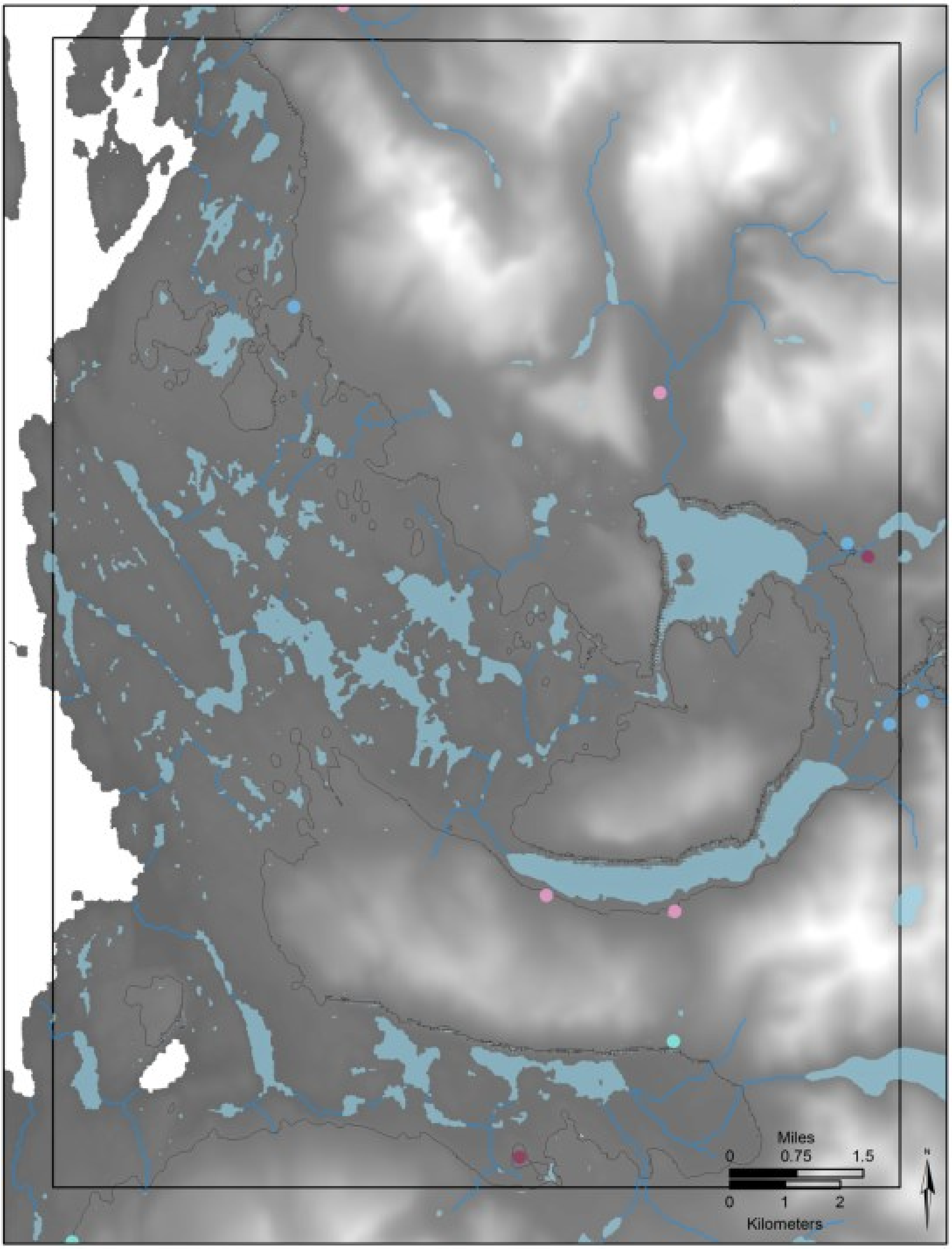
13,500 cal BP



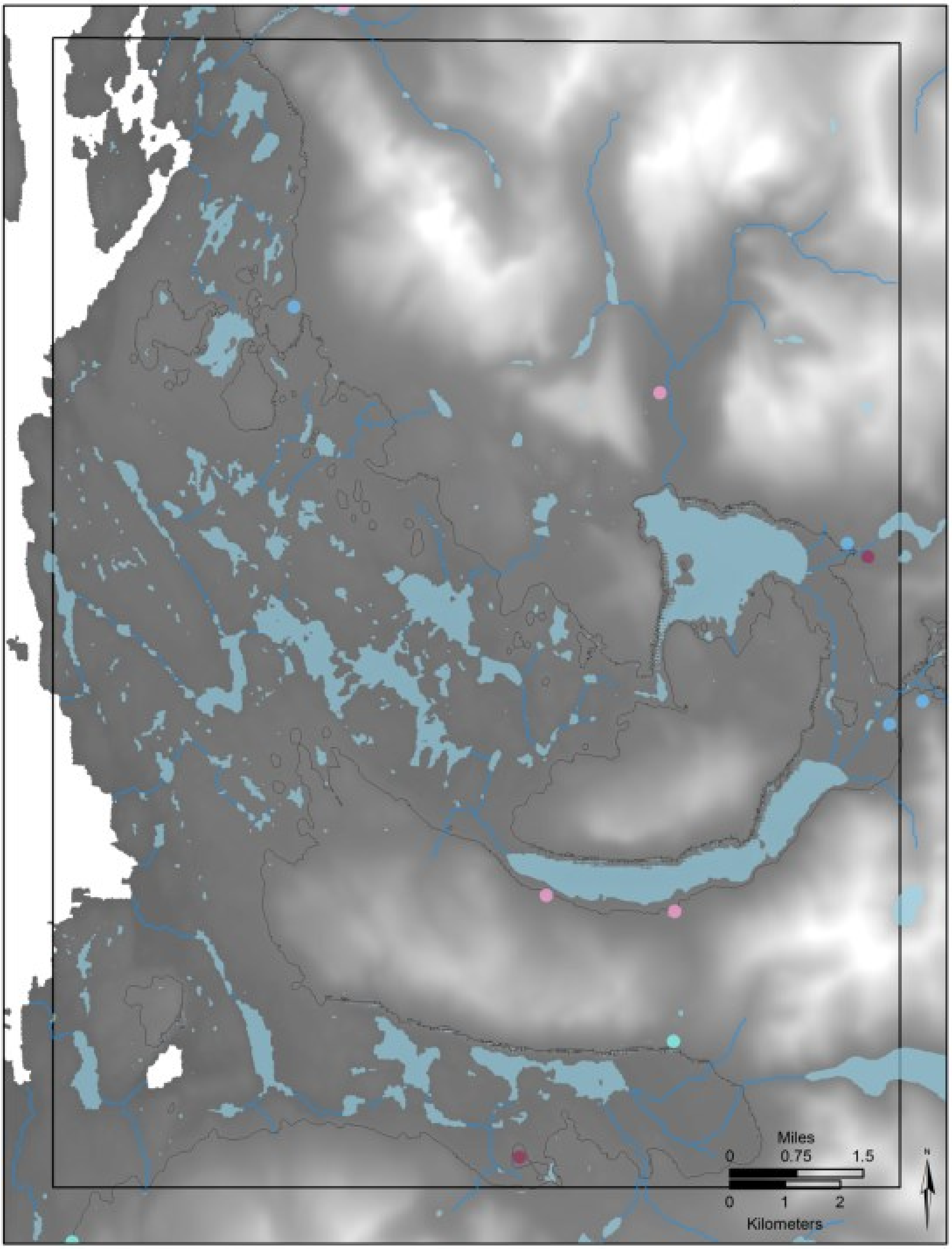
14,000 cal BP



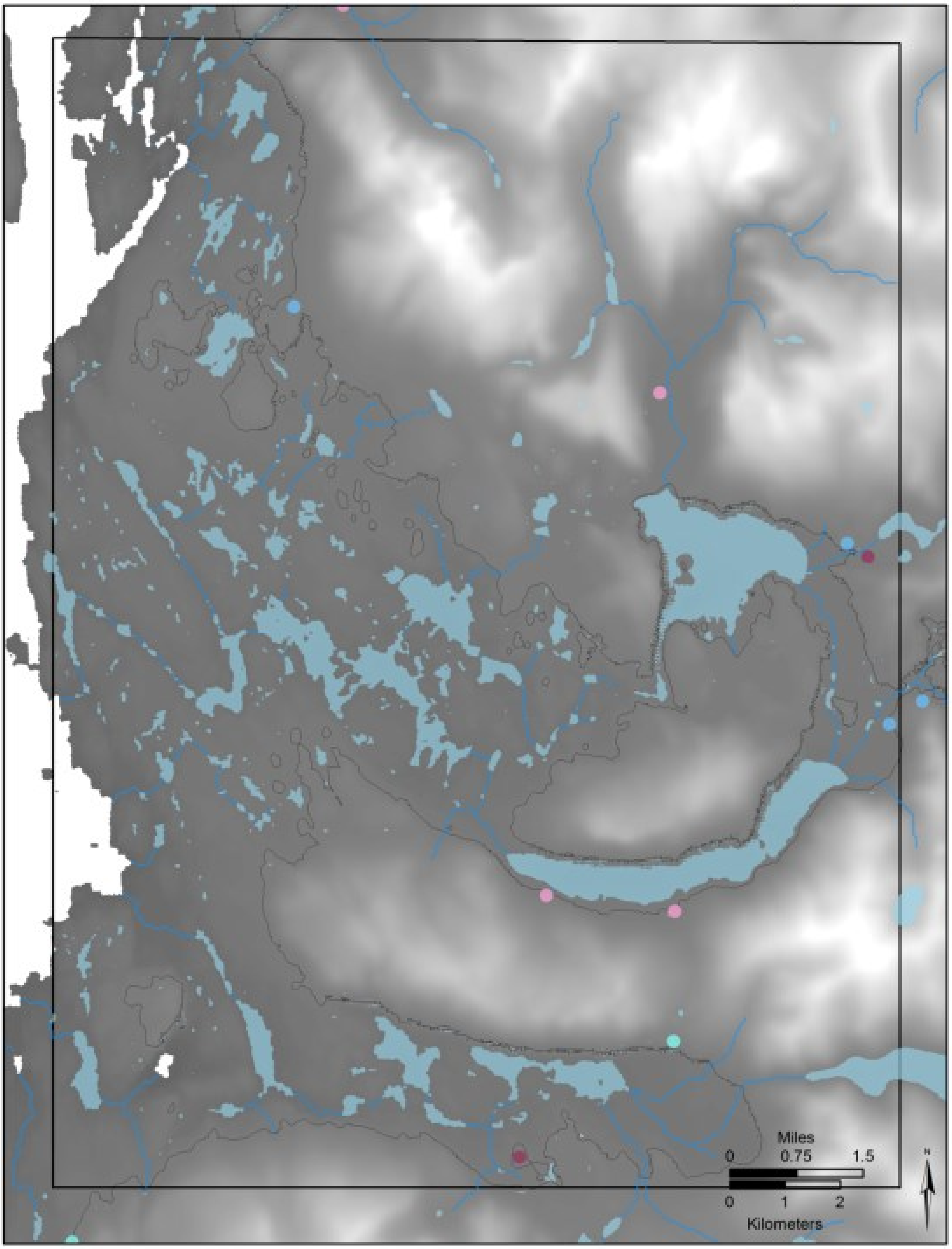
14,500 cal BP



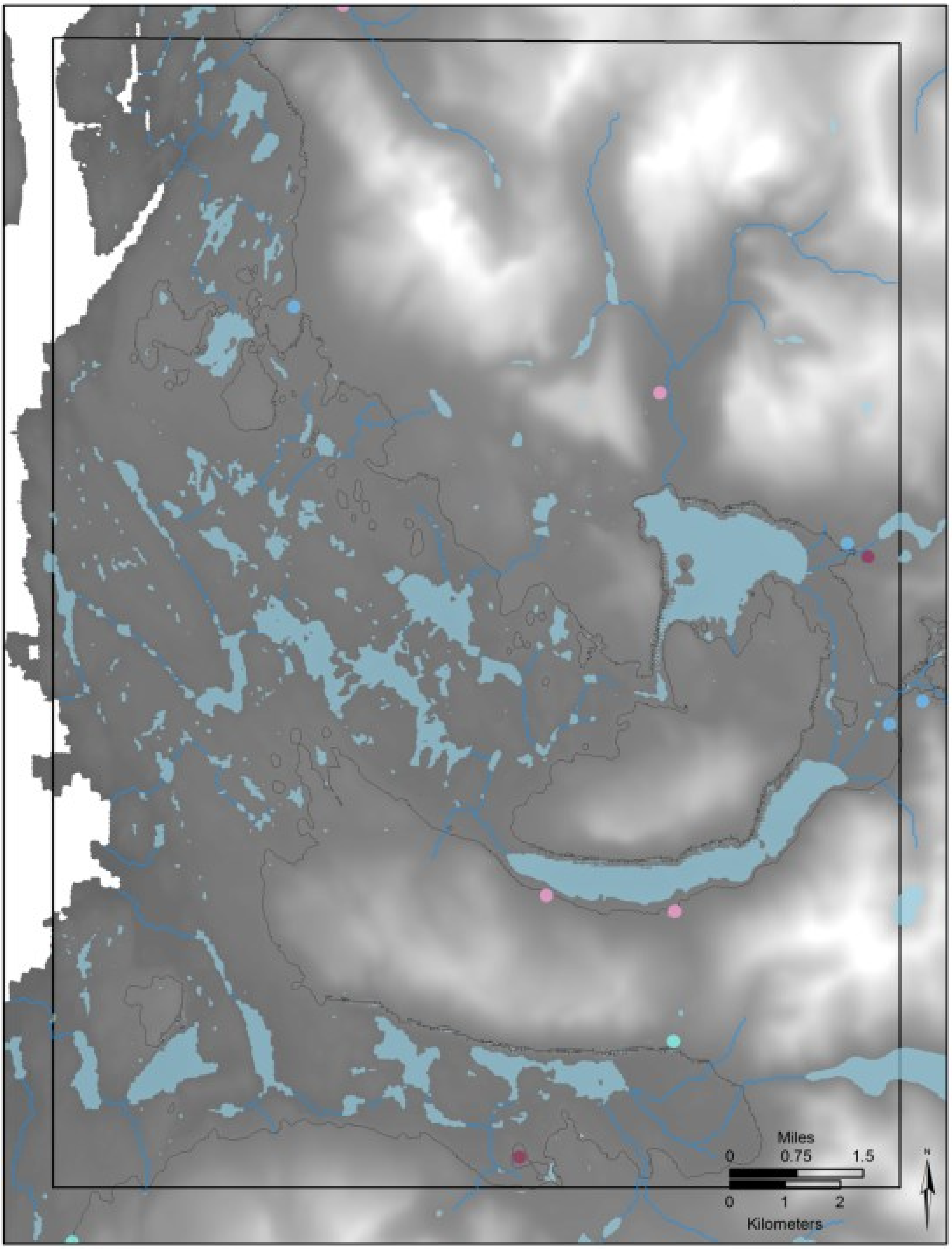
15,000 cal BP



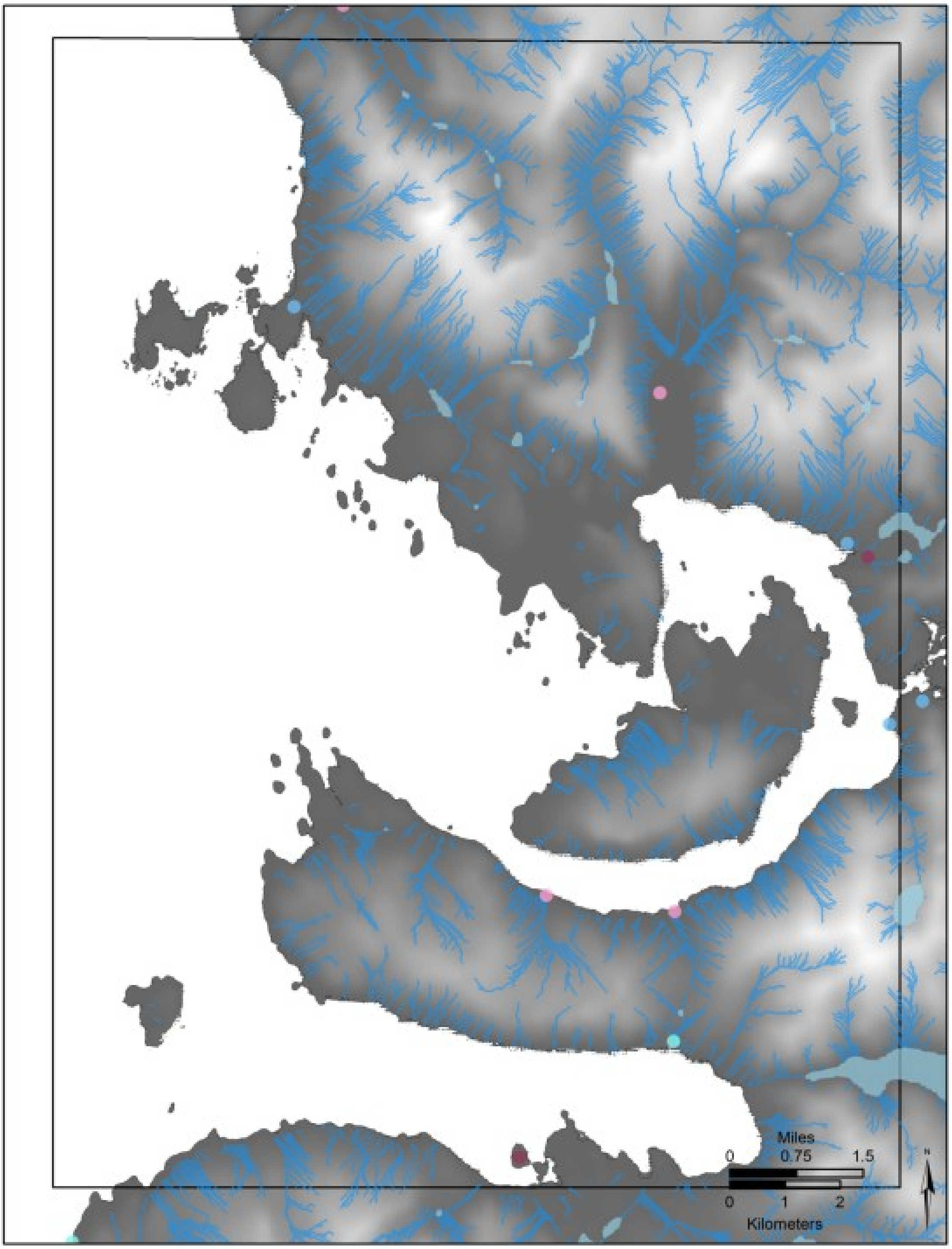
15,500 cal BP

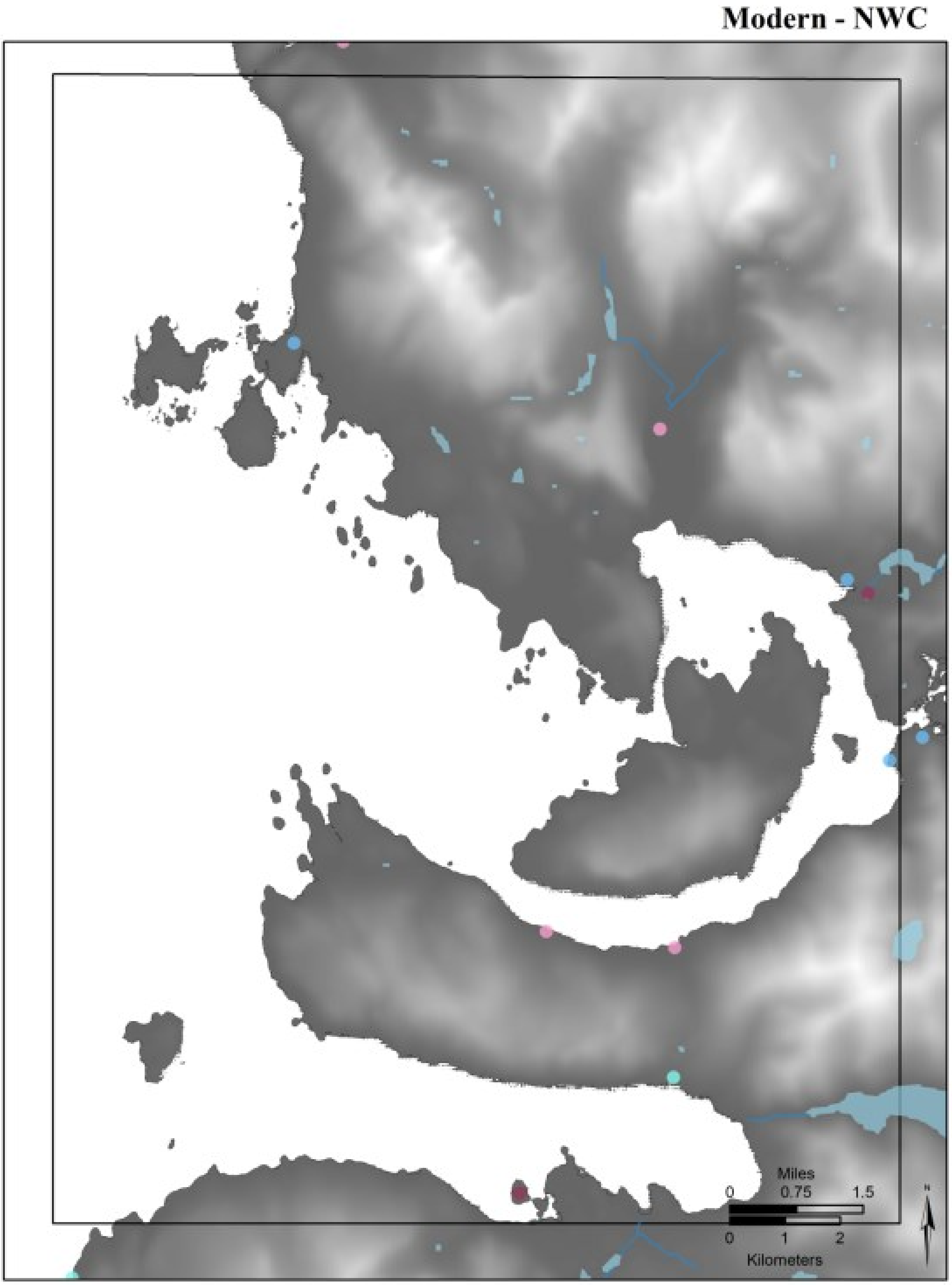


16,000 cal BP

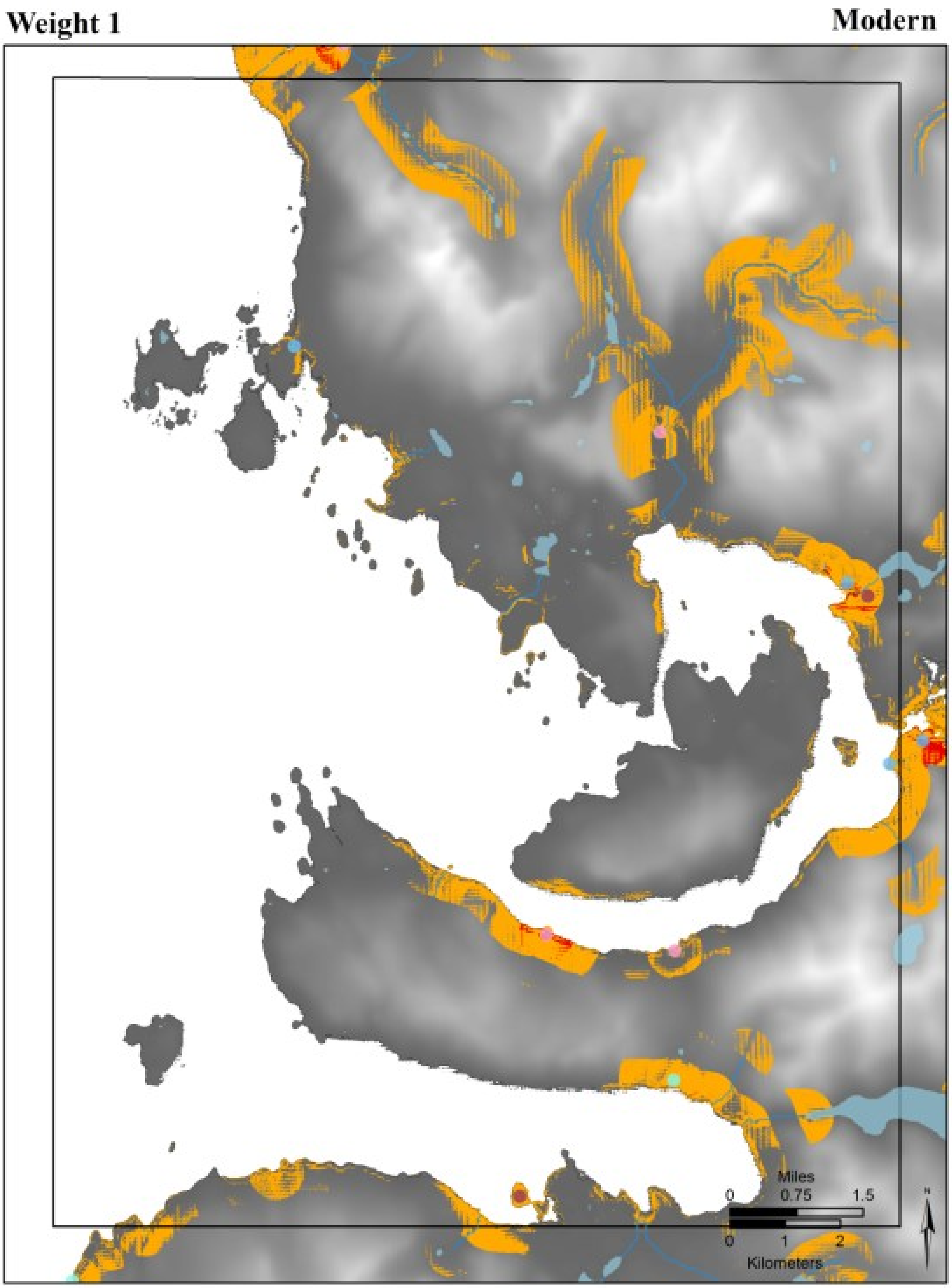


Modern - Small Area

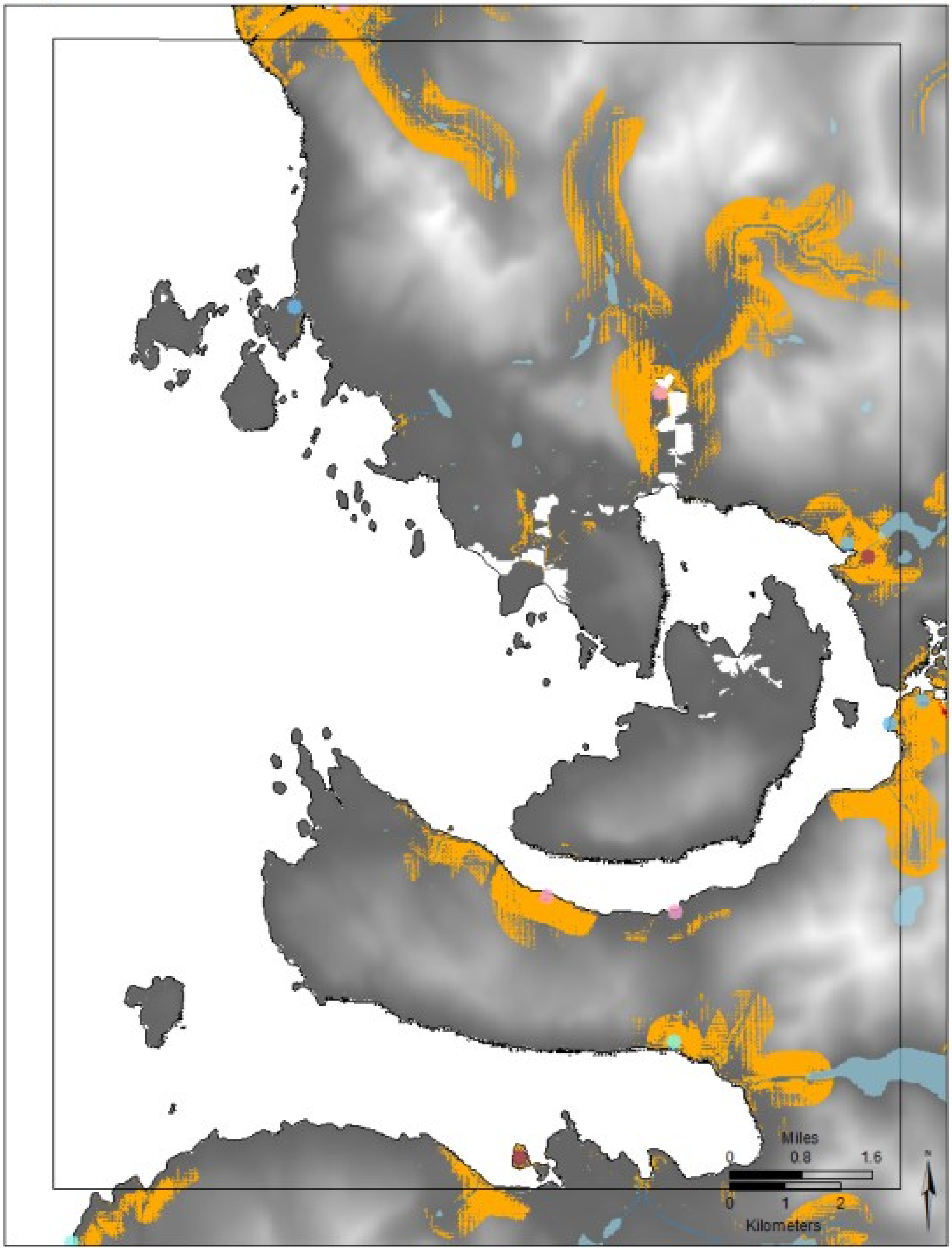



Modern - NWC
Miles
0
0.75
1.5
0
1
2
Kilometers
N

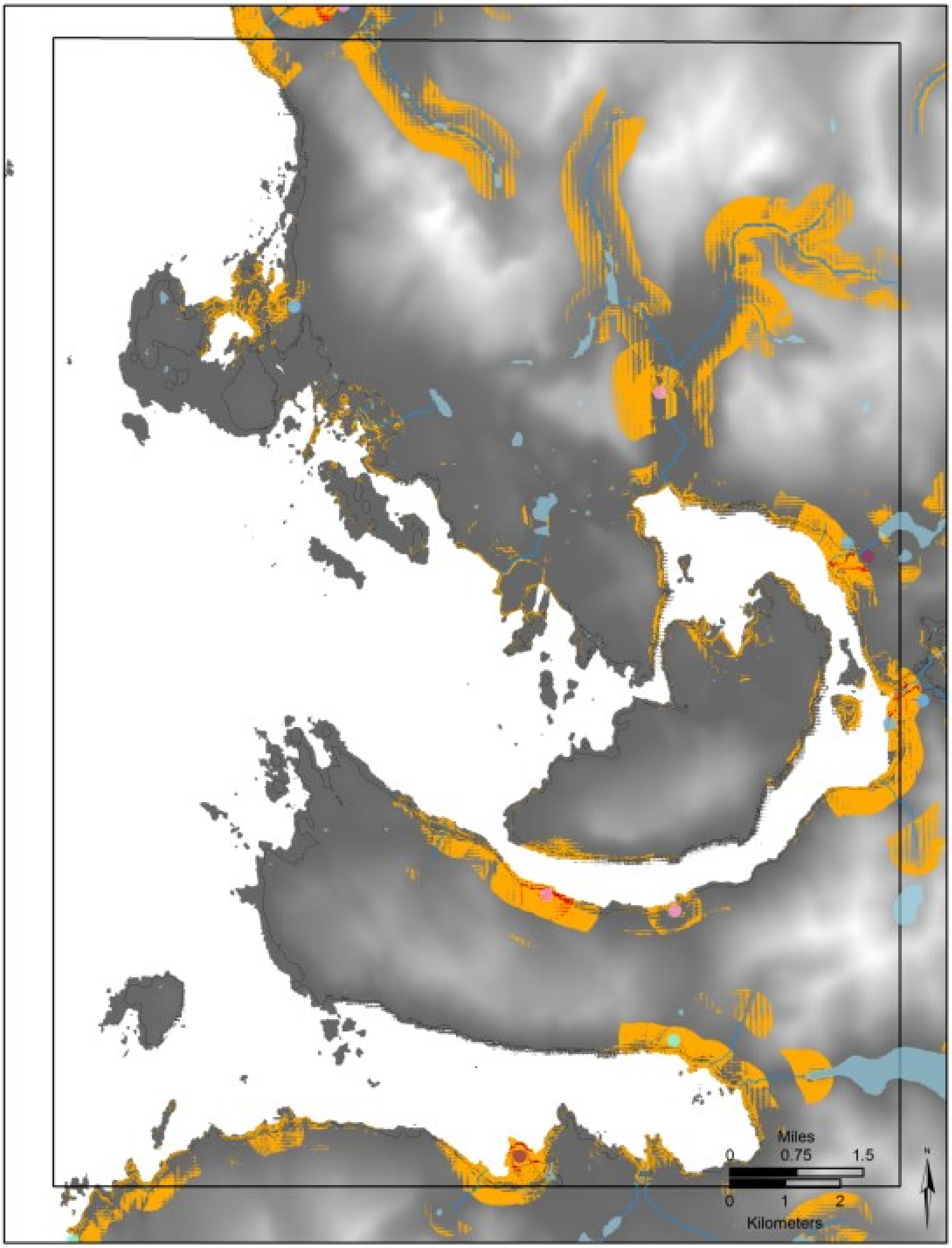
C.2 Weighted Overlay 1



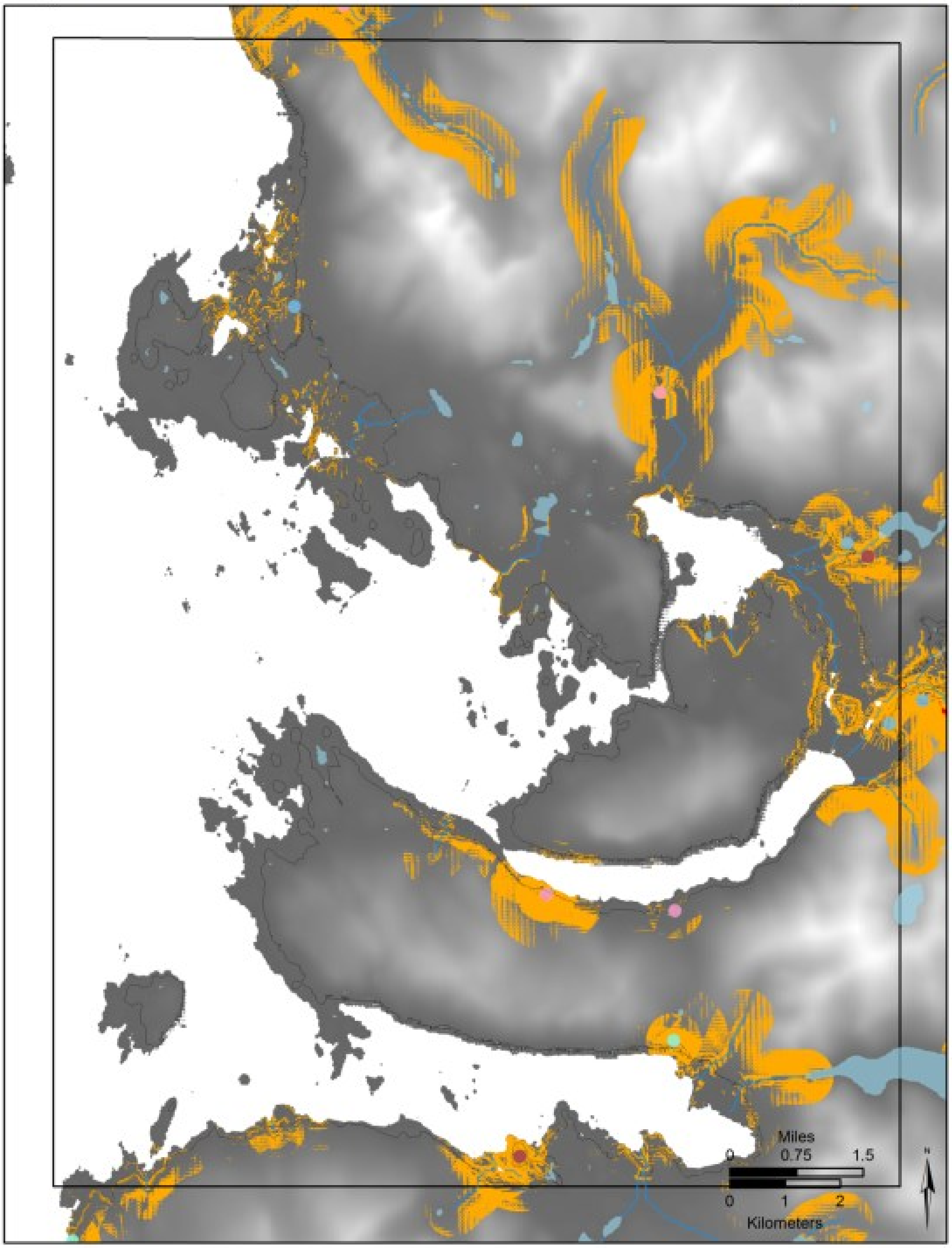
Weight 1 **10,500 cal BP**



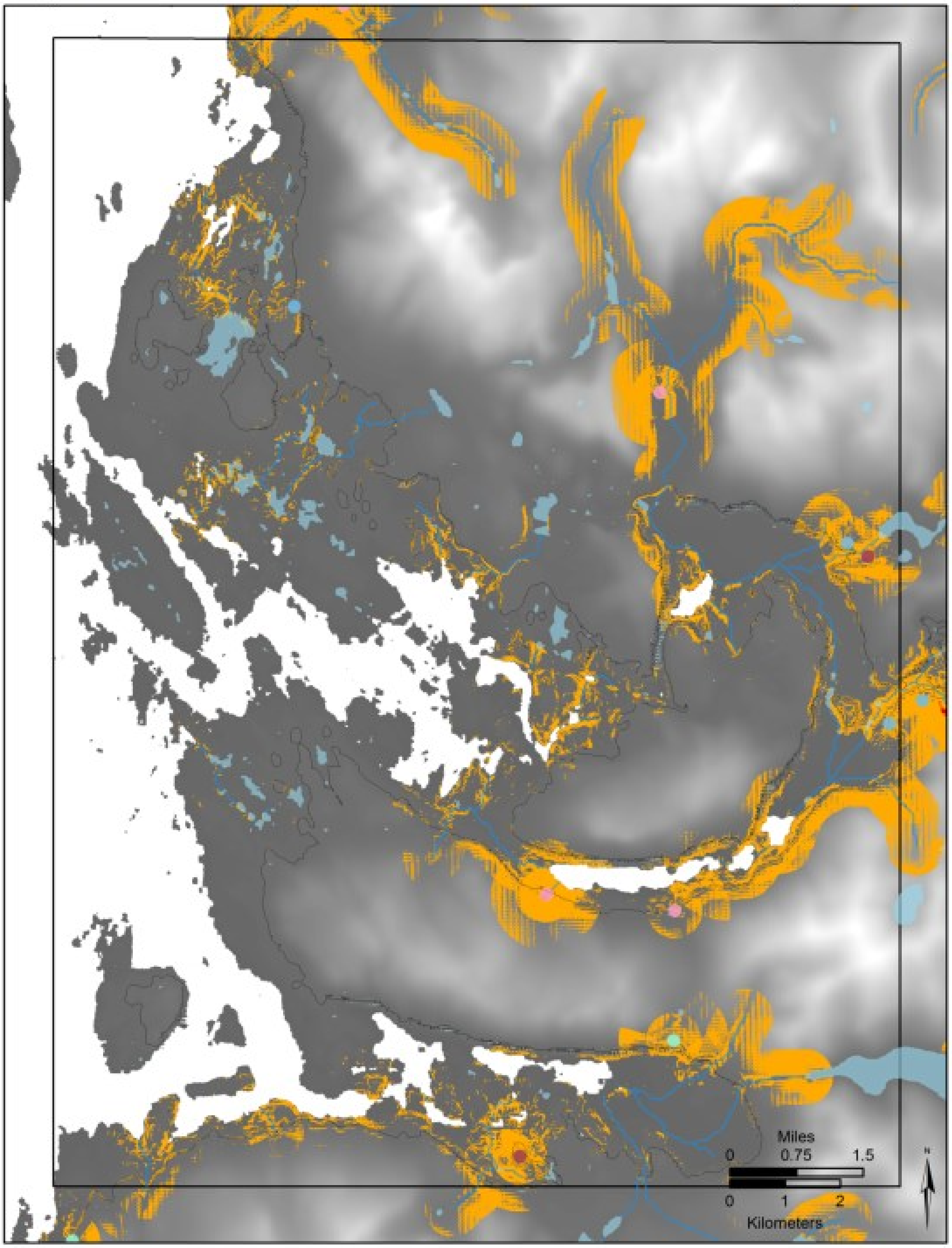
Weight 1 **11,000 cal BP**



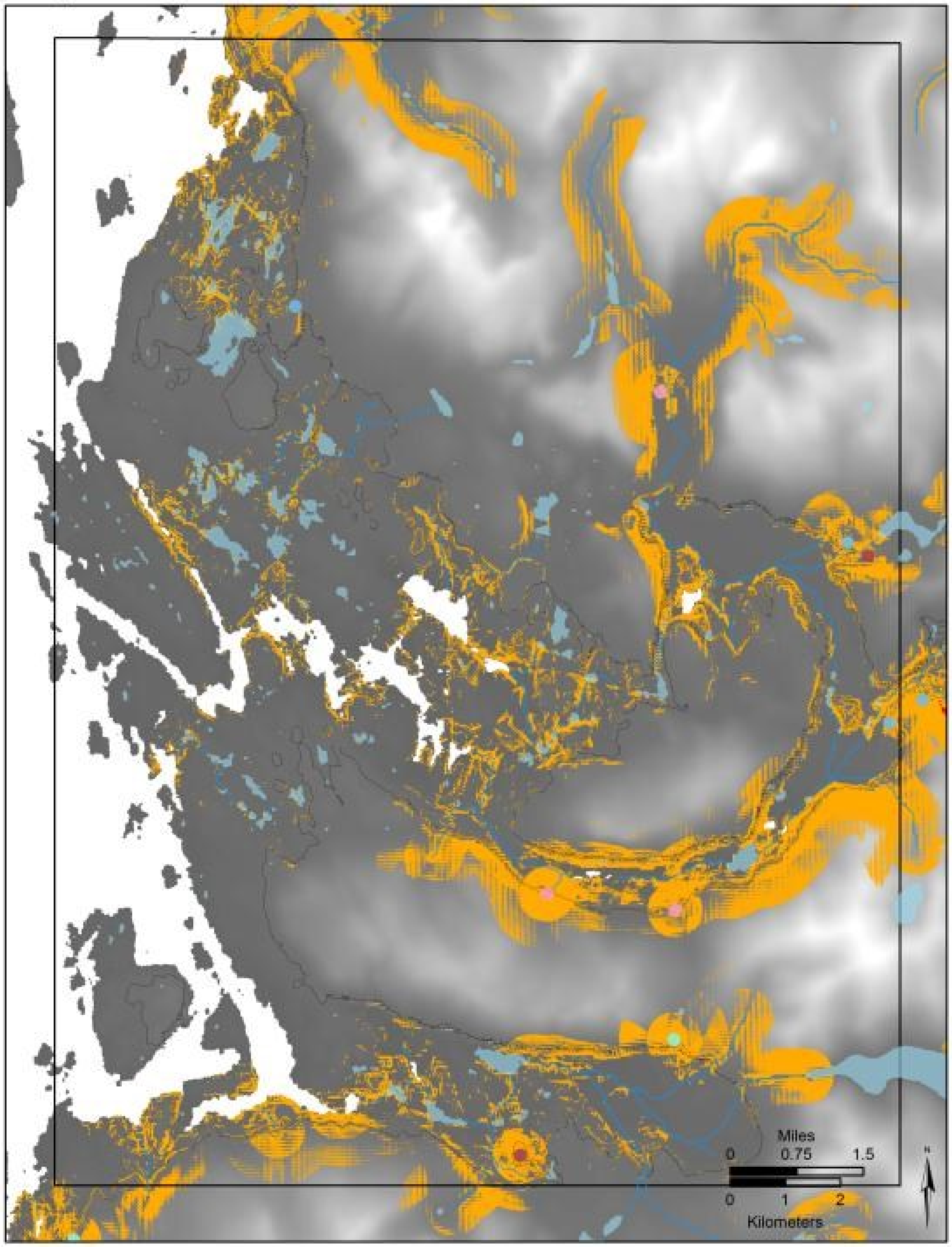
Weight 1 **11,500 cal BP**



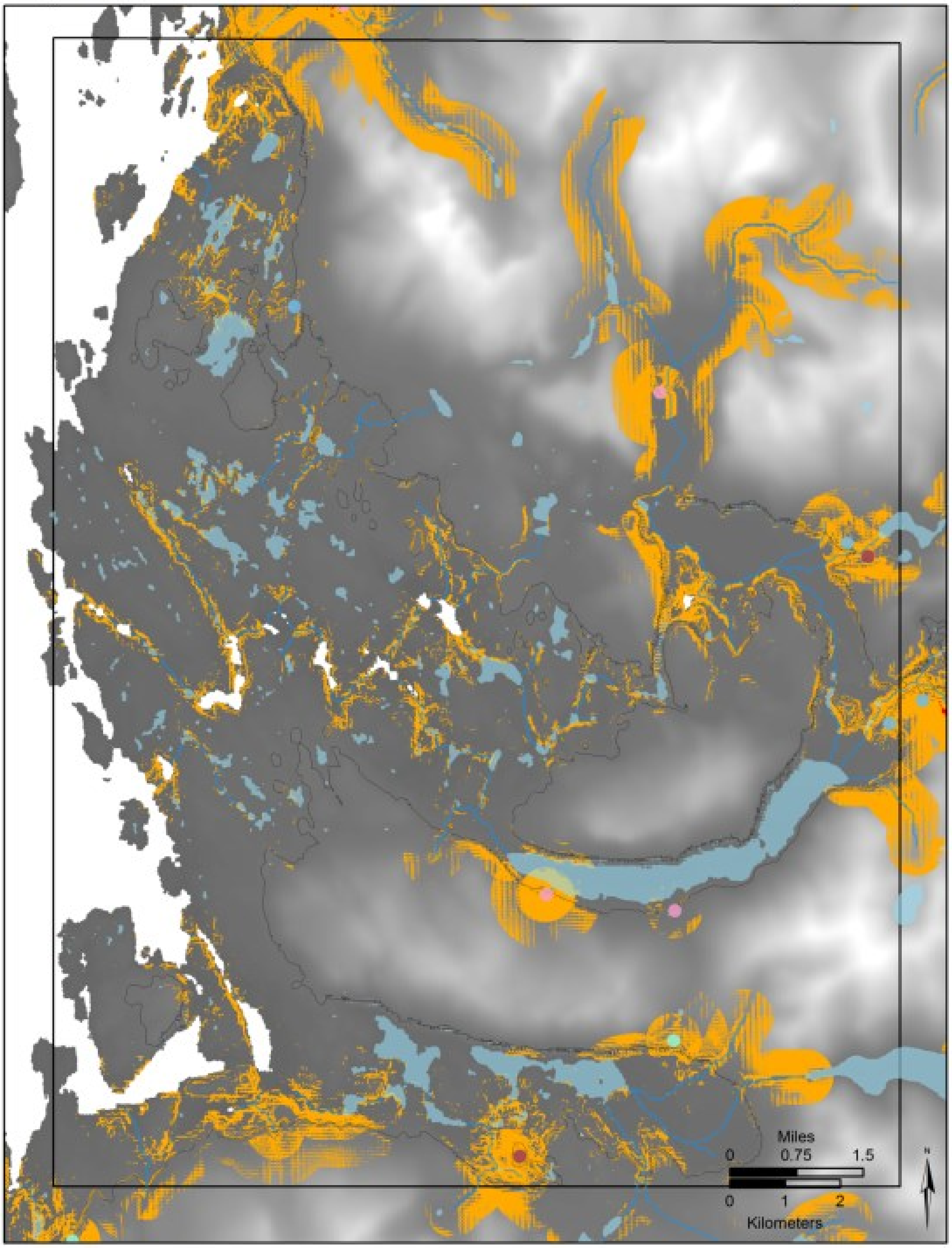
Weight 1 **12,000 cal BP**



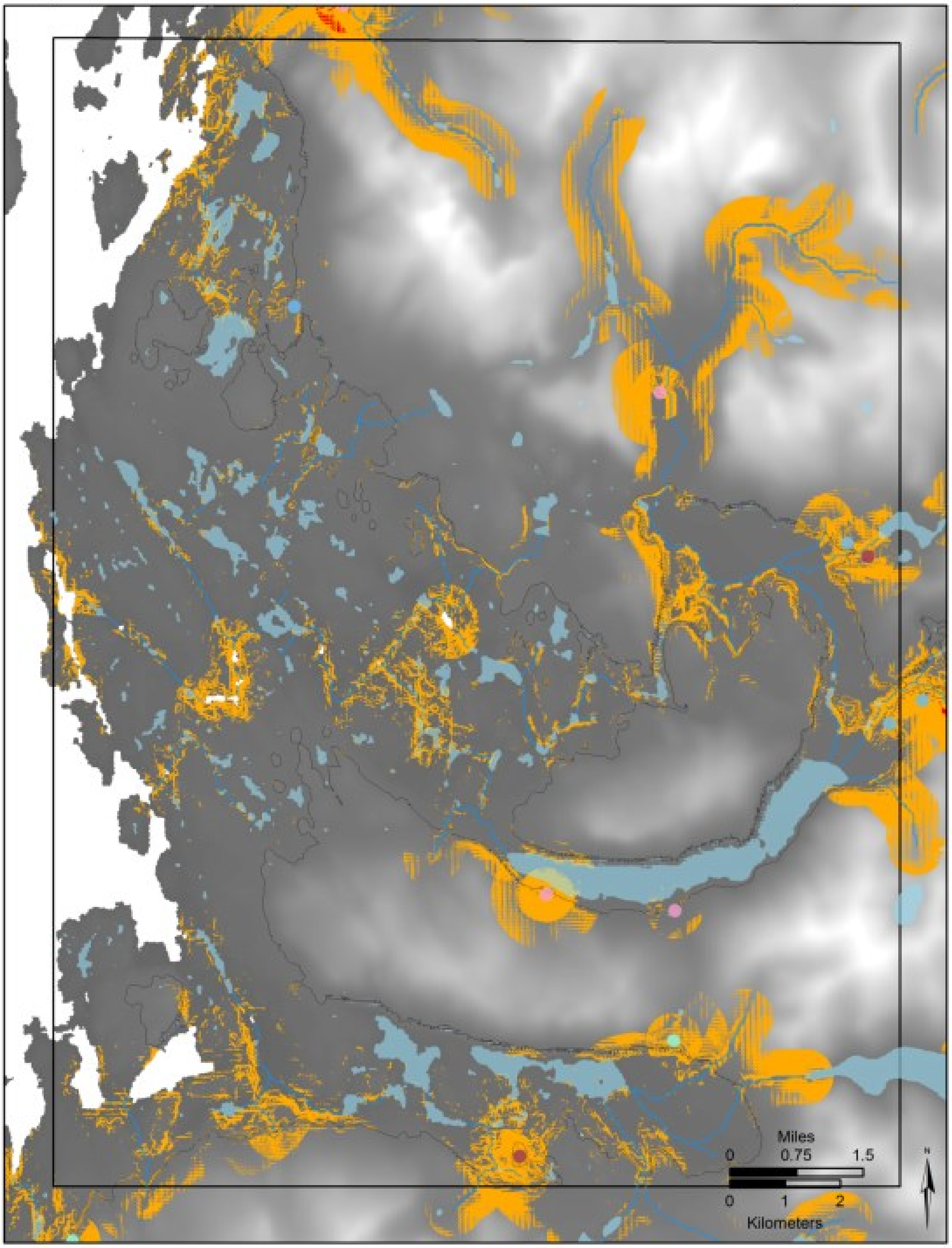
Weight 1 **12,500 cal BP**



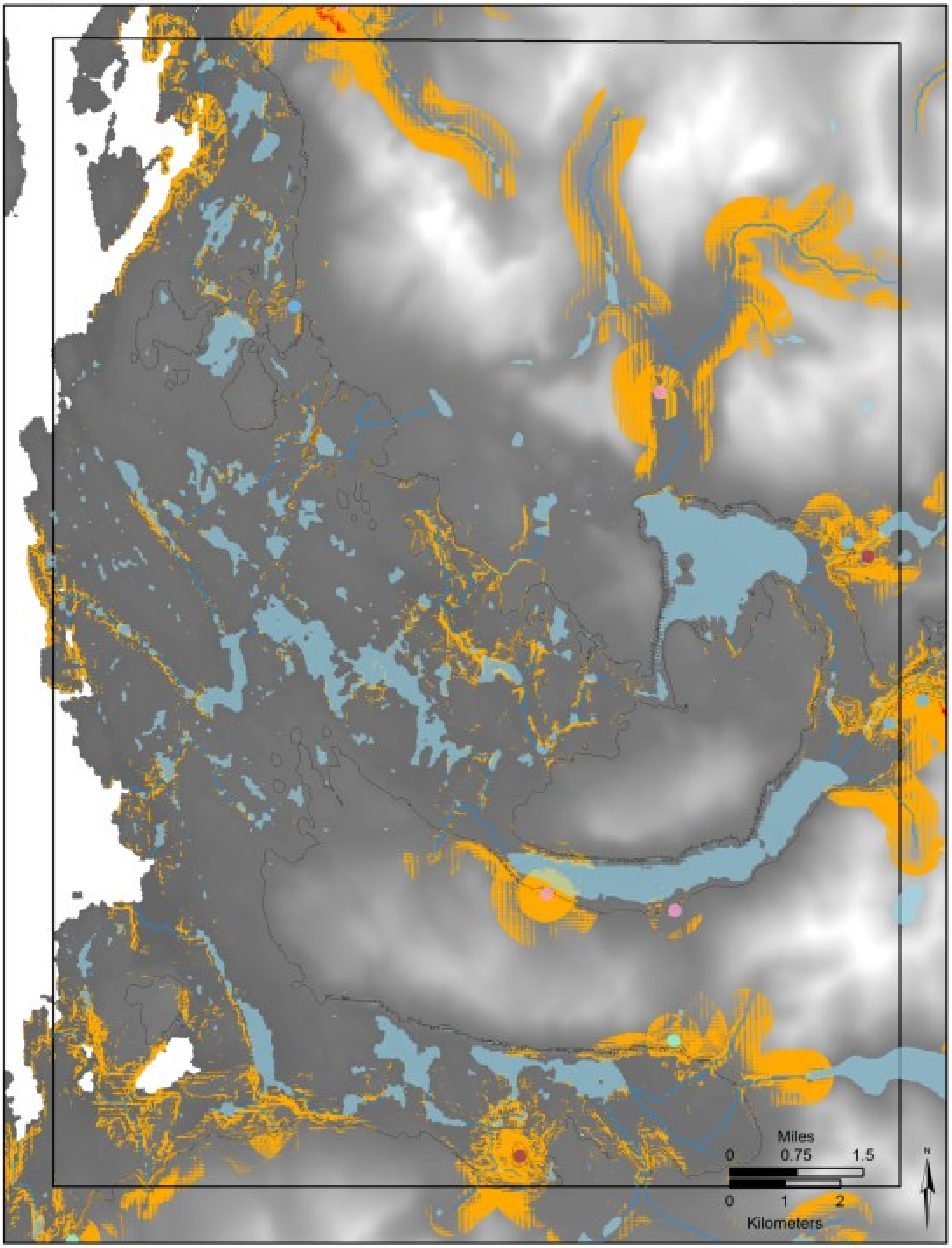
Weight 1 **13,000 cal BP**



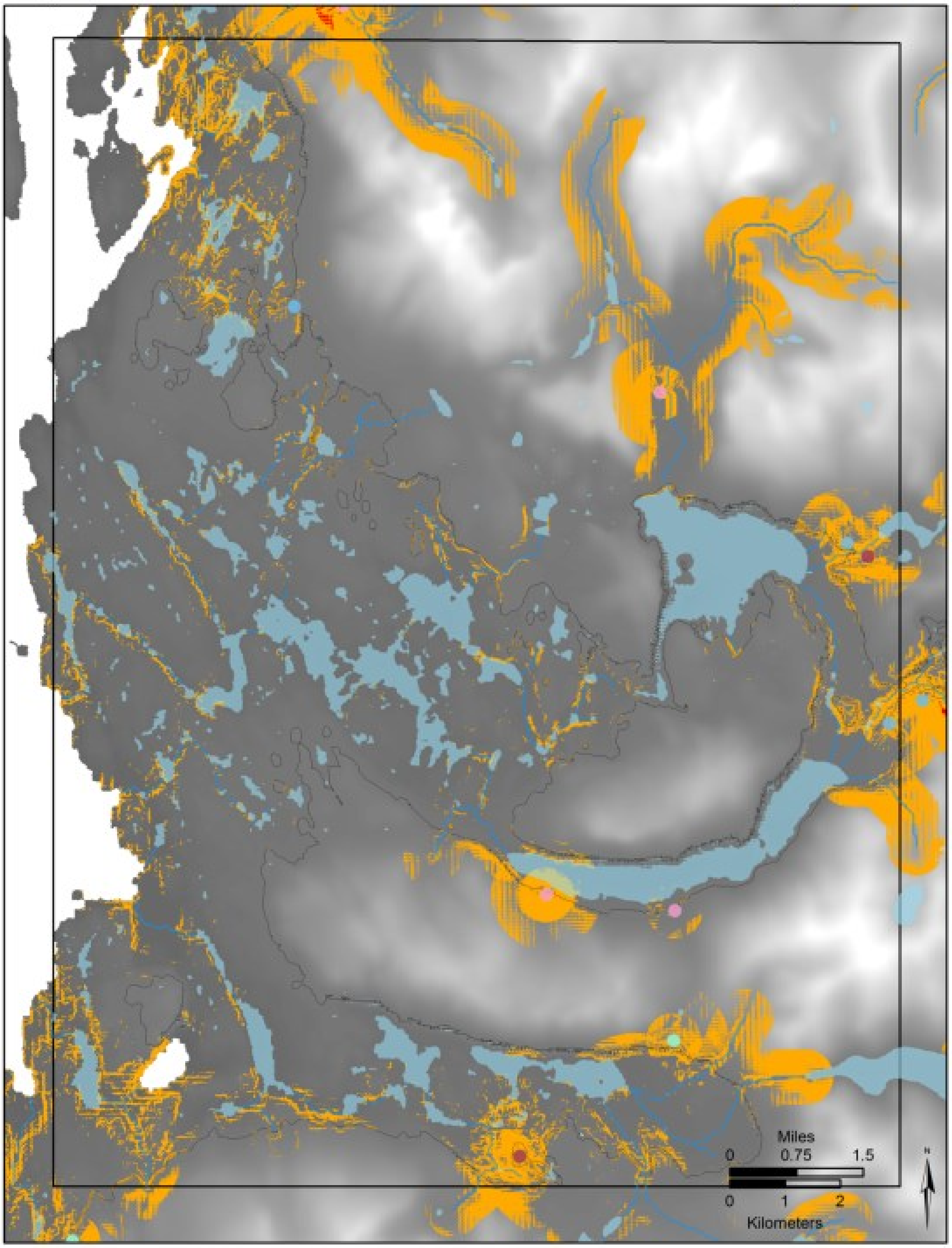
Weight 1 **13,500 cal BP**



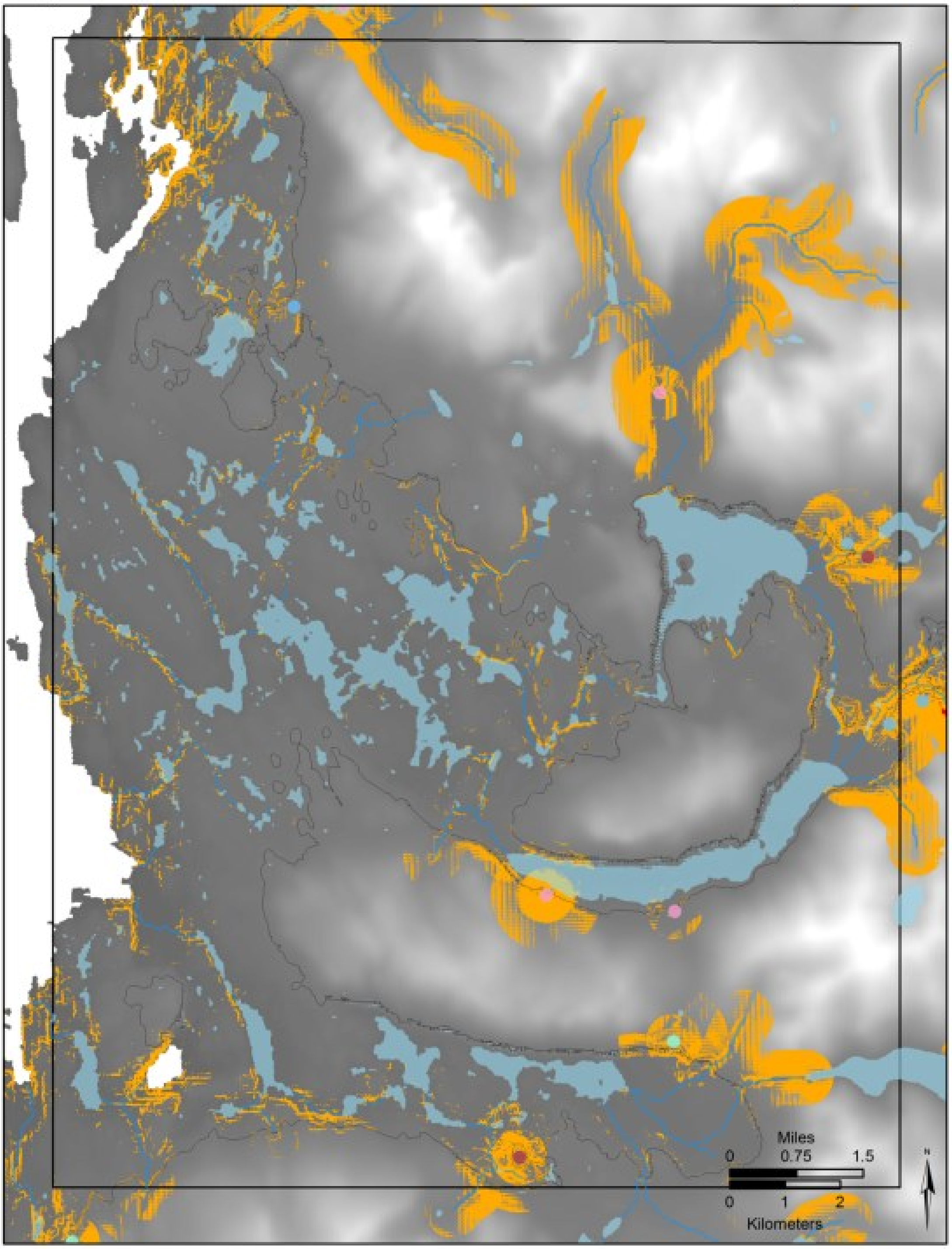
Weight 1 **14,000 cal BP**



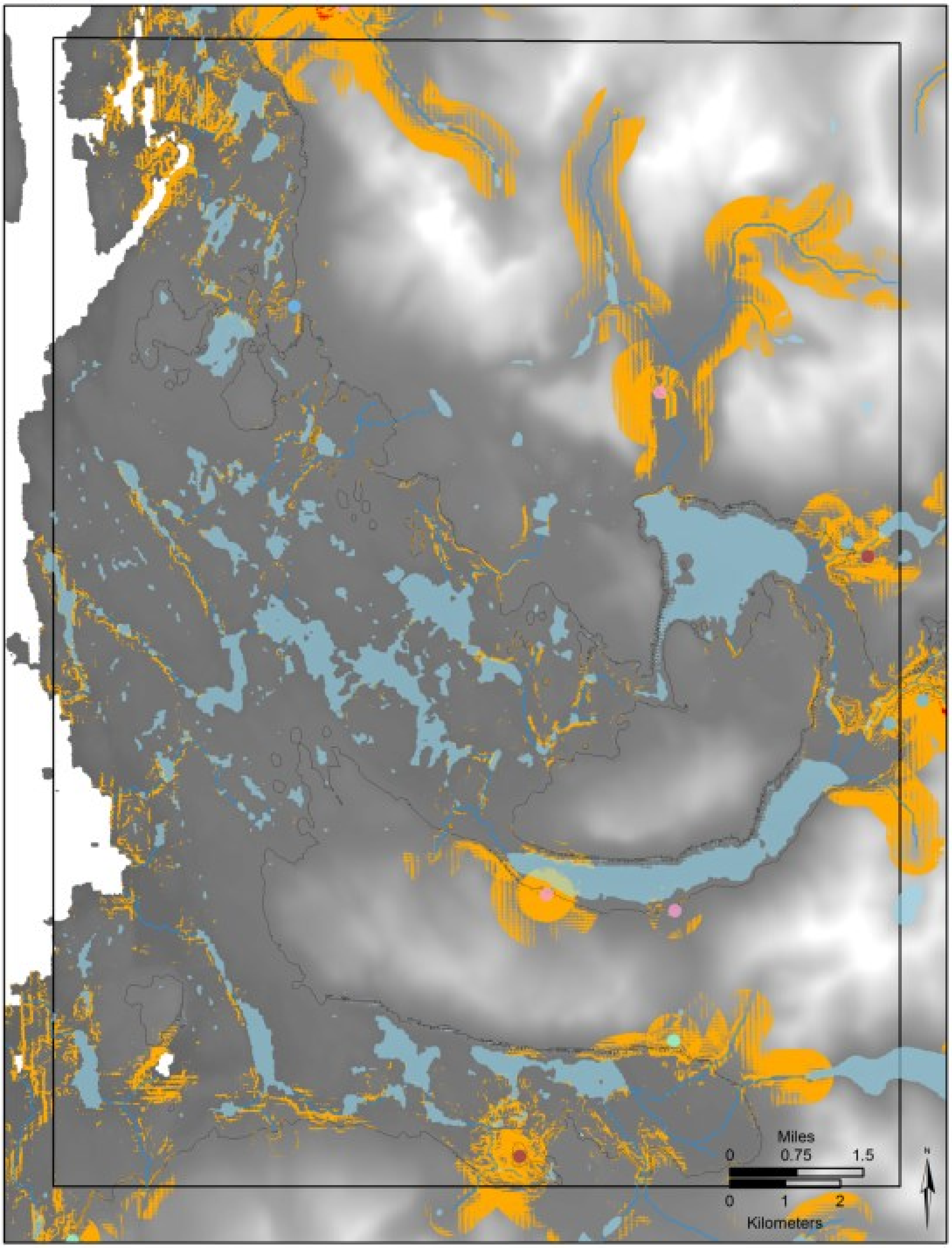
Weight 1 **14,500 cal BP**



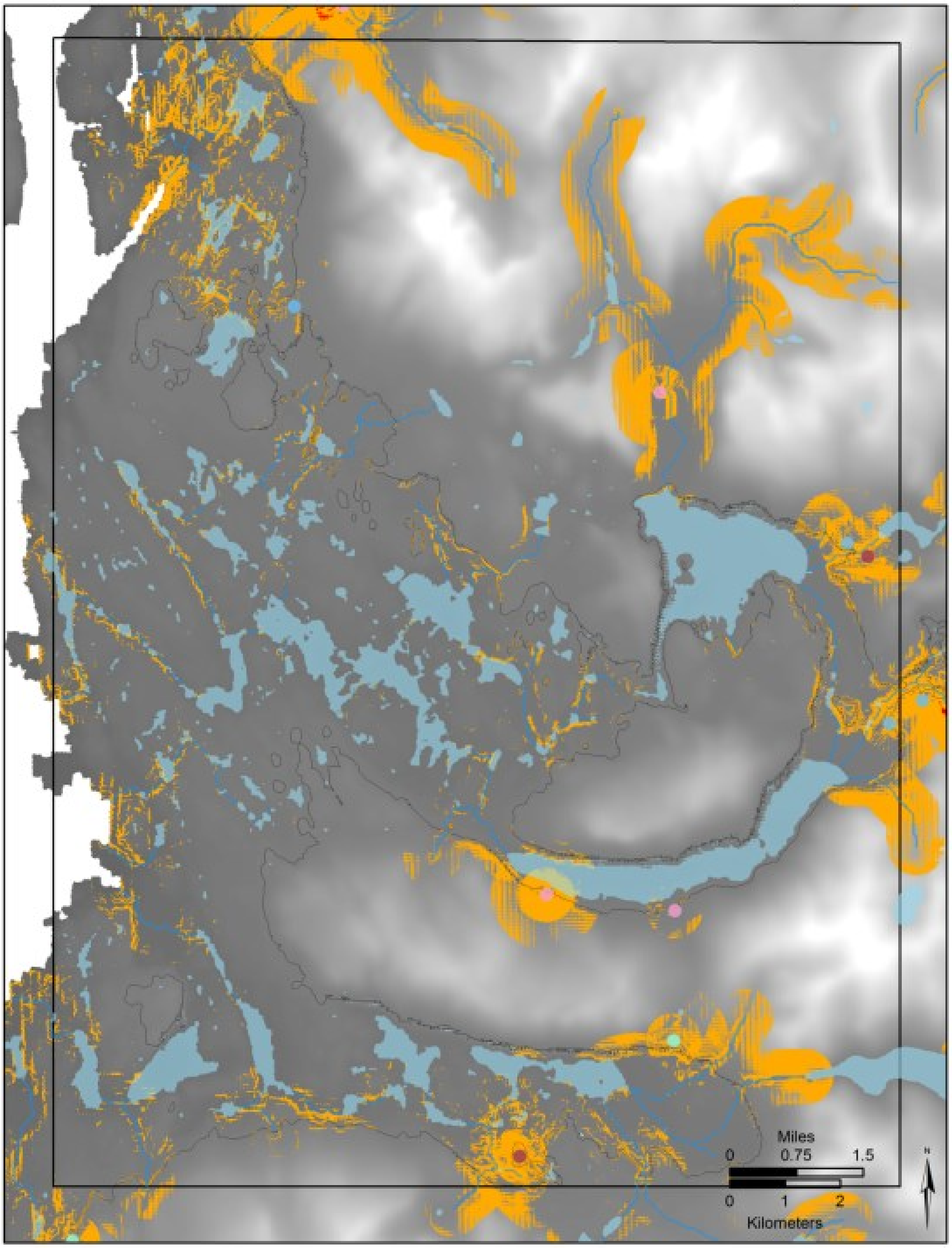
Weight 1 **15,000 cal BP**



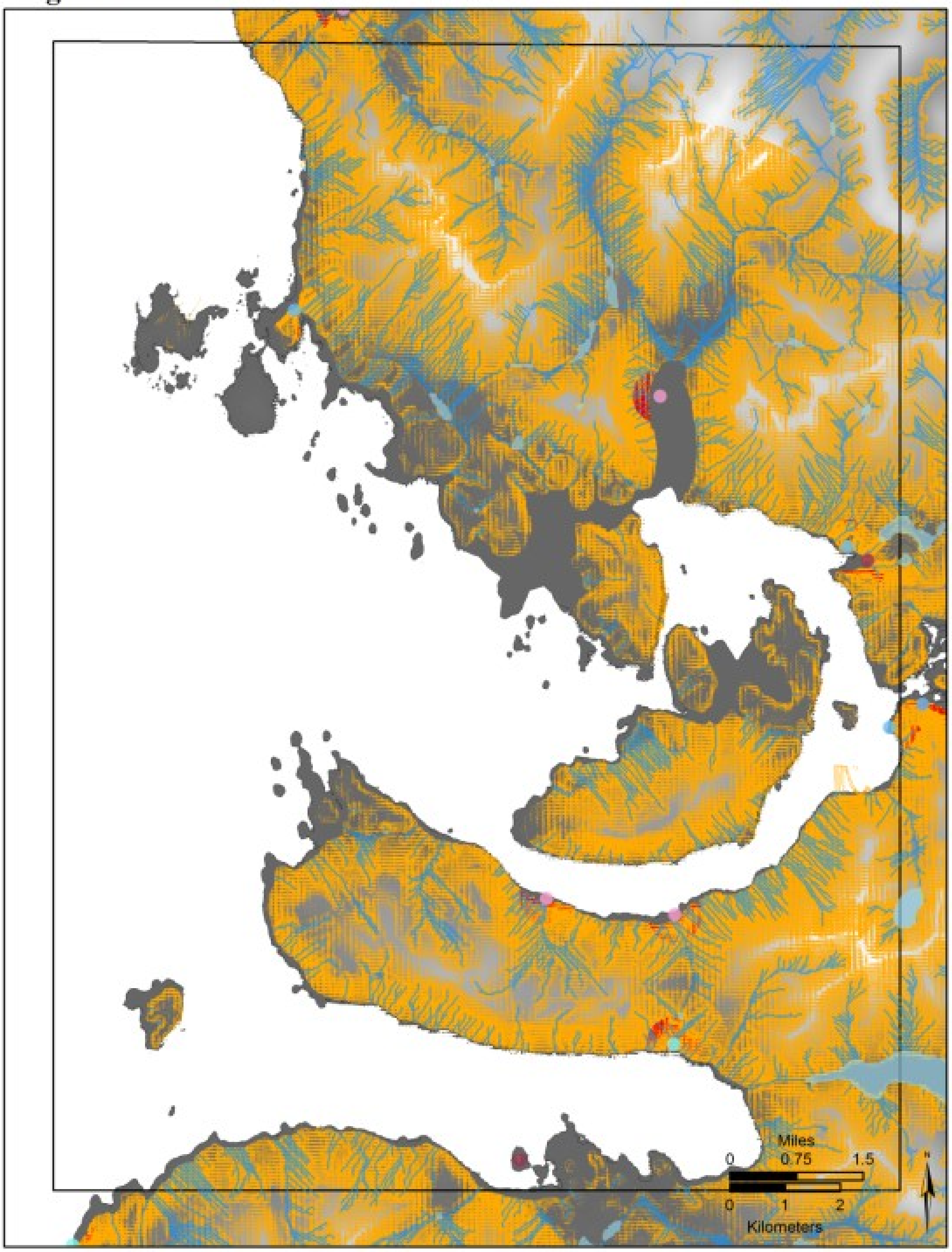
Weight 1 **15,500 cal BP**

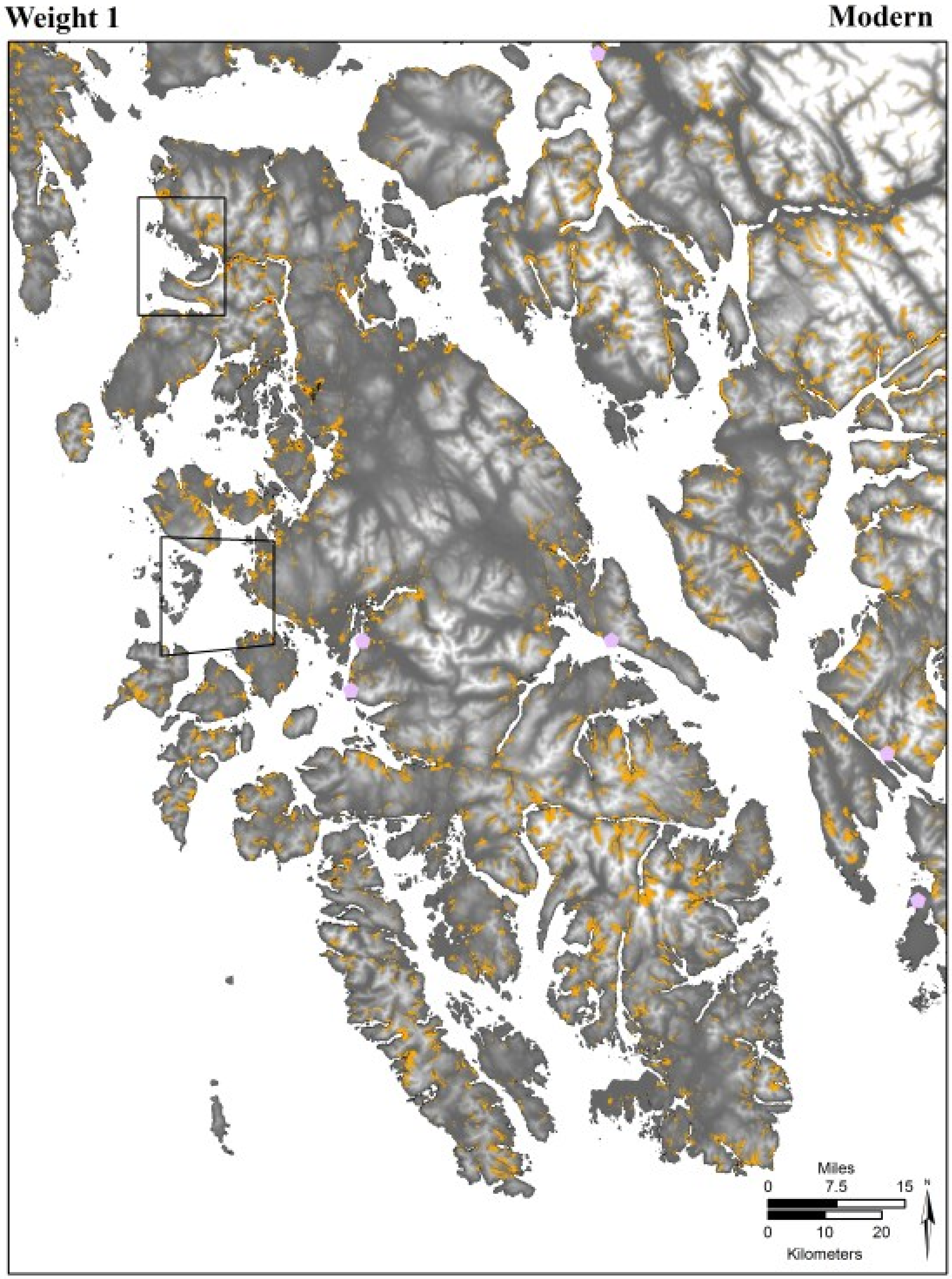


Weight 1 **16,000 cal BP**



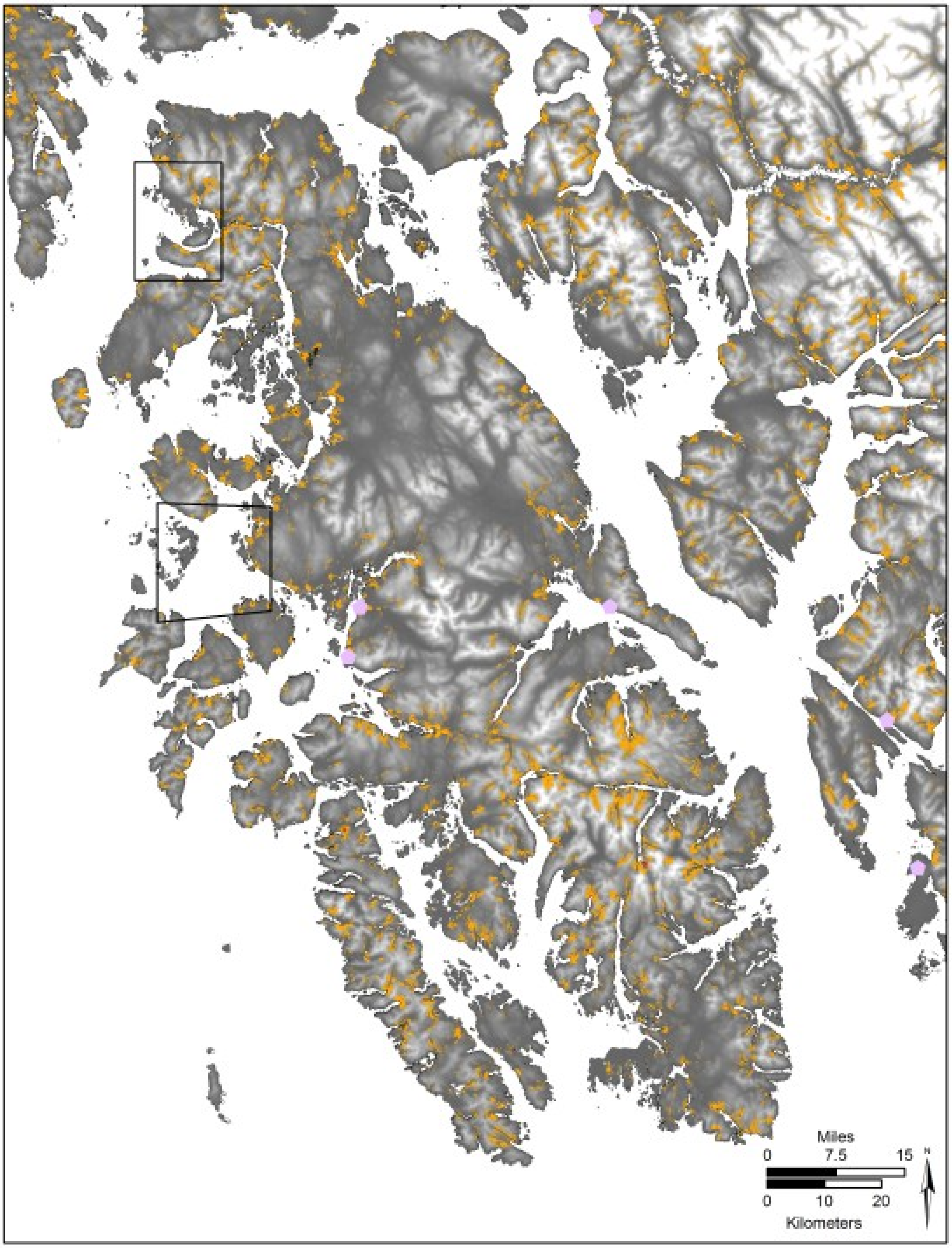
Weight 1 **Modern - Small Area**



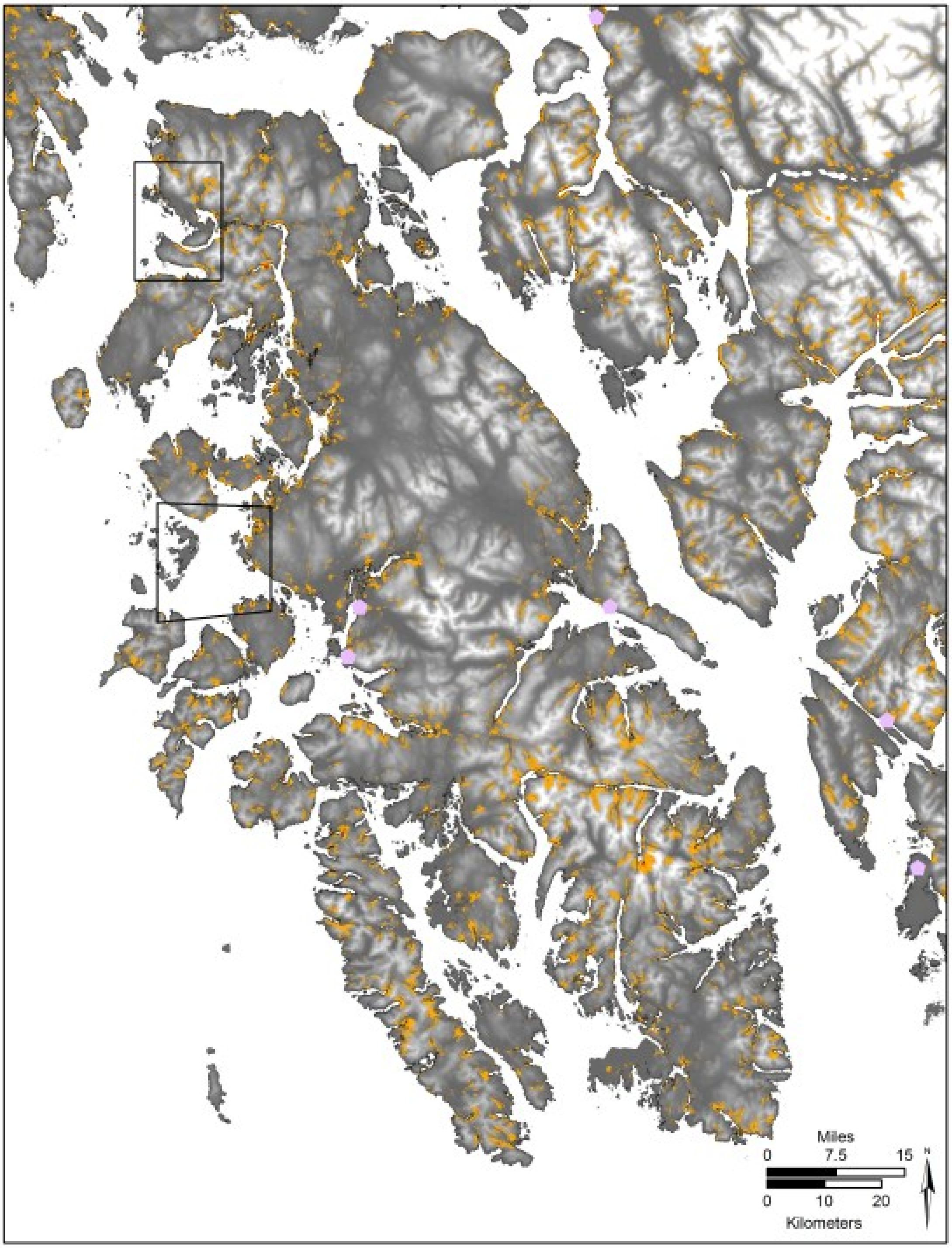


Weight 1
Modern
Miles
0
7.5
15
0
10
20
Kilometers
N

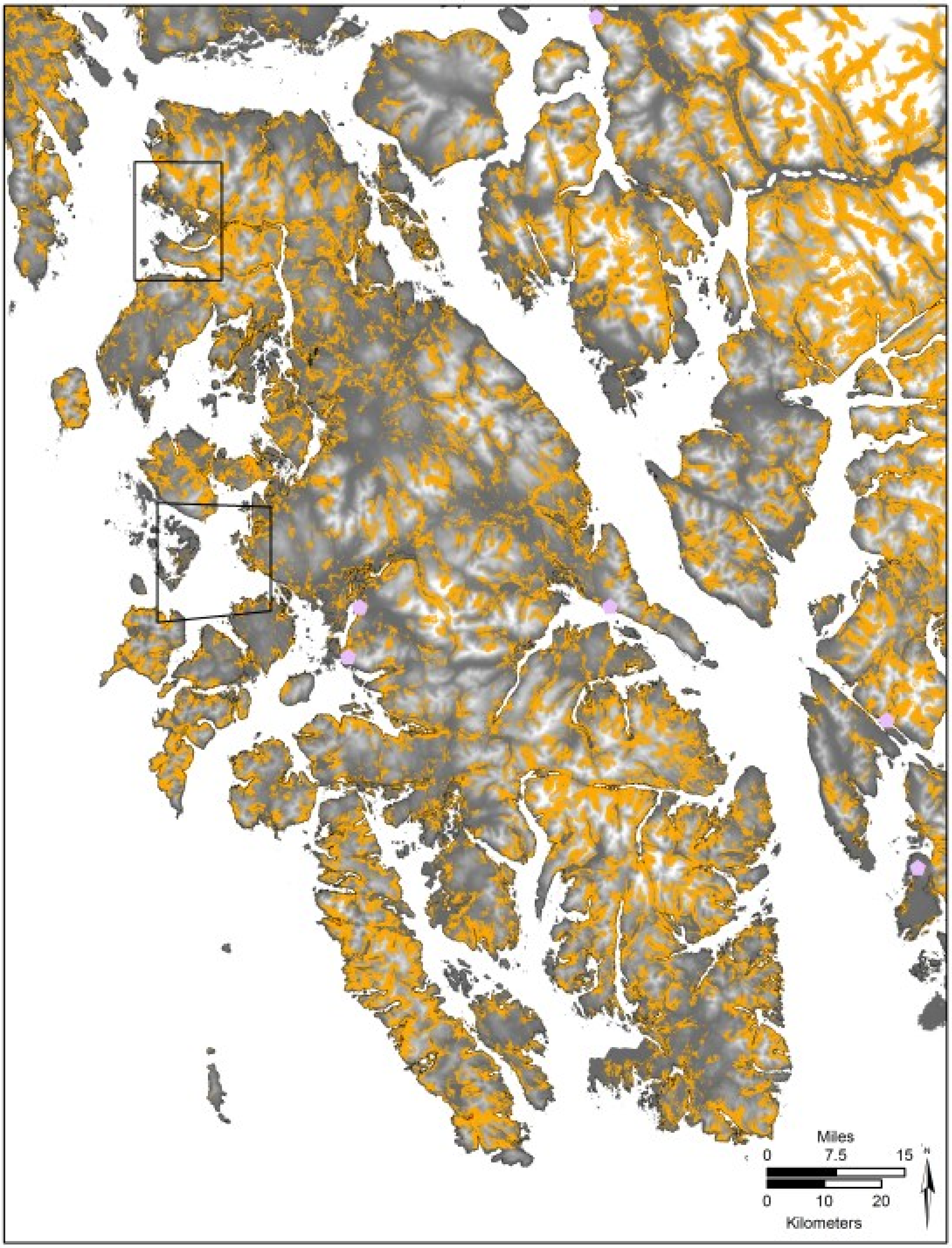
Weight 1 **10,500 cal BP**



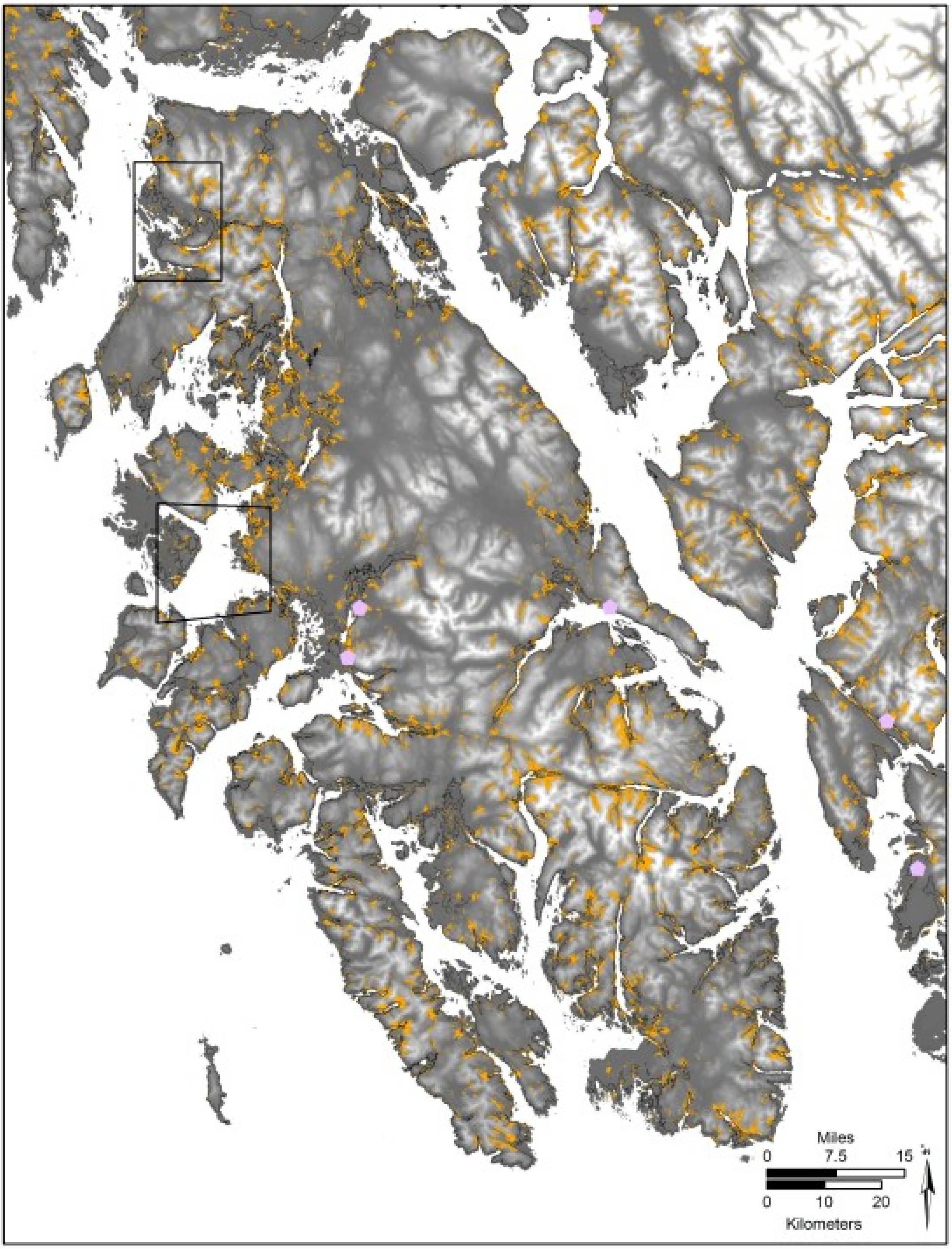
Weight 1 **11,000 cal BP**



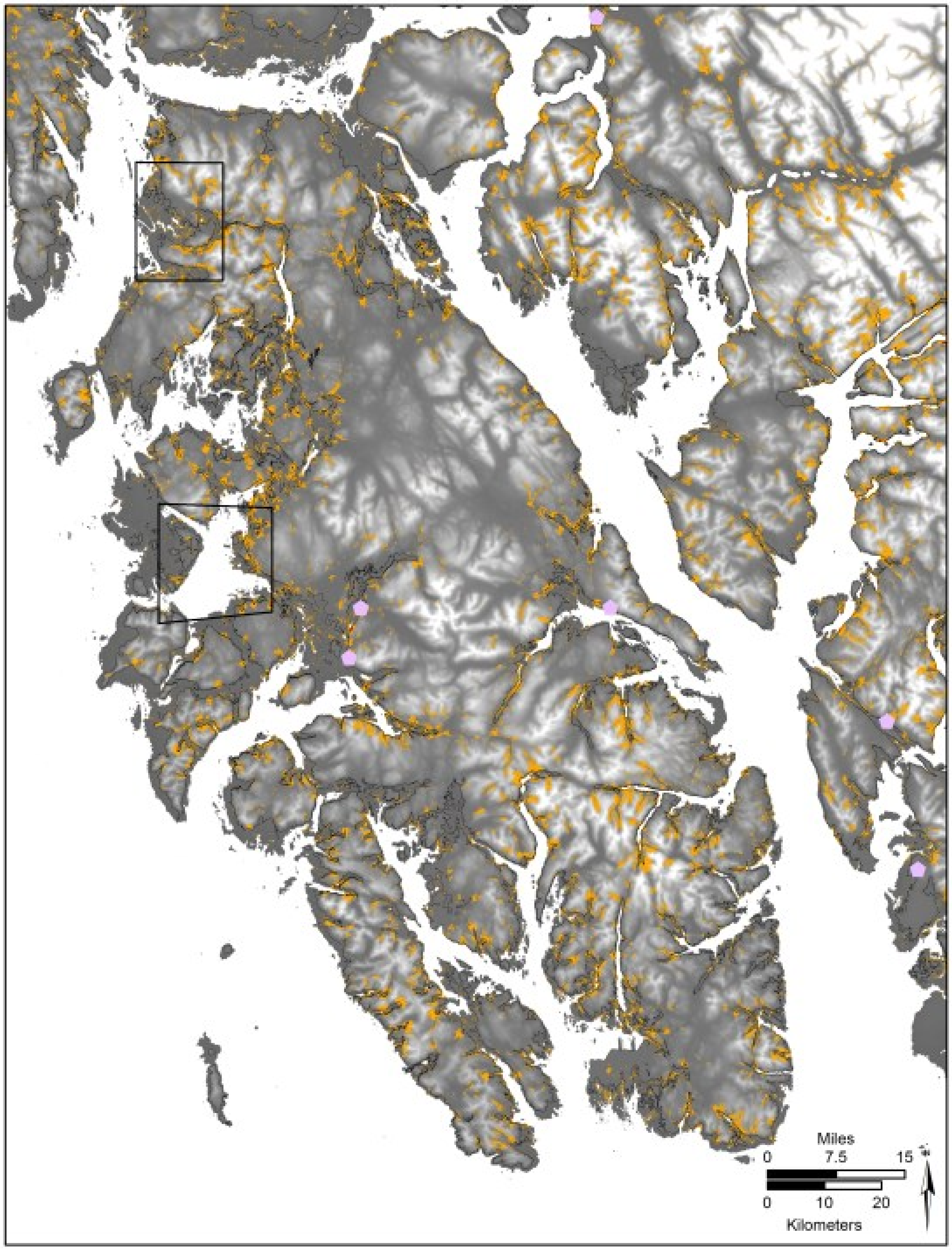
Weight 1a **11,500 cal BP**



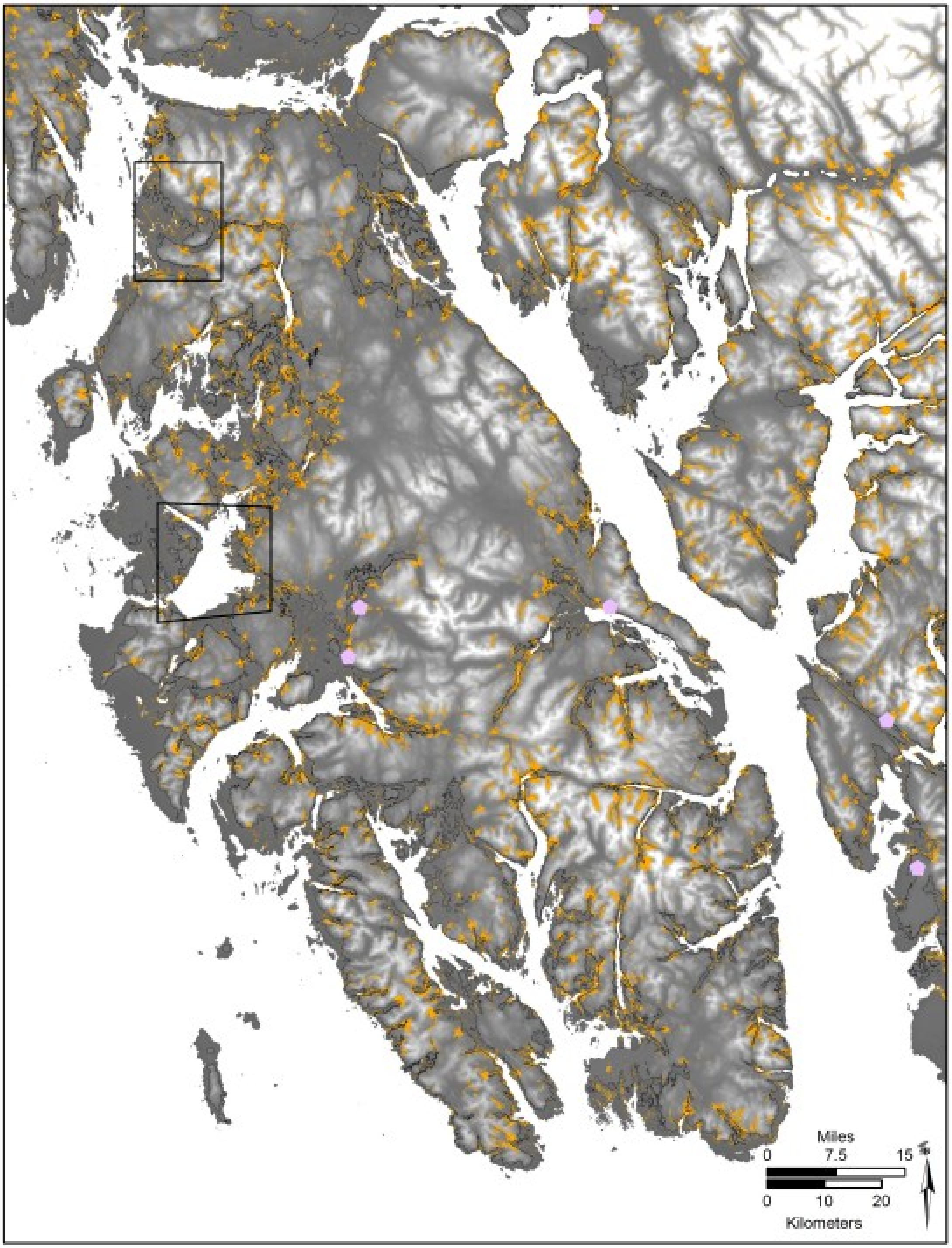
Weight 1 **12,000 cal BP**



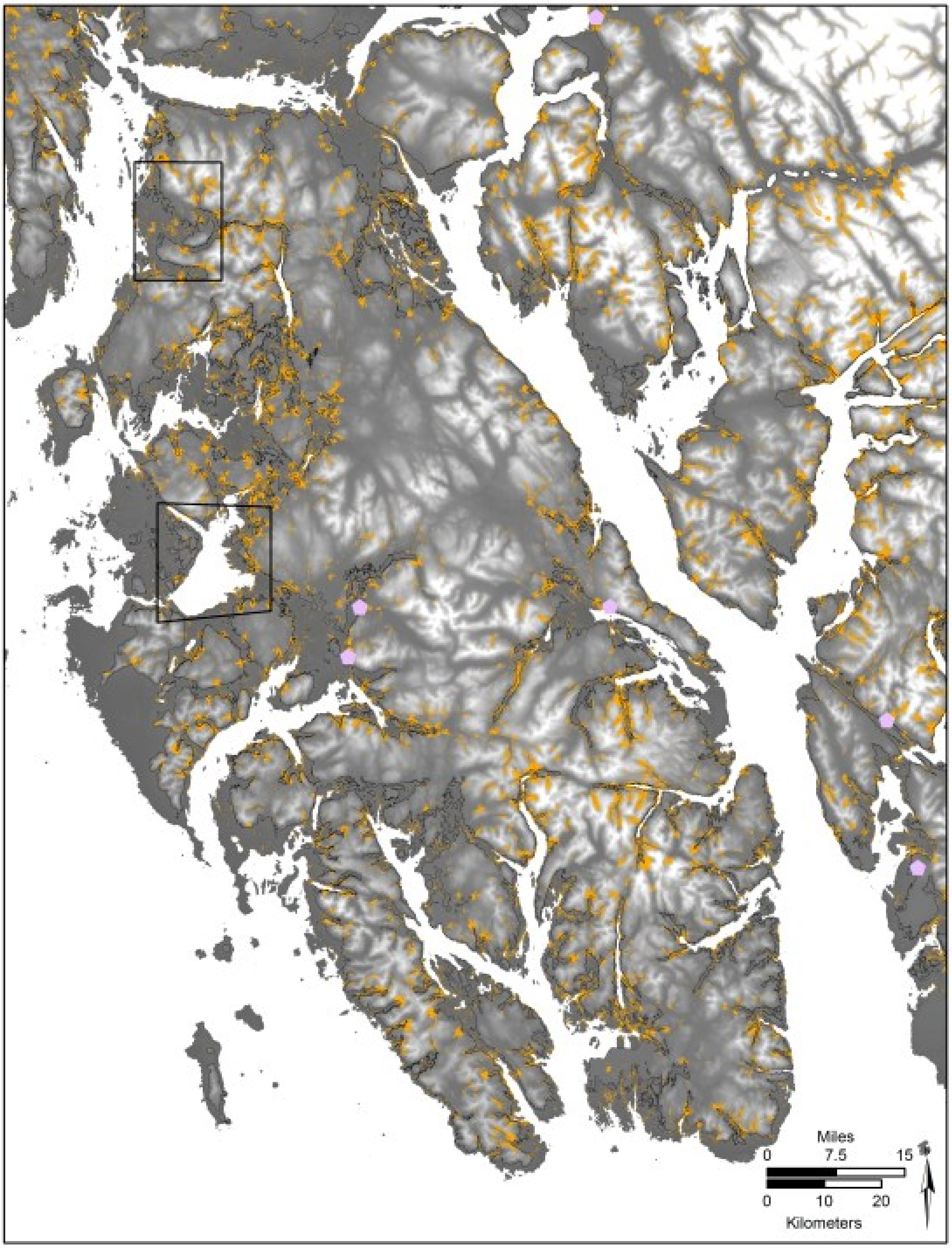
Weight 1 **12,500 cal BP**



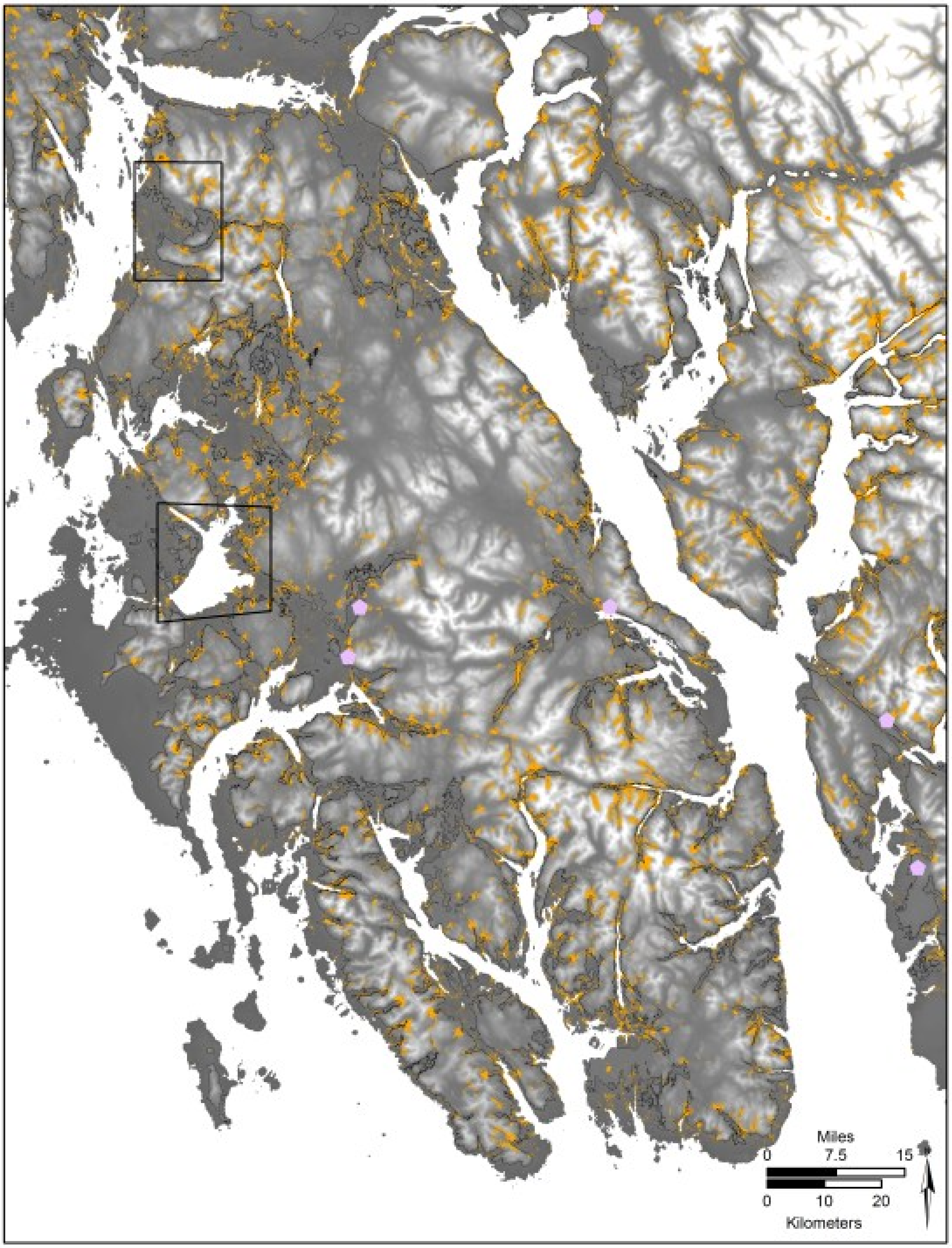
Weight 1 **13,000 cal BP**



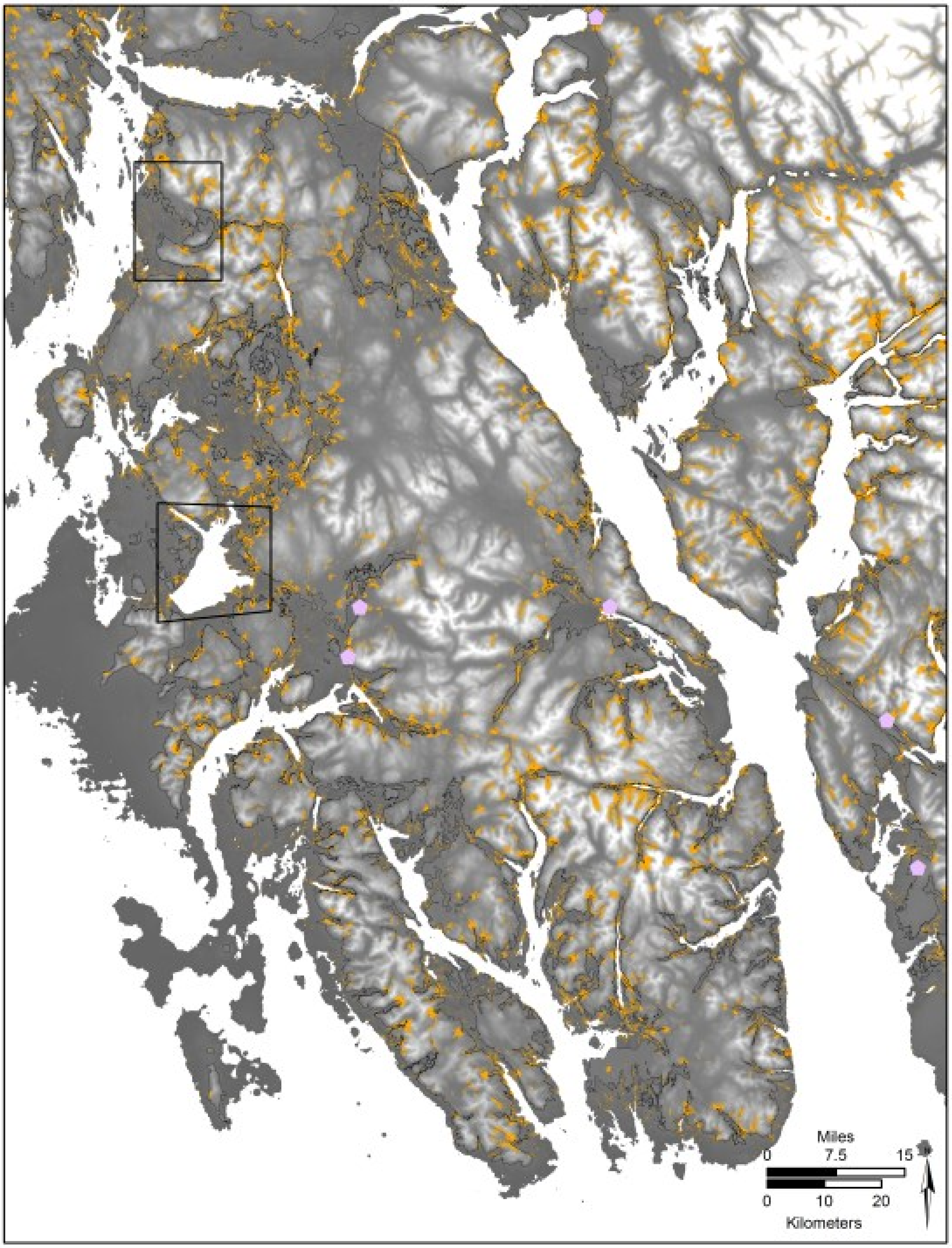
Weight 1 **13,500 cal BP**



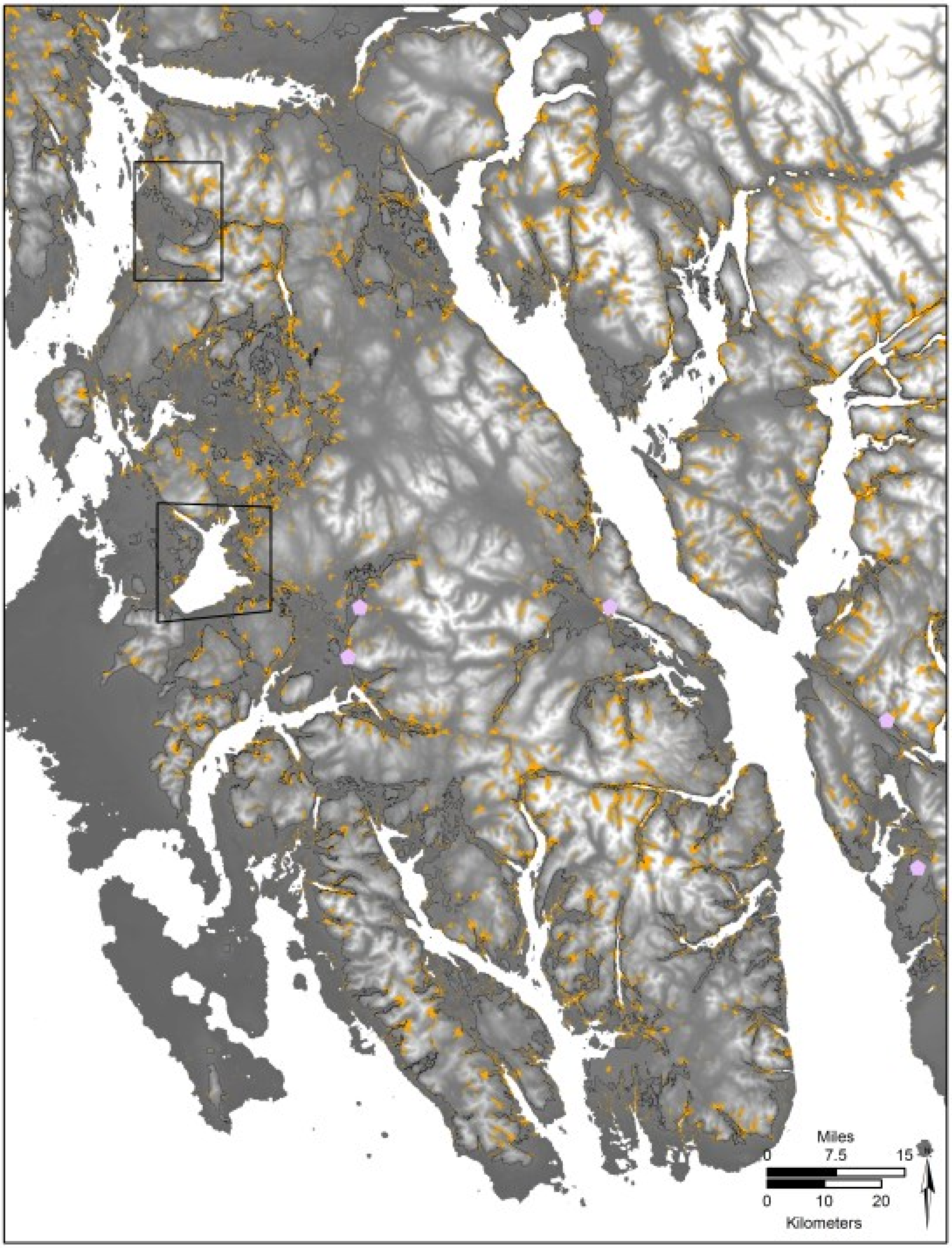
Weight 1 **14,000 cal BP**



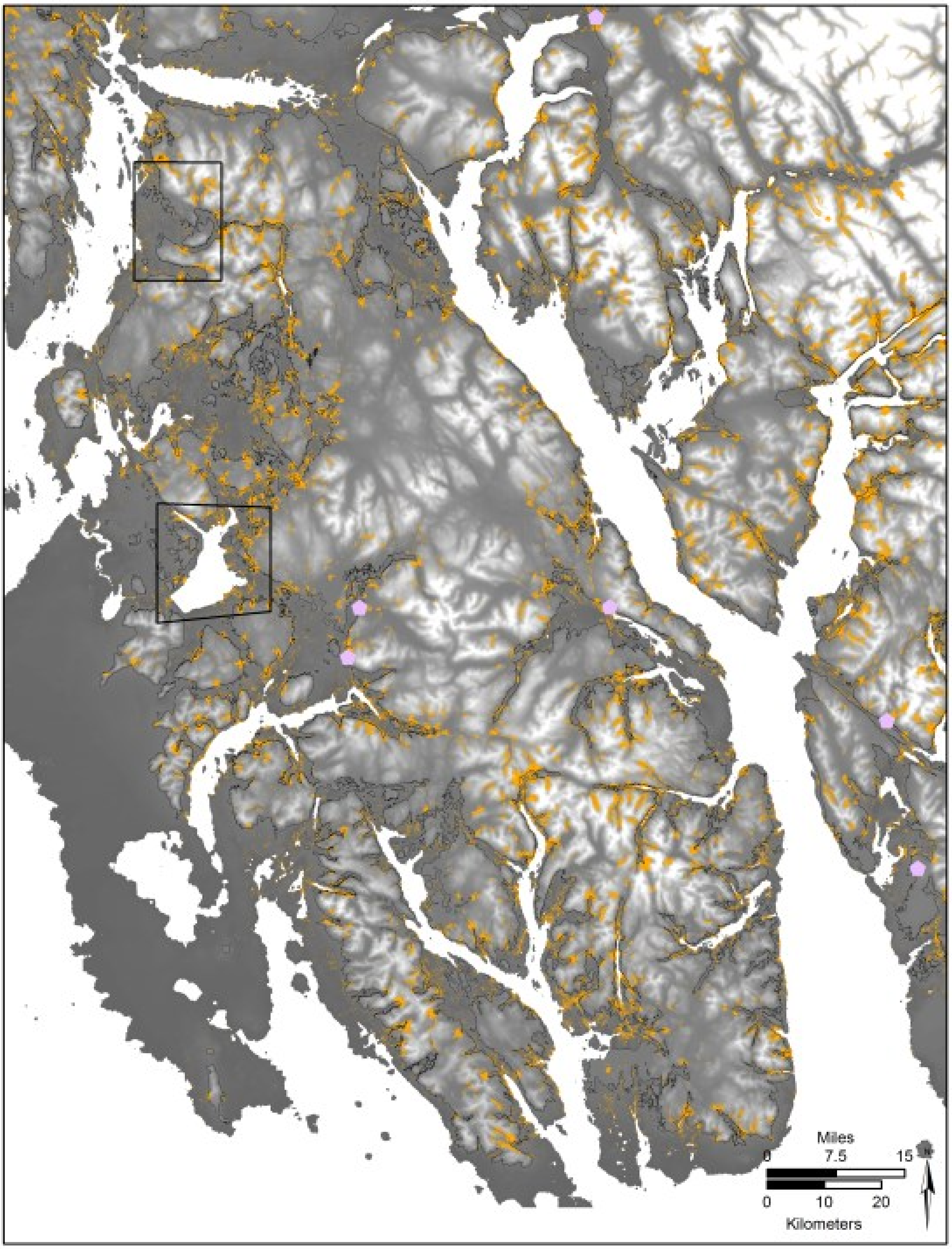
Weight 1 **14,500 cal BP**



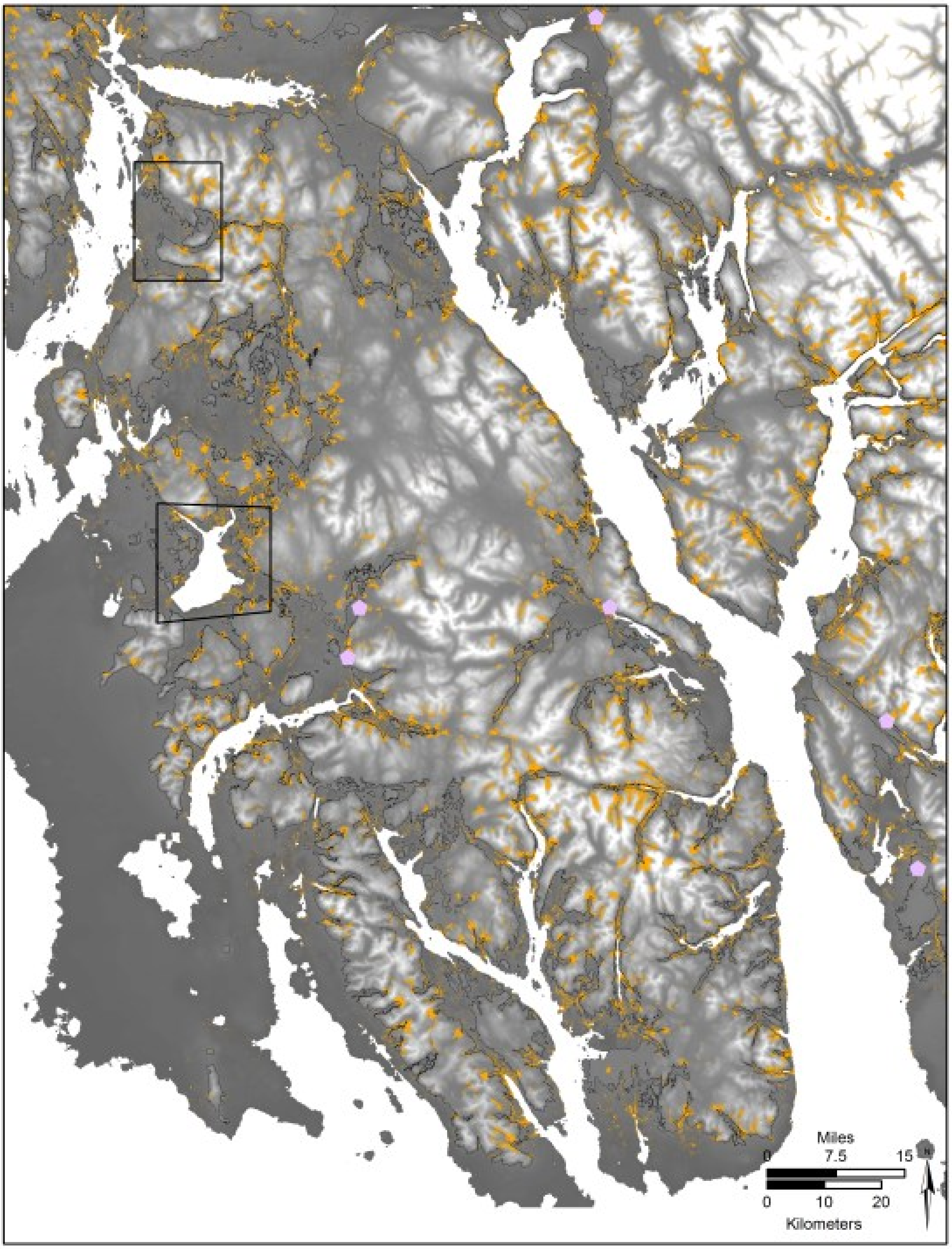
Weight 1 **15,000 cal BP**



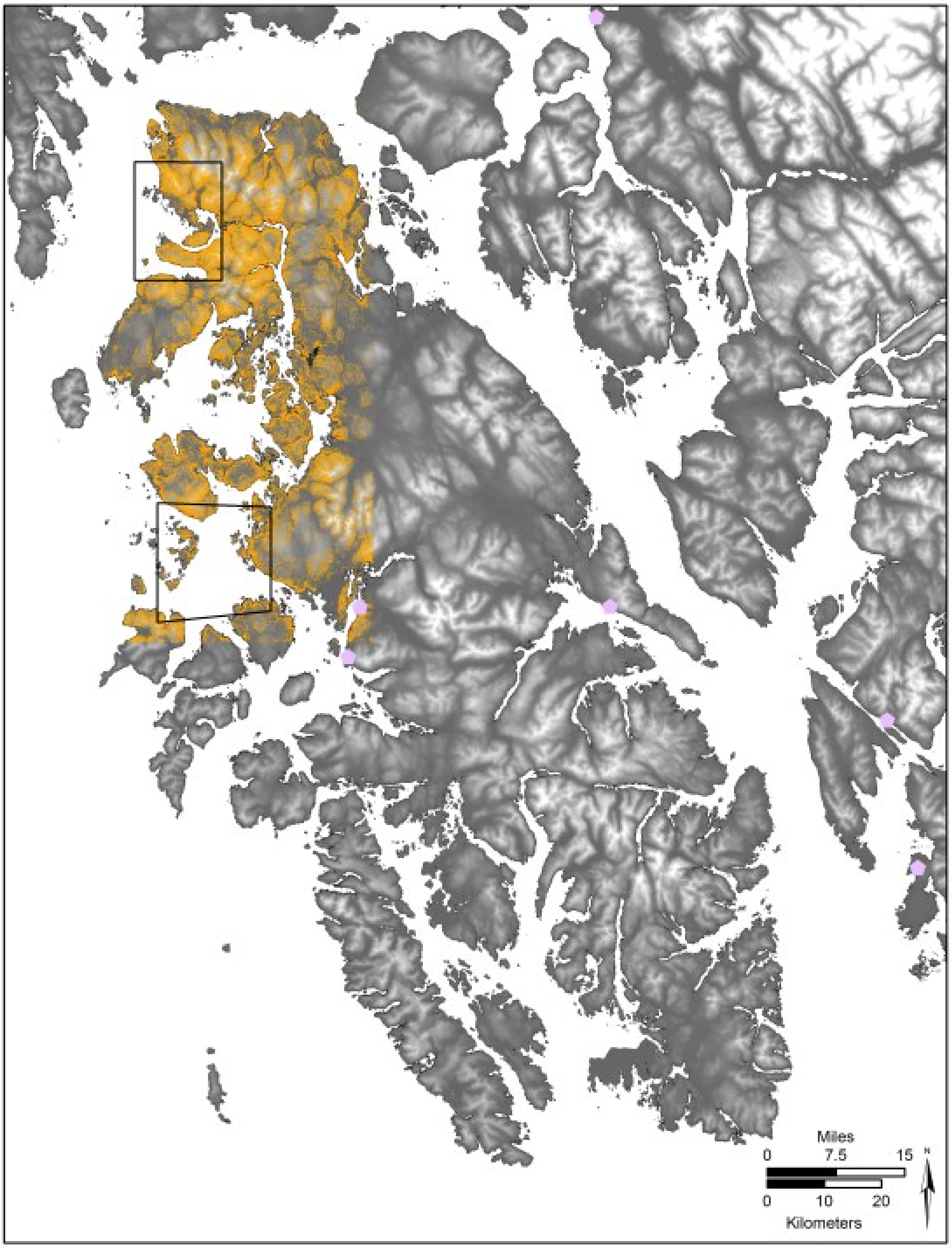
Weight 1 **15,500 cal BP**



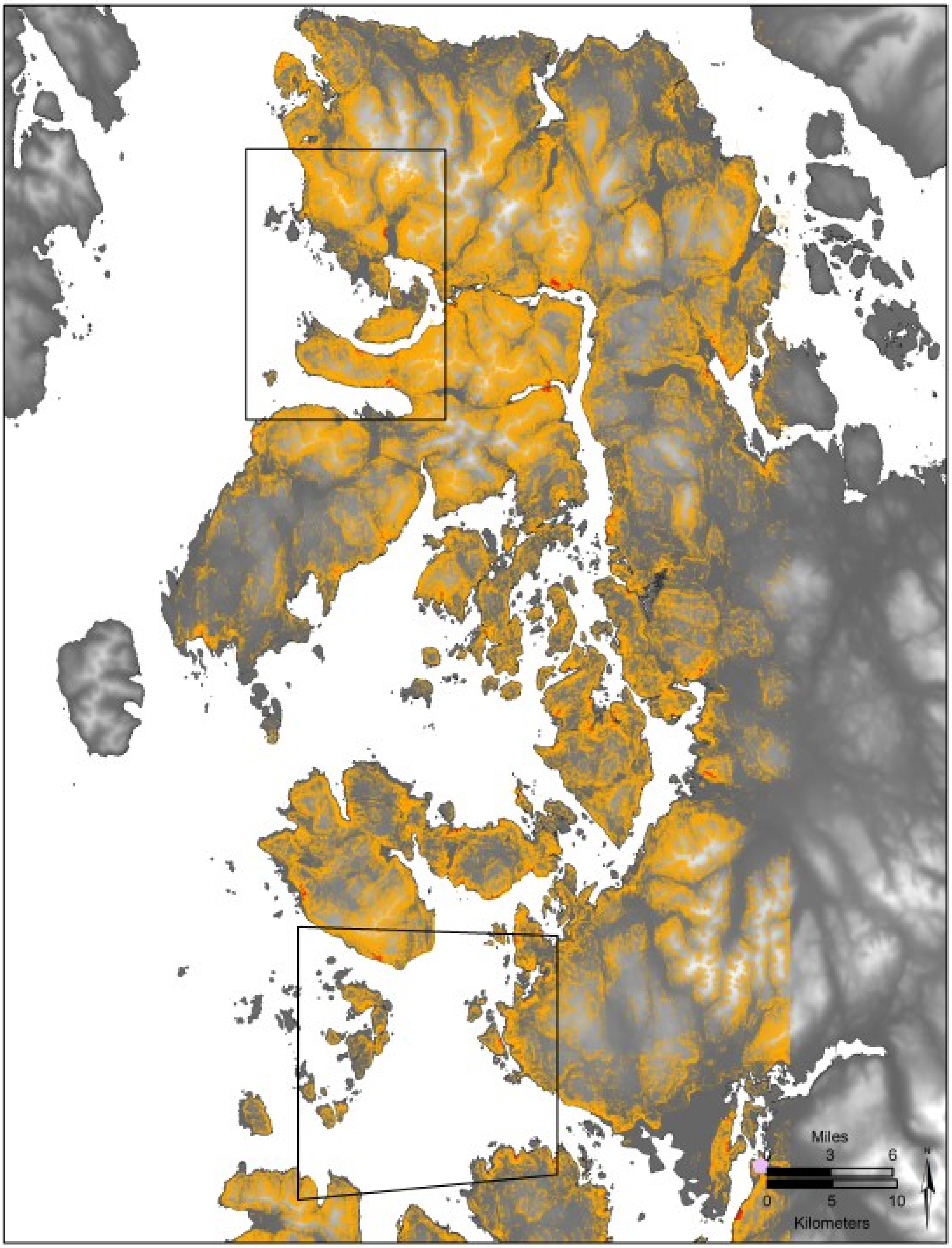
Weight 1 **16,000 cal BP**



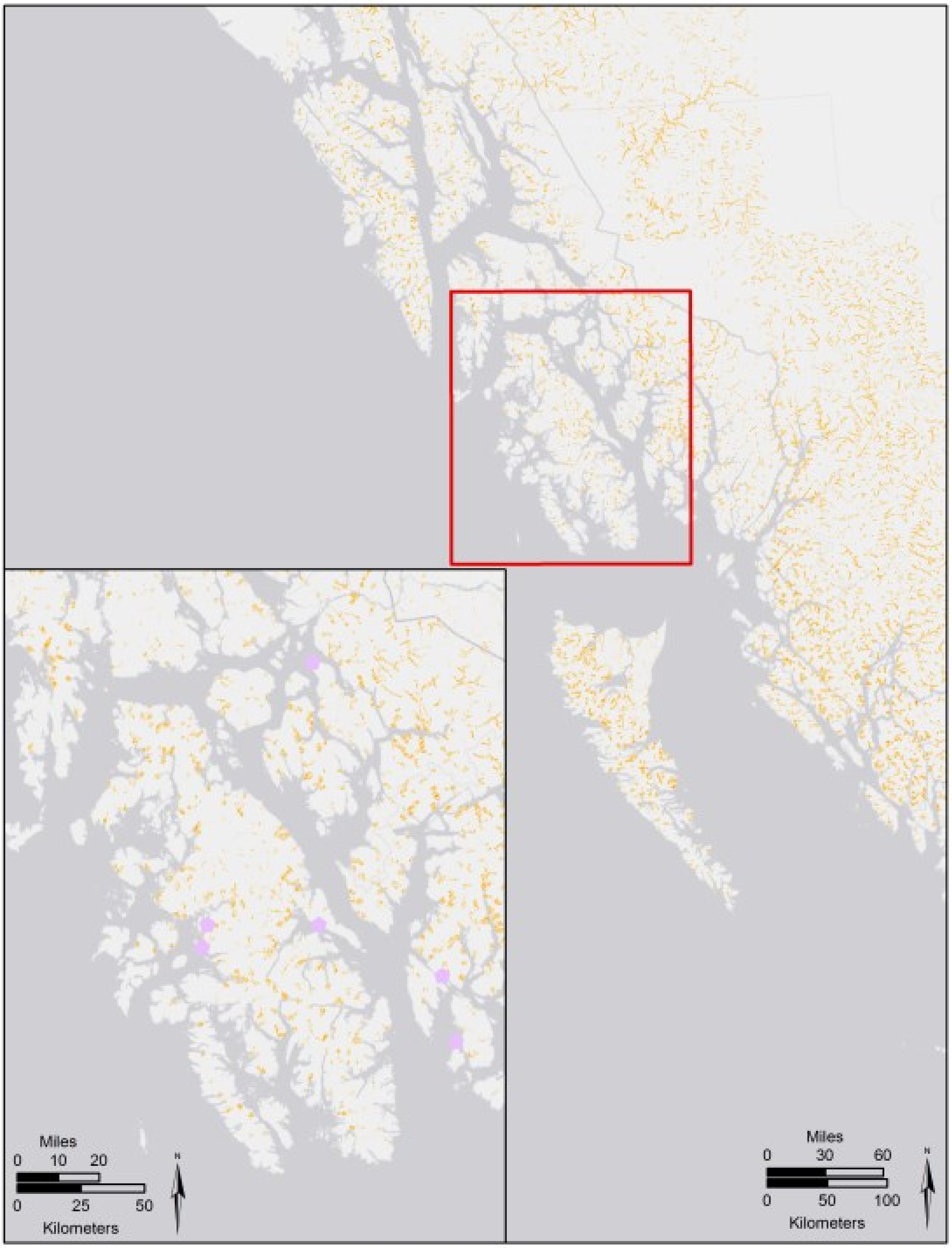
Weight 1 **Modern - Small Area**



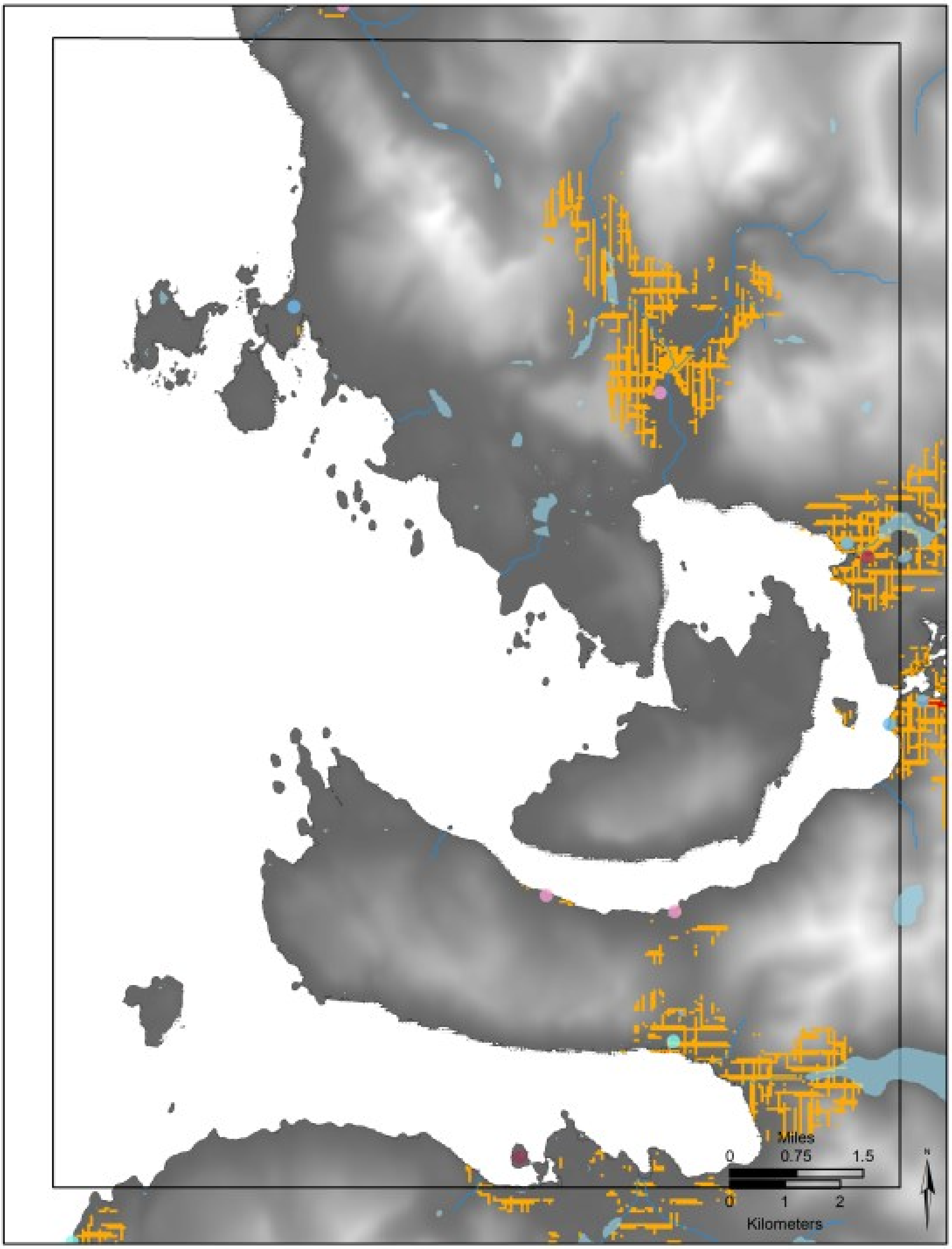
Weight 1 **Modern - Small Area**



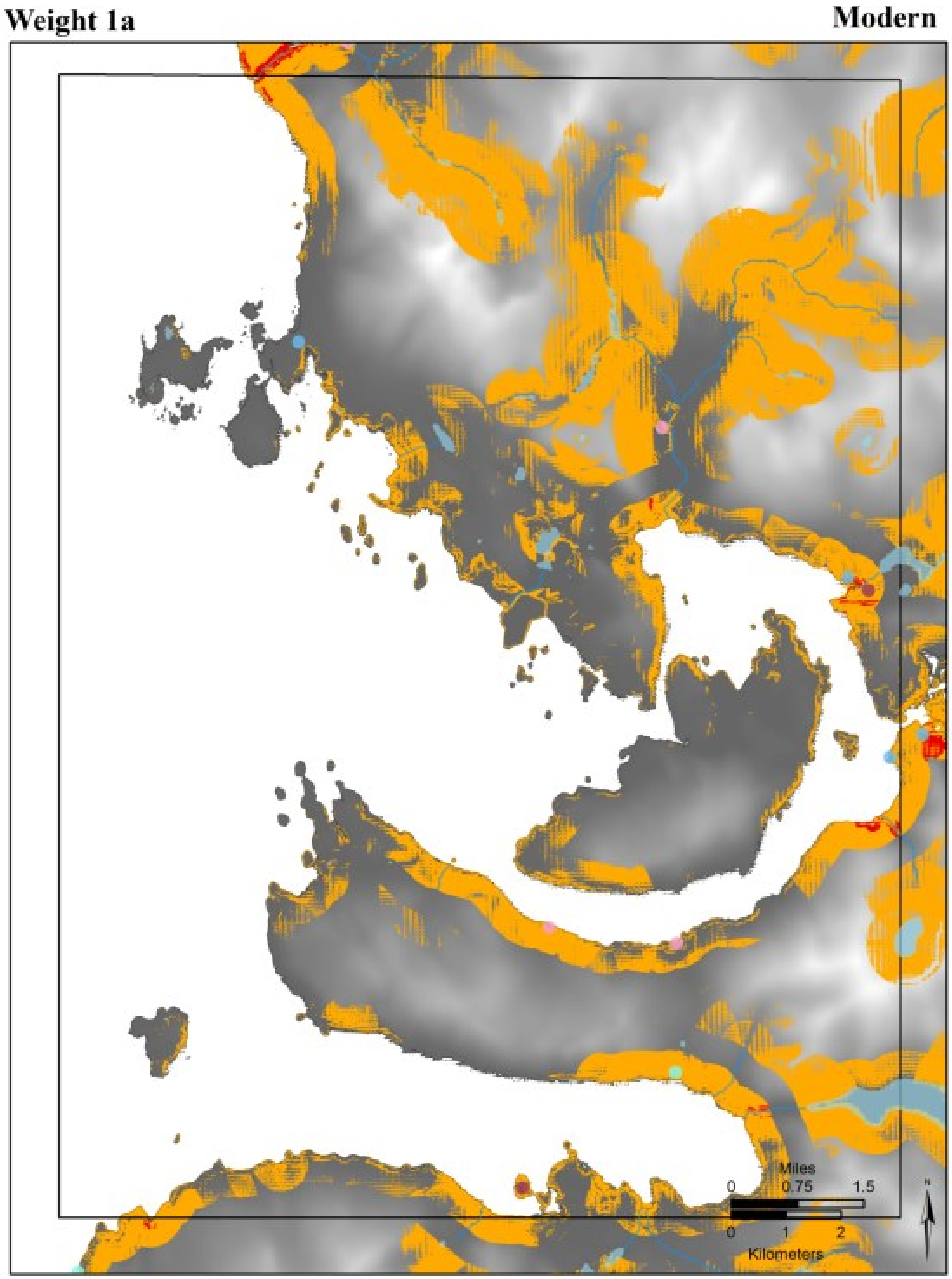
Weight 1 **NWC - modern**



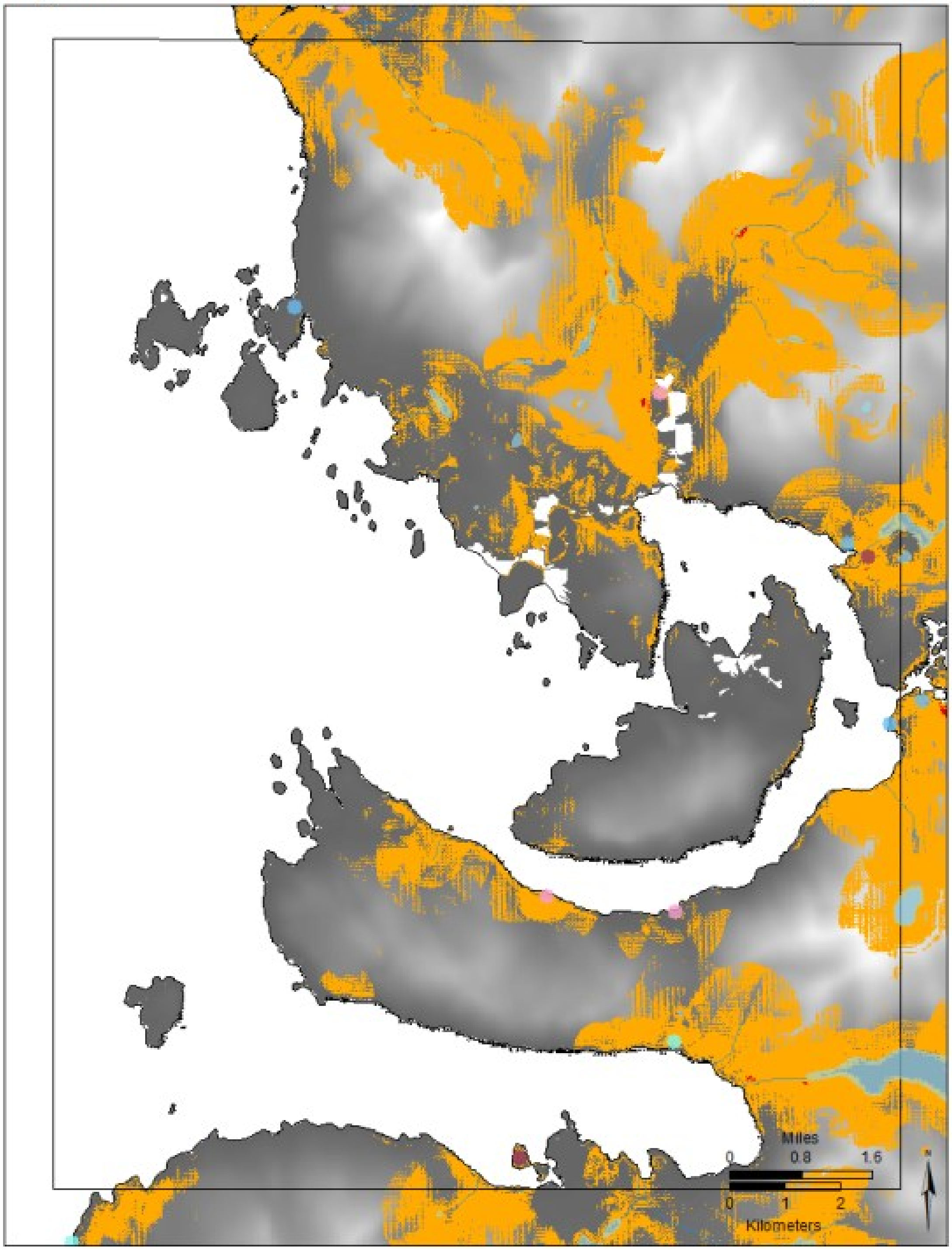
Weight 1 **NWC - modern**



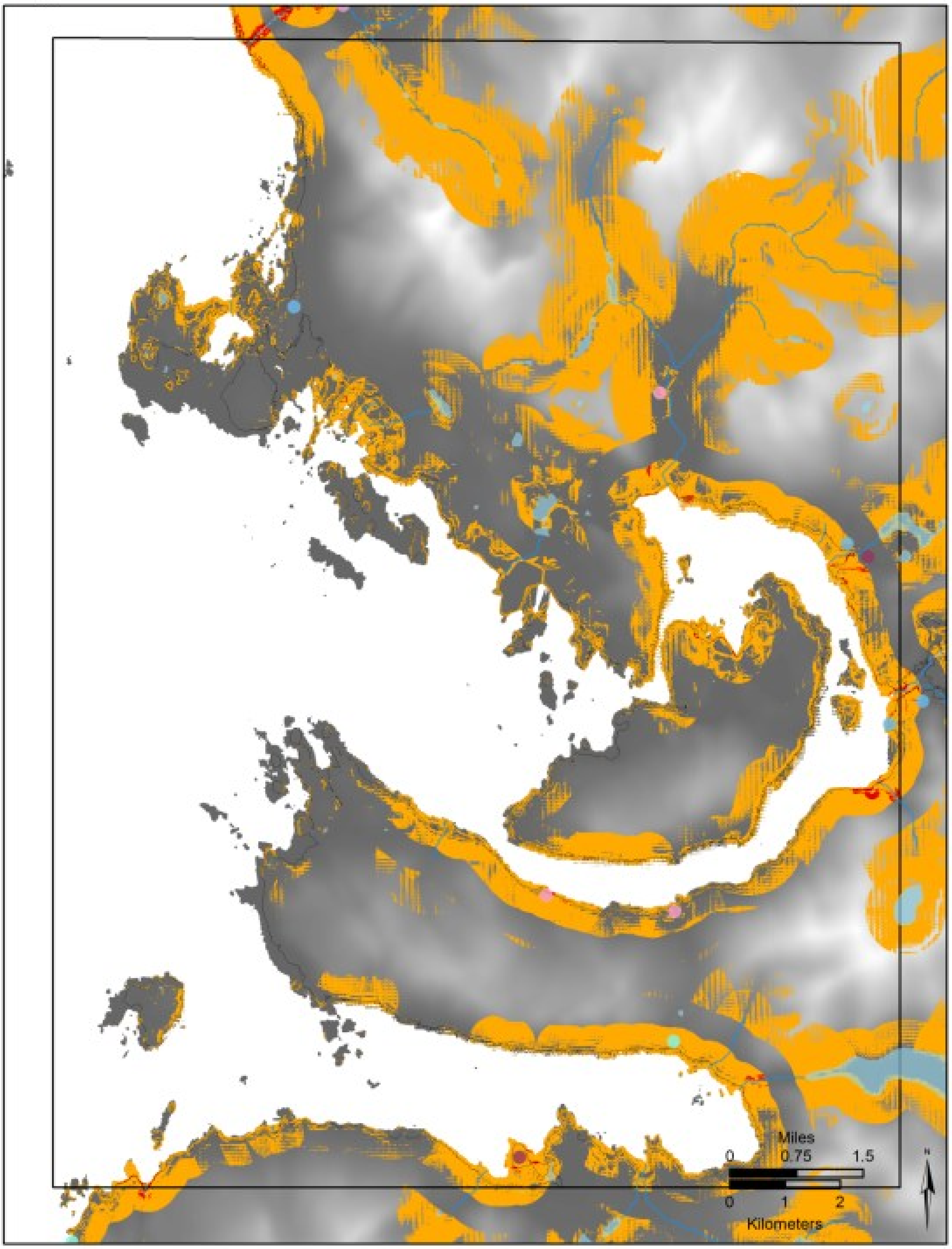
C.3 Weighted Overlay 1a



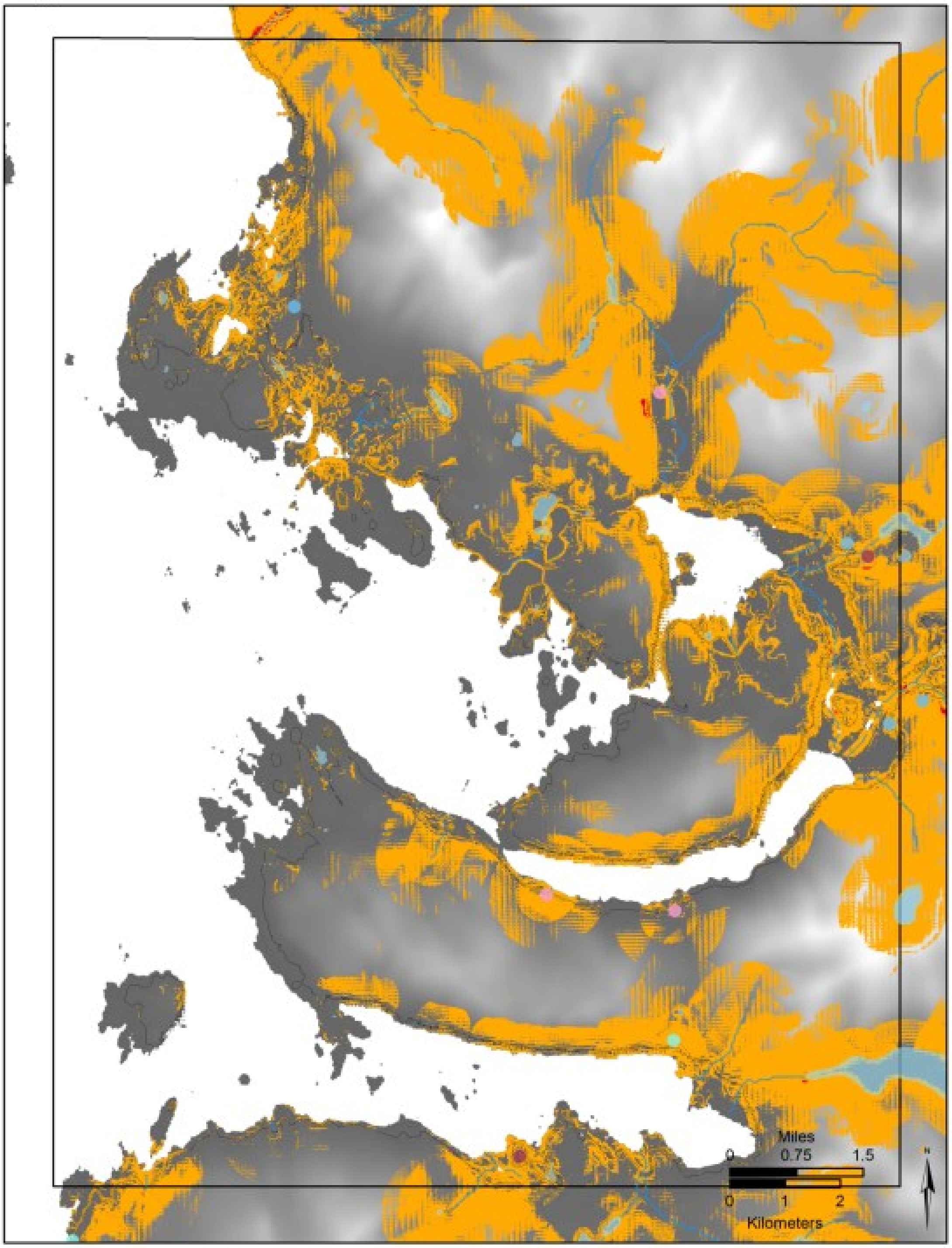
Weight 1a **10,500 cal BP**



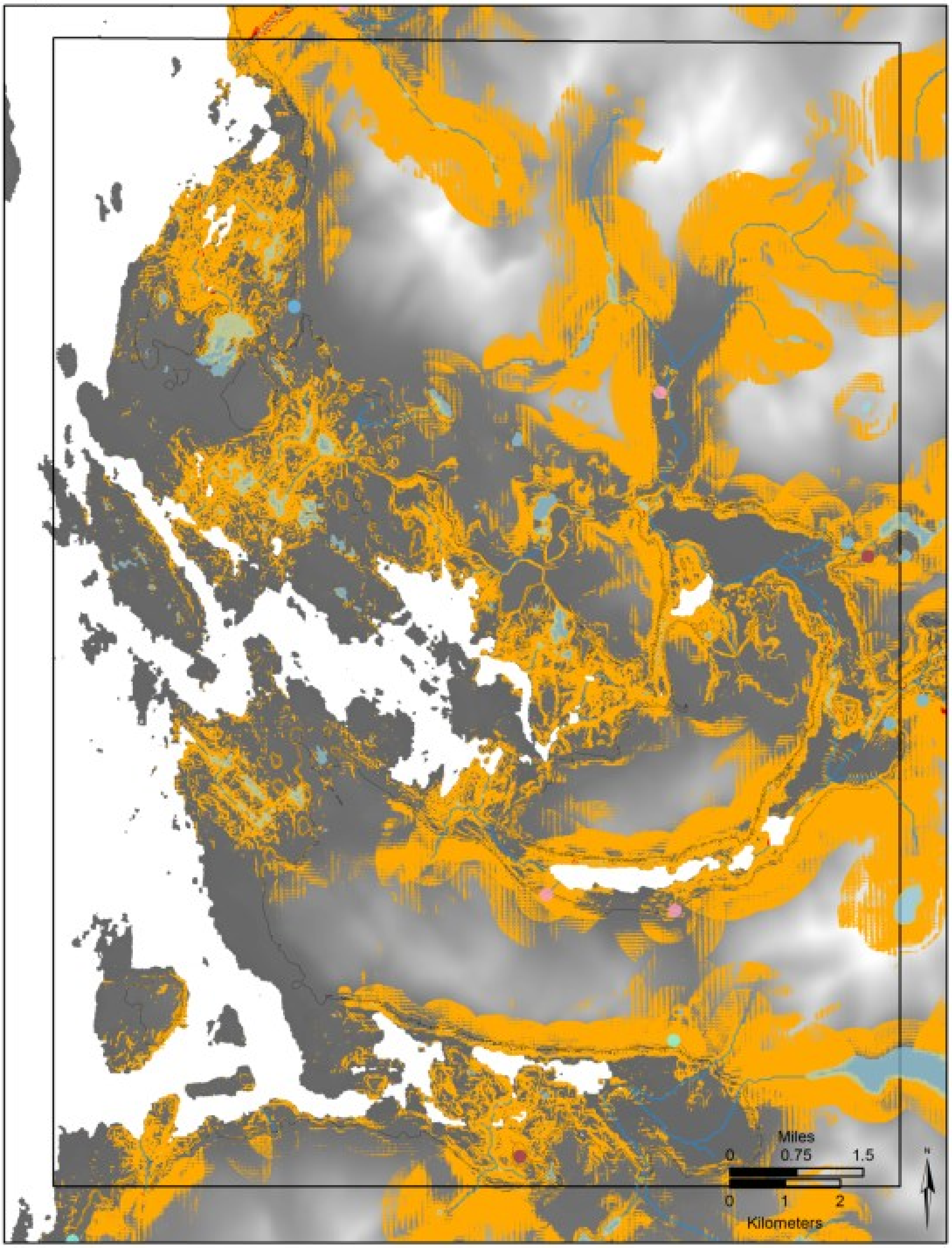
Weight 1a **11,000 cal BP**



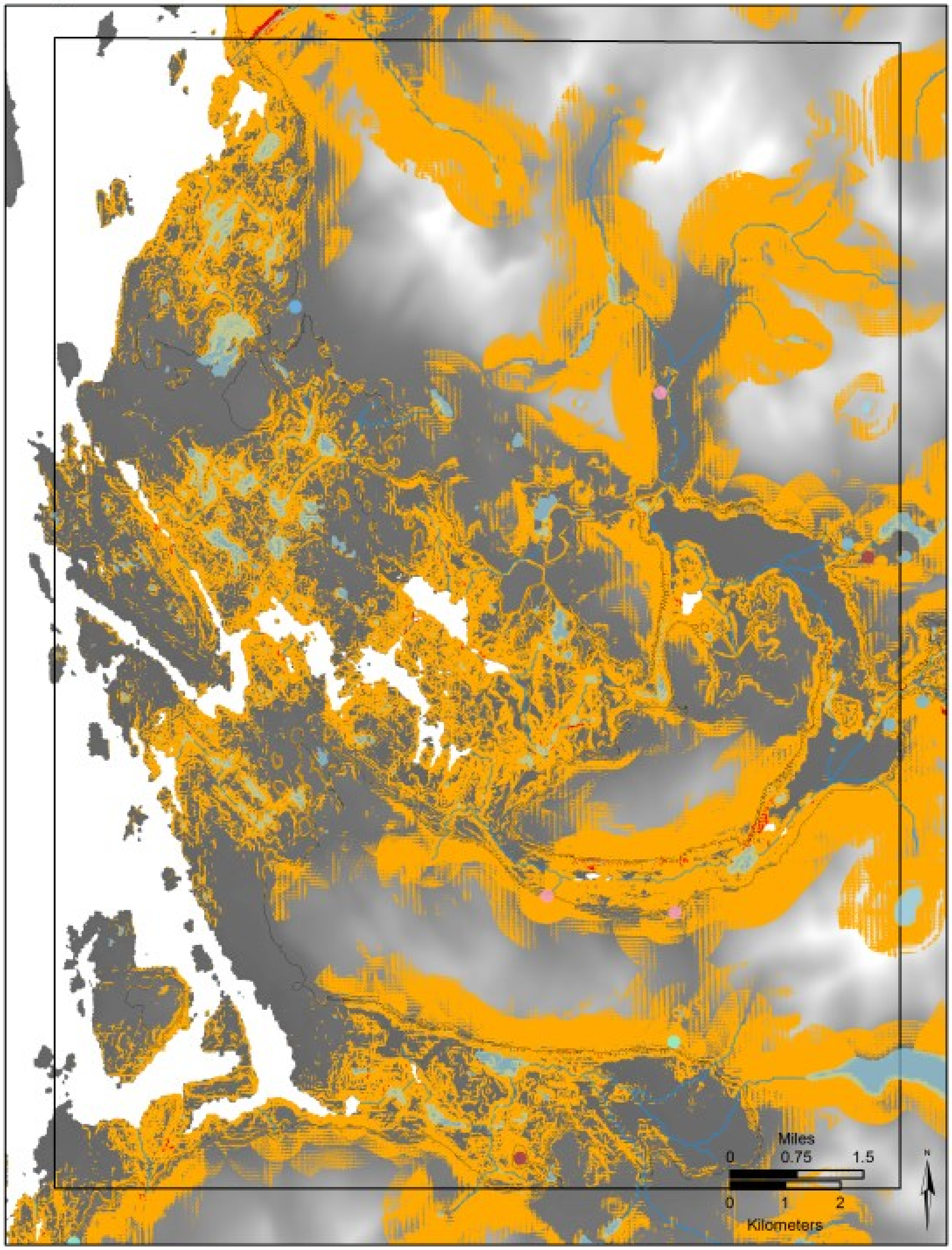
Weight 1a **11,500 cal BP**



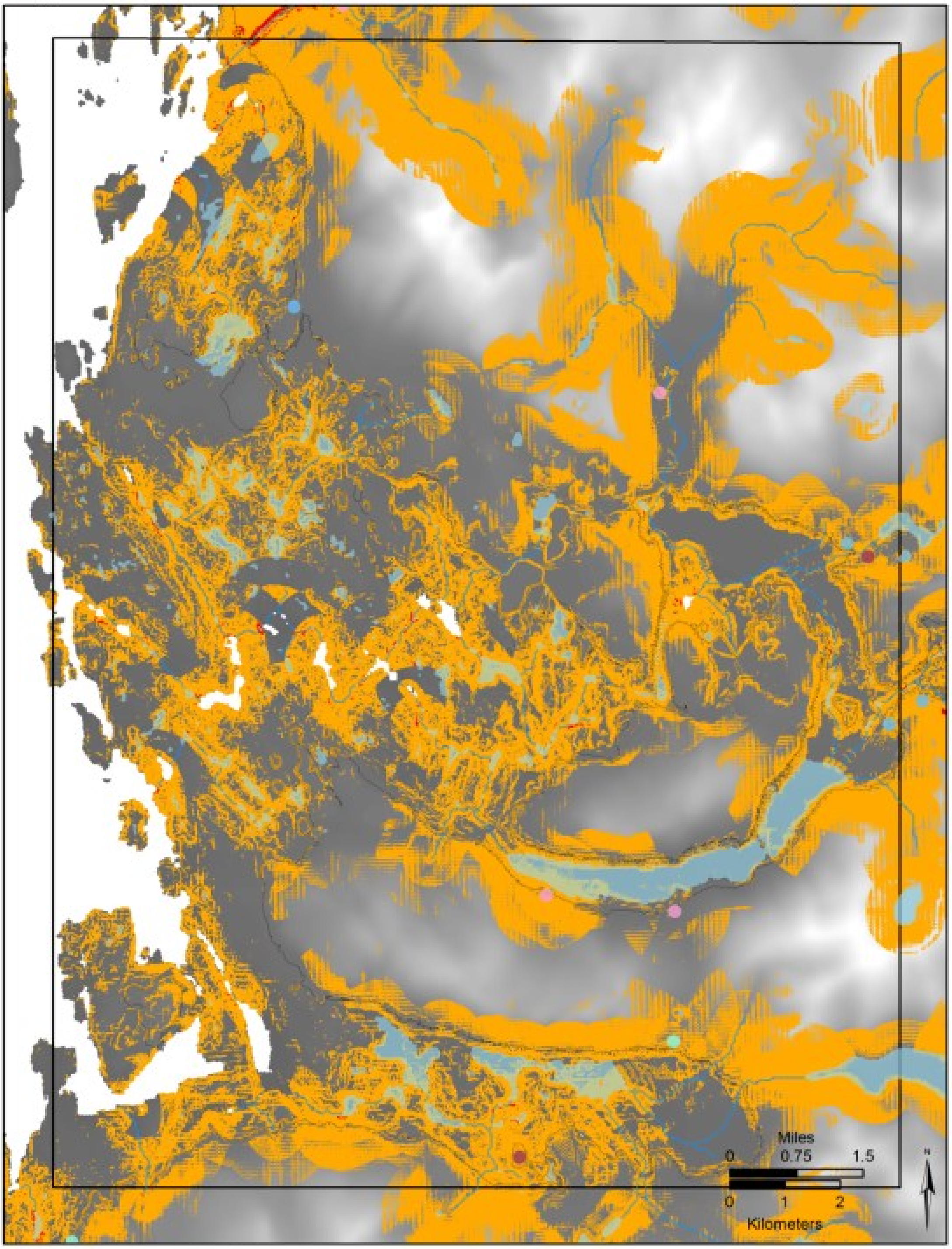
Weight 1a **12,000 cal BP**



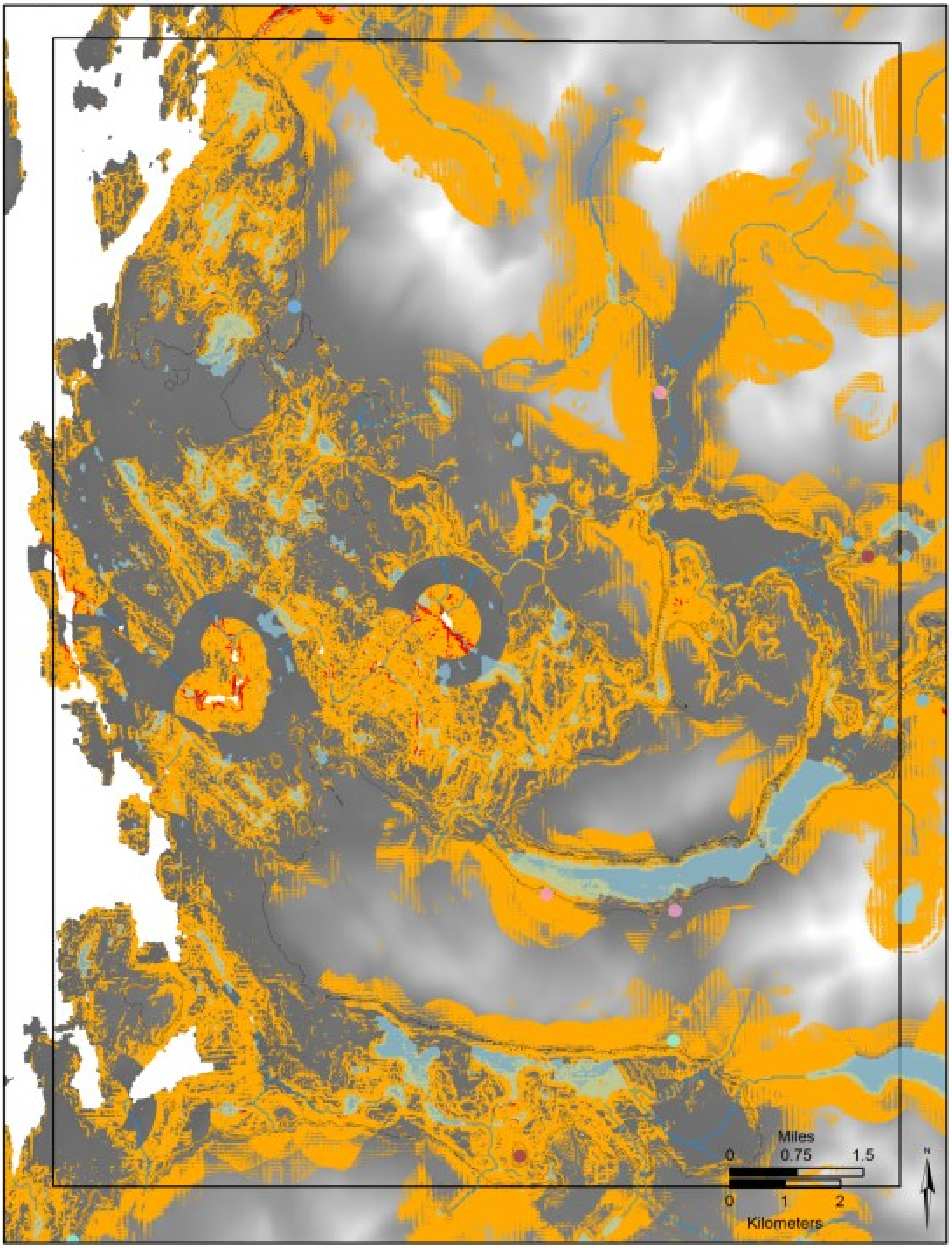
Weight 1a **12,500 cal BP**



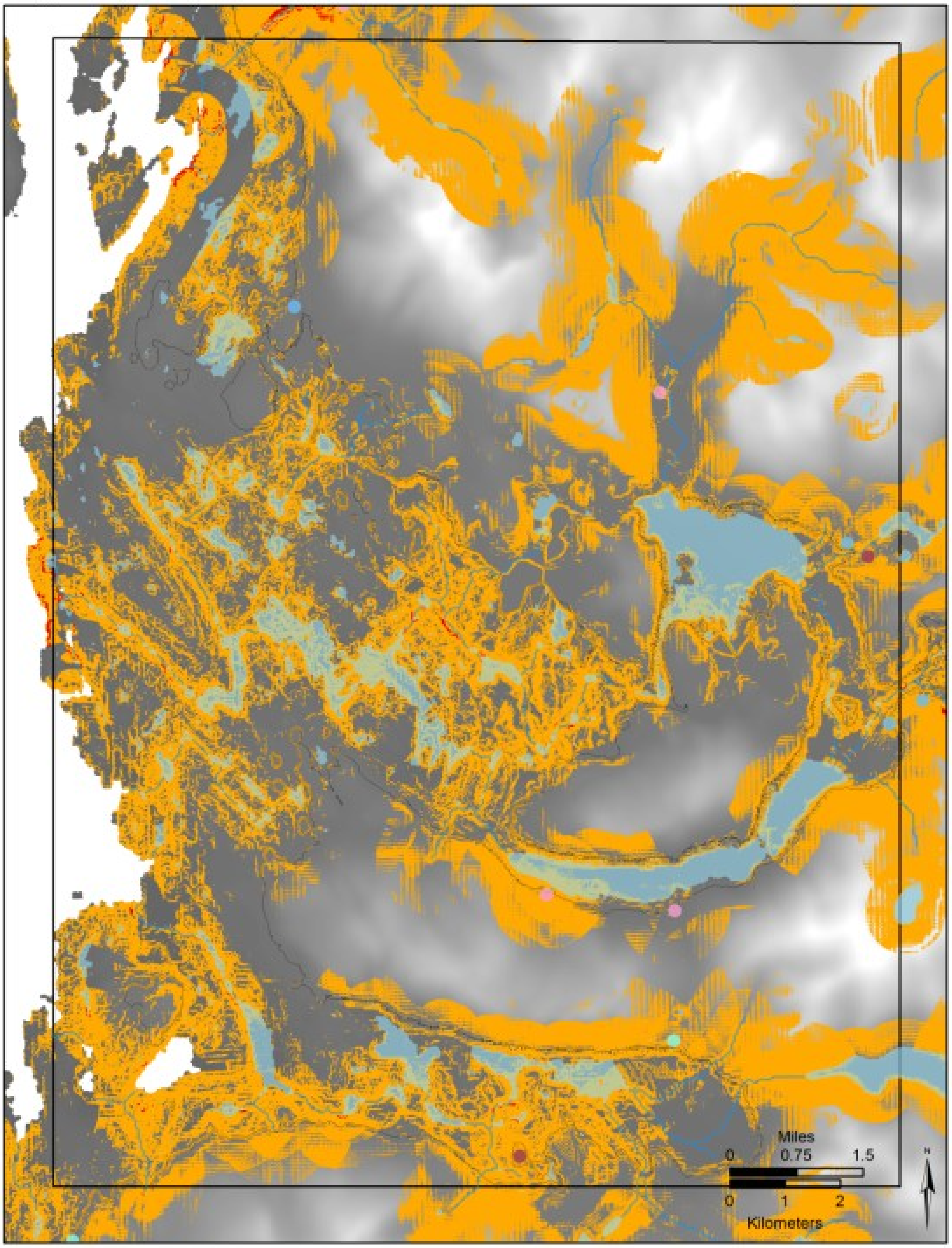
Weight 1a **13,000 cal BP**



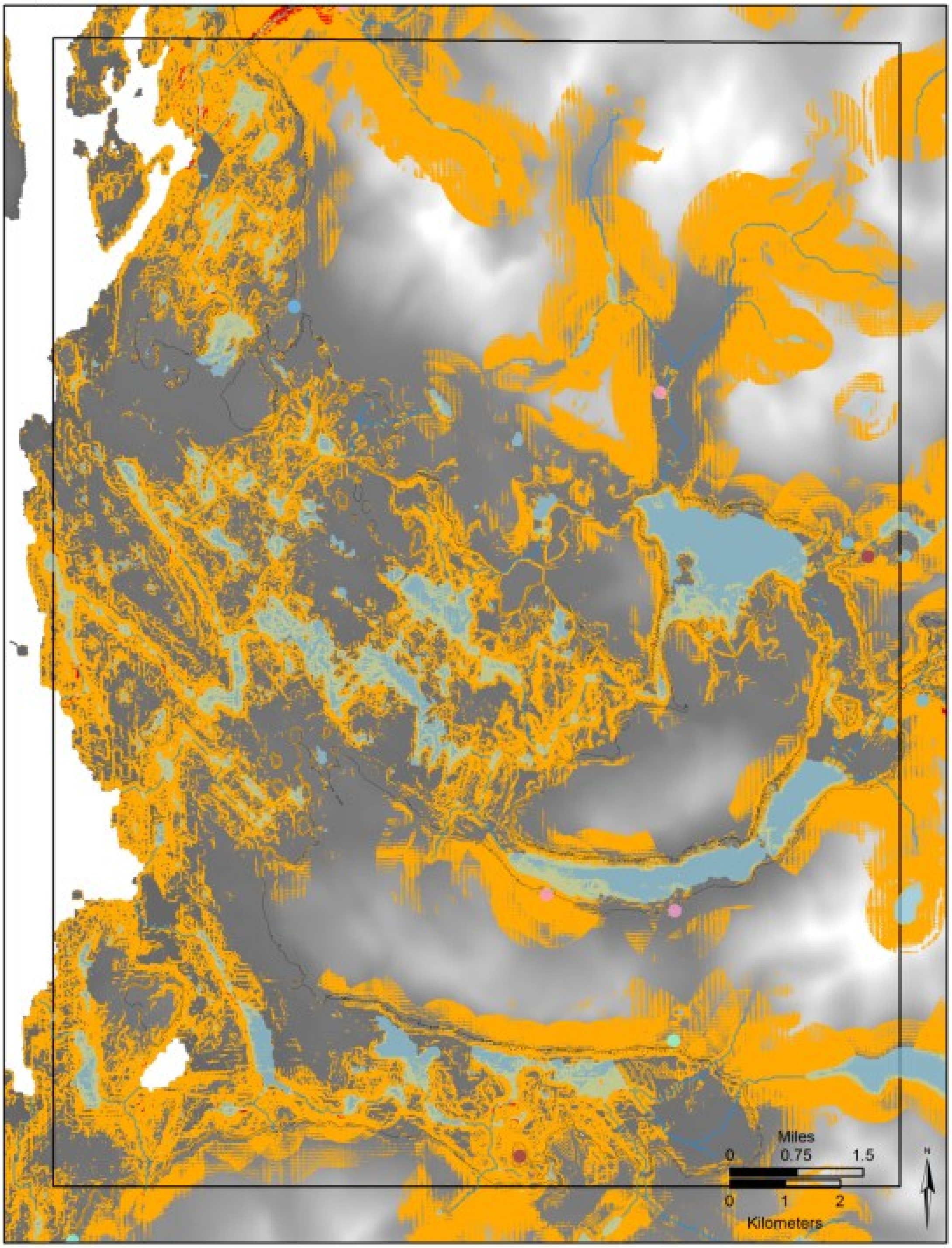
Weight 1a 13,500 cal BP

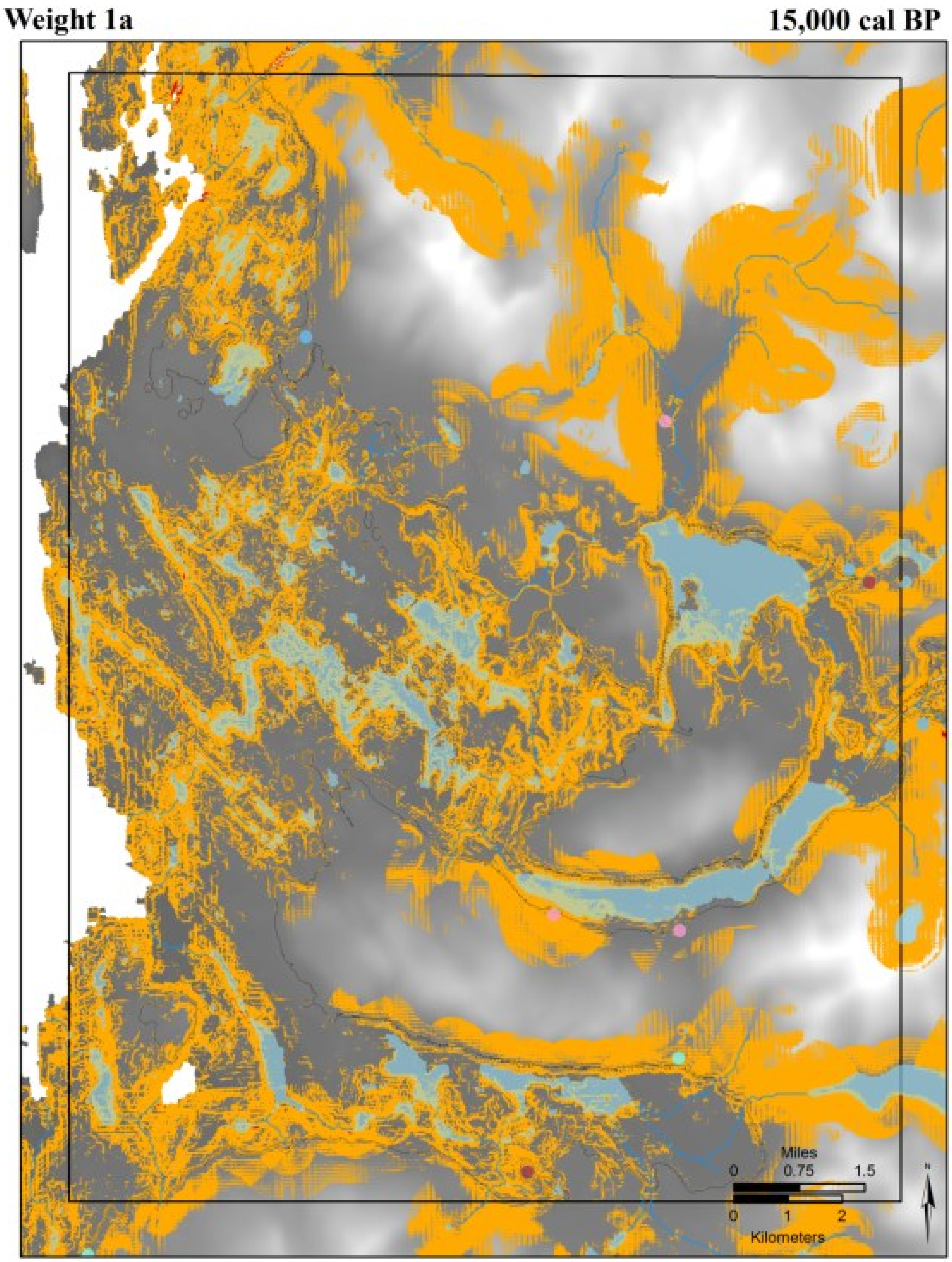


Weight 1a **14,000 cal BP**

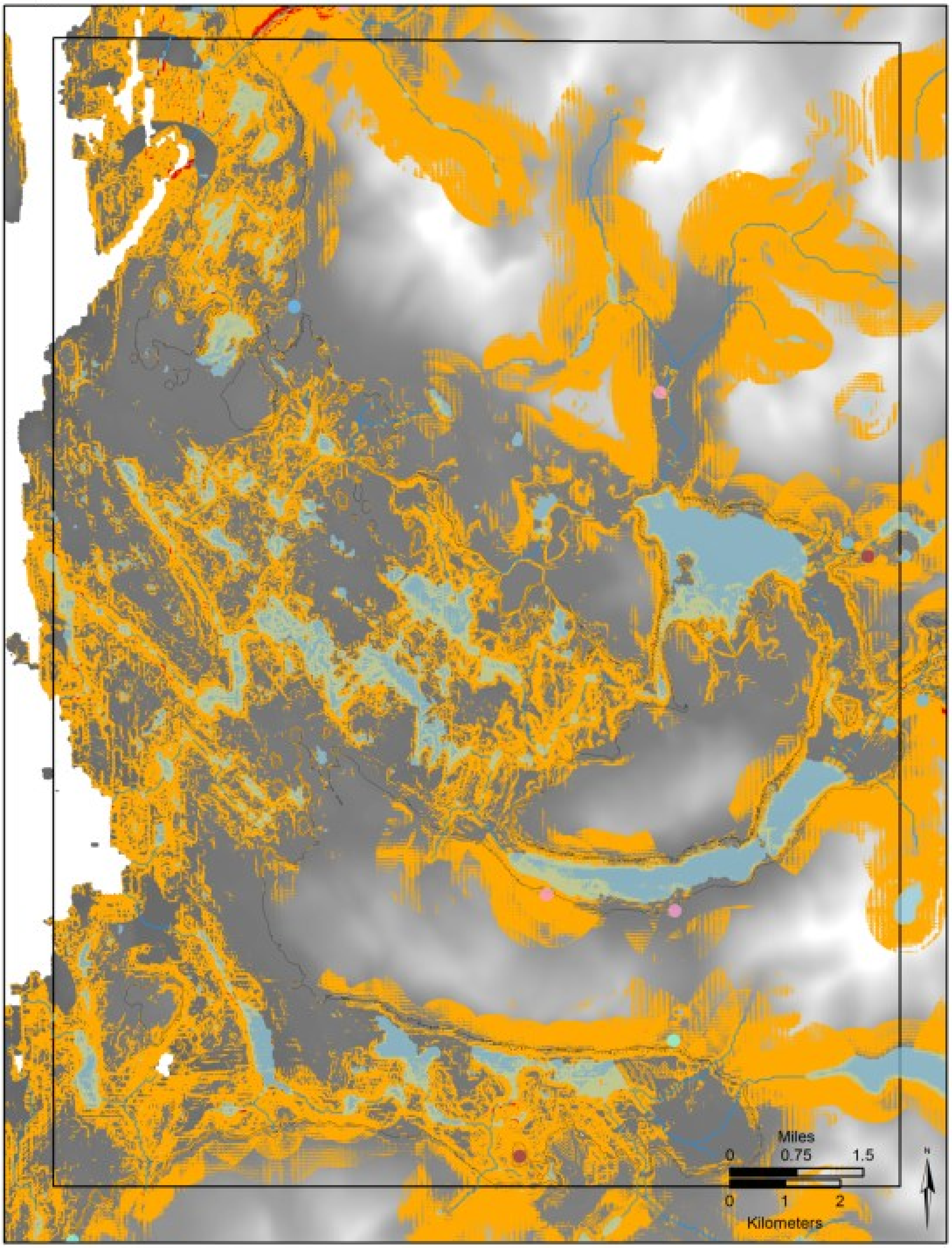


Weight 1a **14,500 cal BP**

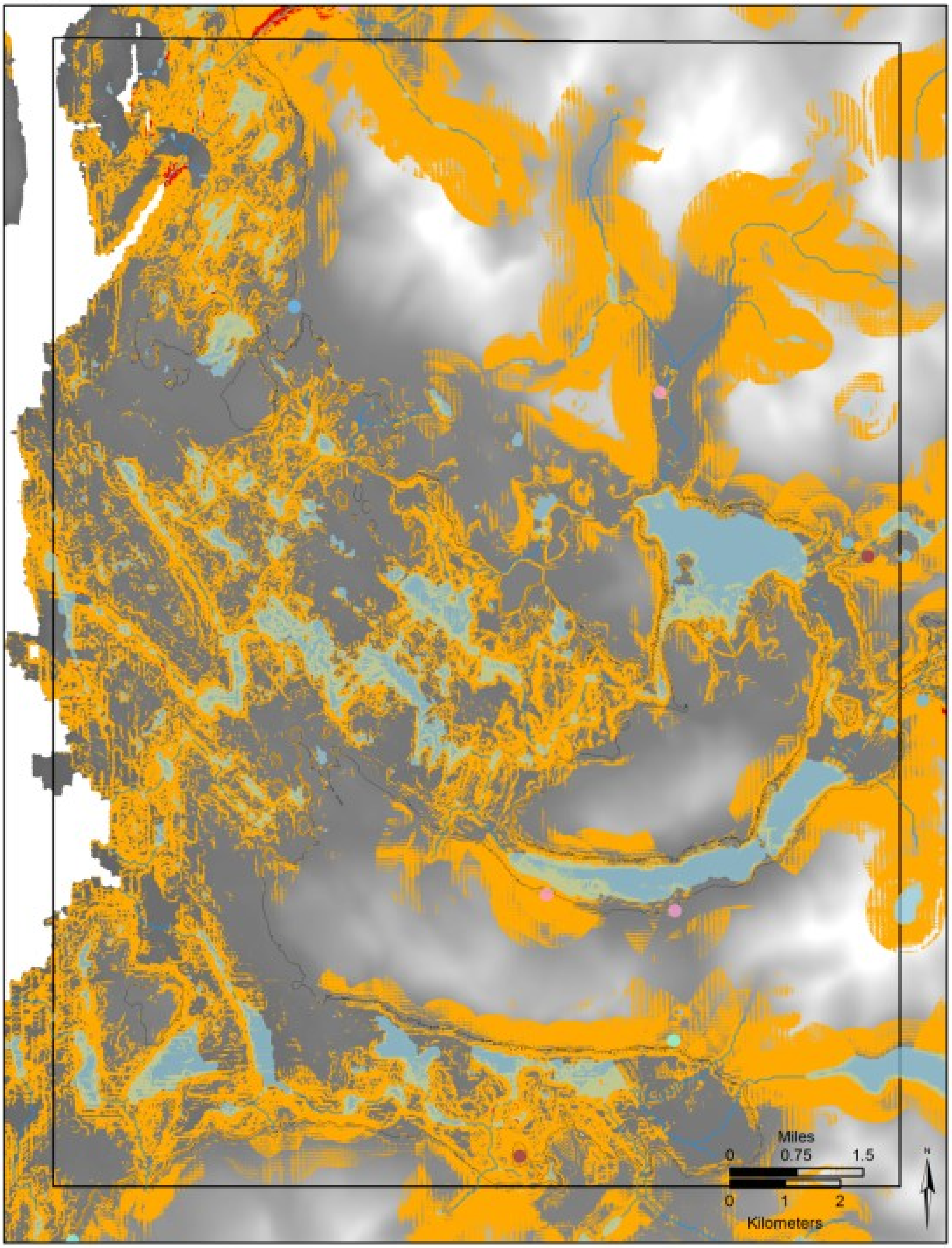



Weight 1a
15,000 cal BP
Miles
0
0.75
1.5
0
1
2
Kilometers

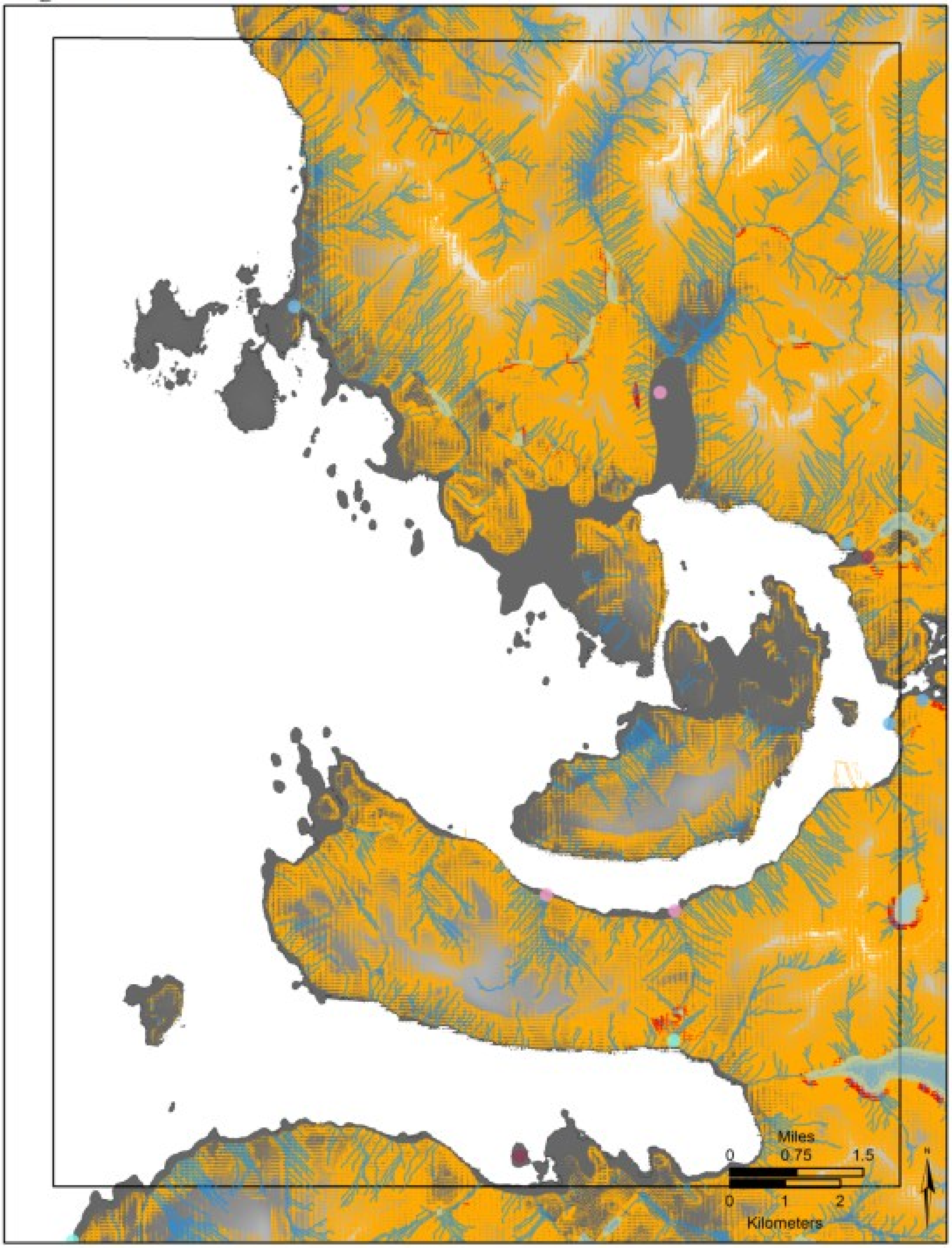
Weight 1a **15,500 cal BP**



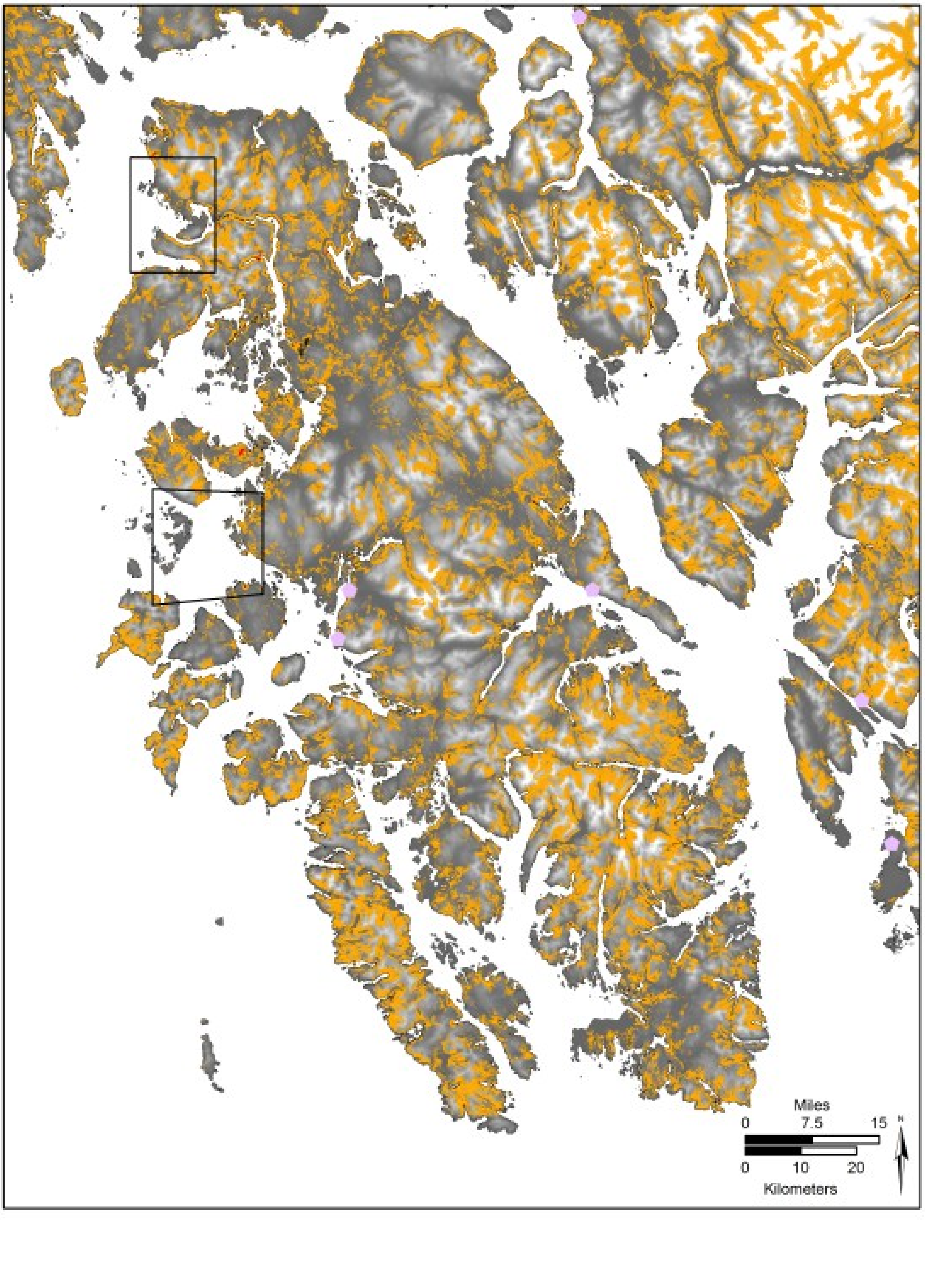
Weight 1a **16,000 cal BP**



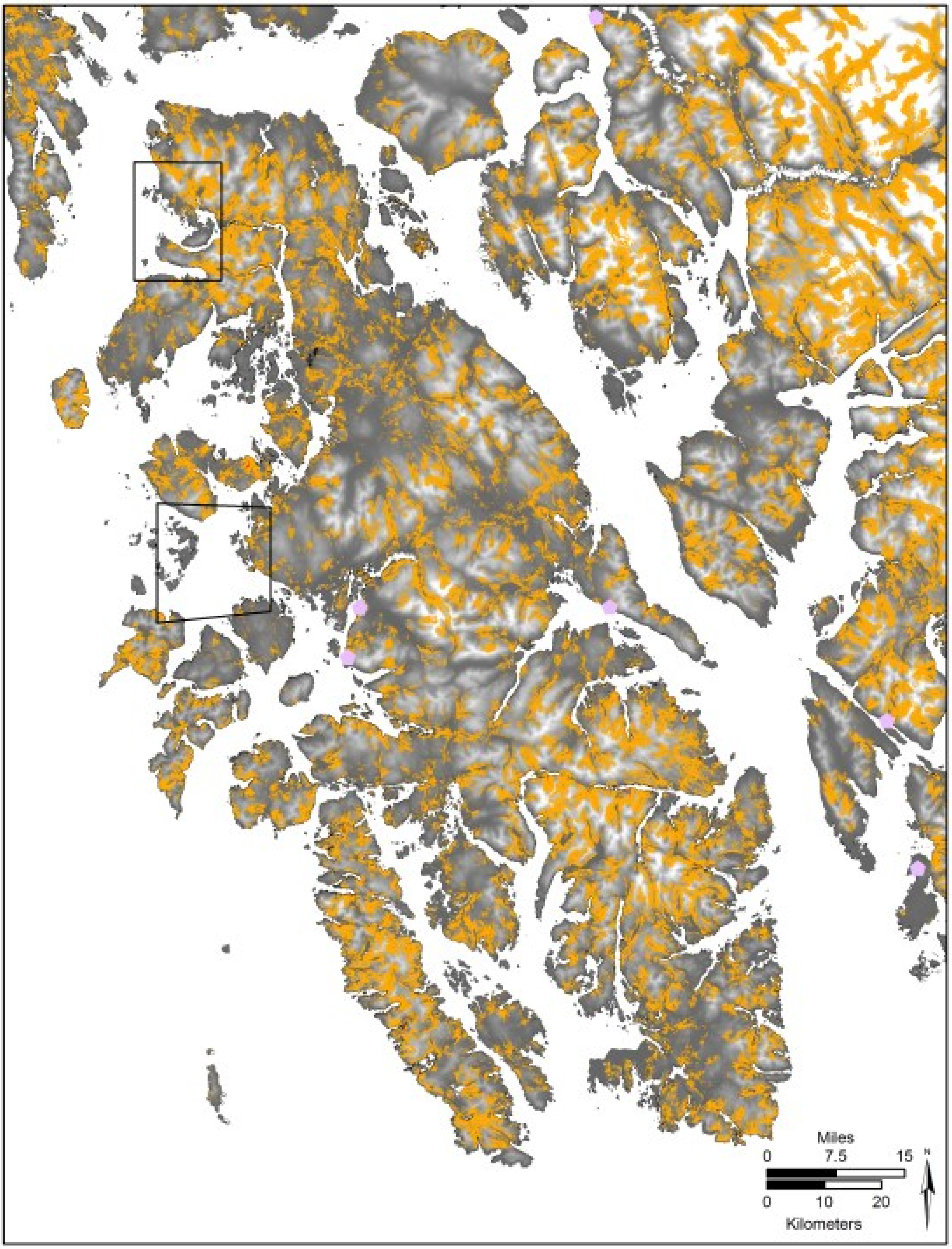
Weight 1a **Modern - Small Area**



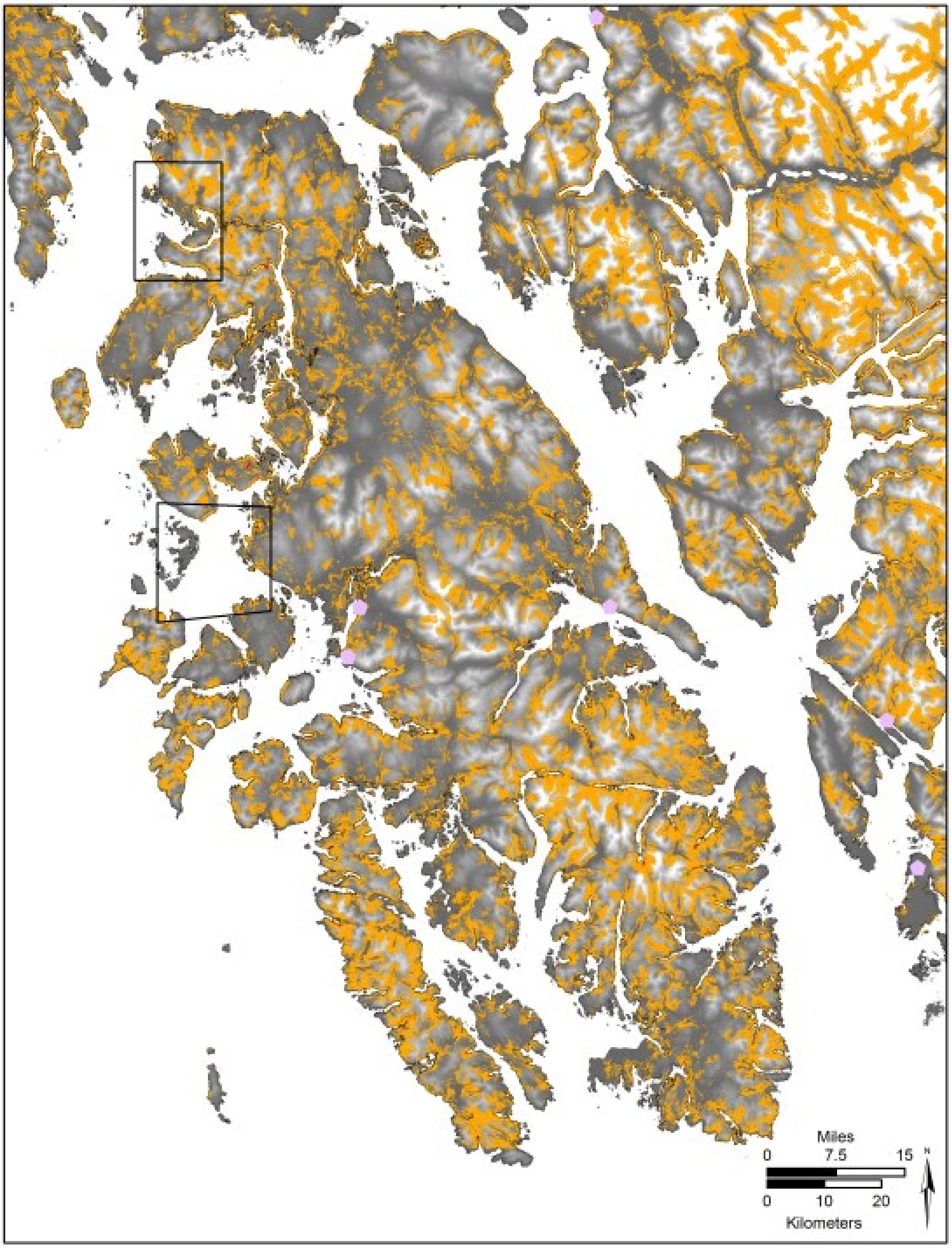
Weight 1a **Modern**



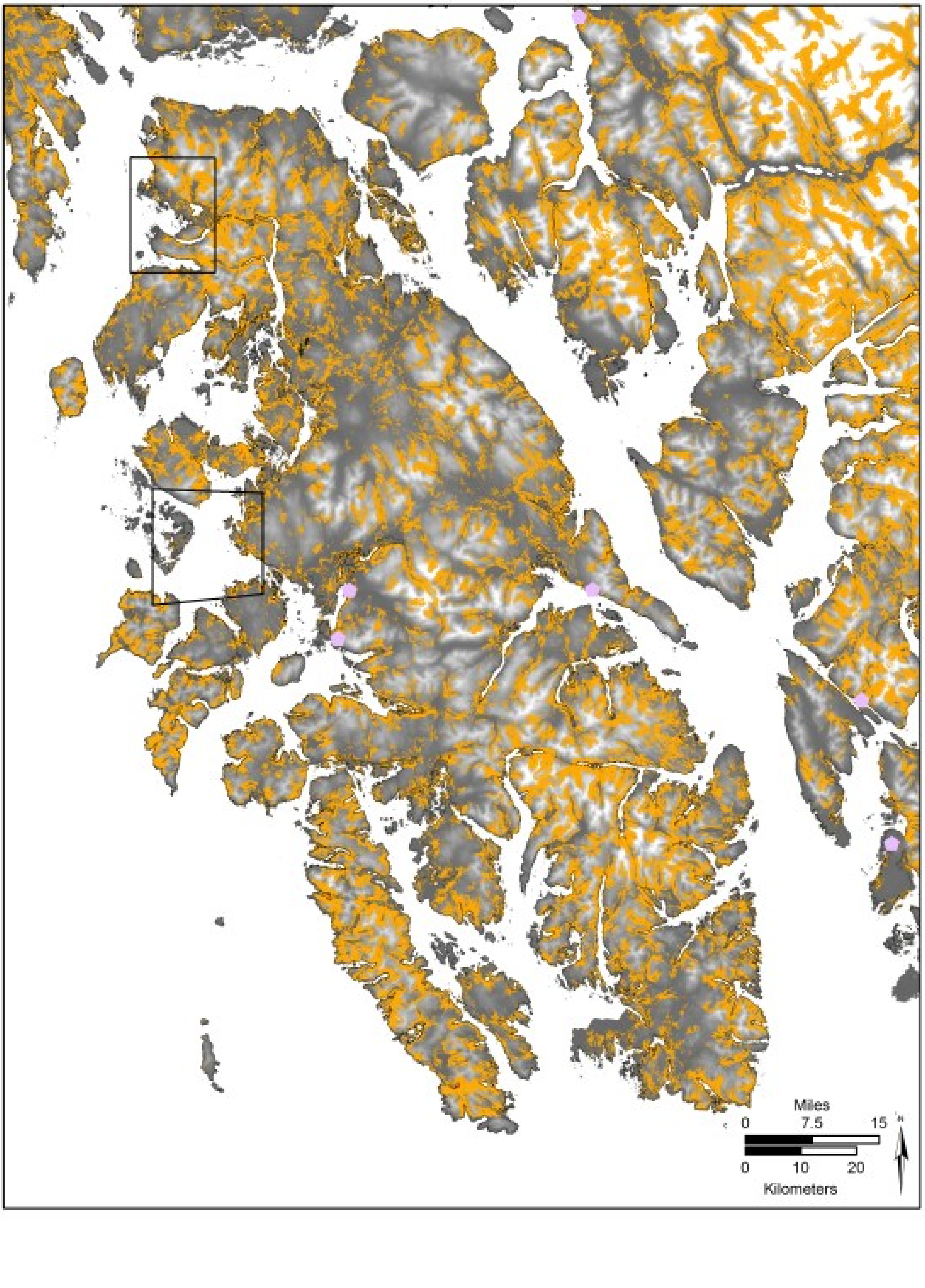
Weight 1a **10,500 cal BP**



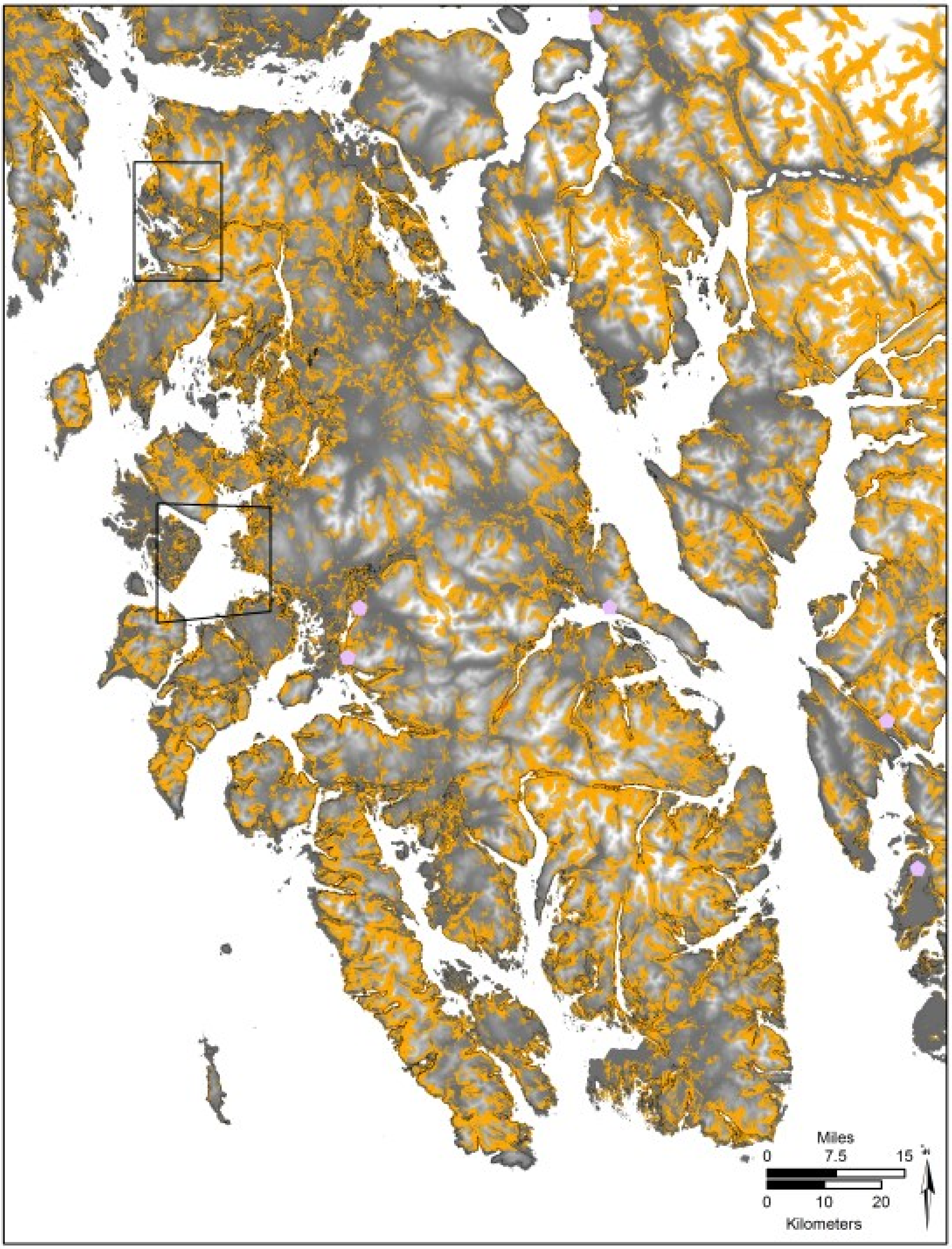
Weight 1a **11,000 cal BP**



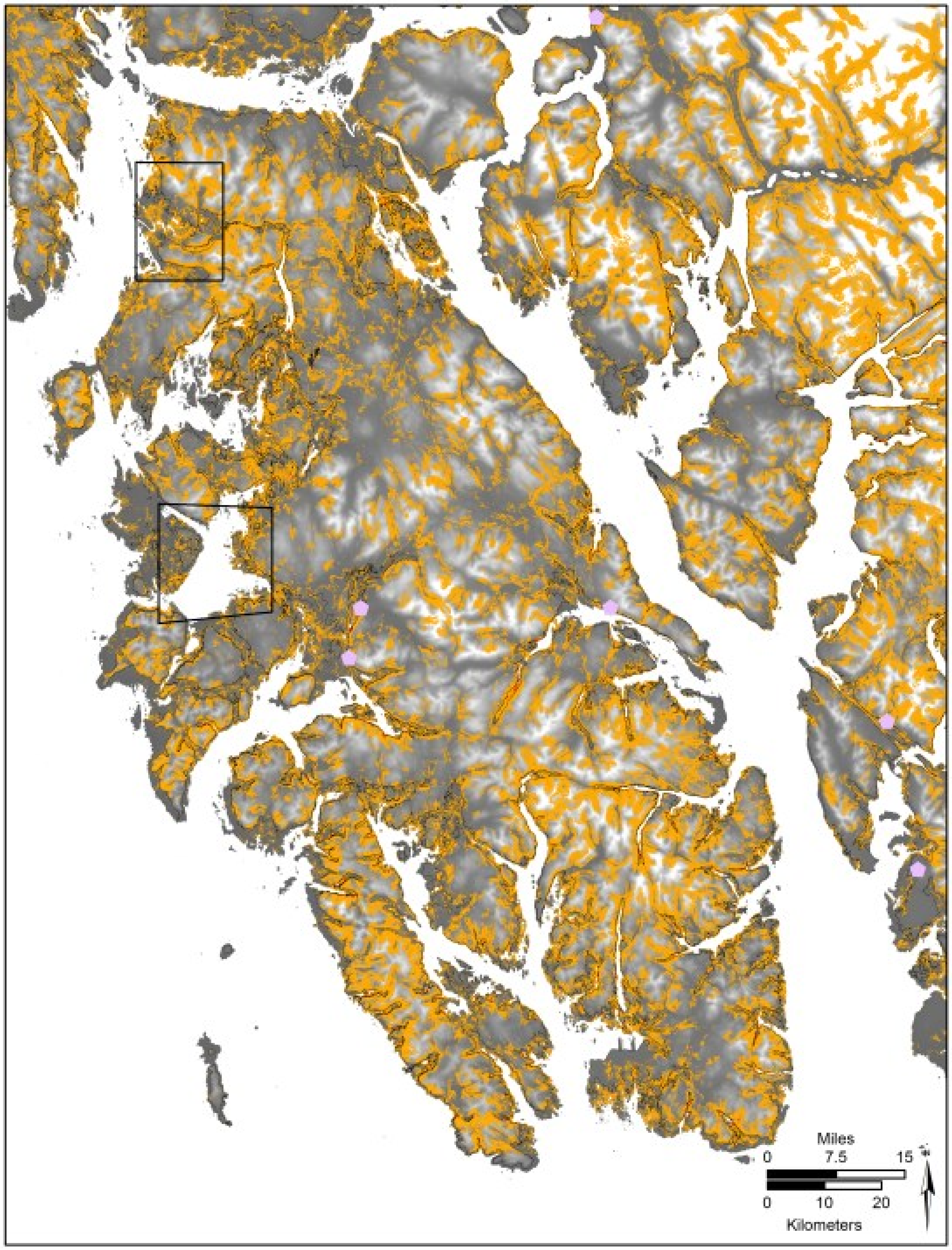
Weight 1a **11,500 cal BP**



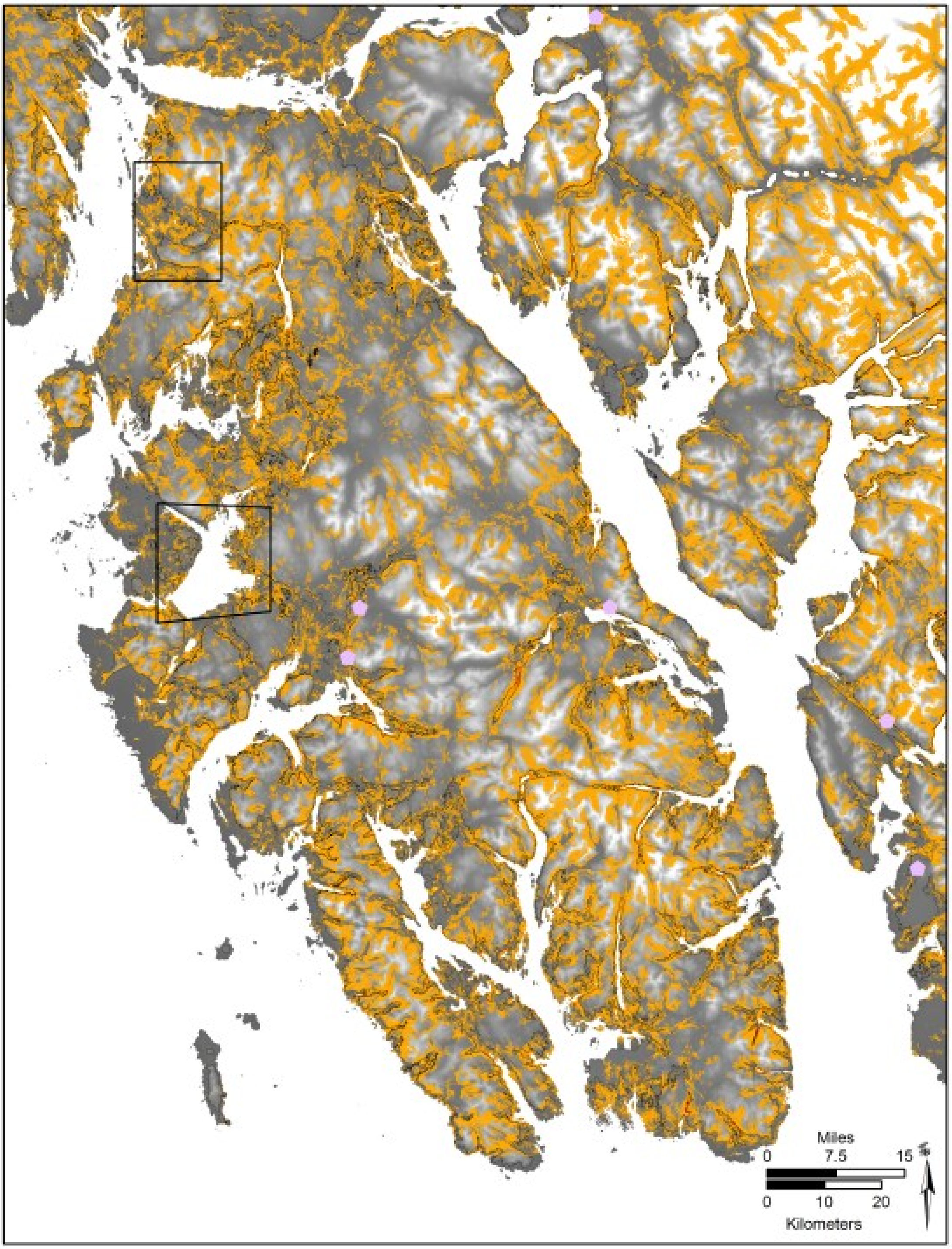
Weight 1a **12,000 cal BP**



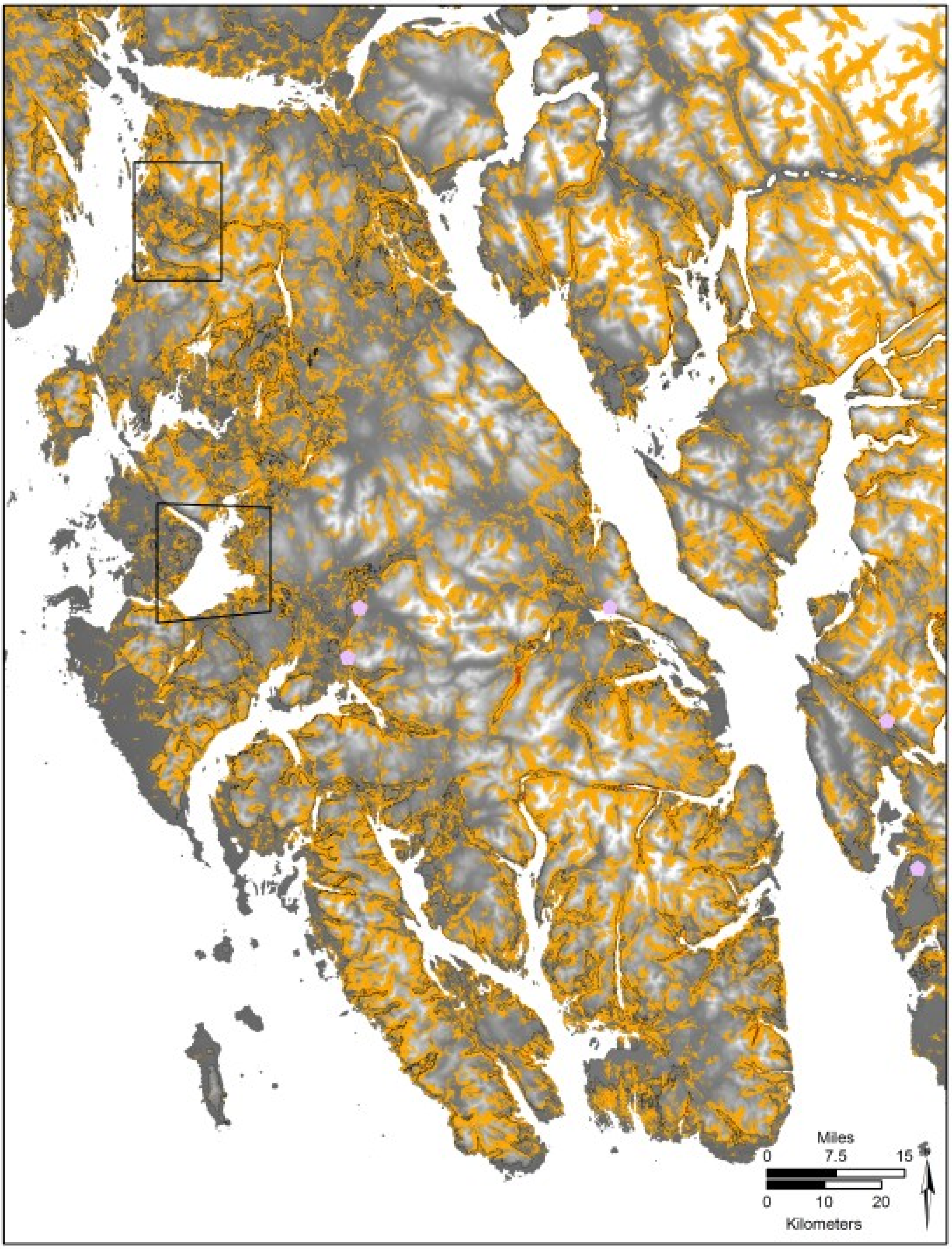
Weight 1a **12,500 cal BP**



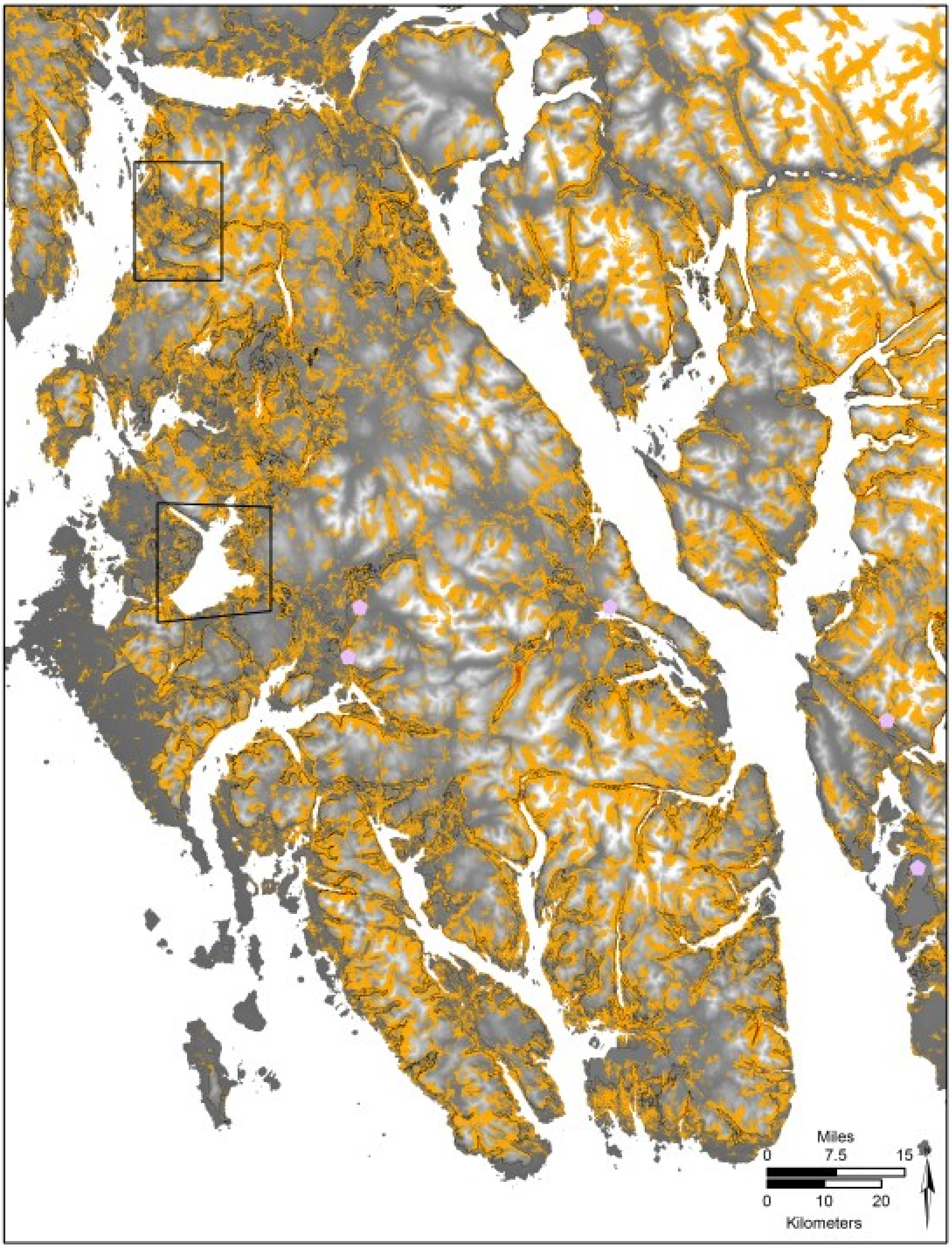
Weight 1a **13,000 cal BP**



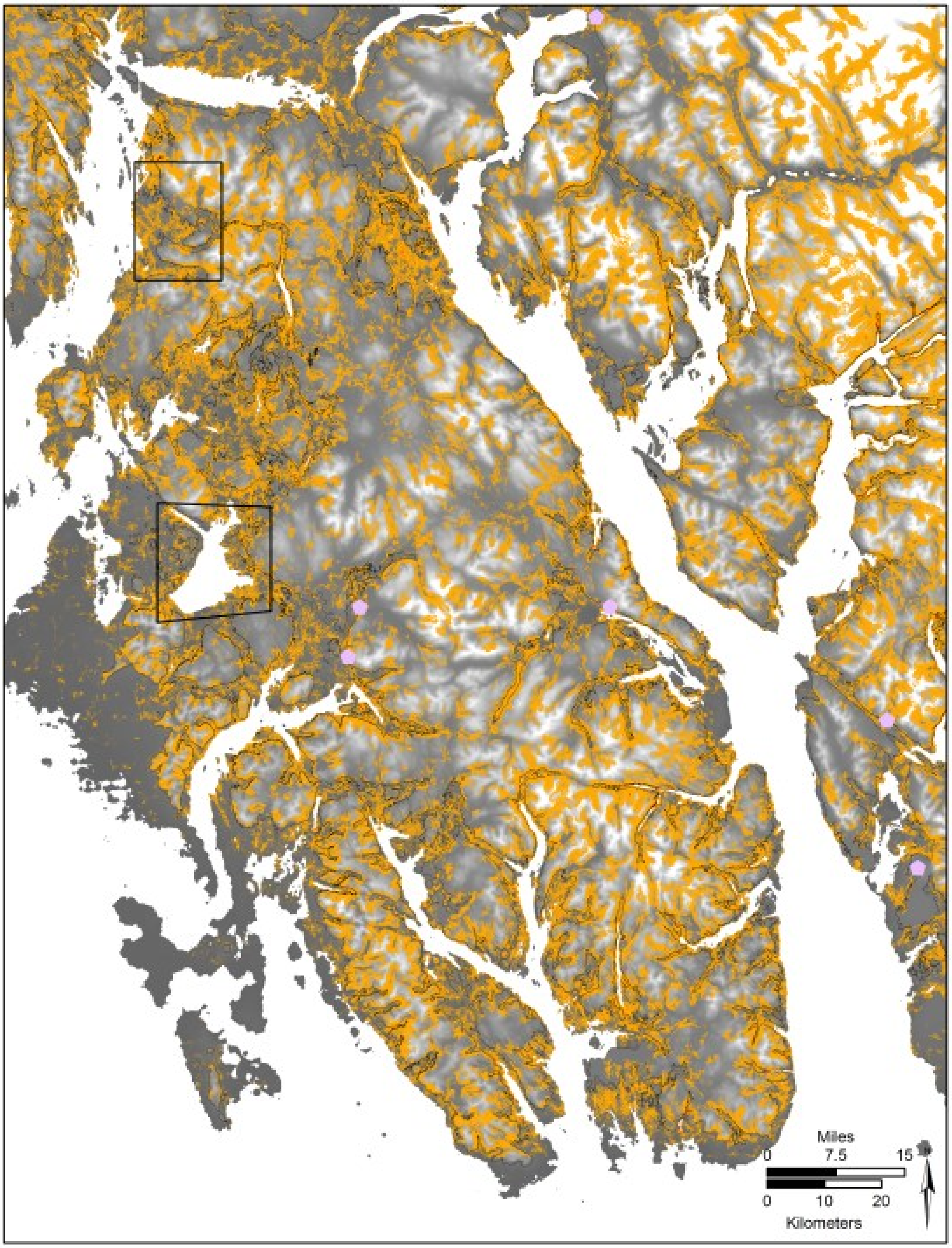
Weight 1a **13,500 cal BP**



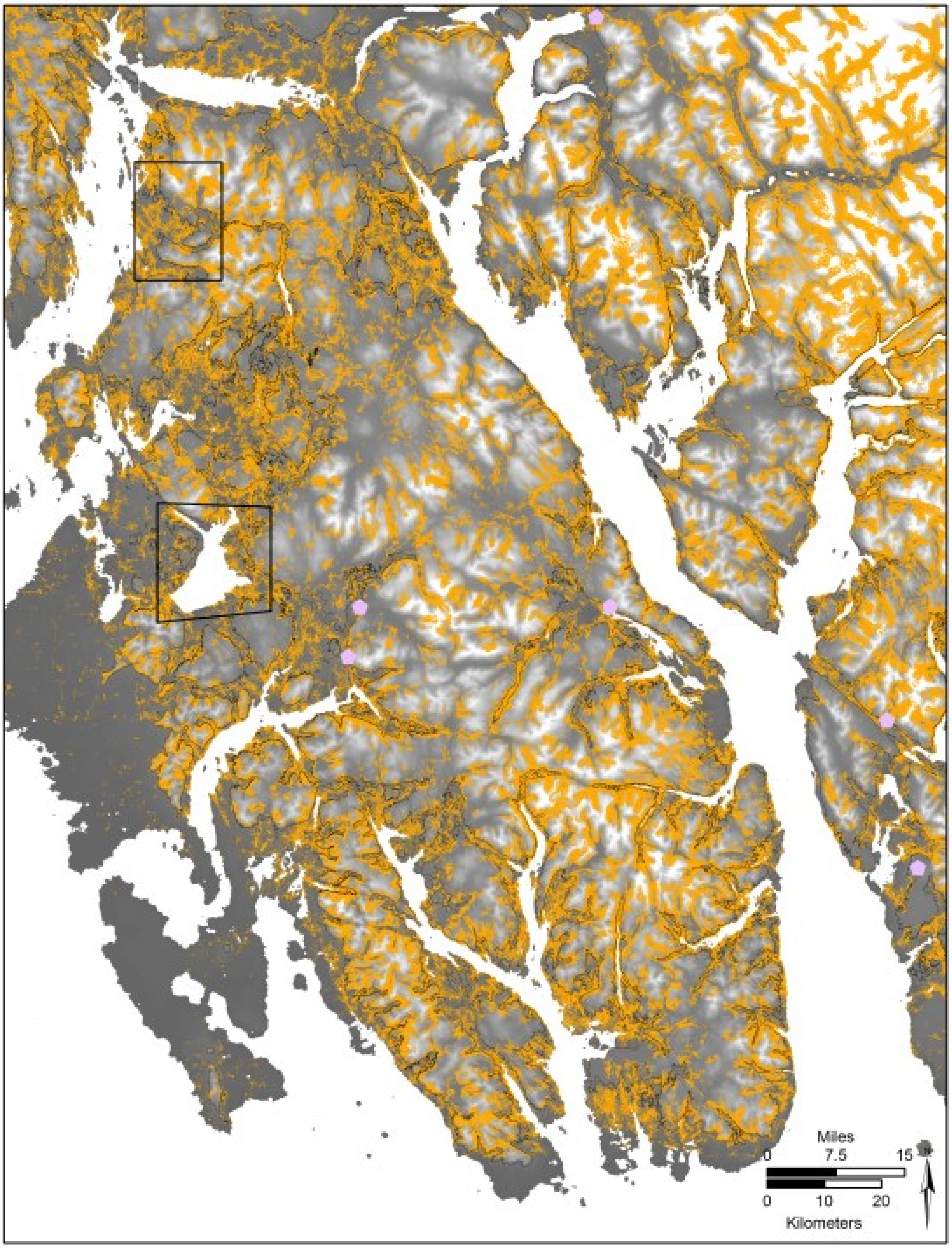
Weight 1a **14,000 cal BP**



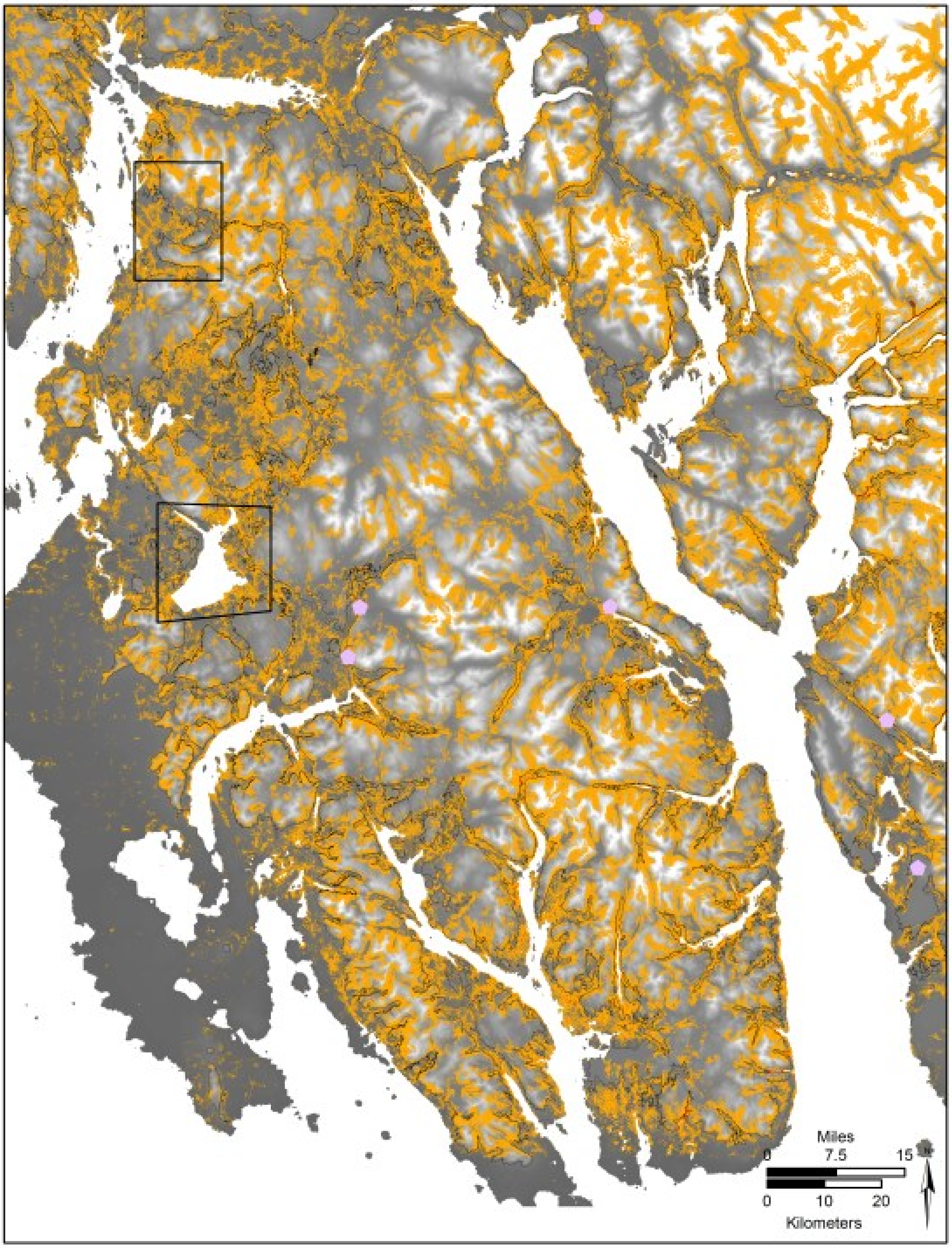
Weight 1a **14,500 cal BP**



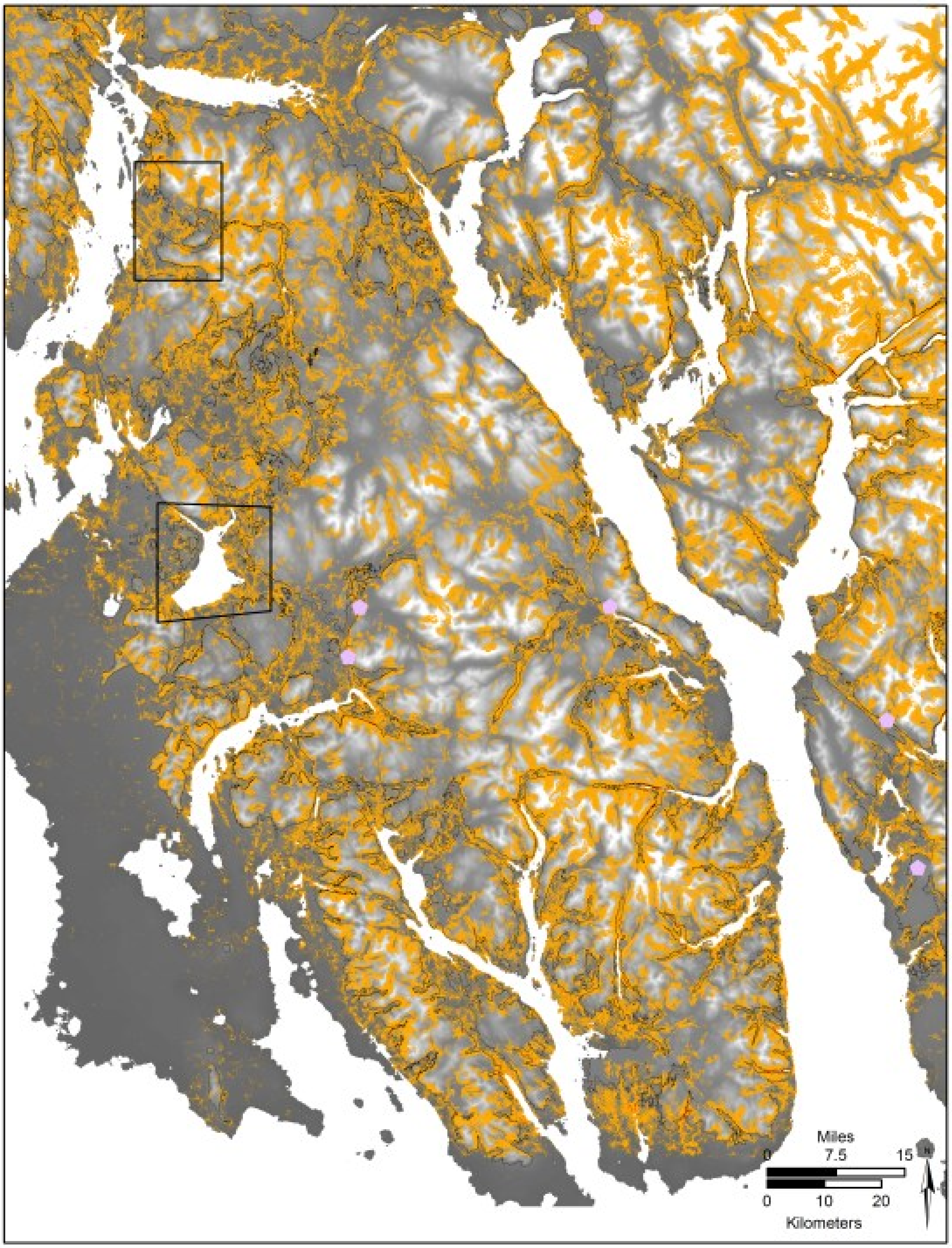
Weight 1a **15,000 cal BP**



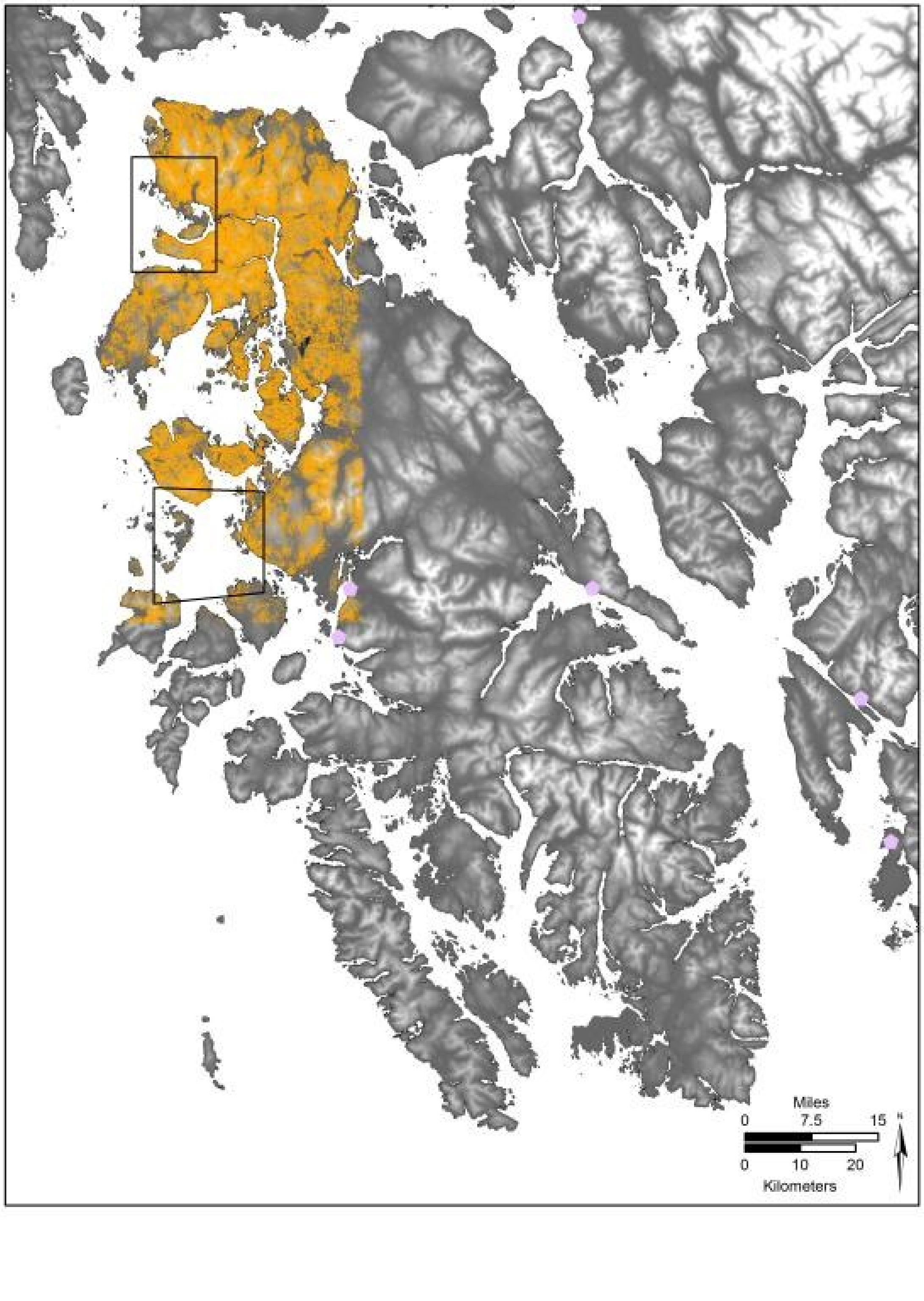
Weight 1a **15,500 cal BP**



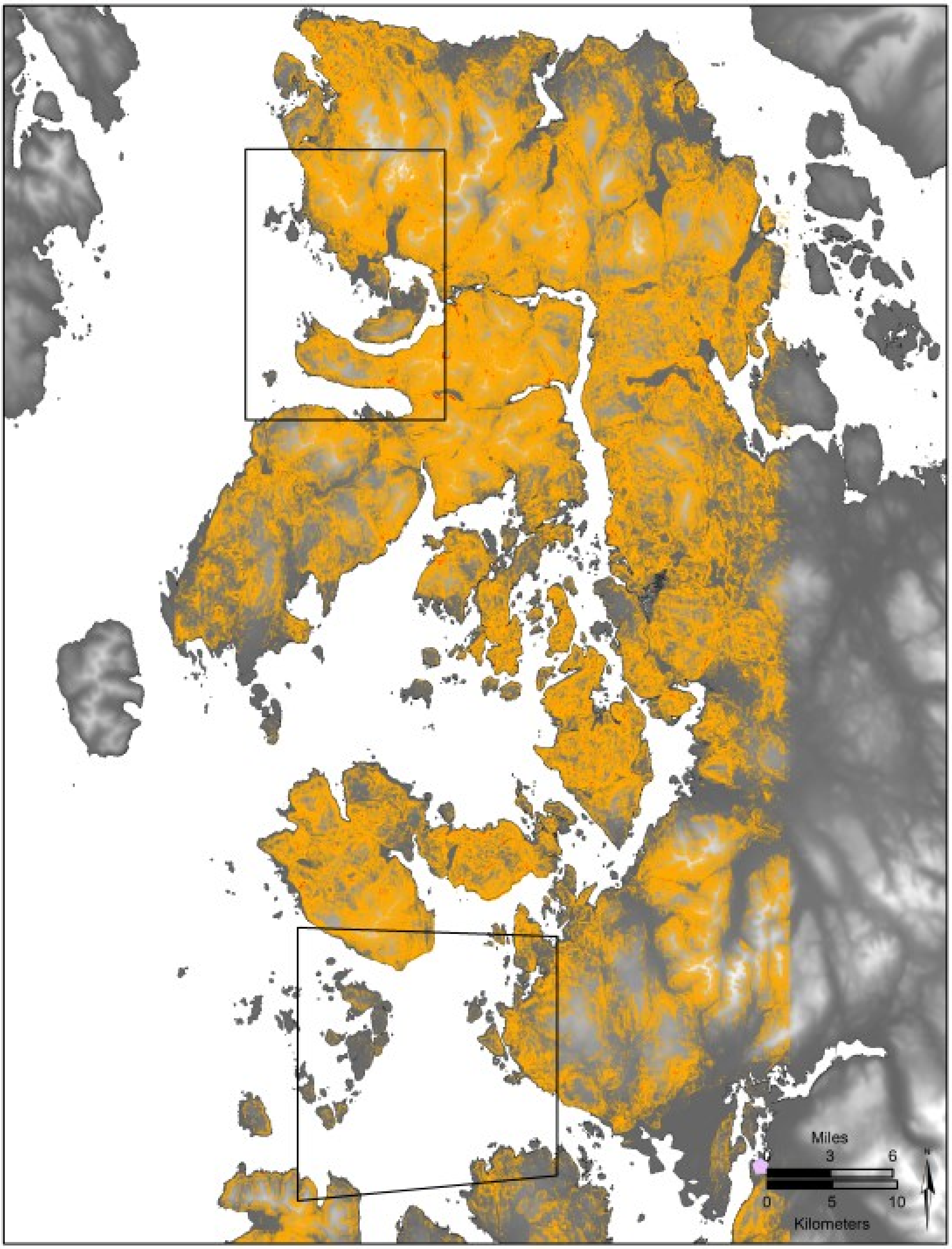
Weight 1a **16,000 cal BP**



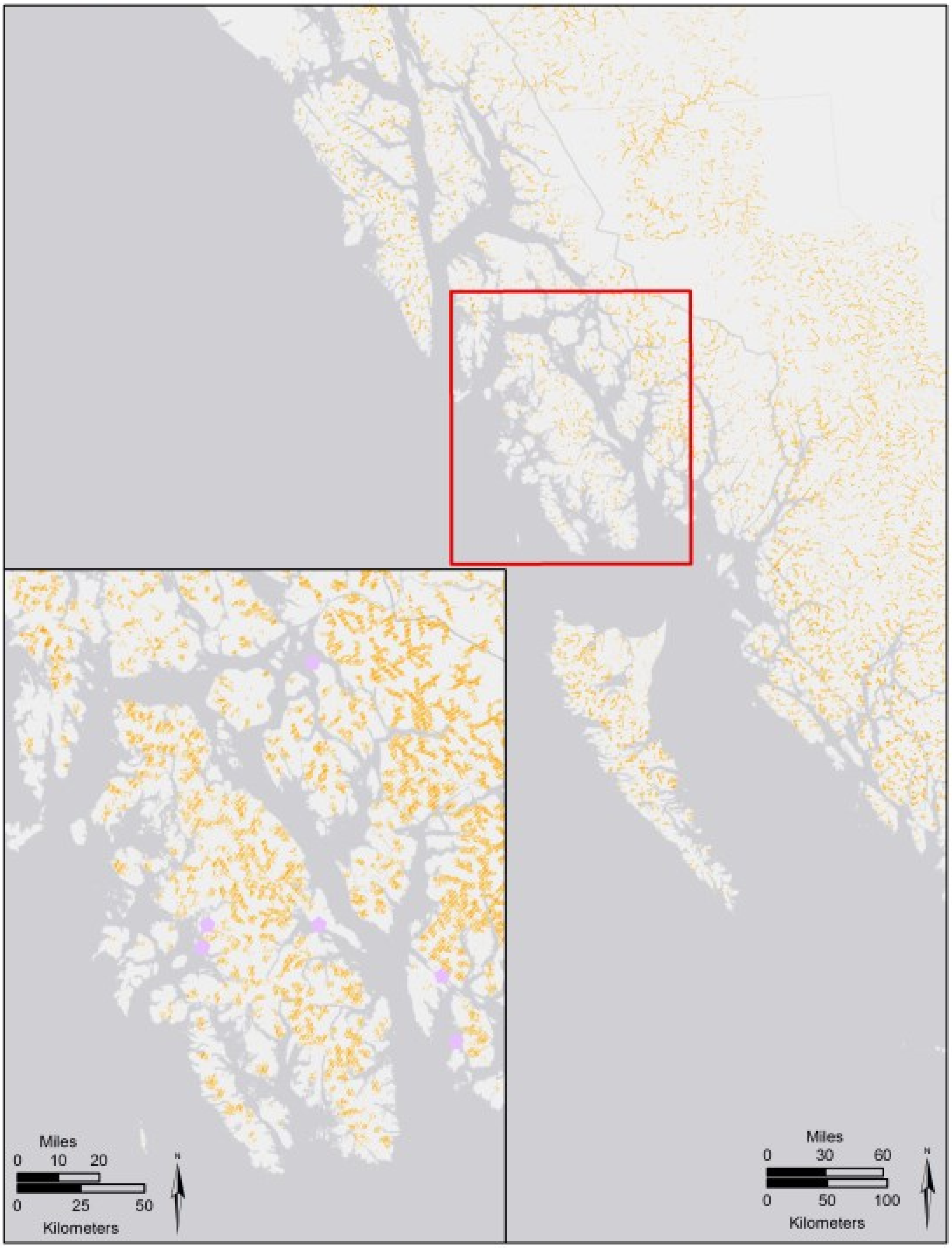
Weight 1a **Modern - Small Area**



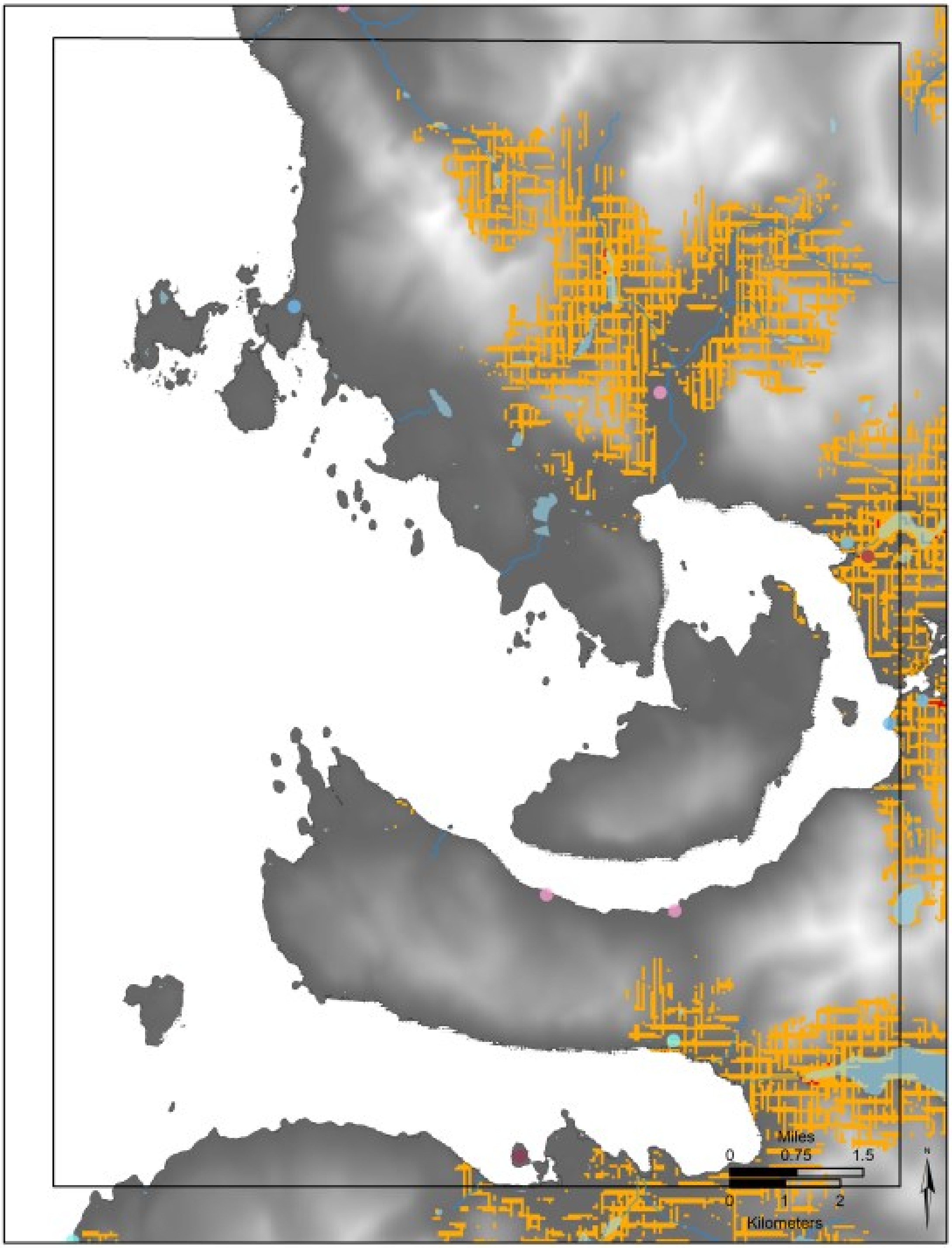
Weight 1a **Modern - Small Area**



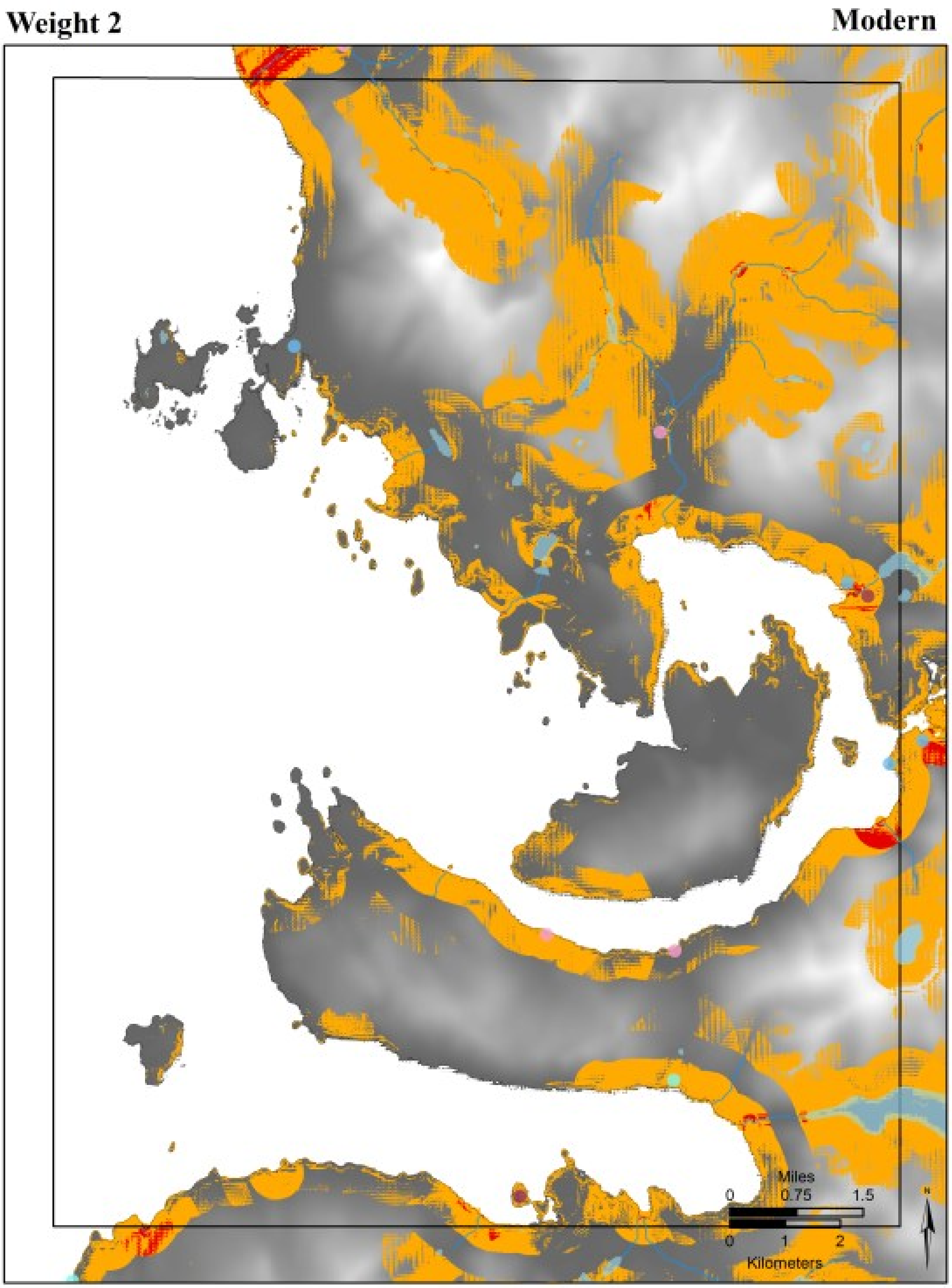
Weight 1a **NWC - modern**



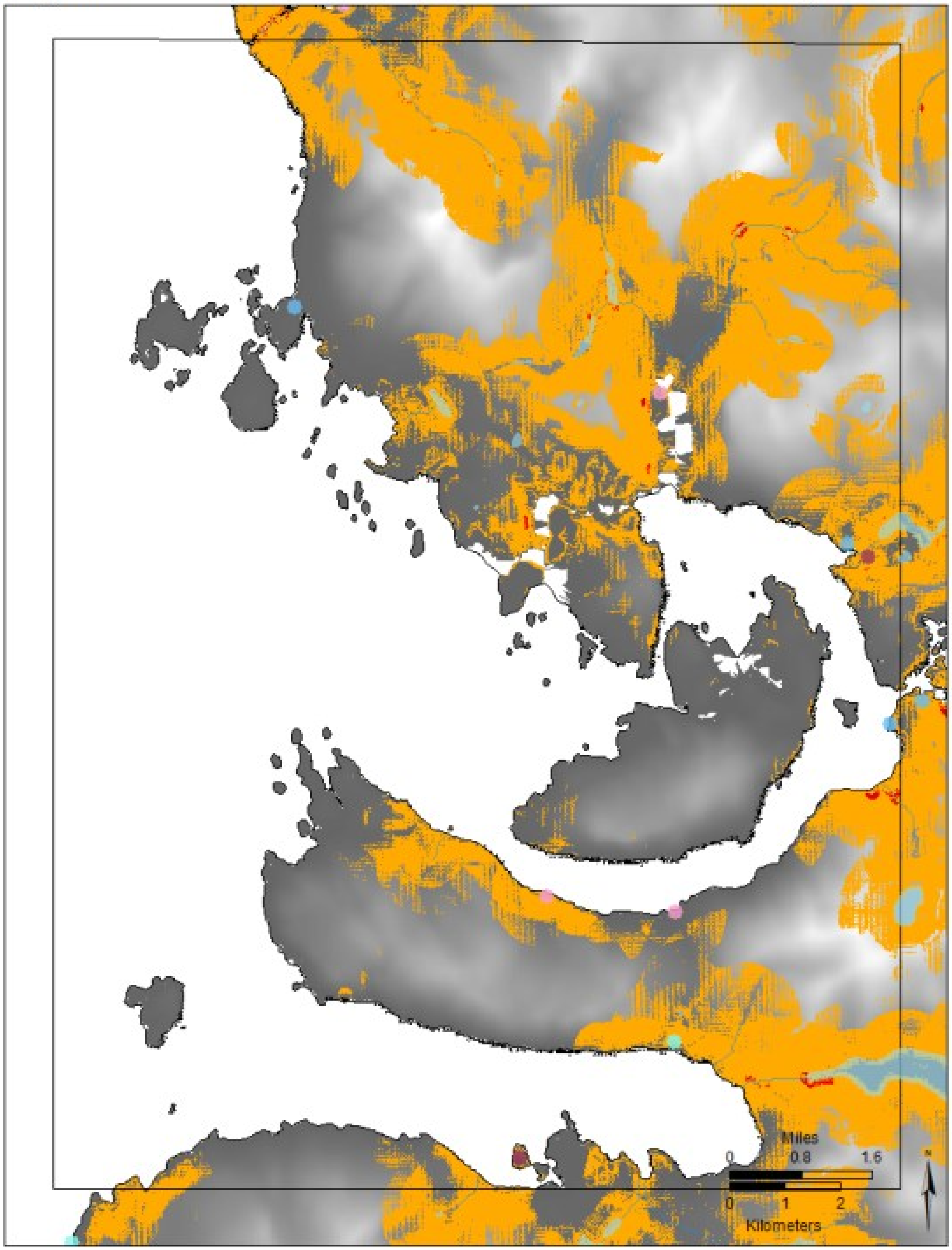
Weight 1a **NWC - modern**



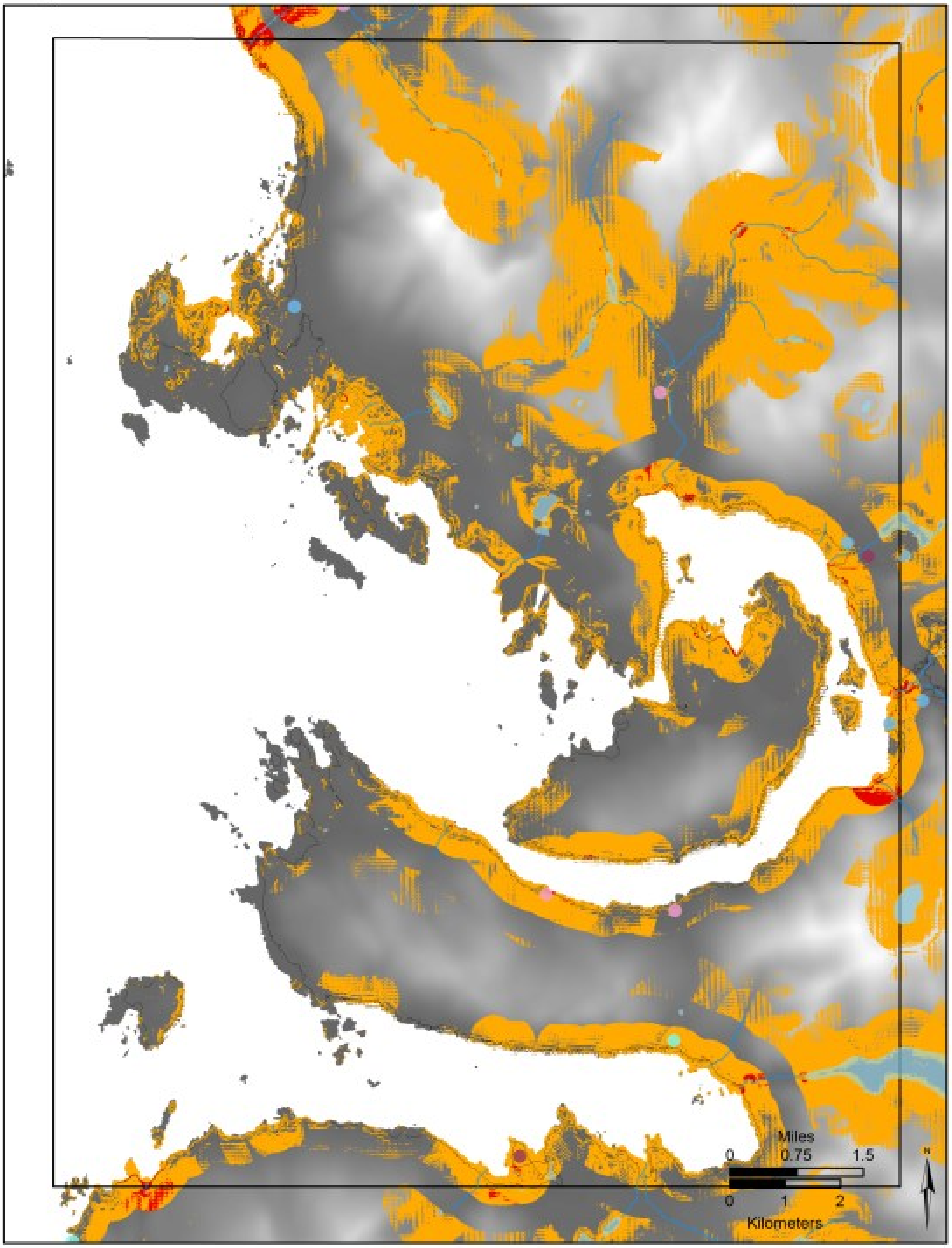
C.4 Weighted Overlay 2



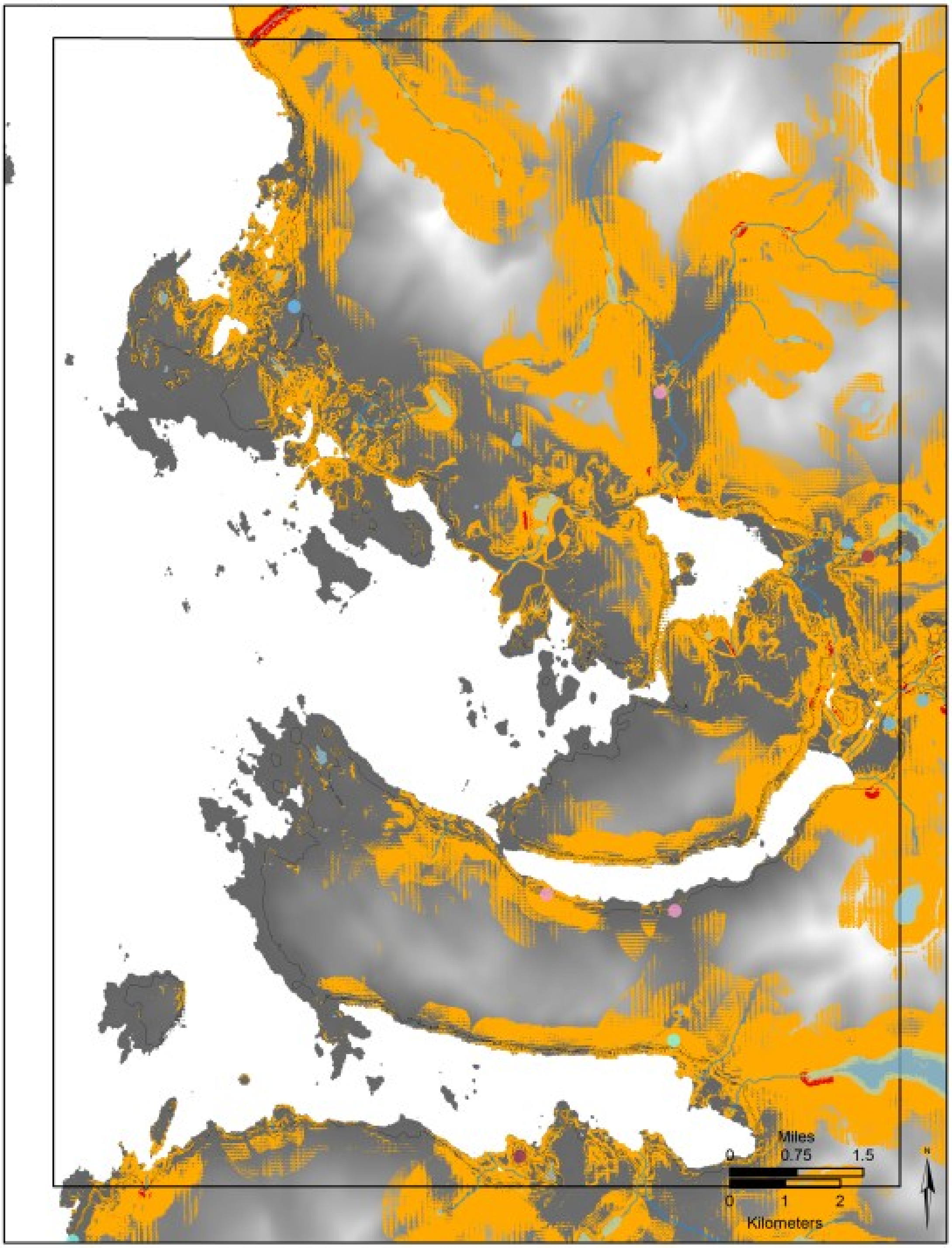
Weight 2 **10,500 cal BP**



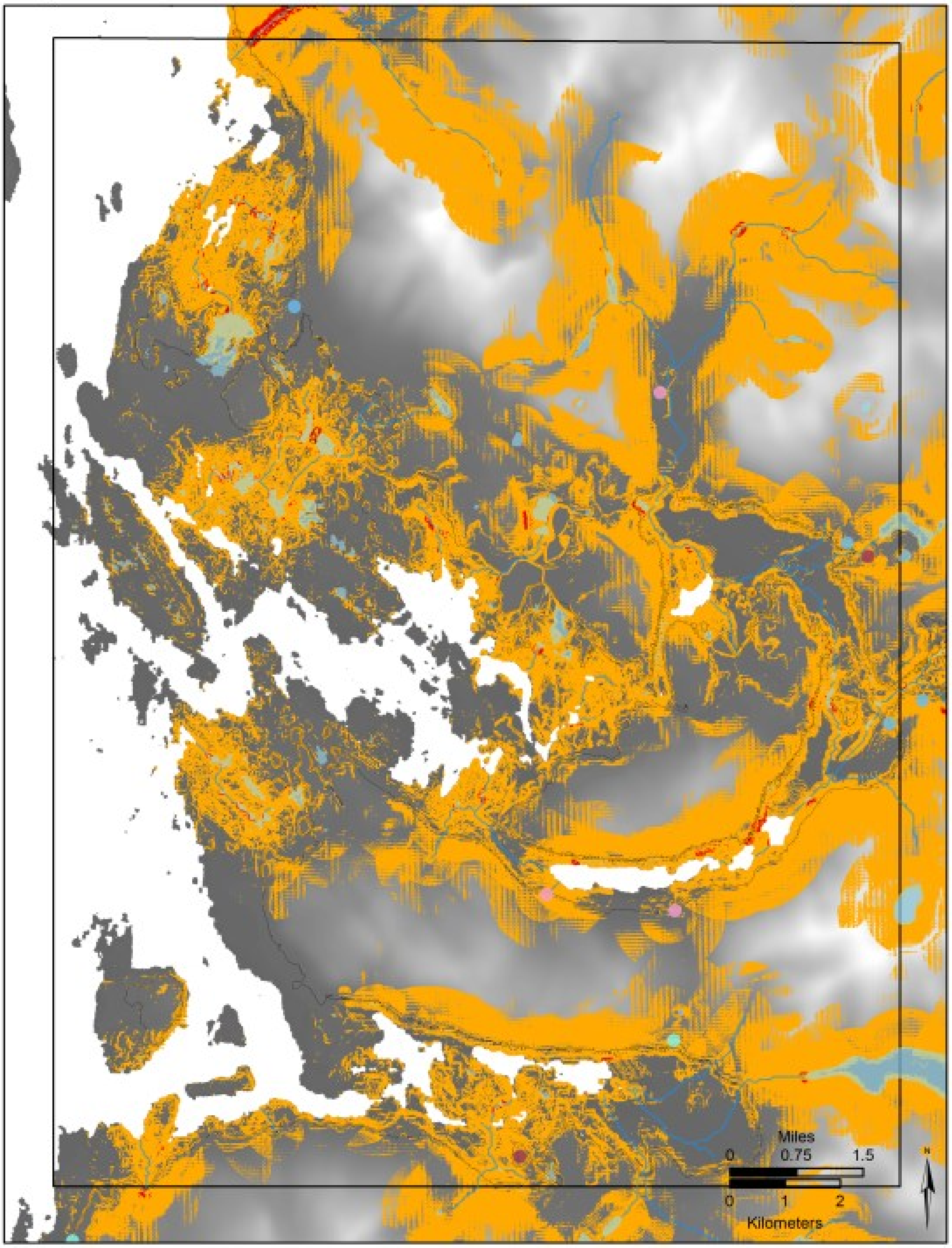
Weight 2 **11,000 cal BP**



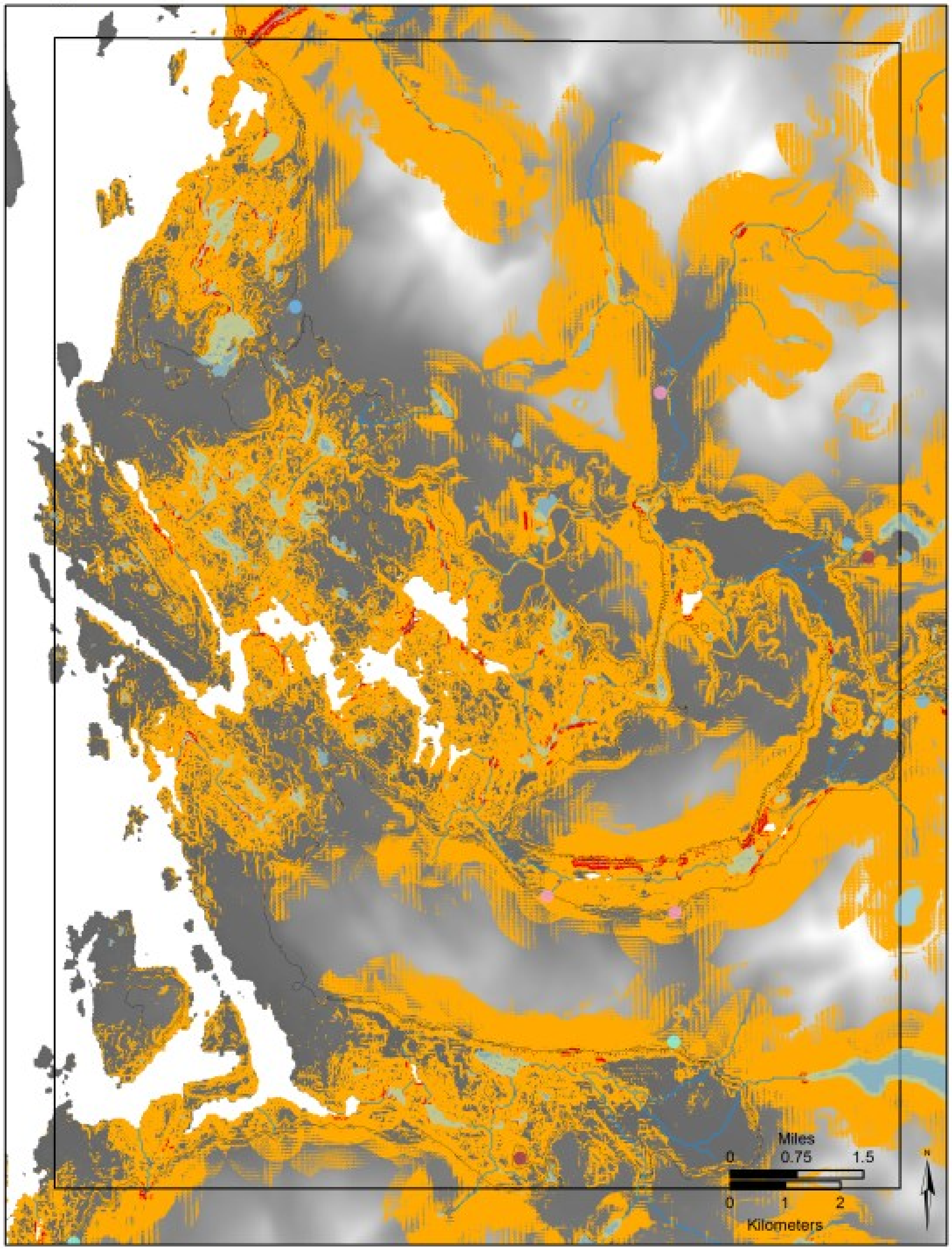
Weight 2 **11,500 cal BP**



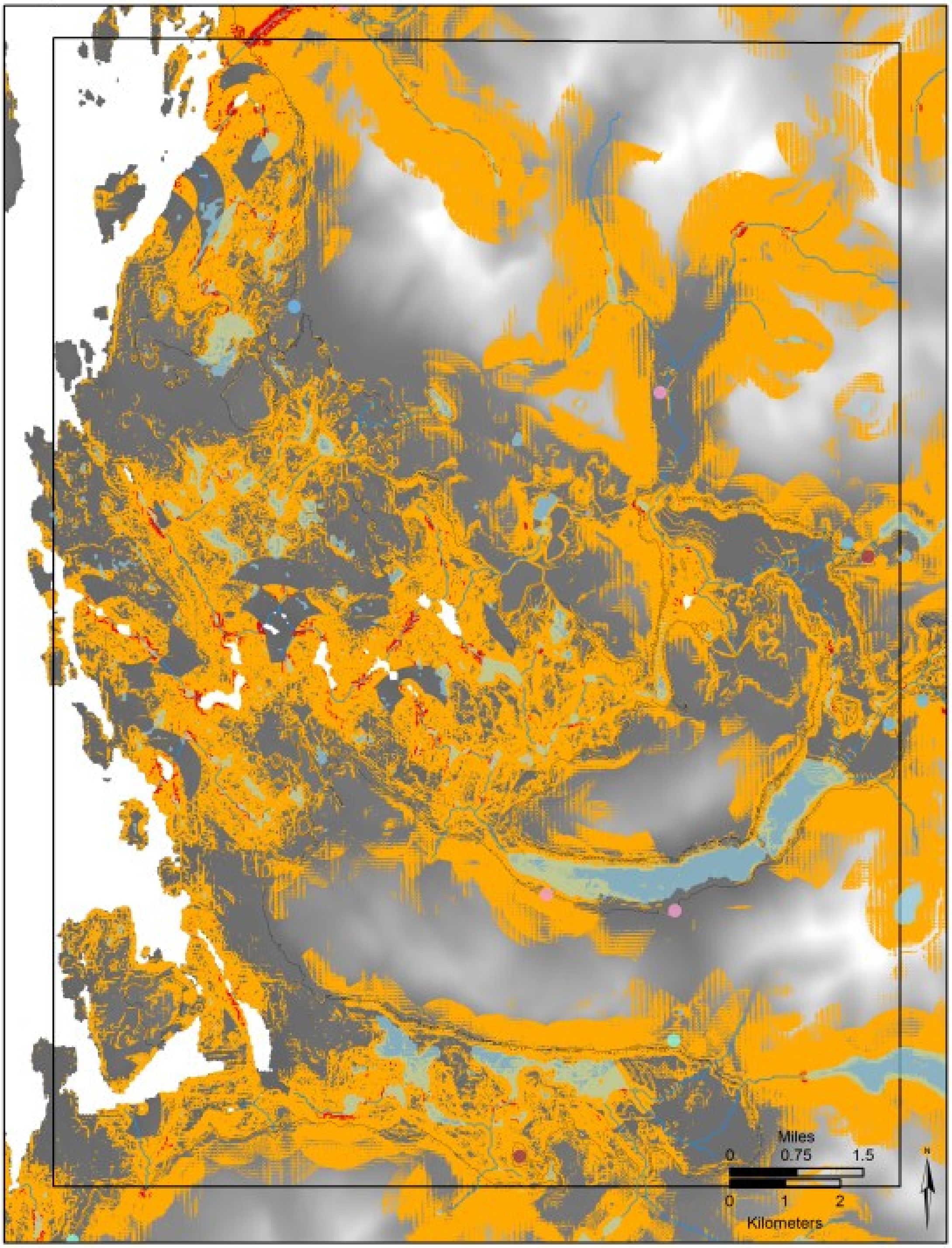
Weight 2 **12,000 cal BP**



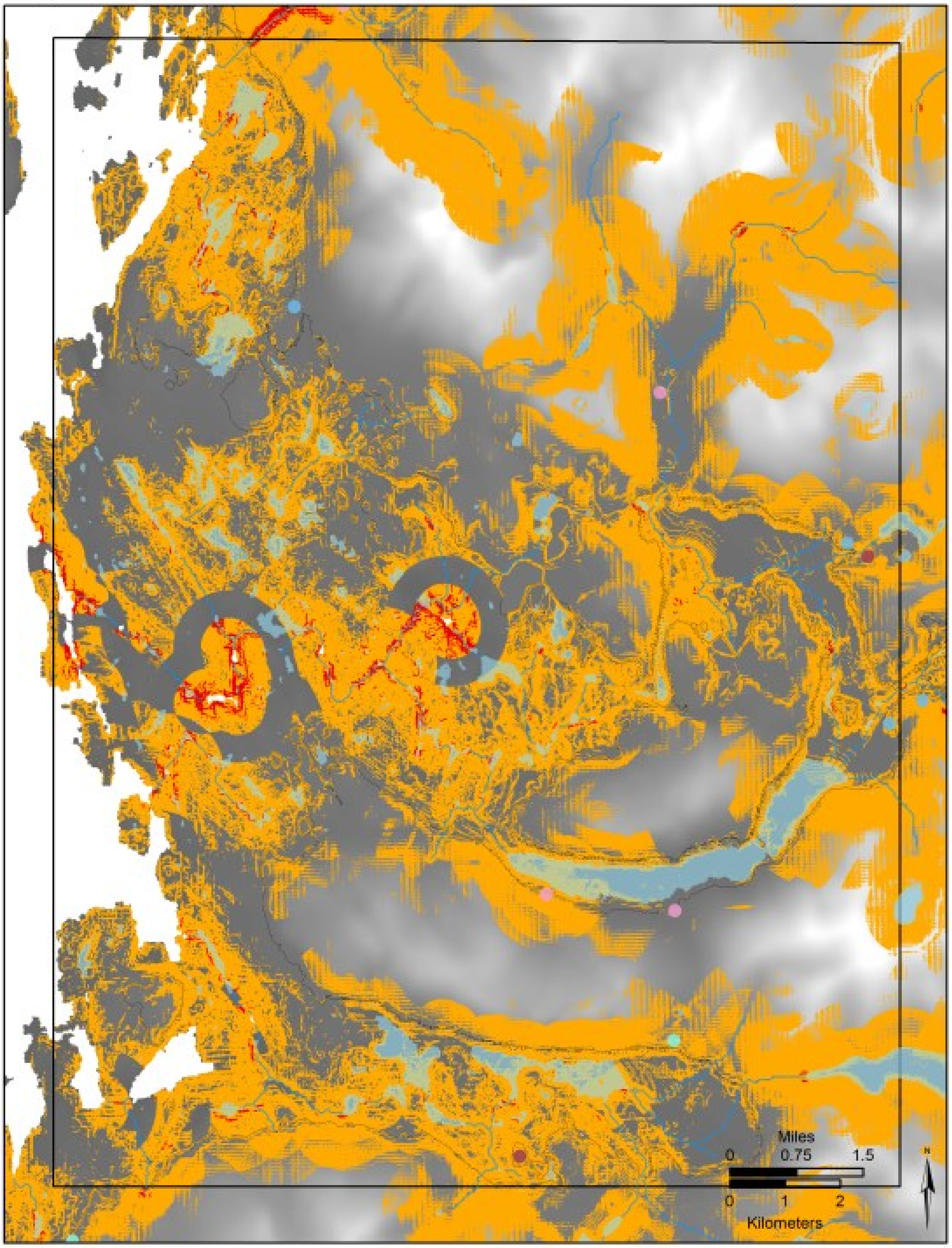
Weight 2 **12,500 cal BP**



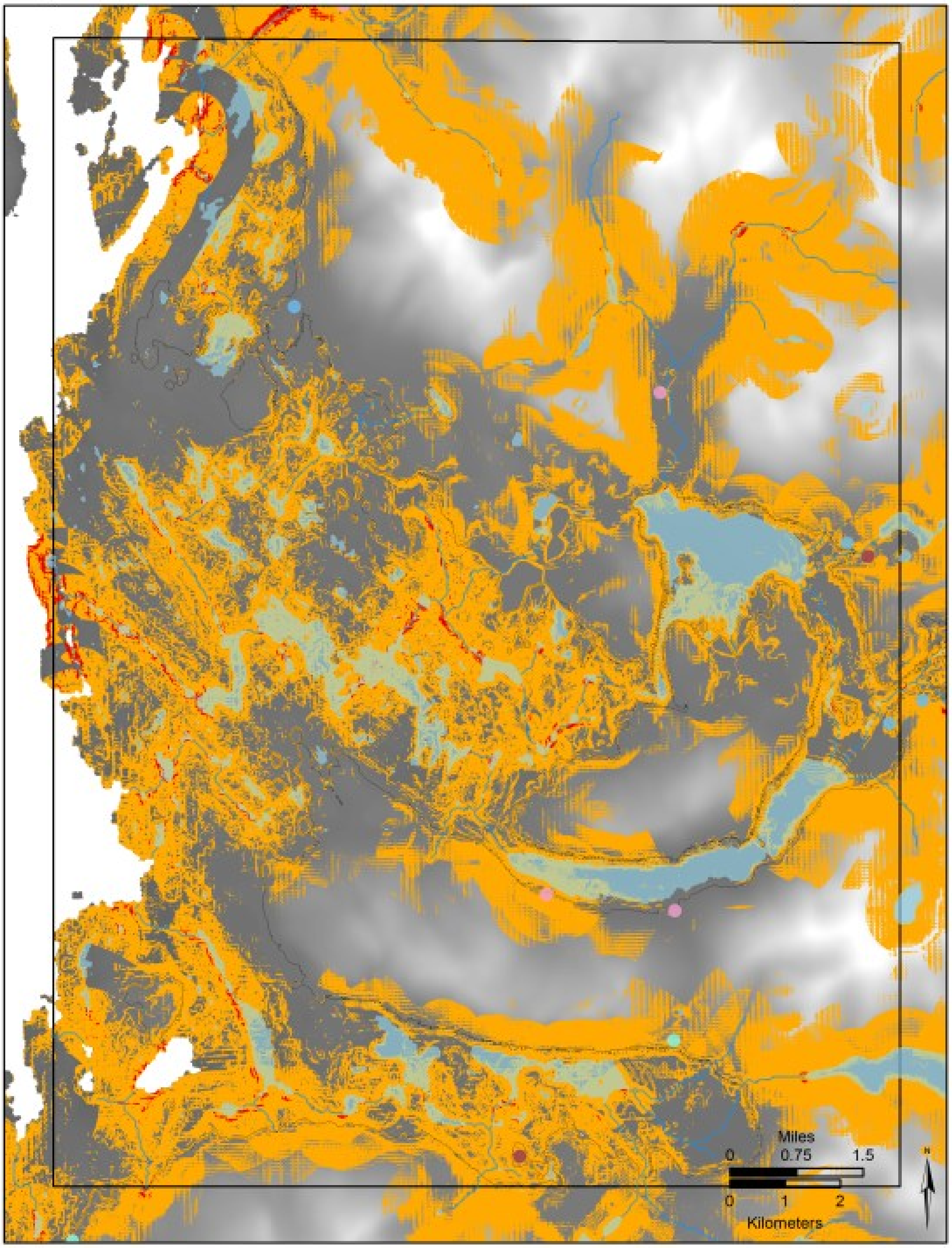
Weight 2 **13,000 cal BP**



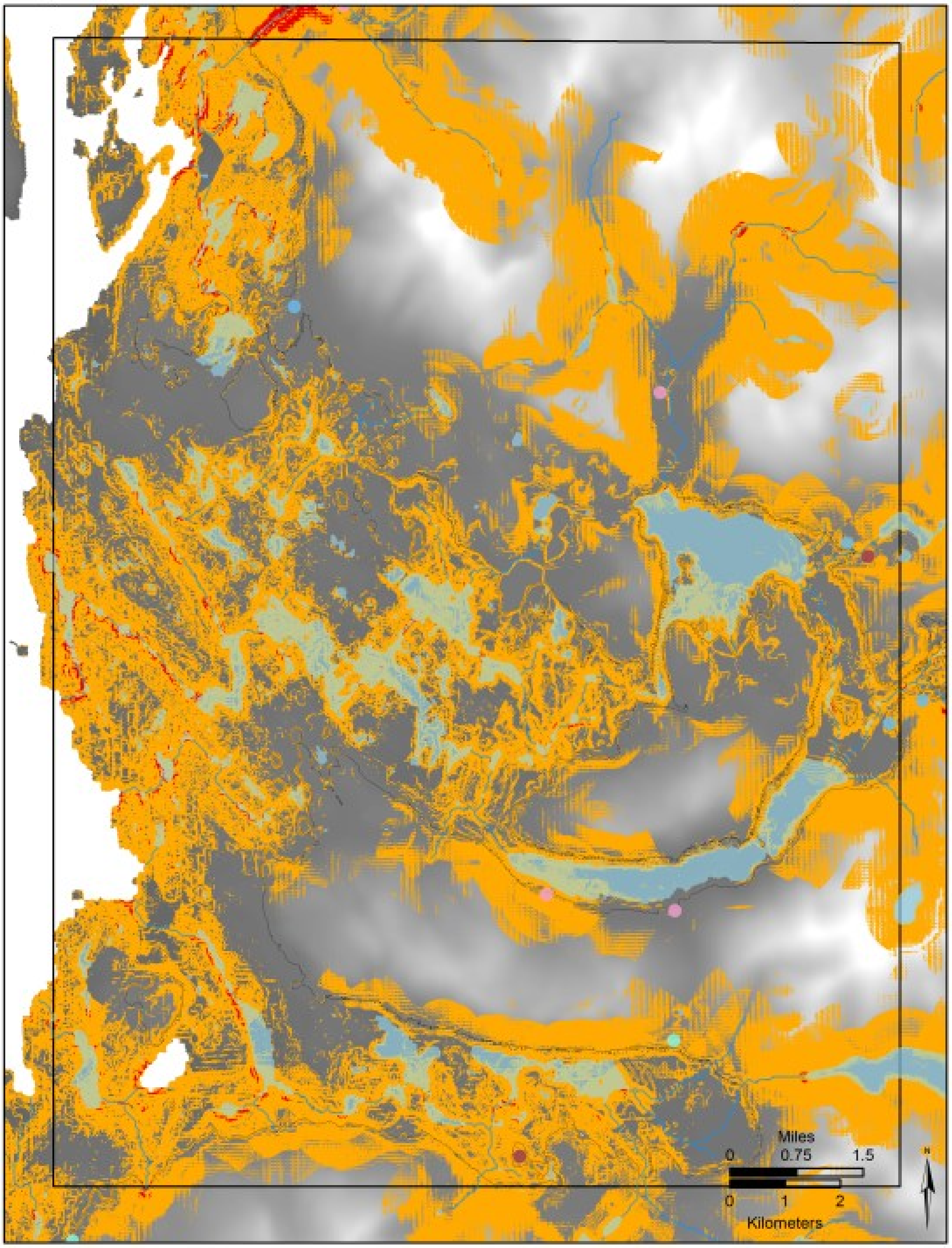
Weight 2 **13,500 cal BP**



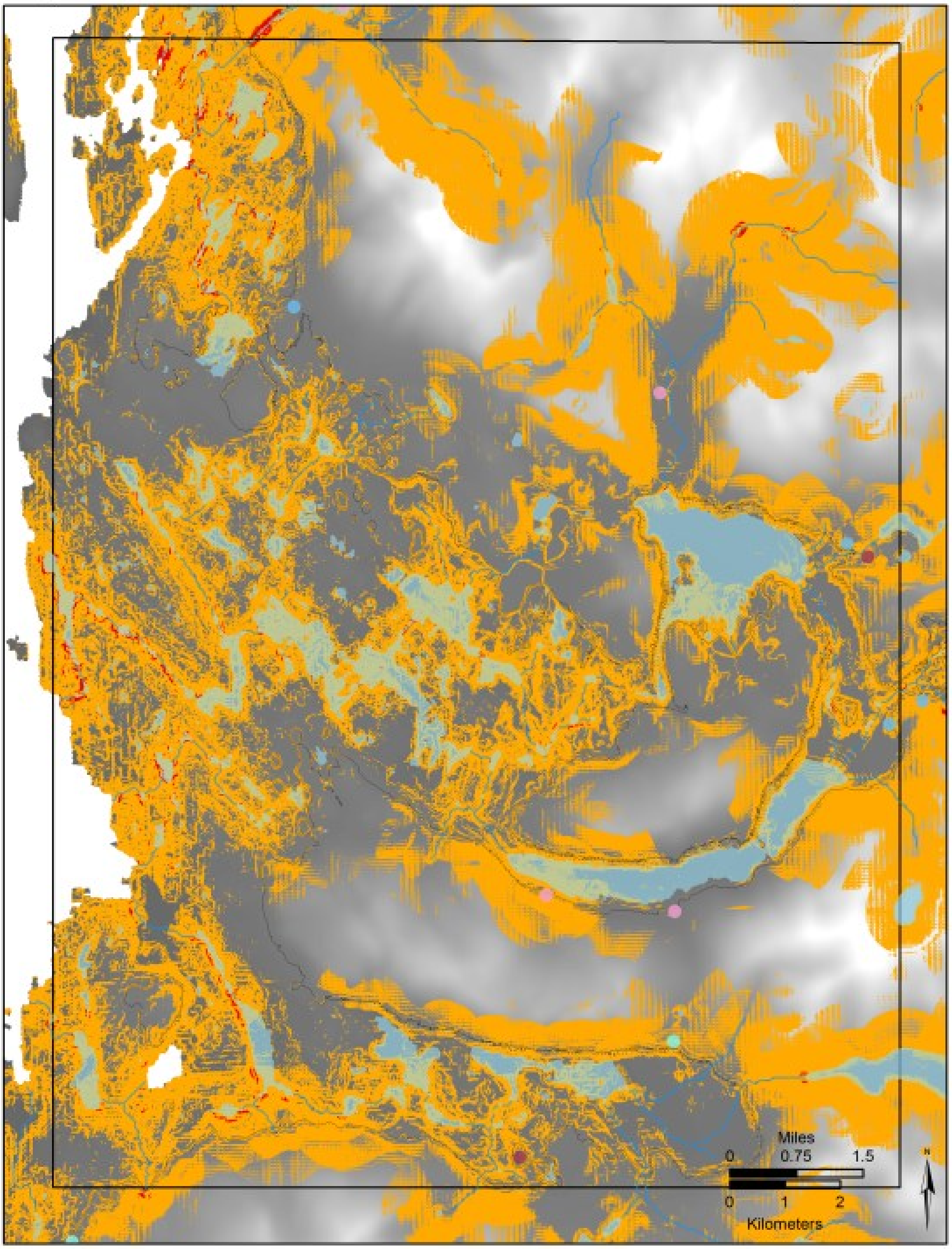
Weight 2 **14,000 cal BP**



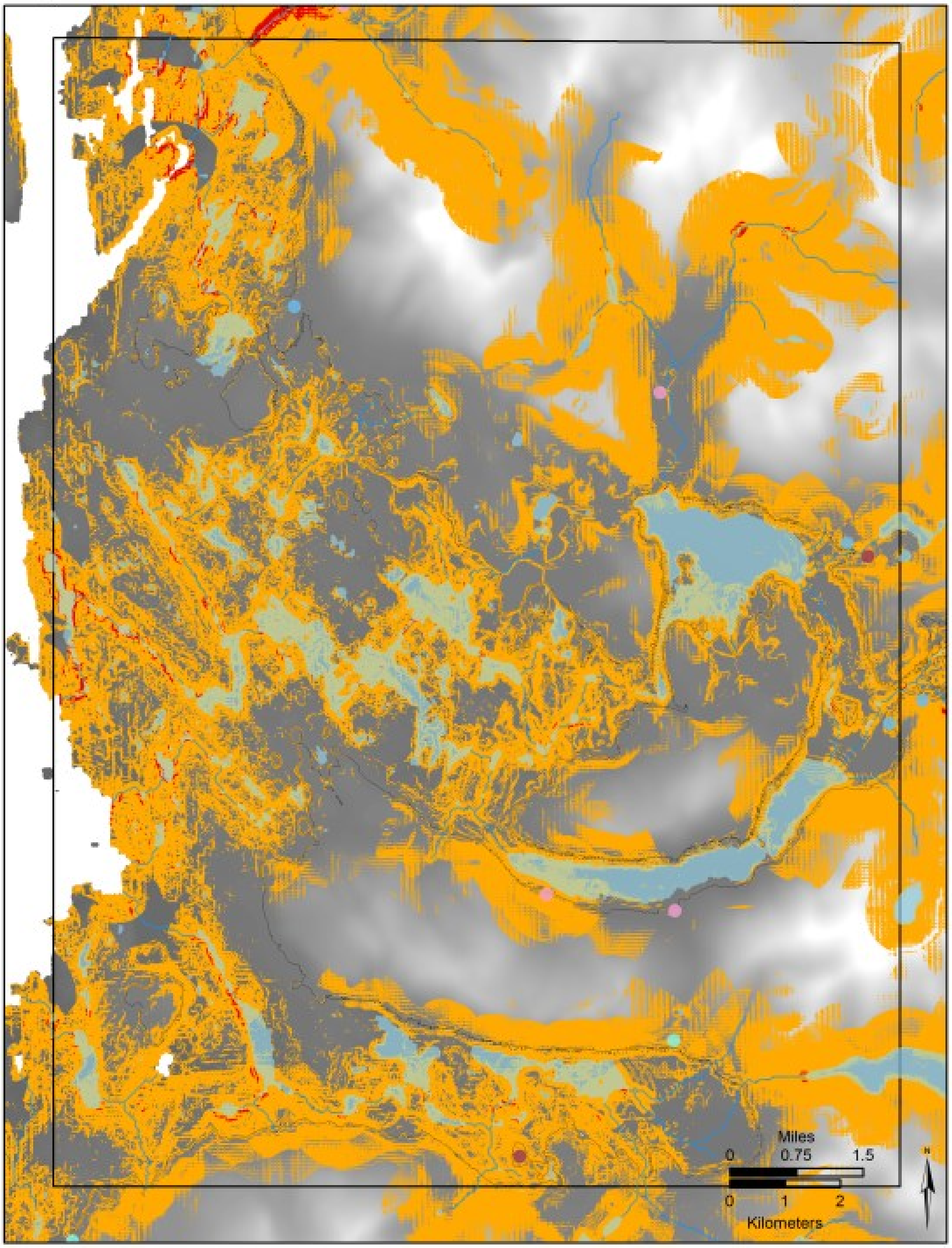
Weight 2 **14,500 cal BP**



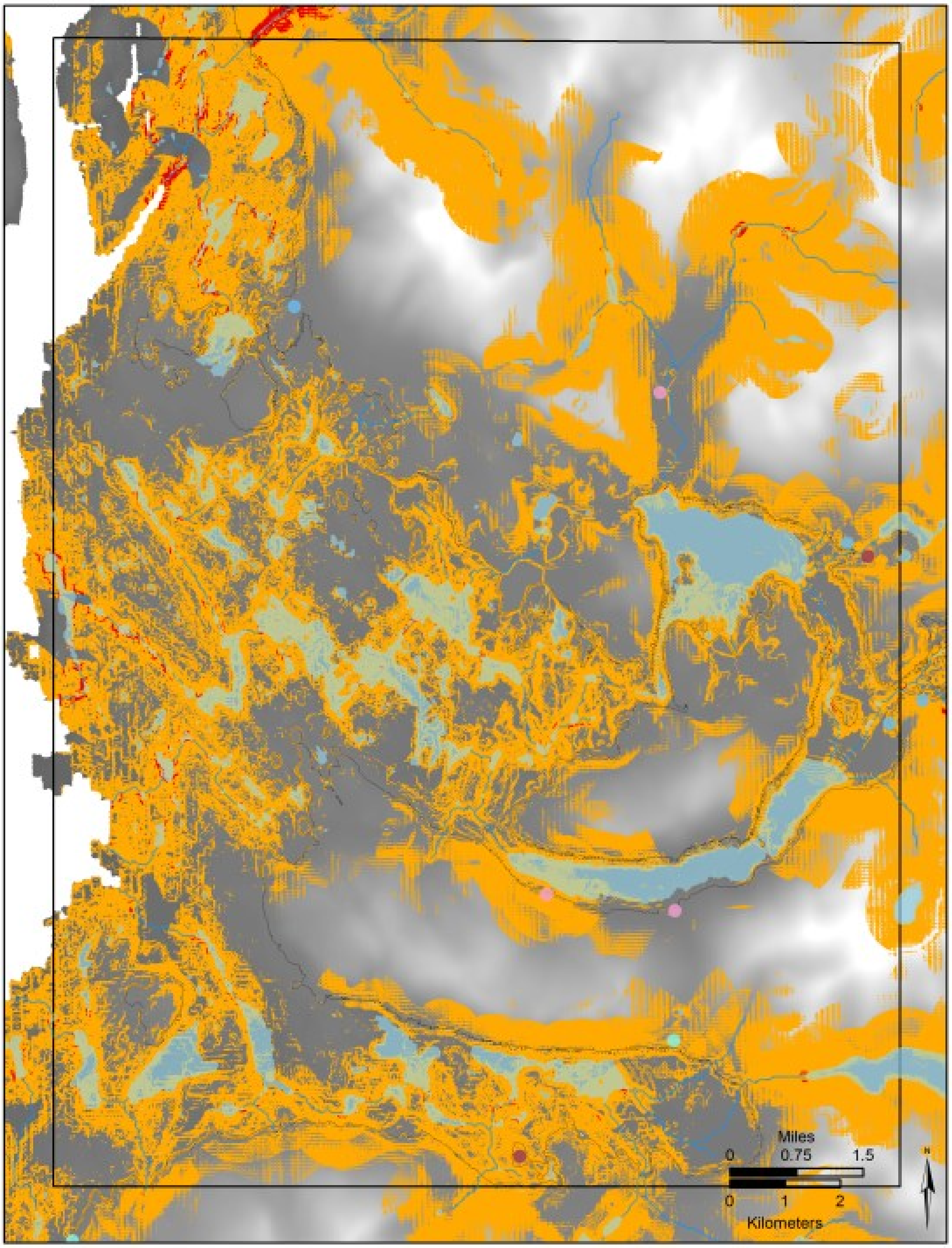
Weight 2 **15,000 cal BP**



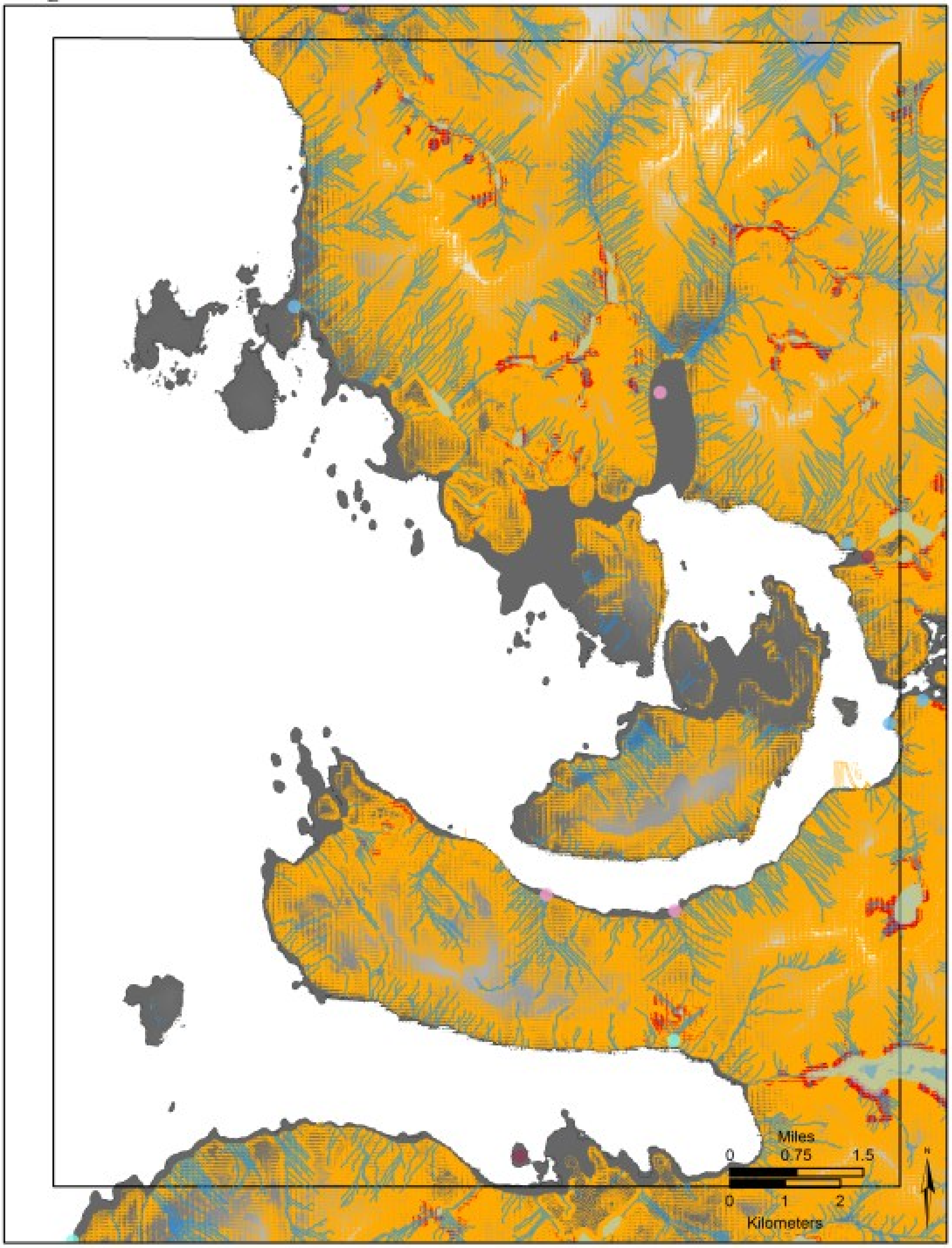
Weight 2 **15,500 cal BP**



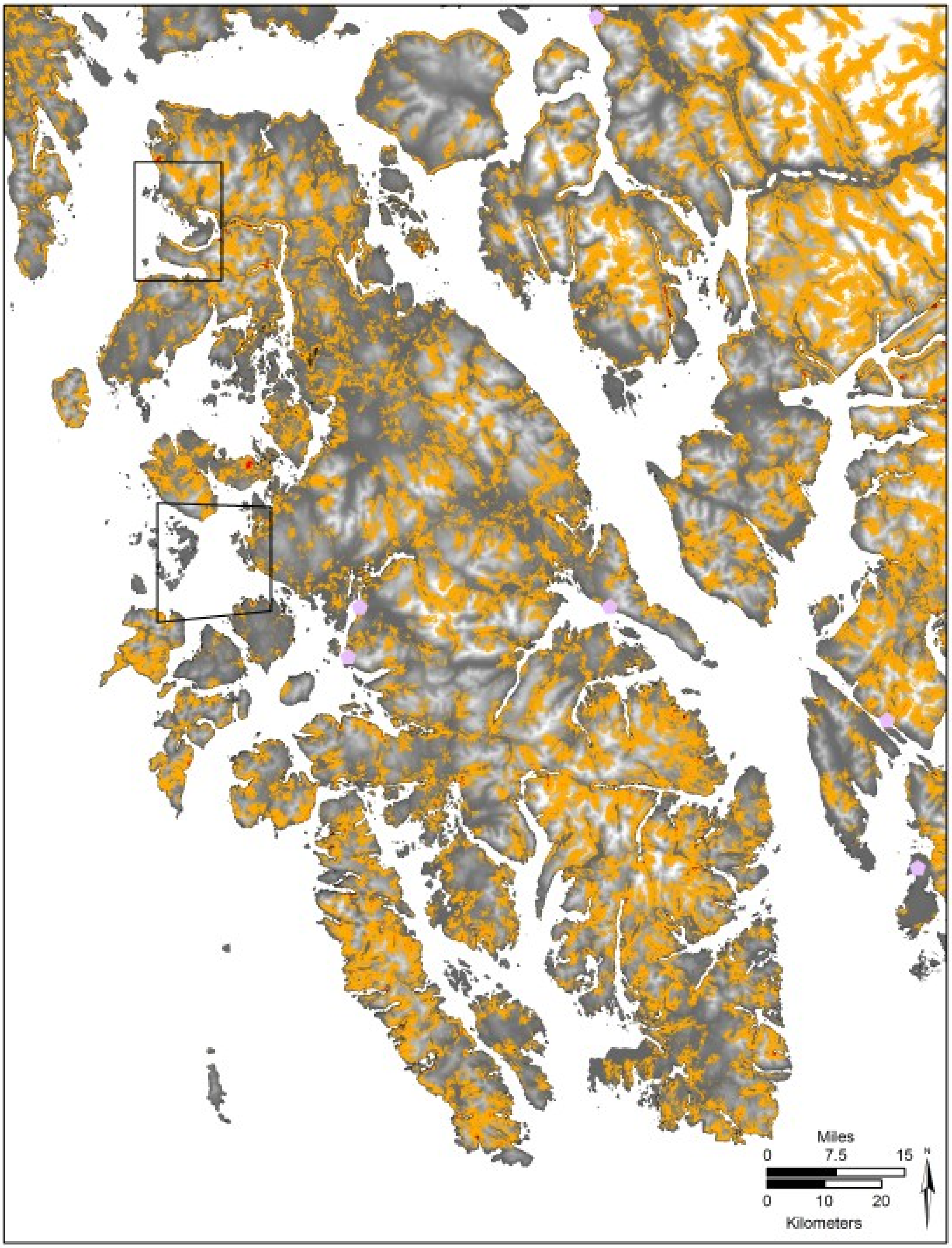
Weight 2 **16,000 cal BP**



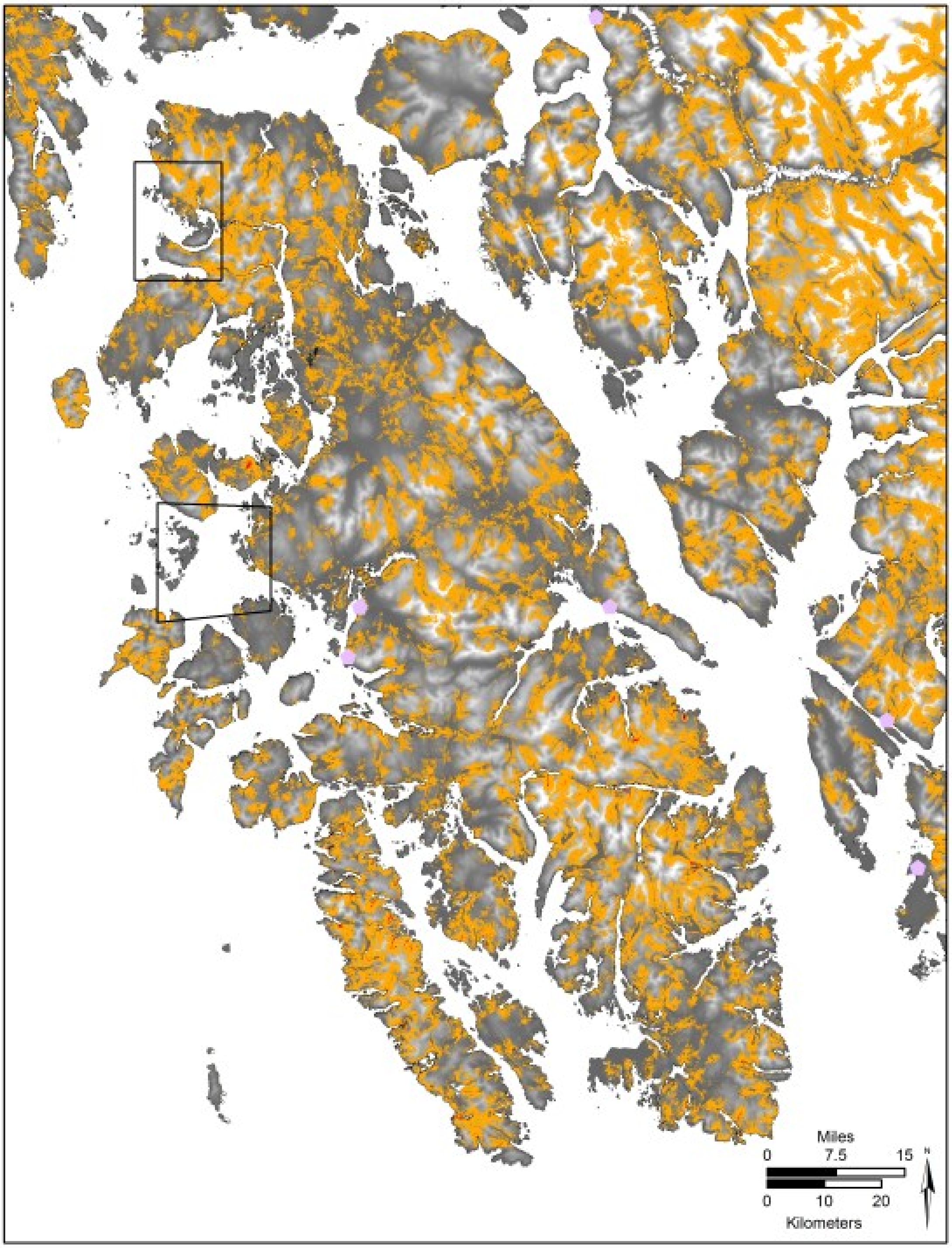
Weight 2 **Modern - Small Area**



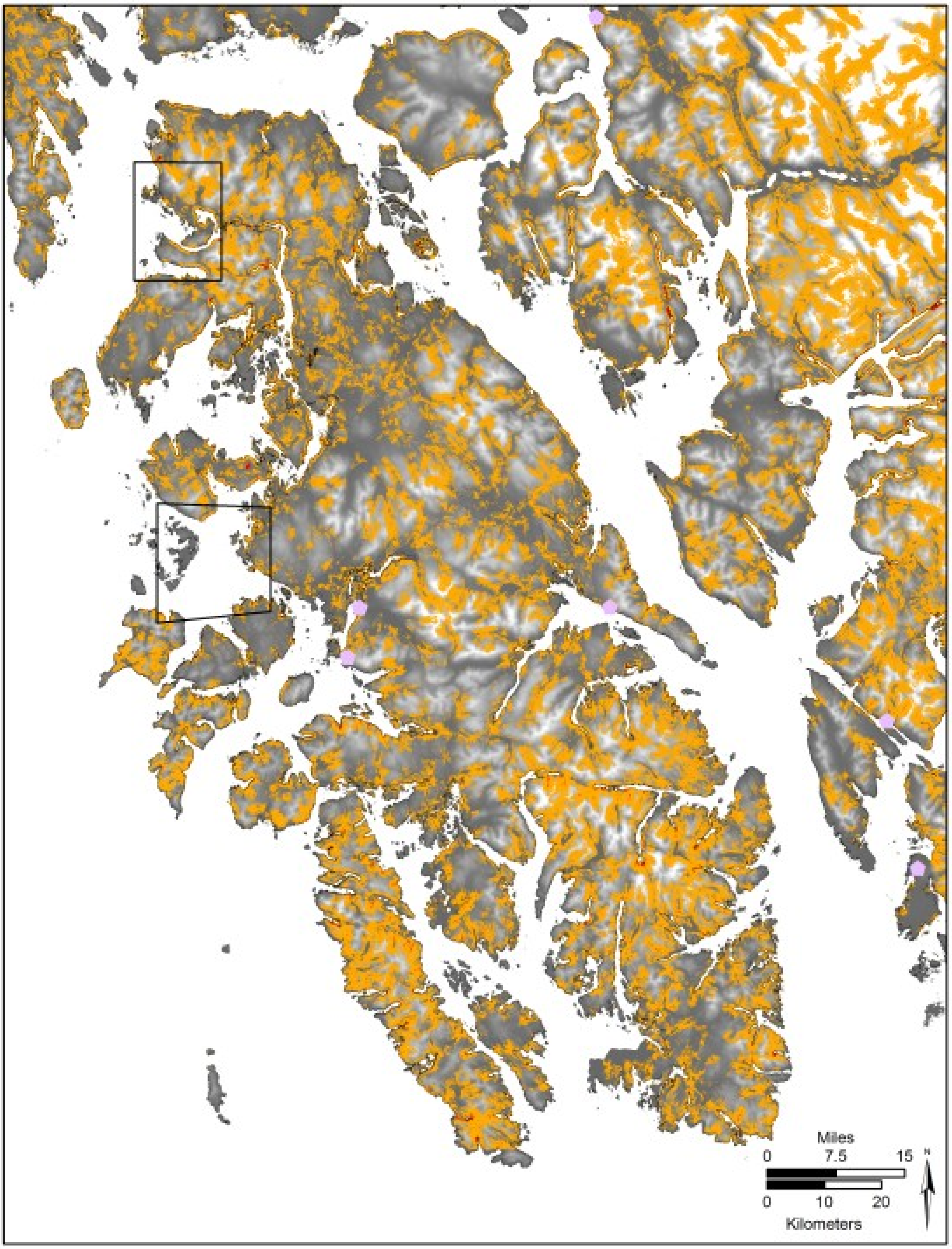
Weight 2 **Modern**



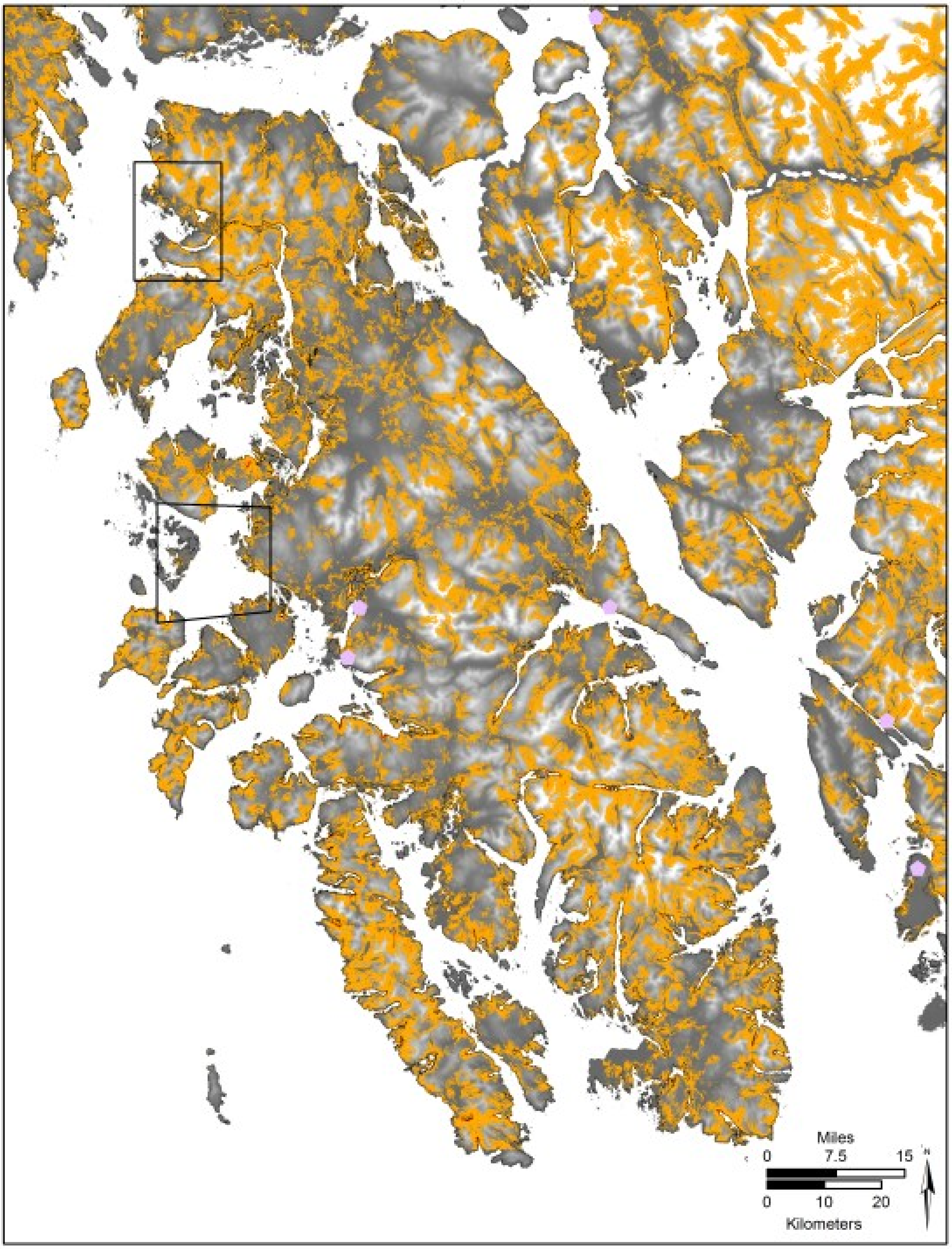
Weight 2 **10,500 cal BP**



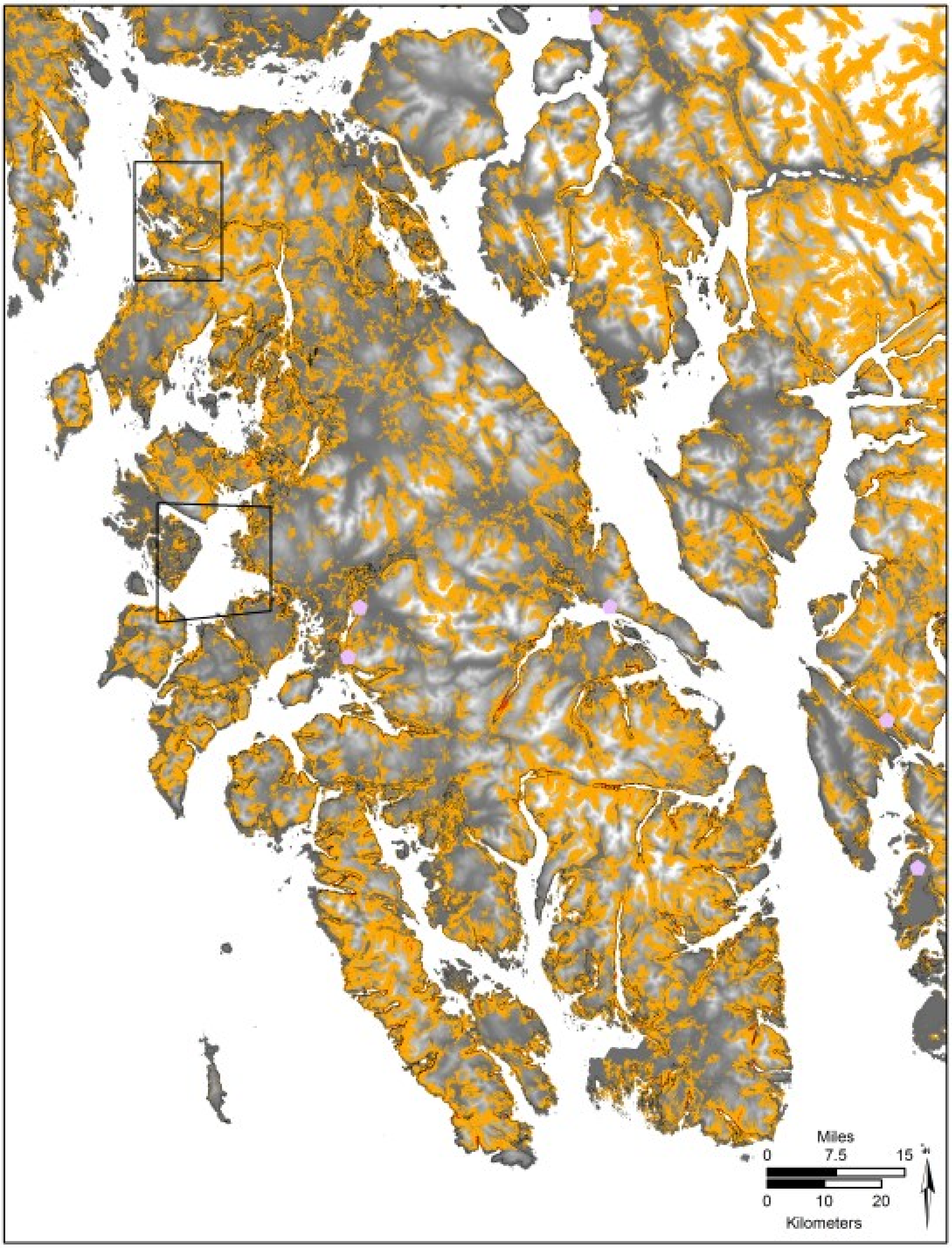
Weight 2 **11,000 cal BP**

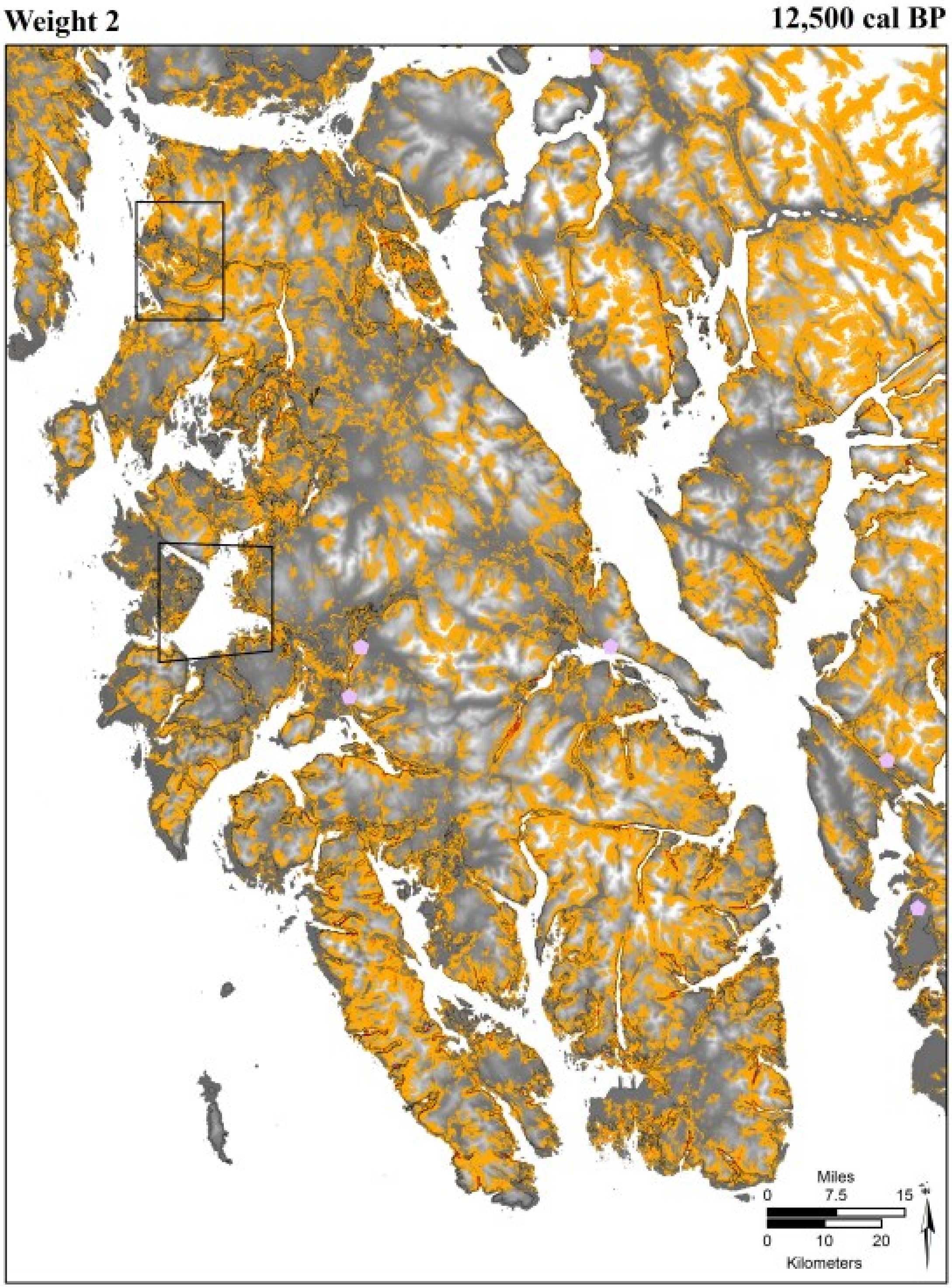


Weight 2 **11,500 cal BP**

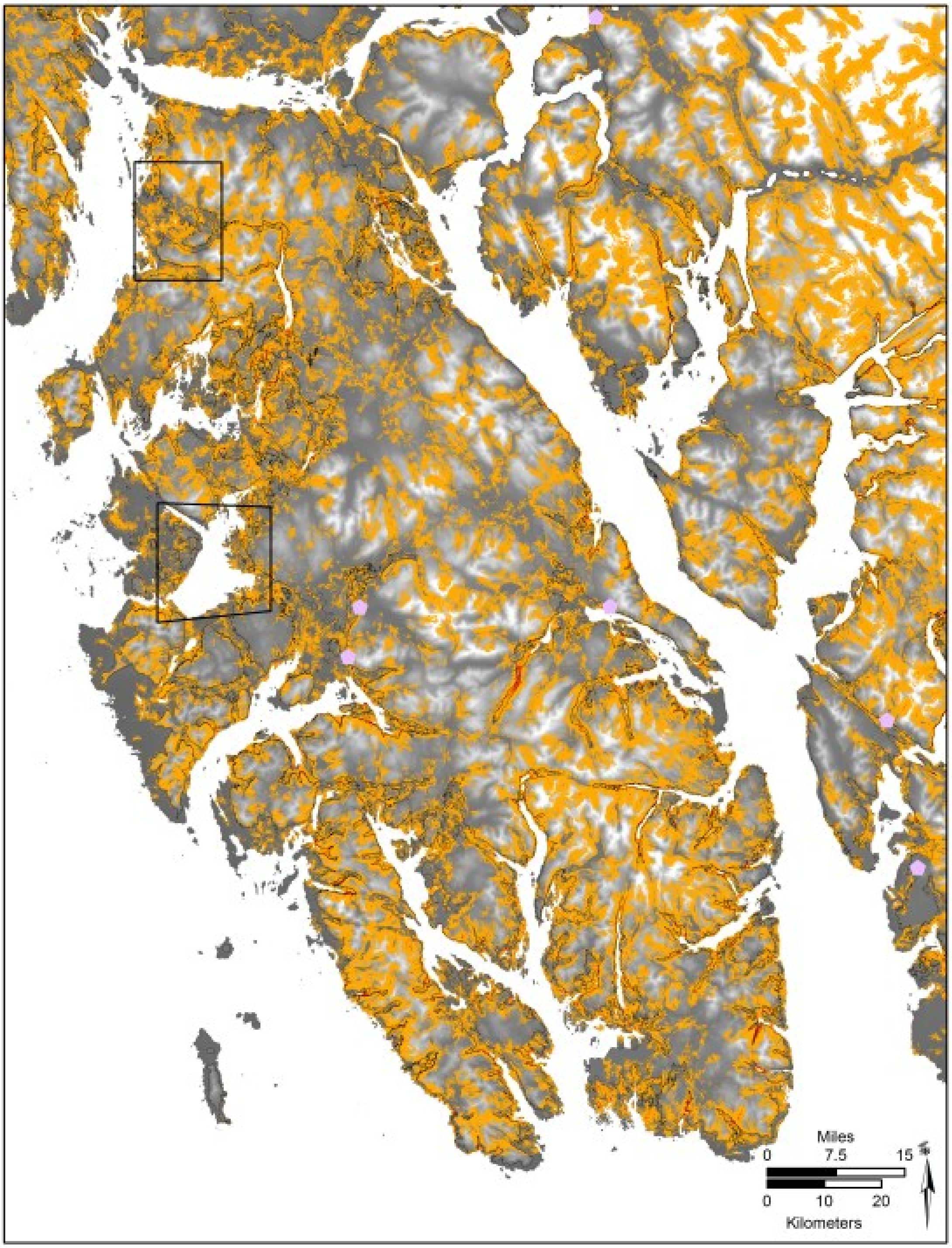


Weight 2 **12,000 cal BP**

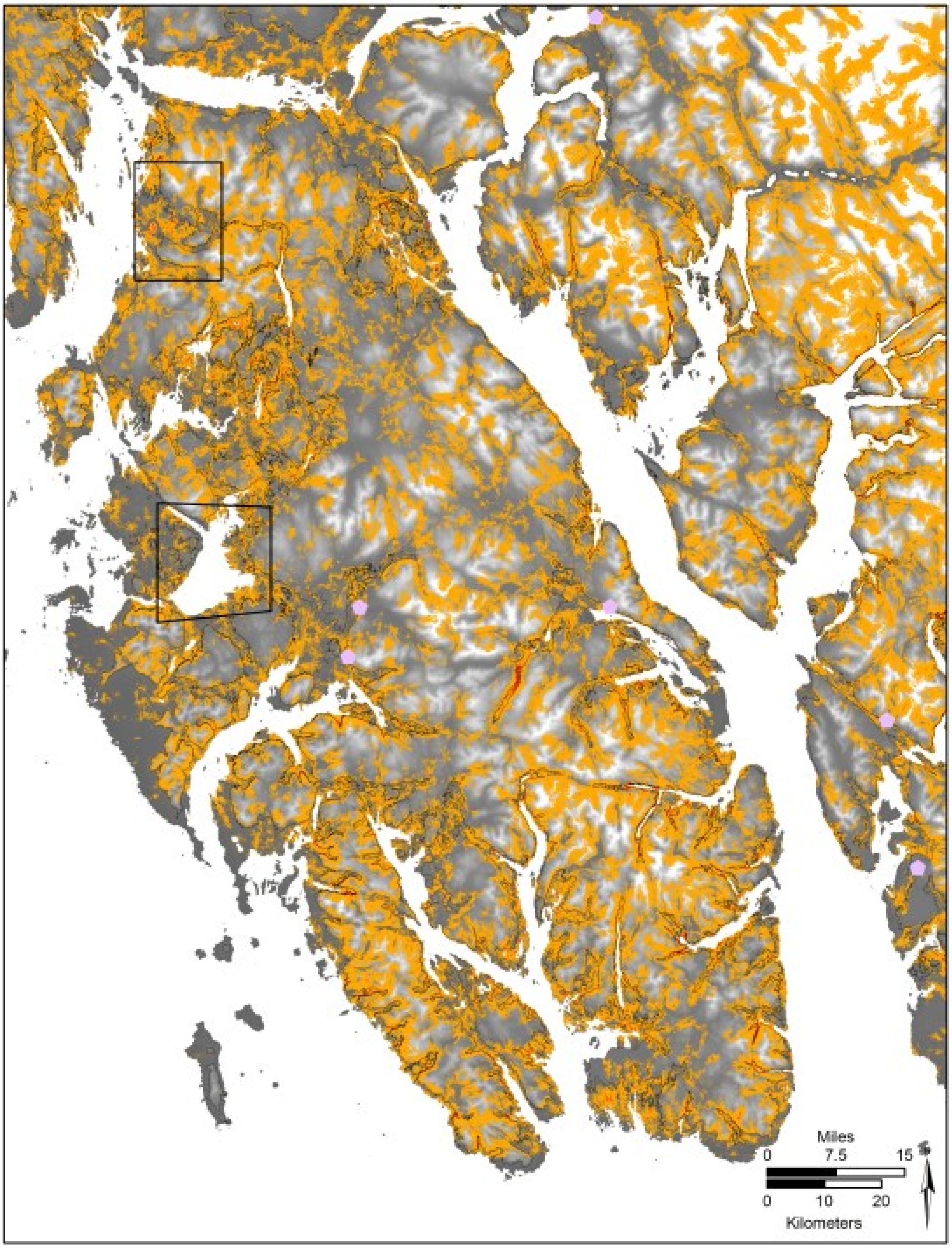



Weight 2
12,500 cal BP
Miles
0
7.5
15
0
10
20
Kilometers

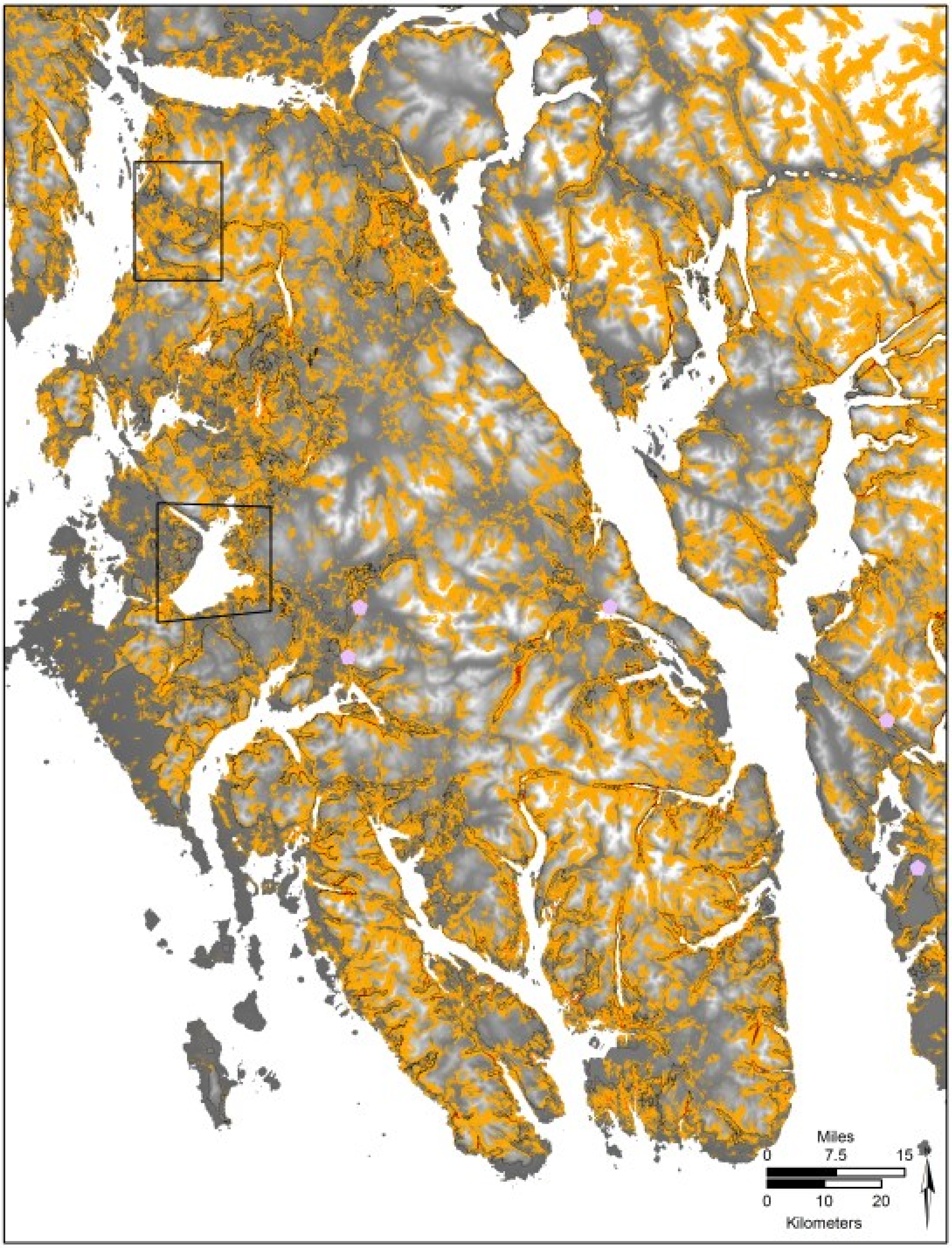
Weight 2 **13,000 cal BP**



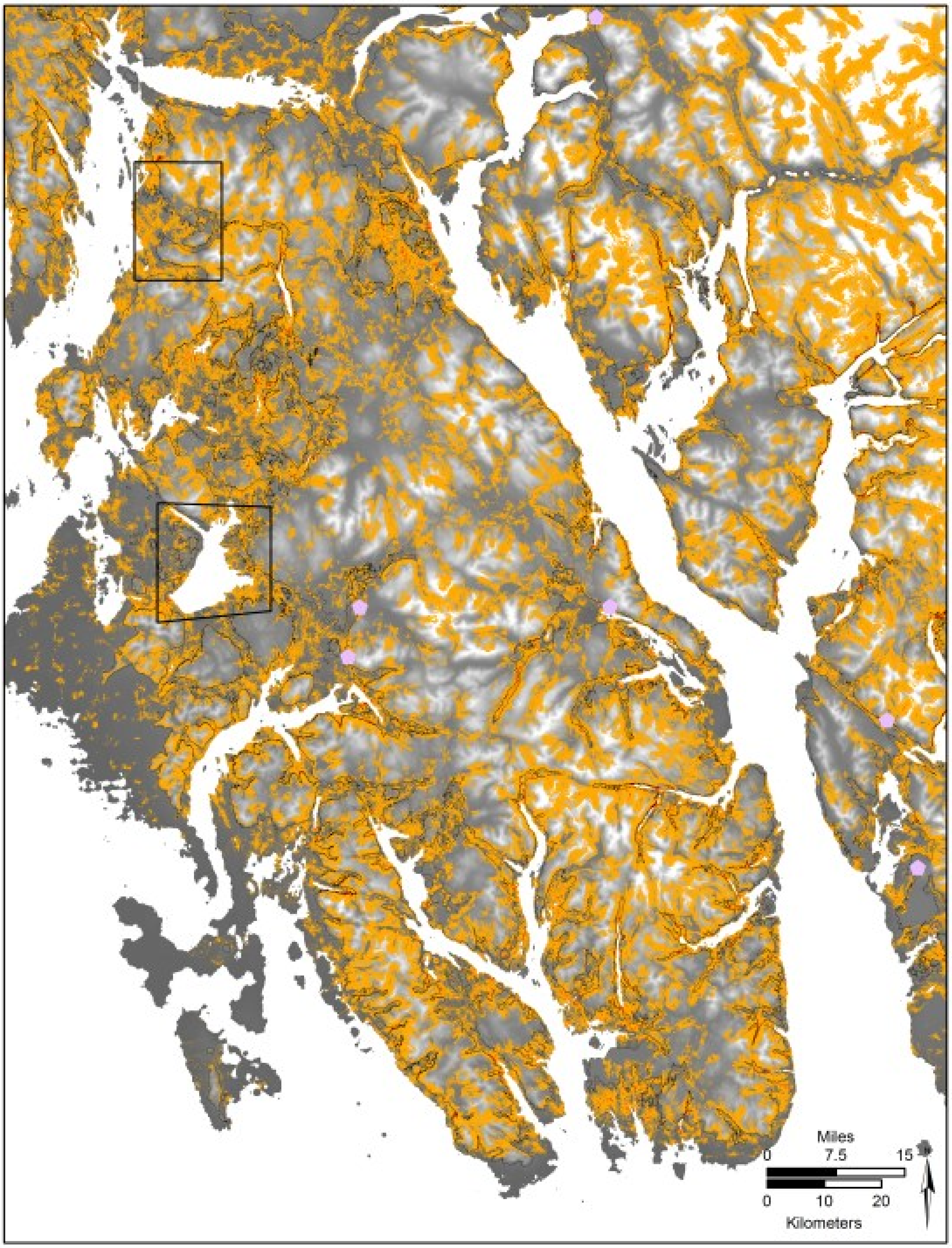
Weight 2 **13,500 cal BP**



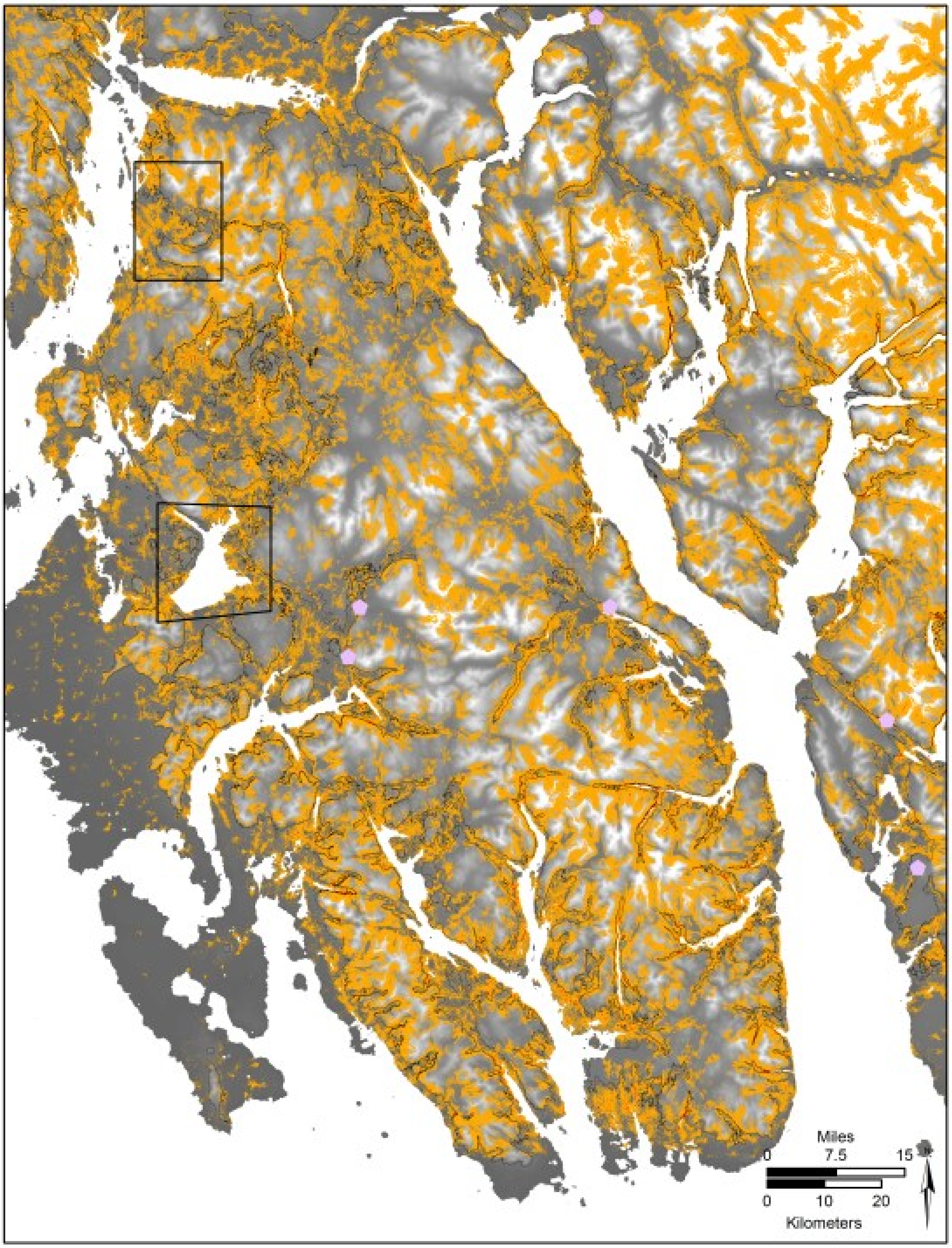
Weight 2 **14,000 cal BP**



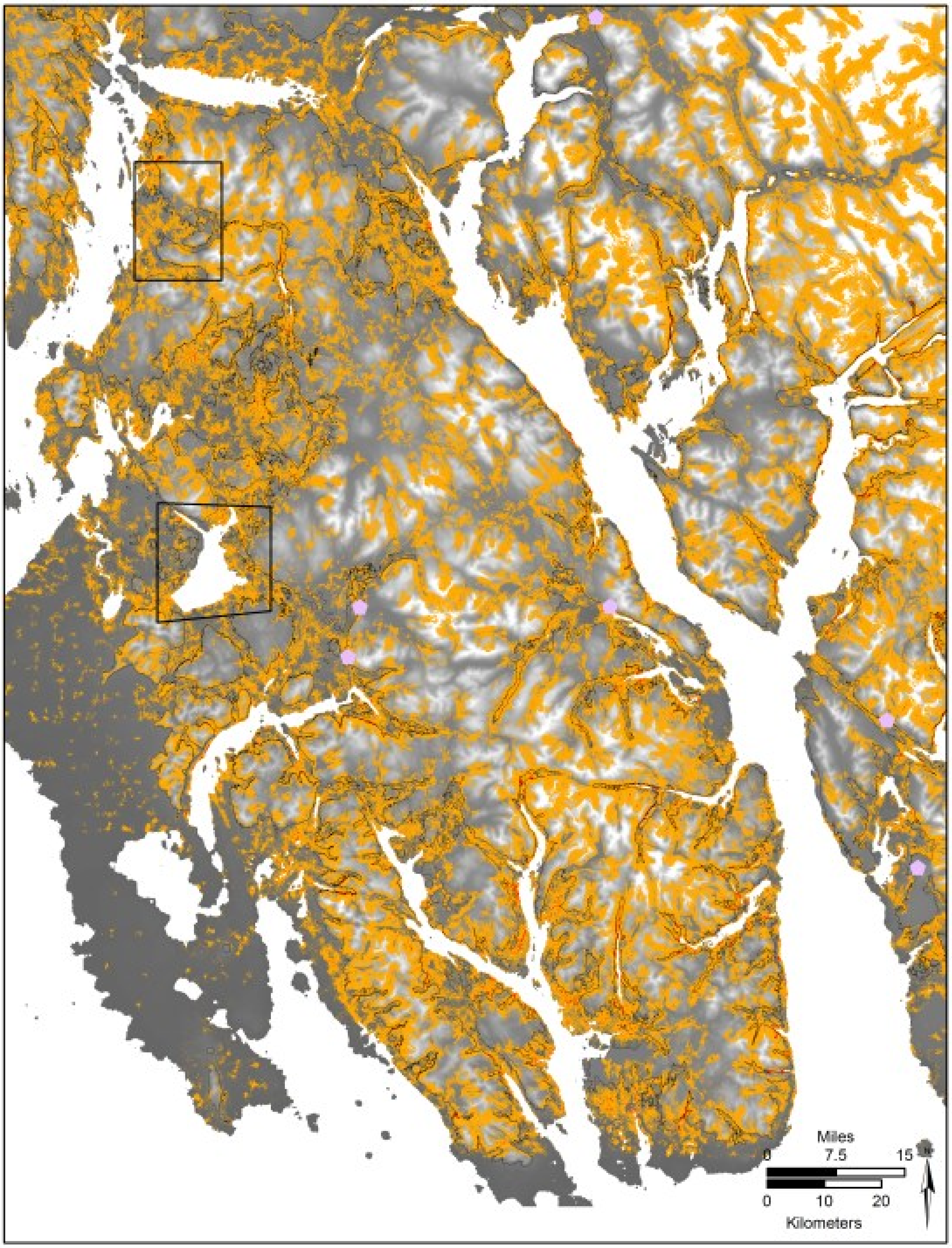
Weight 2 **14,500 cal BP**



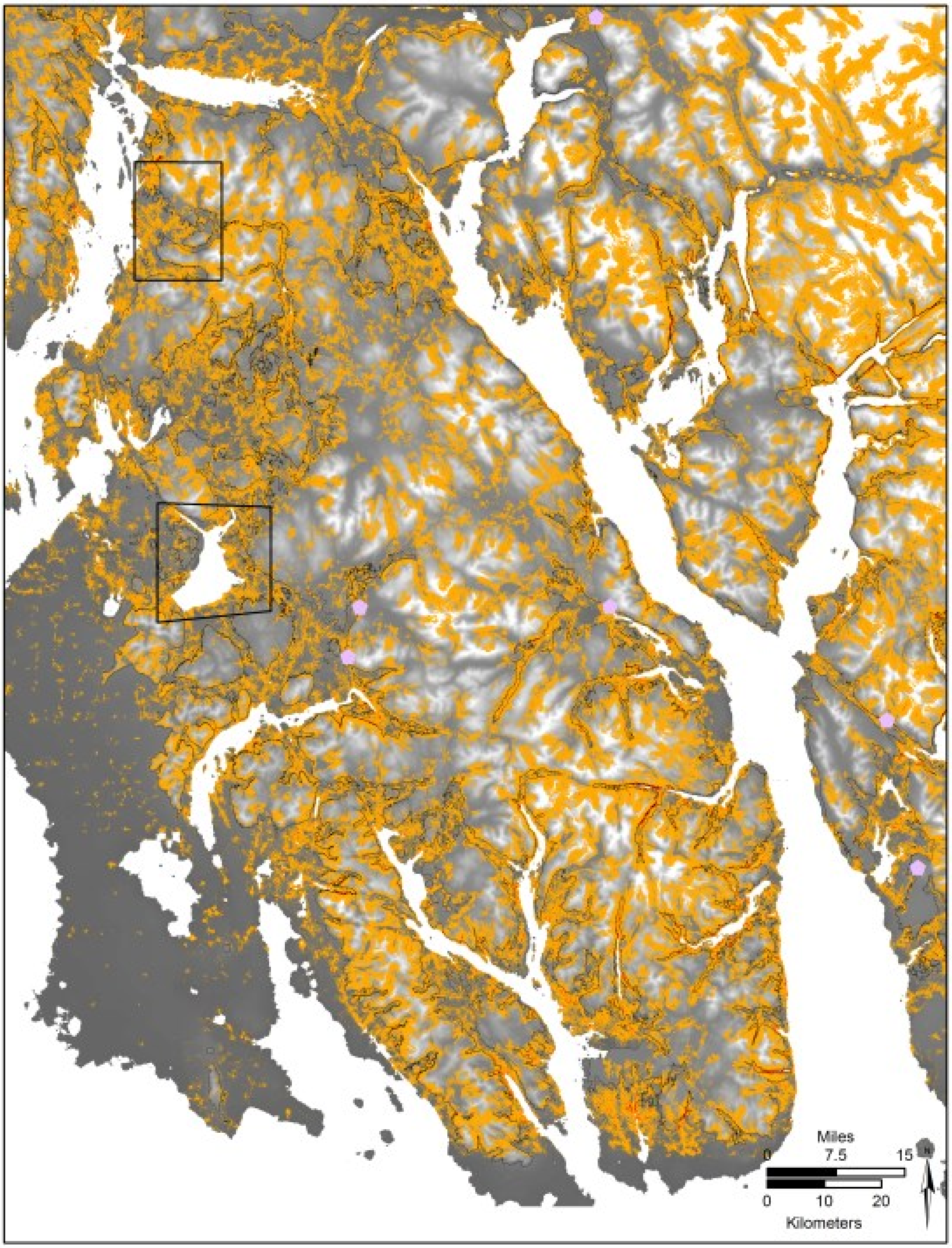
Weight 2 **15,000 cal BP**



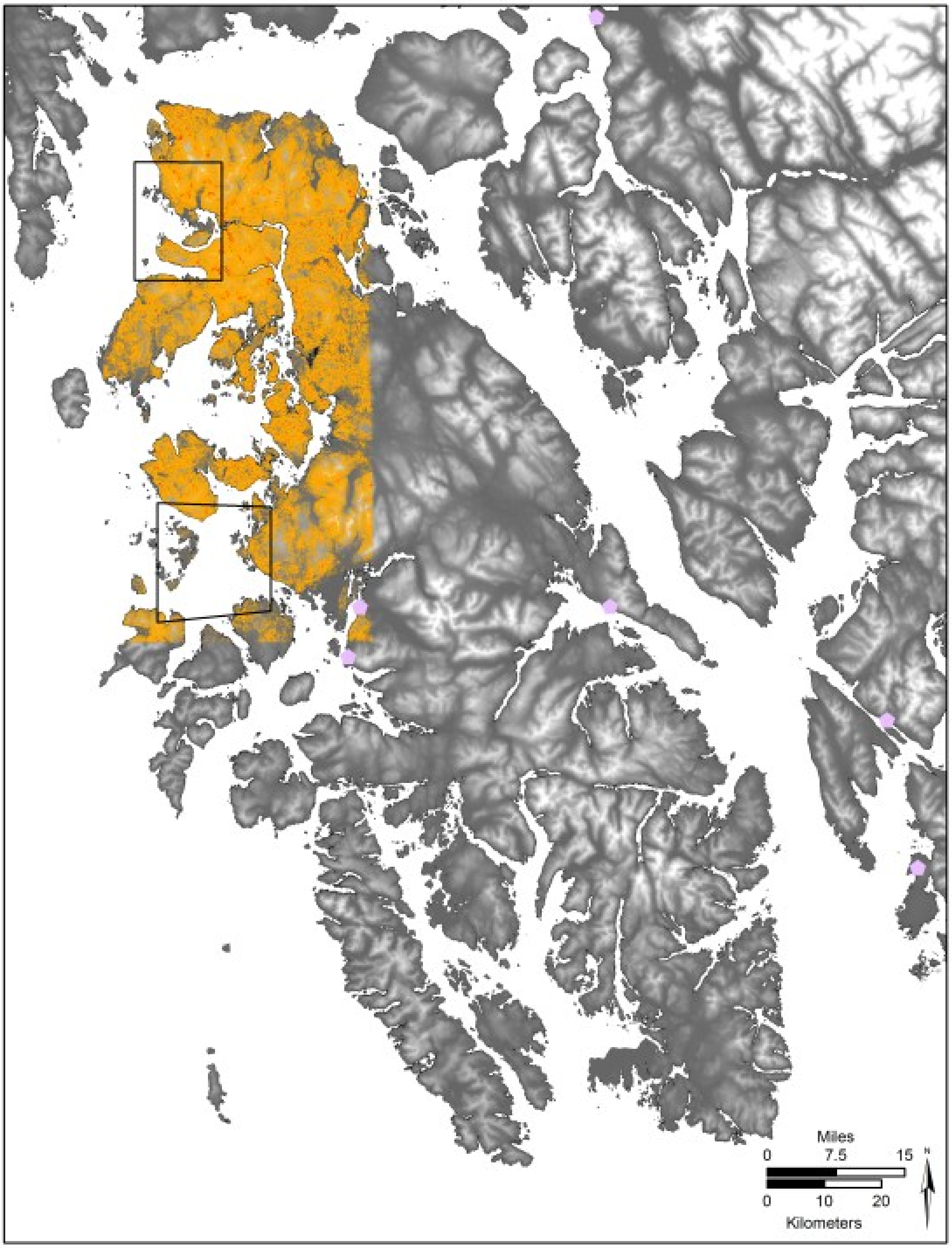
Weight 2 **15,500 cal BP**



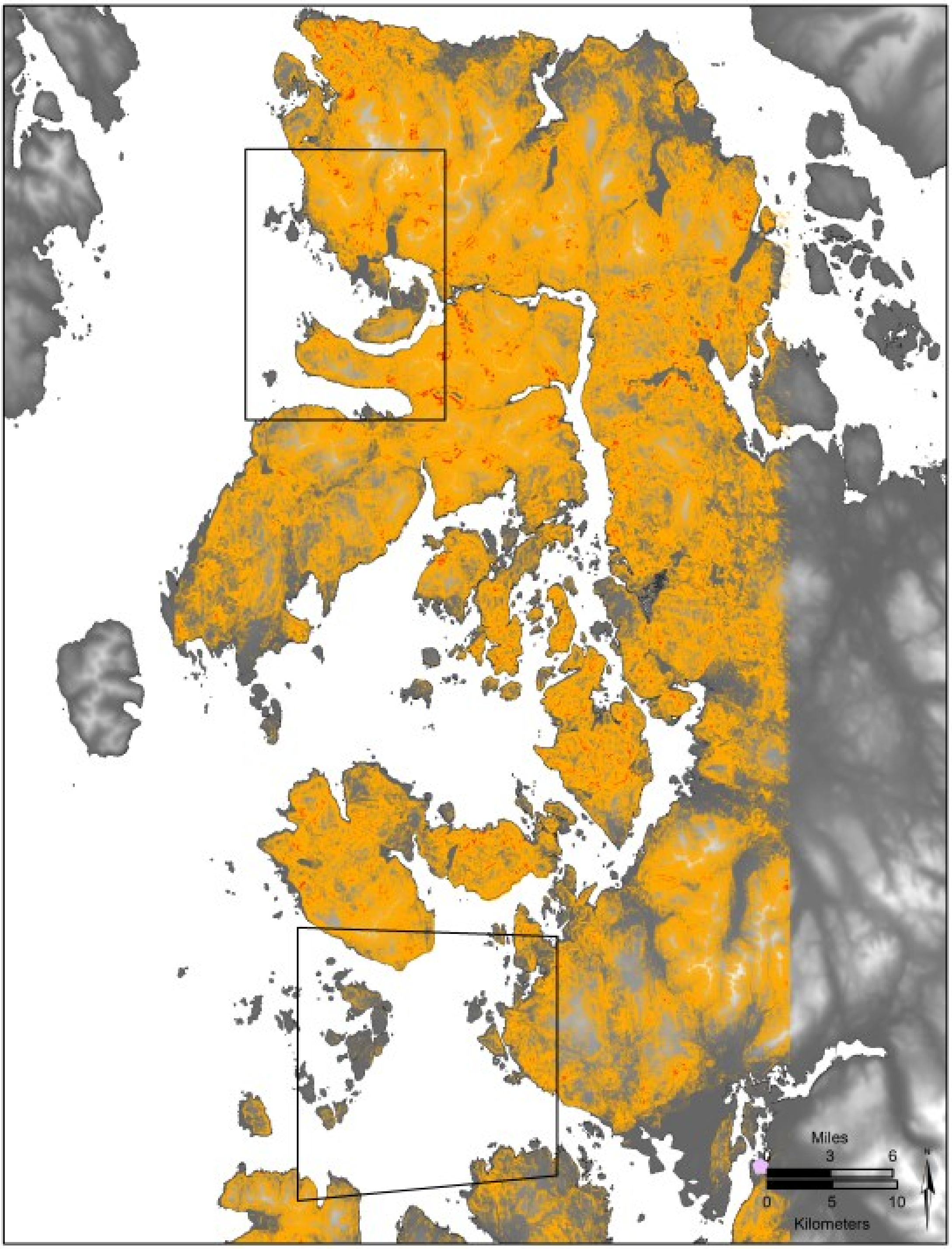
Weight 2 **16,000 cal BP**



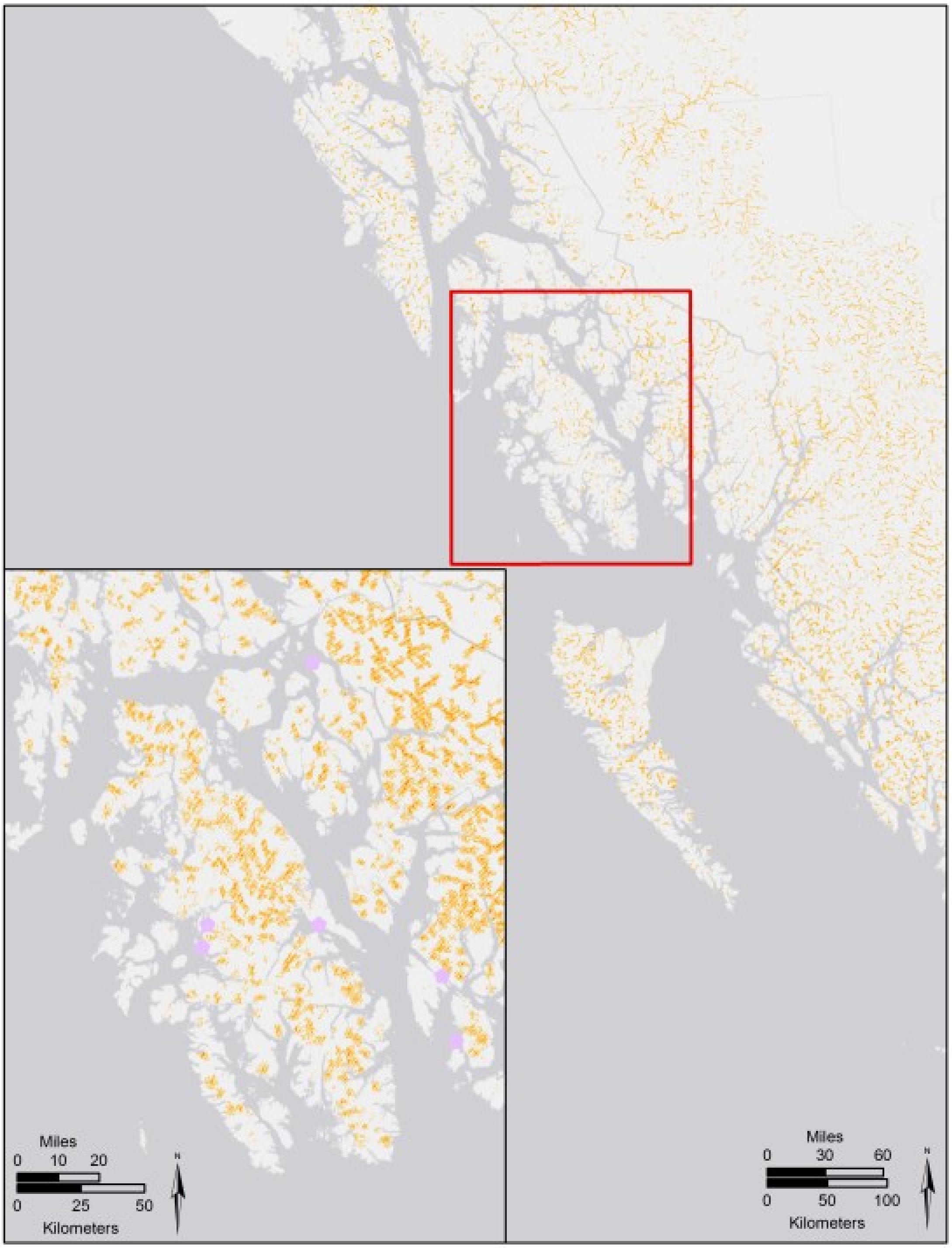
Weight 2 **Modern - Small Area**



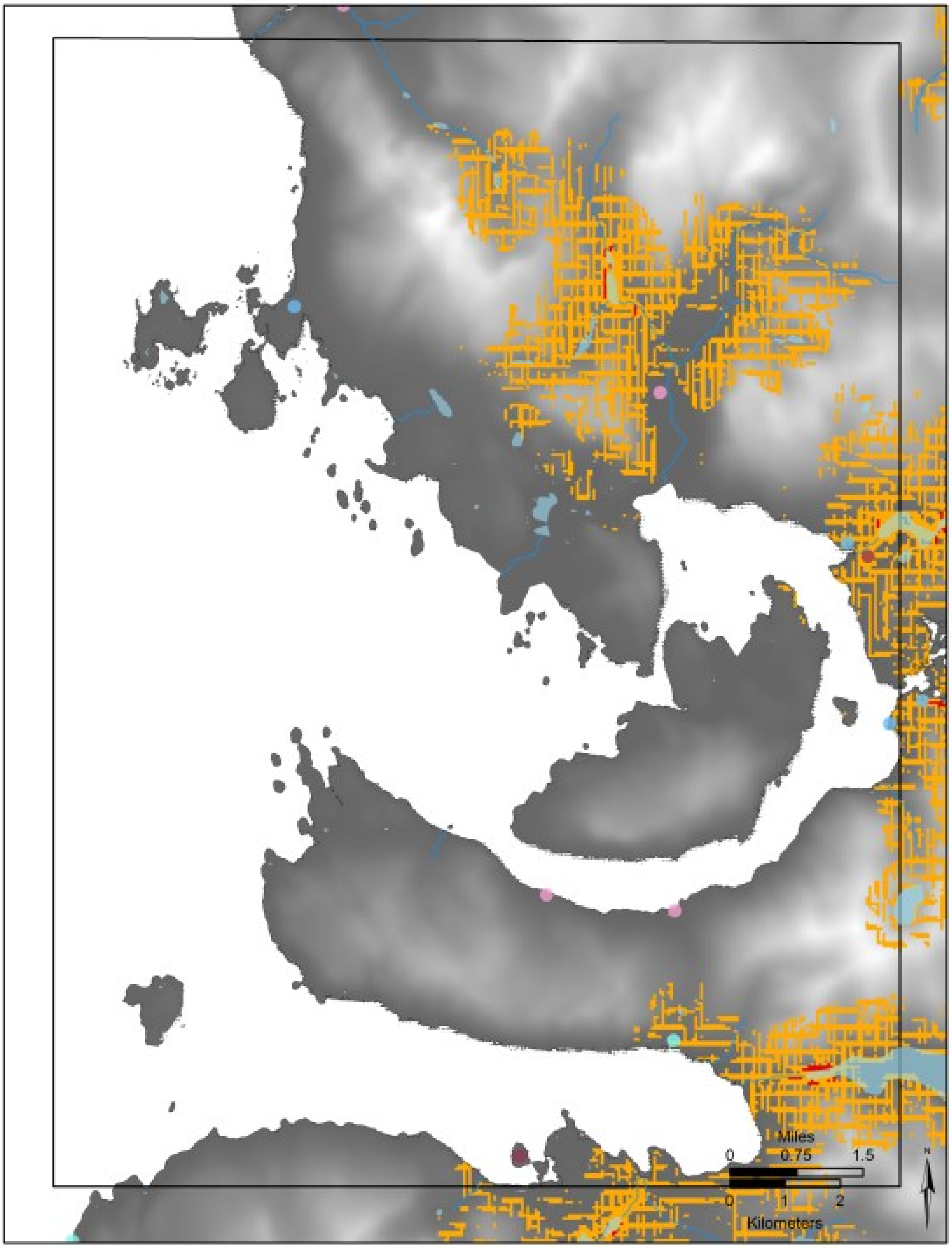
Weight 2 **Modern - Small Area**



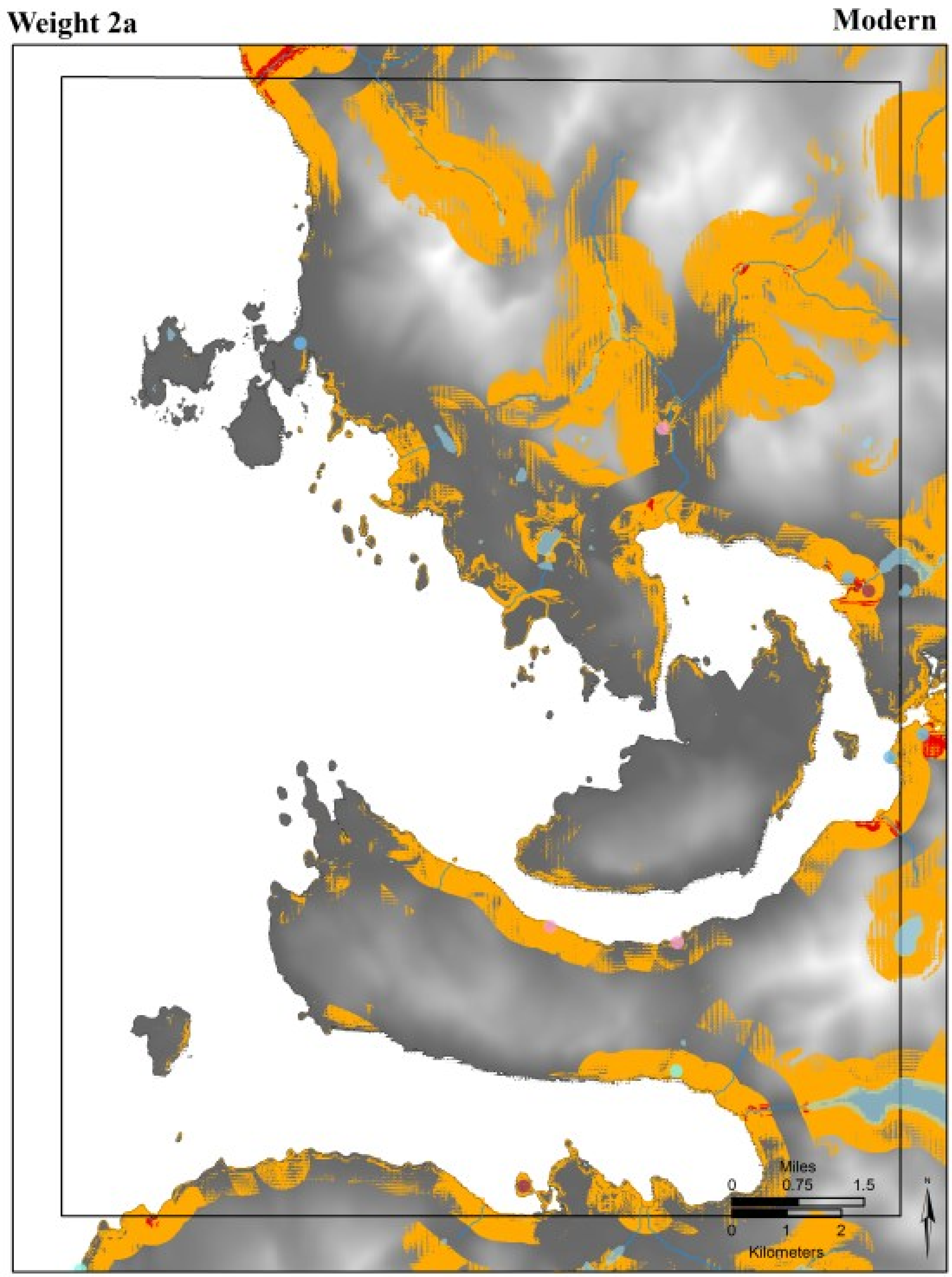
Weight 2 **NWC - modern**



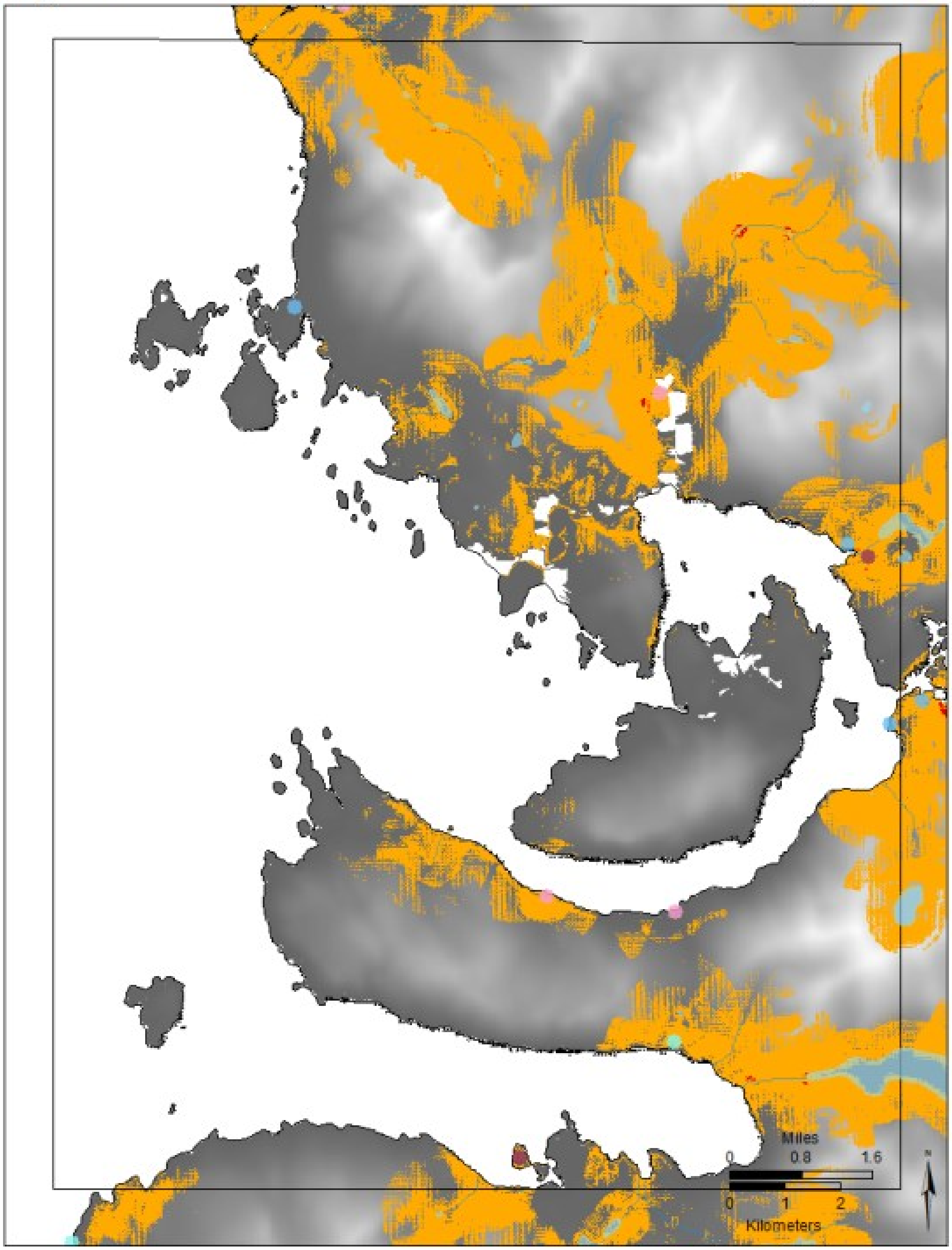
Weight 2 **NWC - modern**



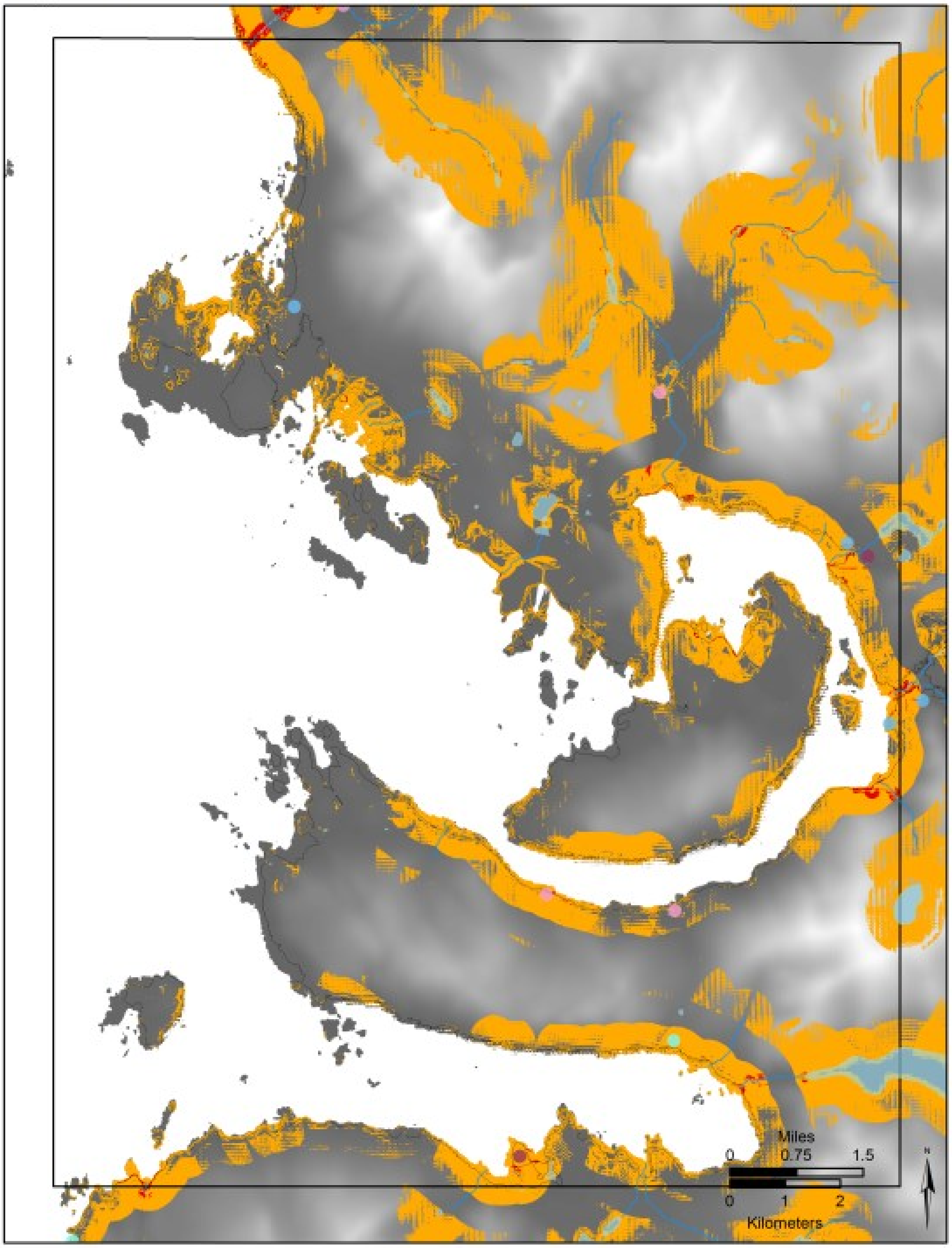
C.5 Weighted Overlay 2a



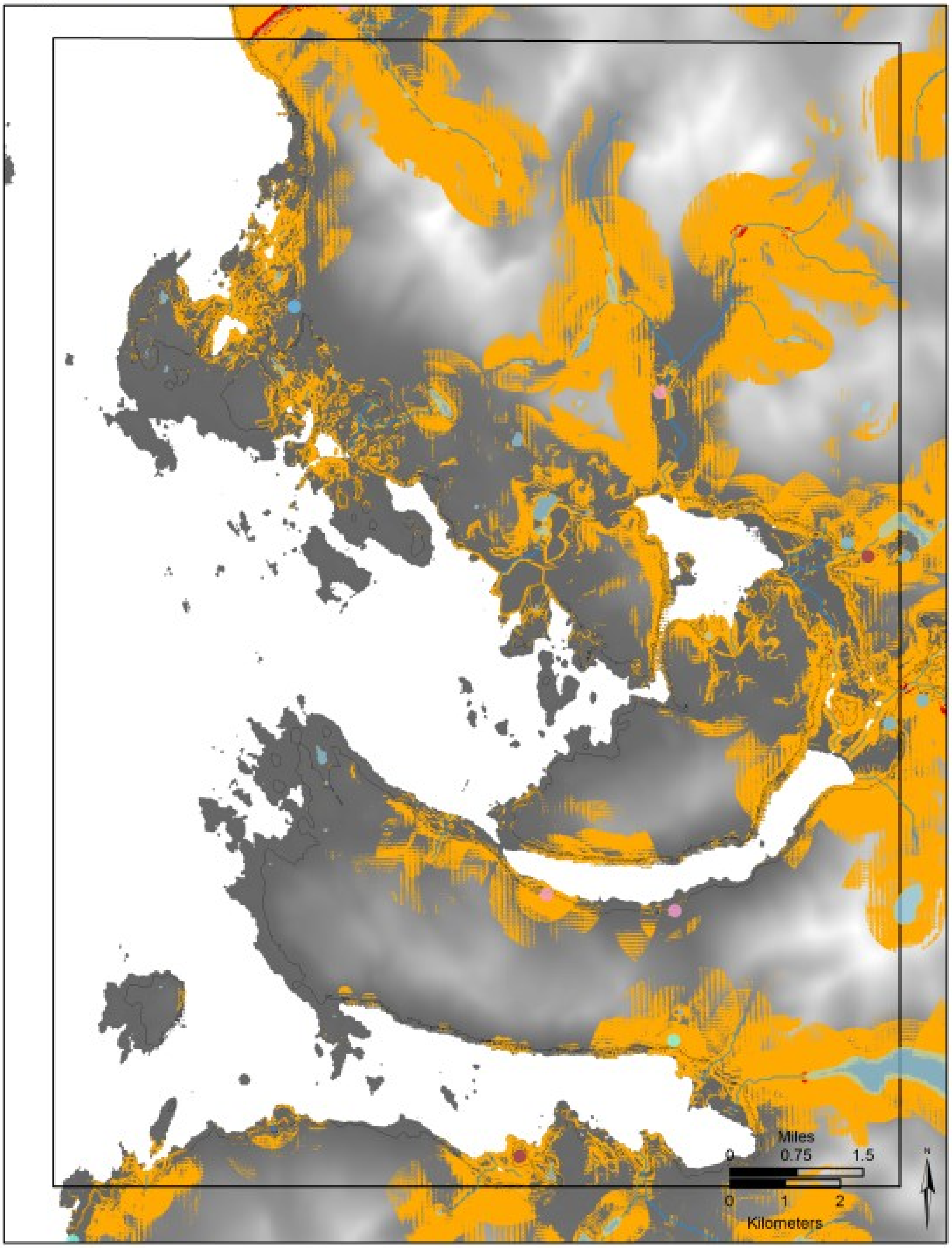
Weight 2a **10,500 cal BP**



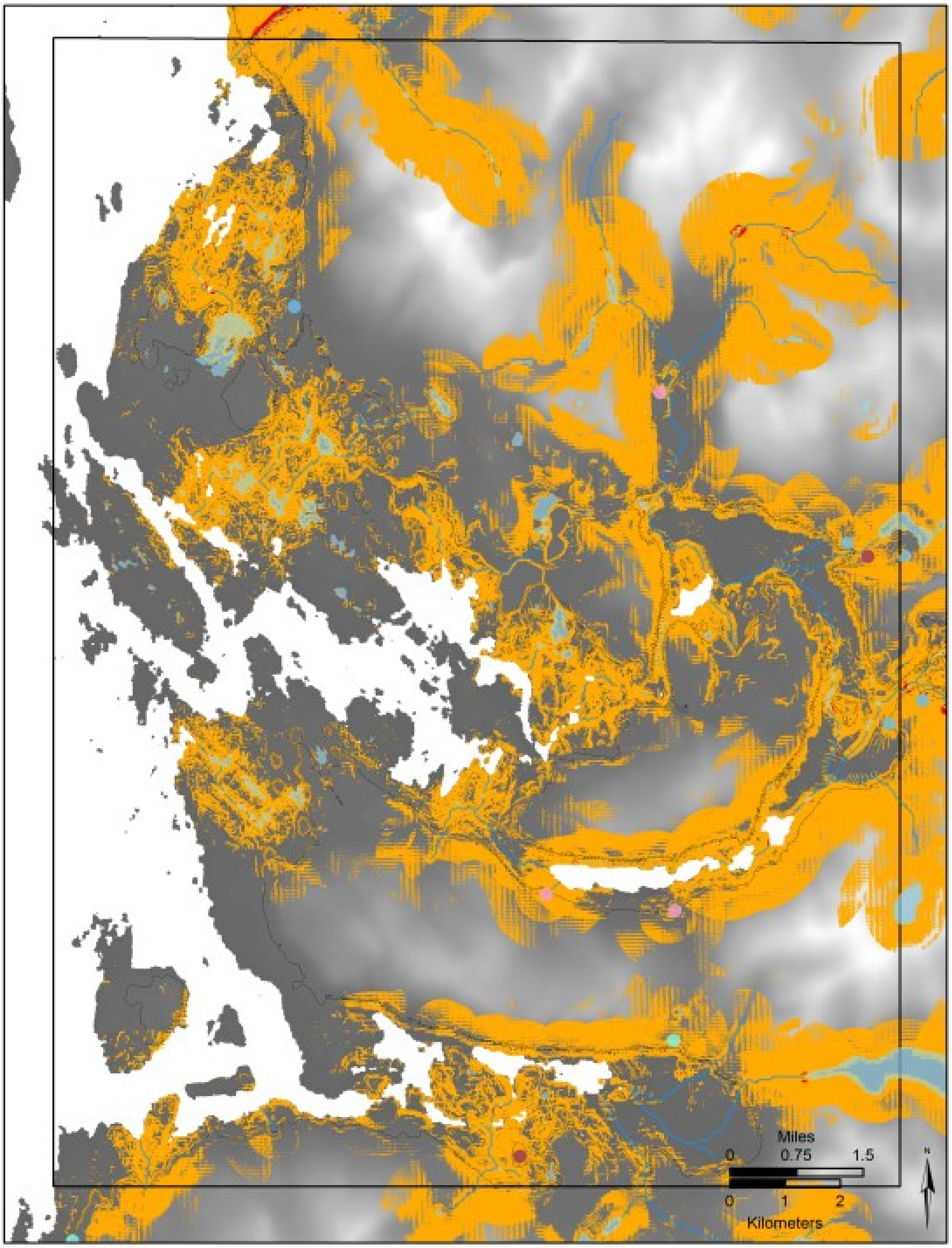
Weight 2a **11,000 cal BP**

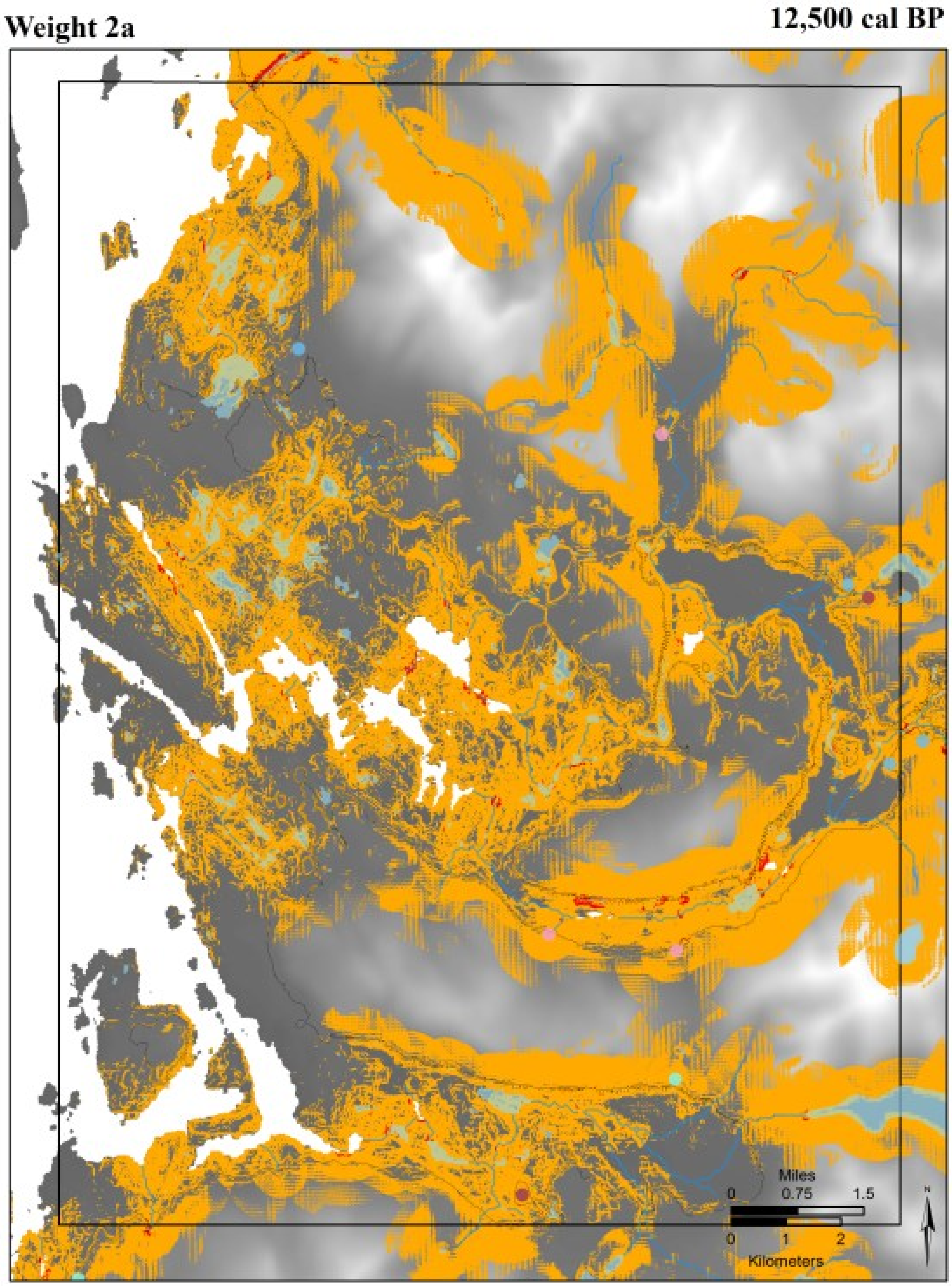


Weight 2a **11,500 cal BP**

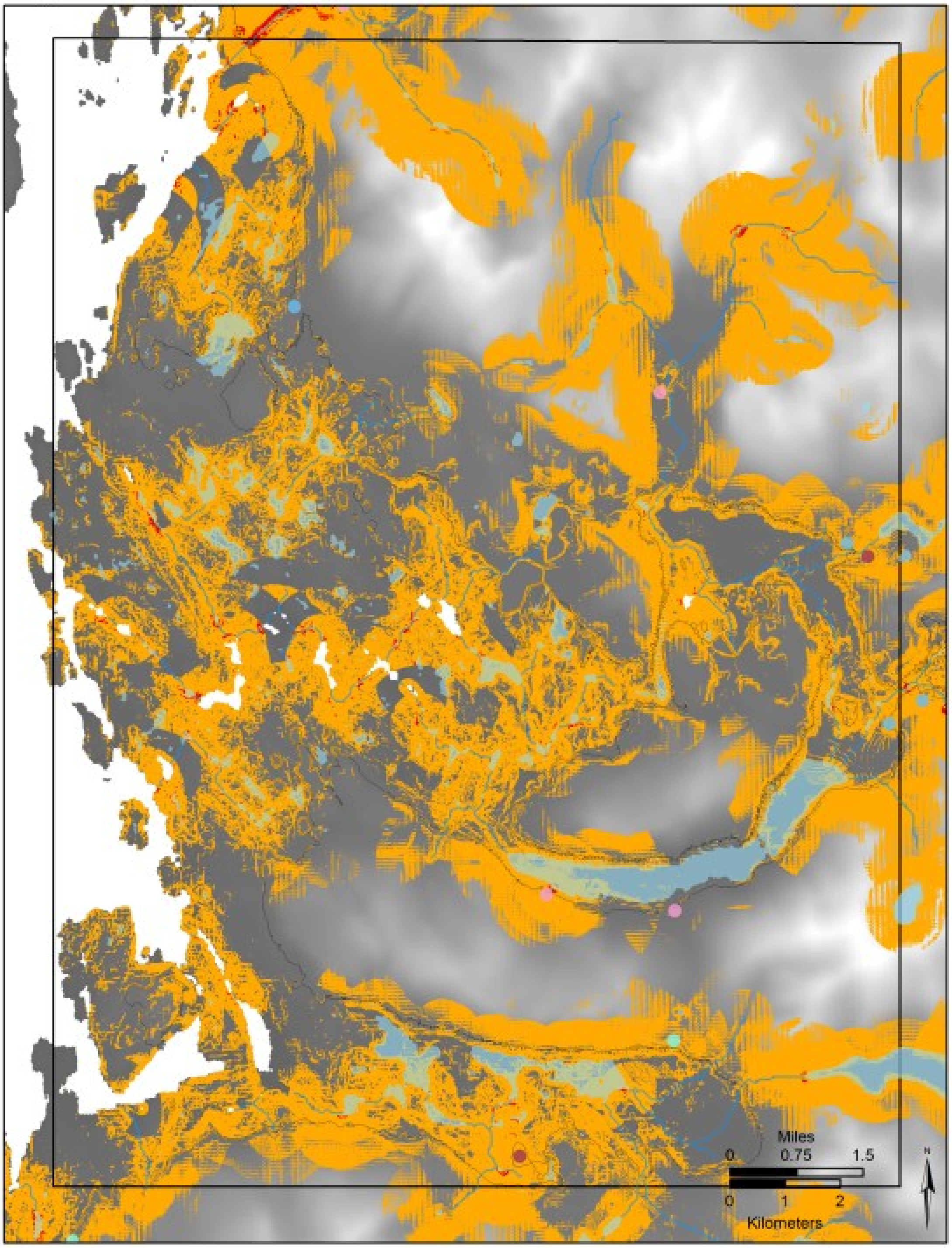


Weight 2a **12,000 cal BP**

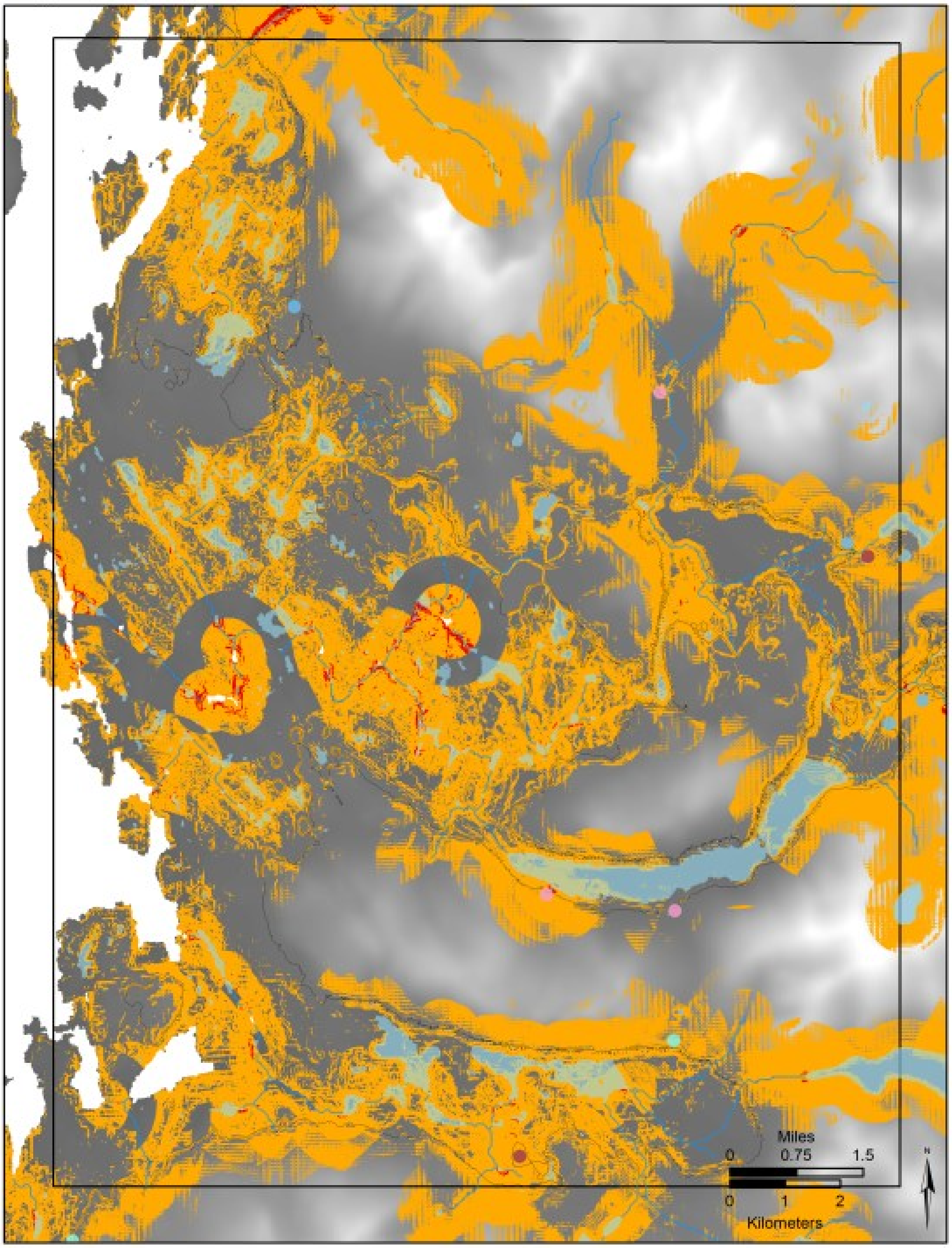



Weight 2a
12,500 cal BP
Miles
0
0.75
1.5
0
1
2
Kilometers

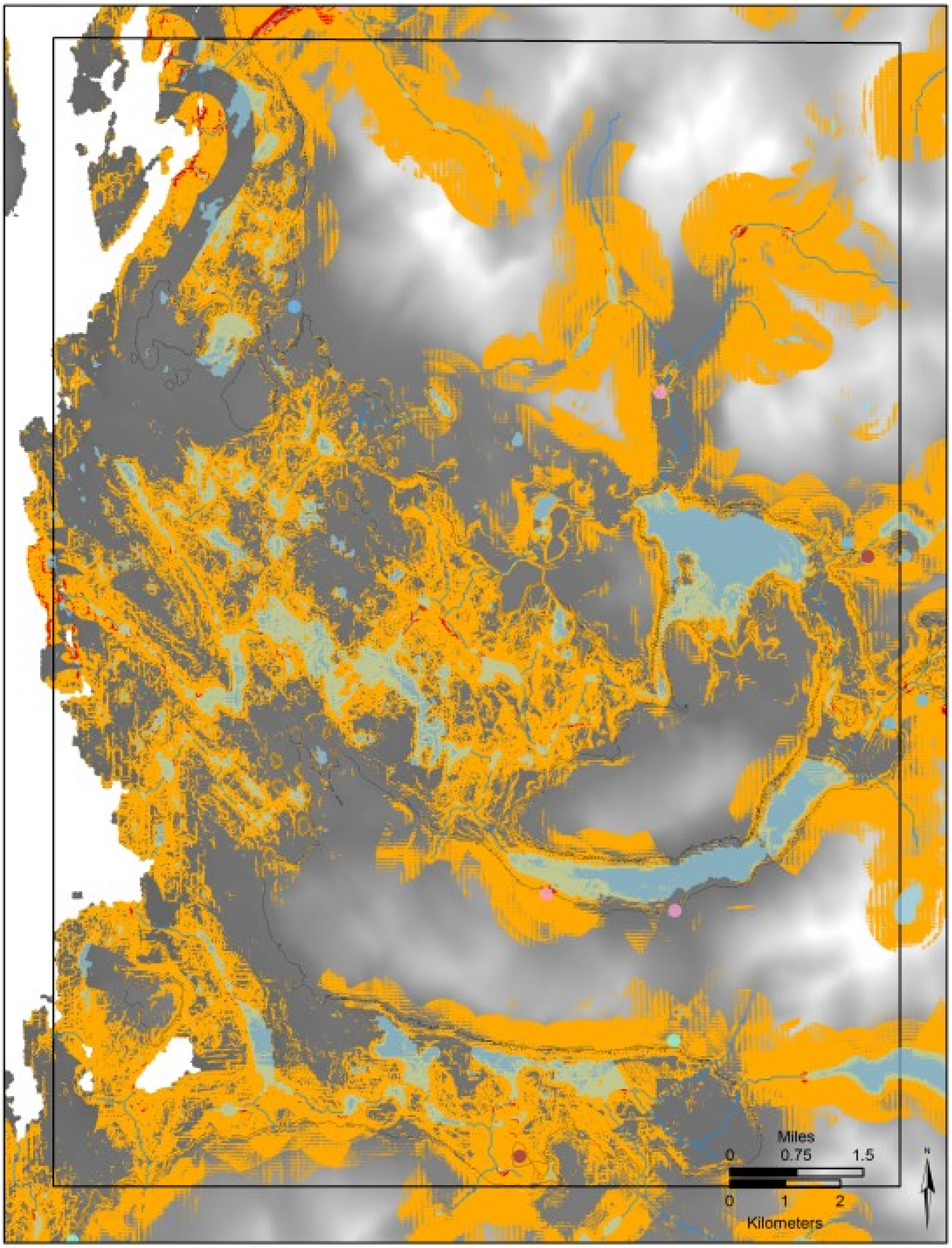
Weight 2a **13,000 cal BP**



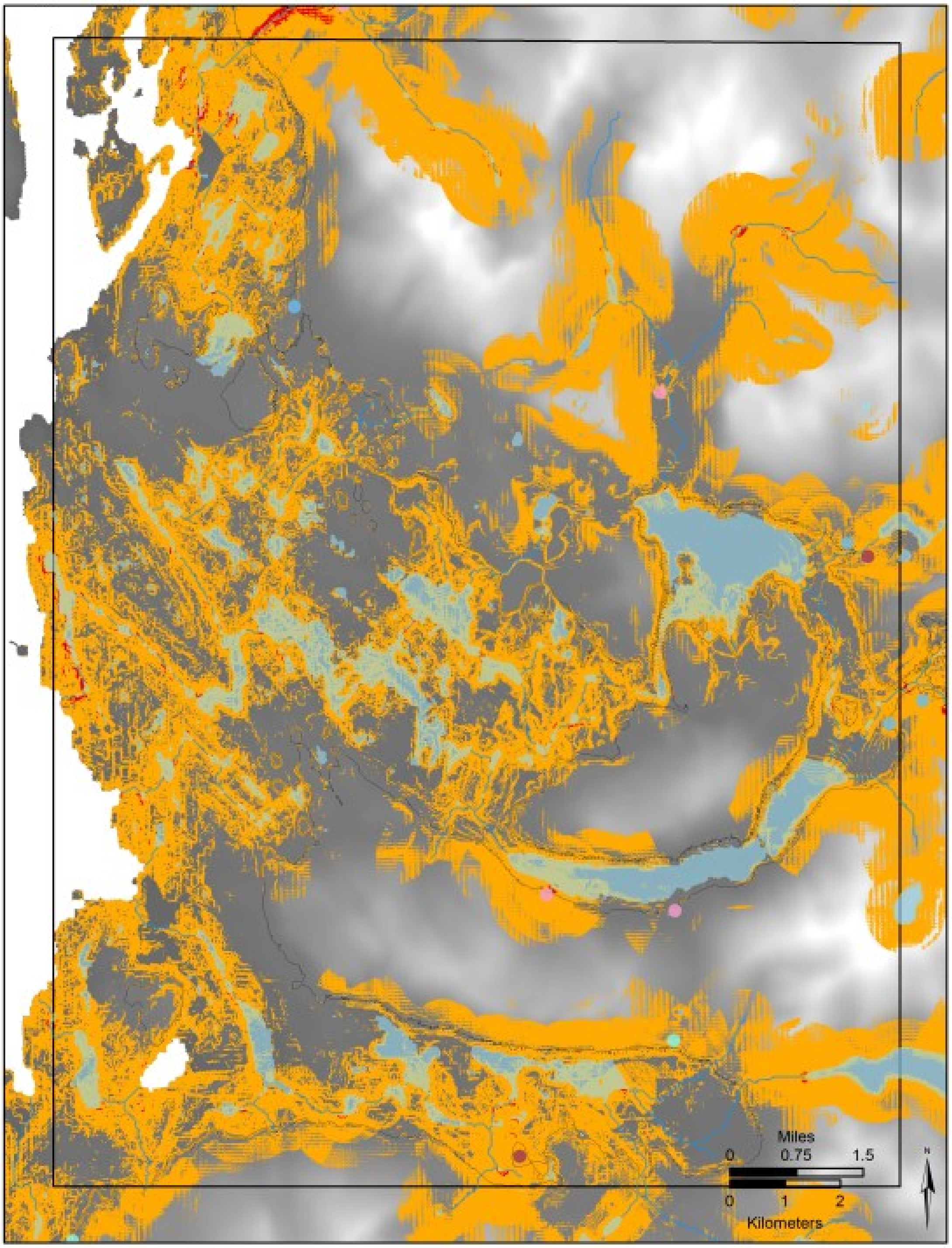
Weight 2a **13,500 cal BP**



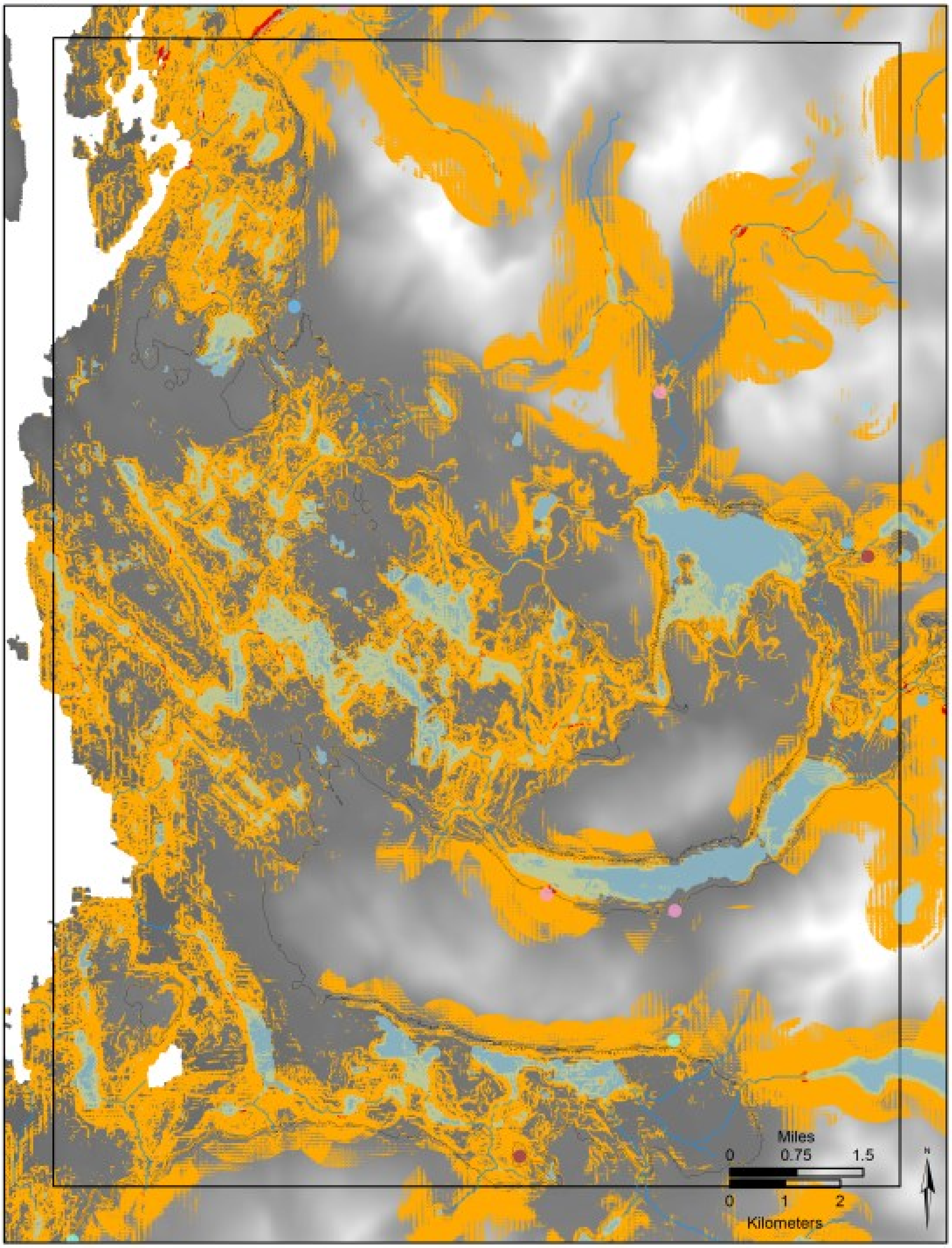
Weight 2a **14,000 cal BP**



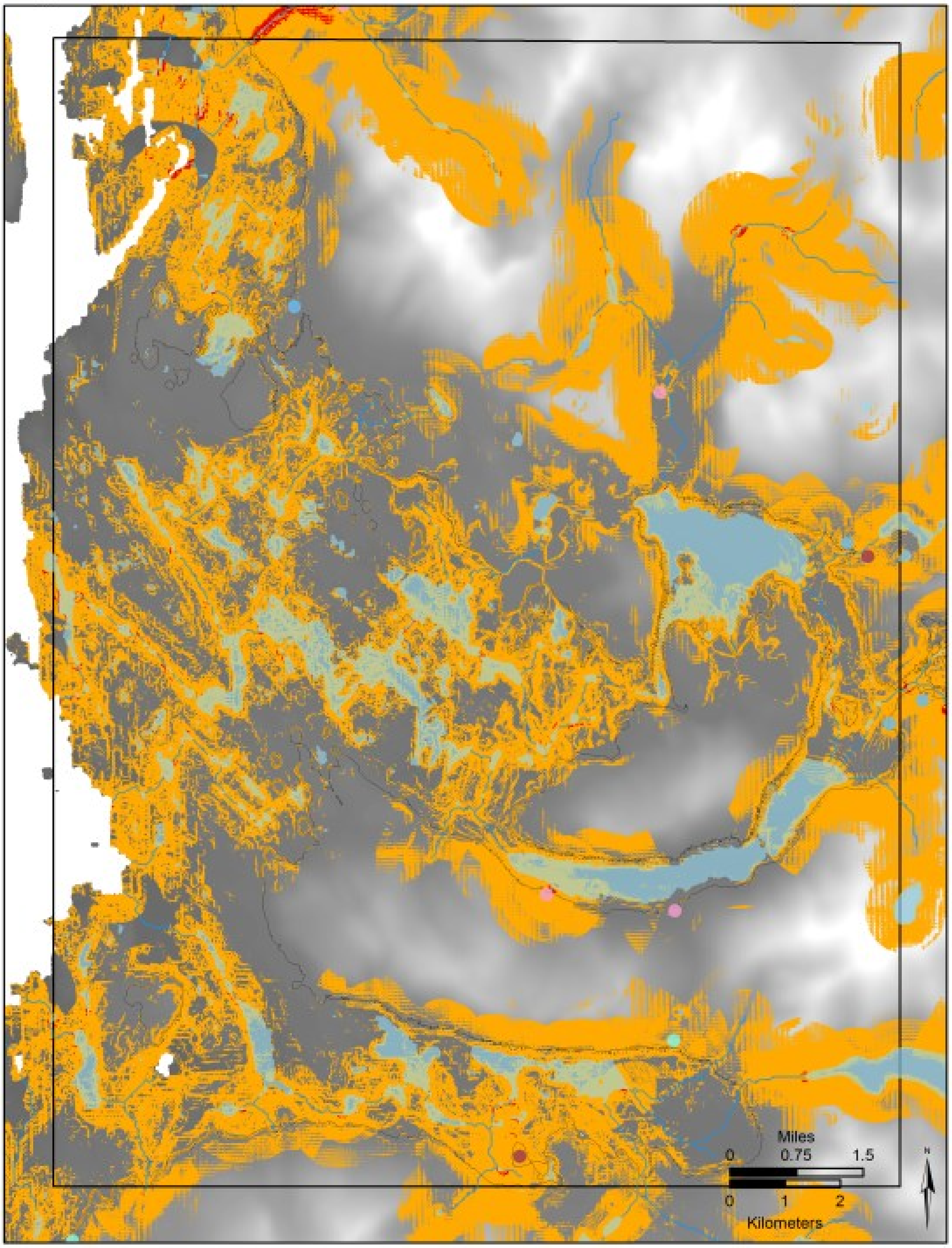
Weight 2a **14,500 cal BP**



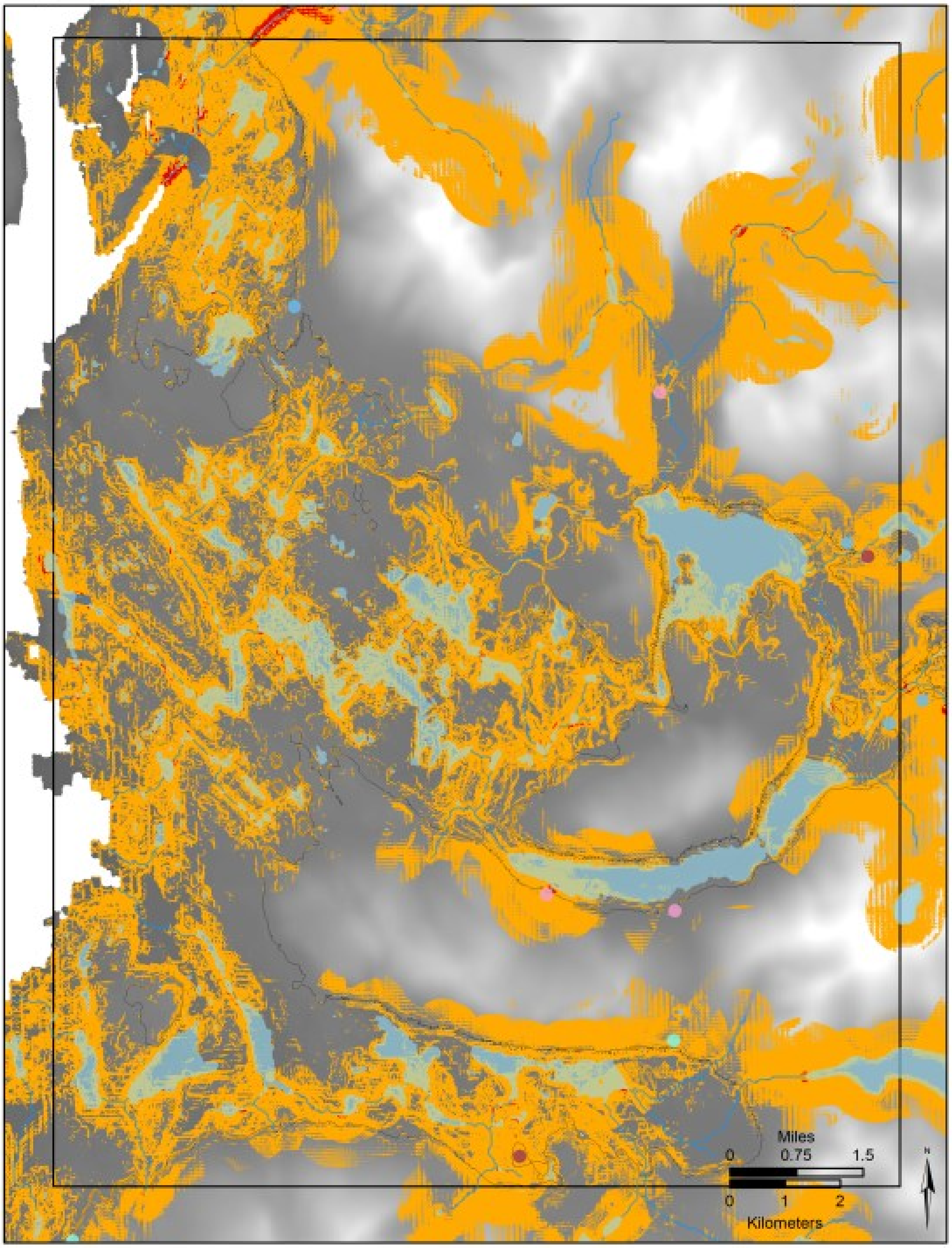
Weight 2a **15,000 cal BP**



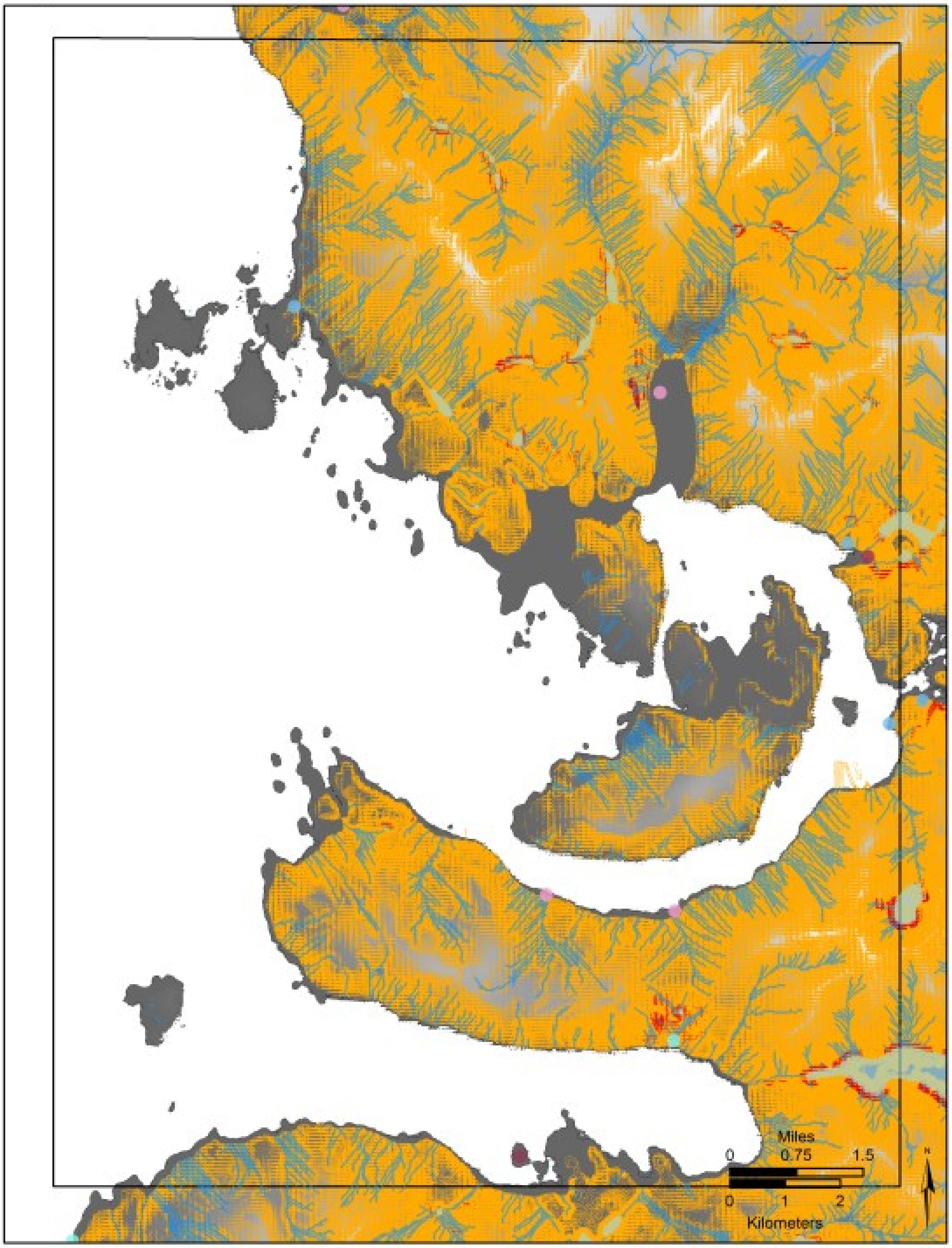
Weight 2a **15,500 cal BP**



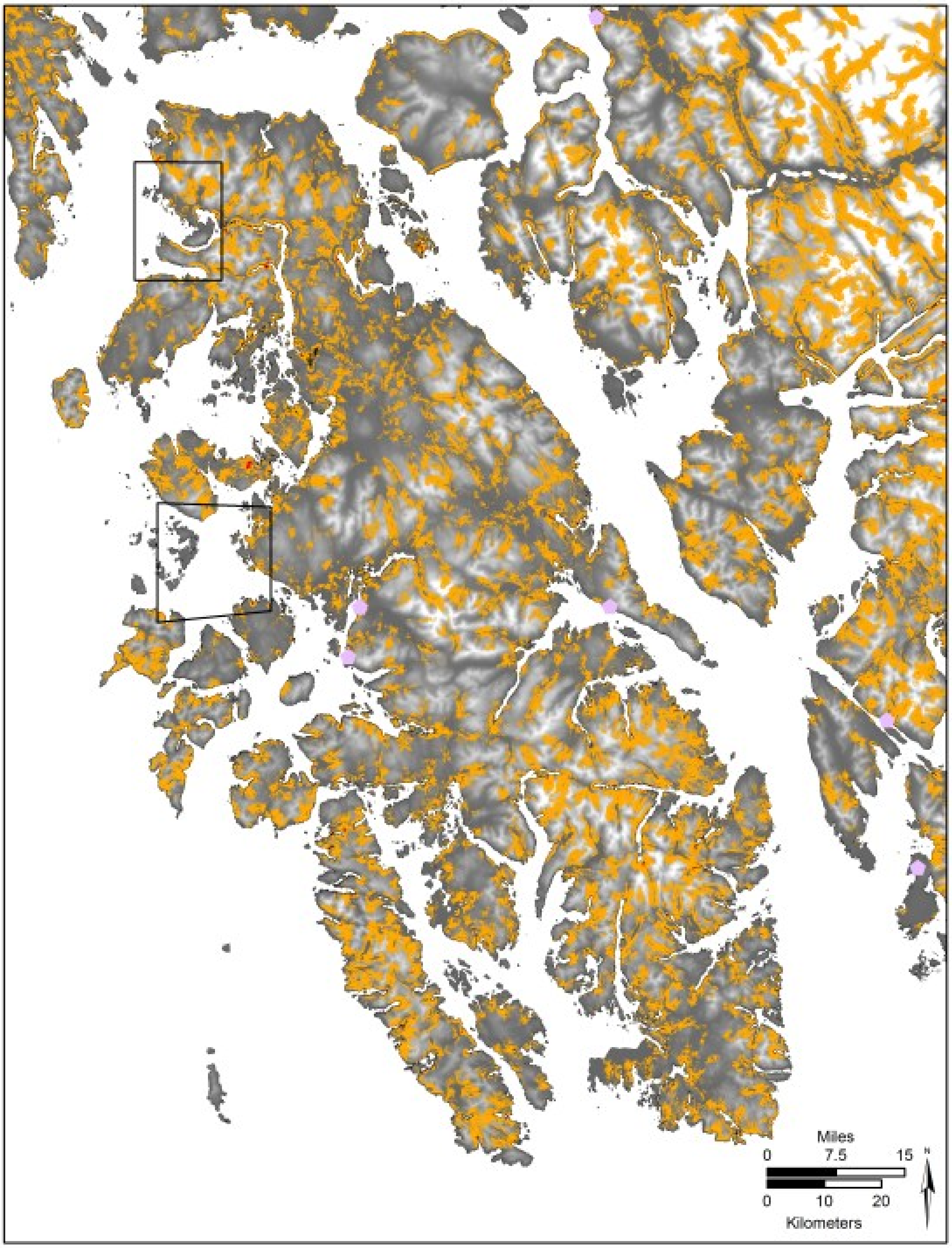
Weight 2a **16,000 cal BP**



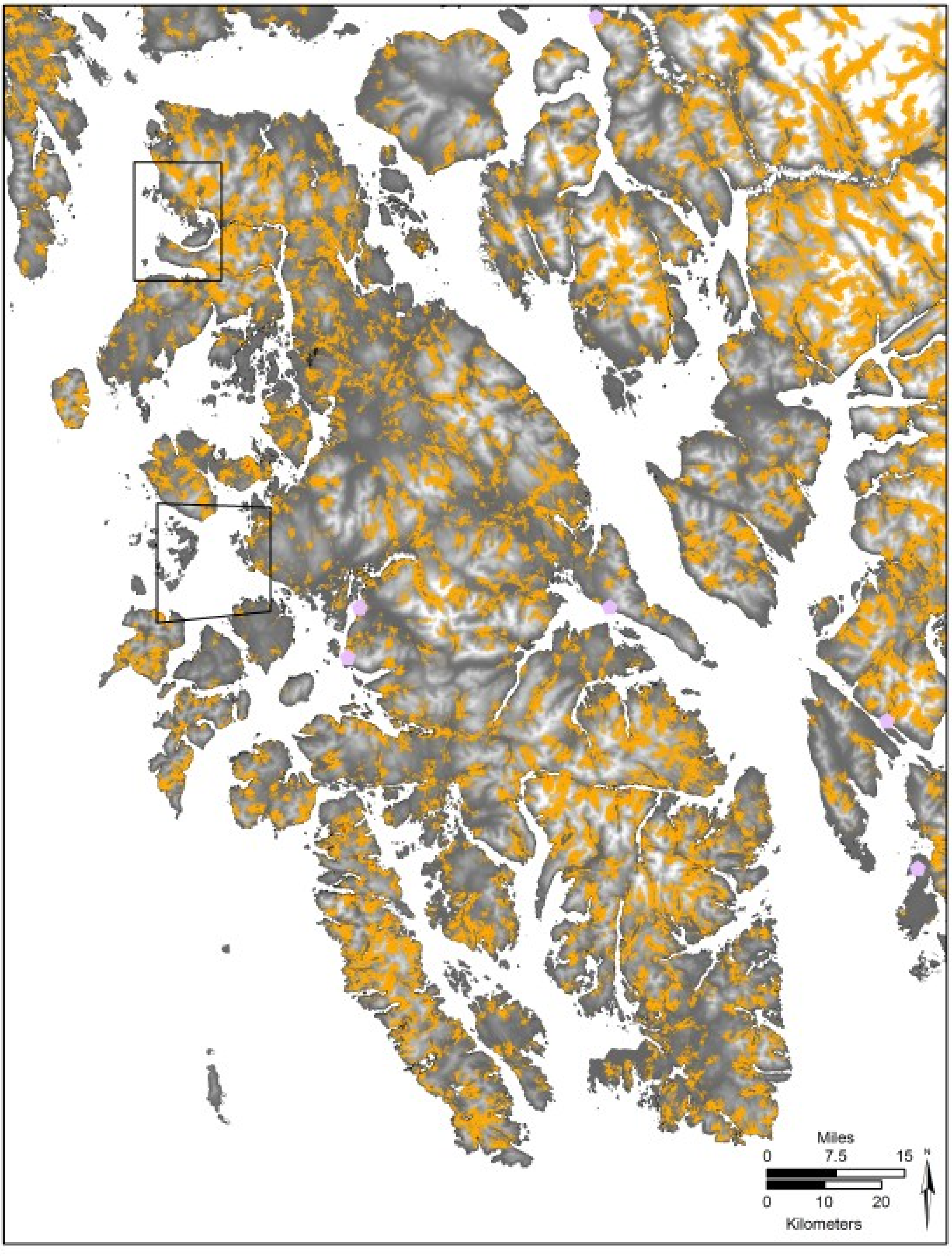
Weight 2a **Modern - Small Area**



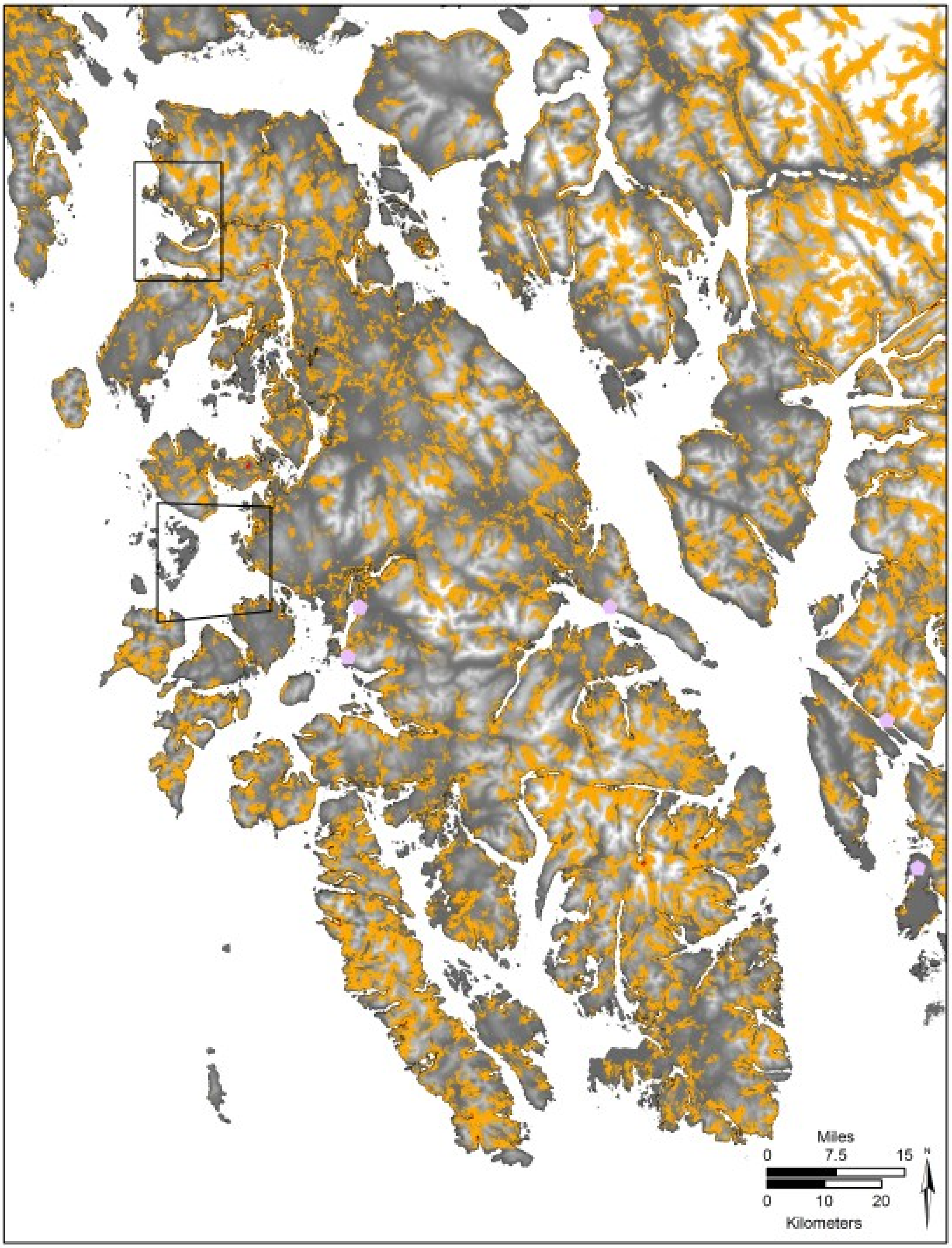
Weight 2a **Modern**



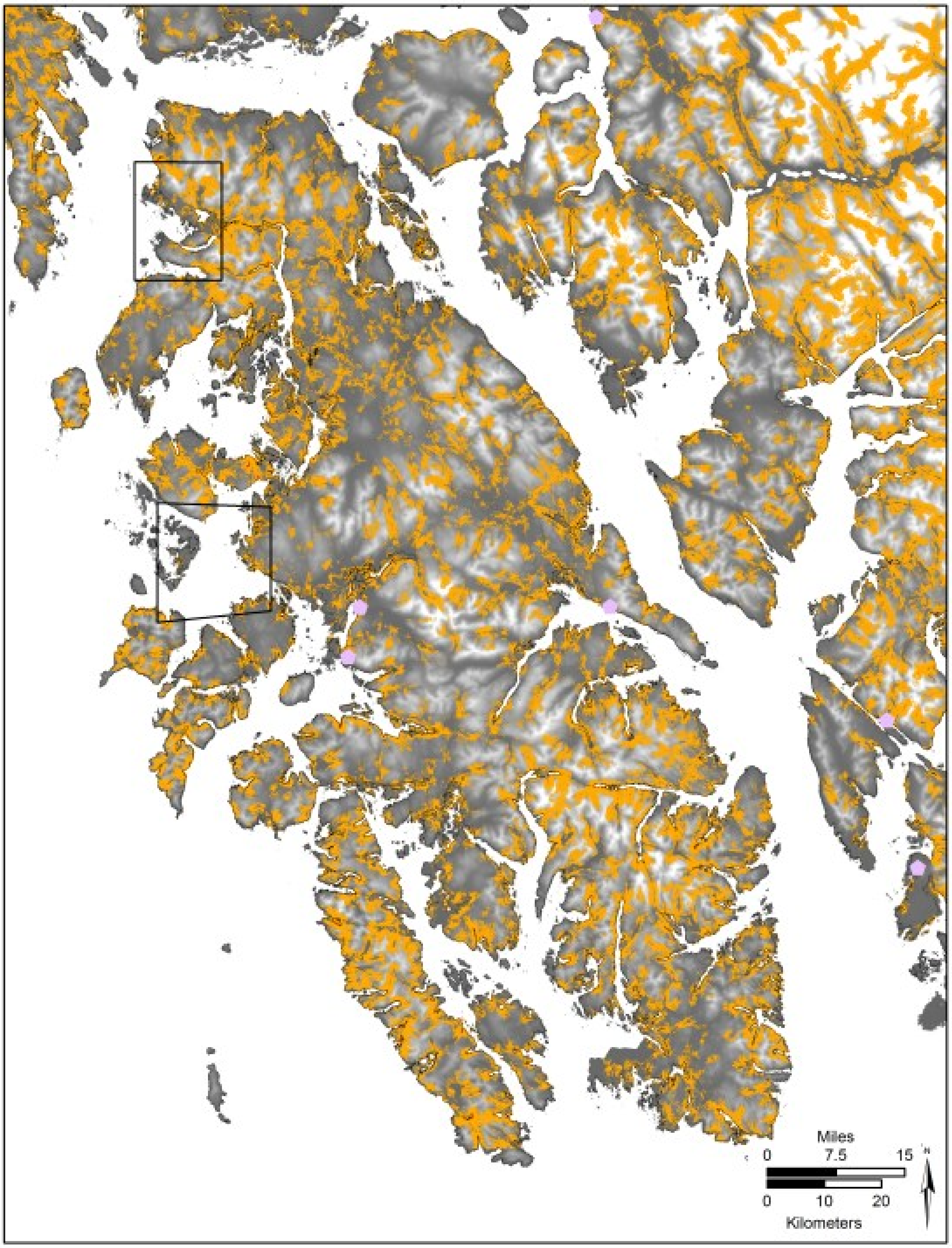
Weight 2a **10,500 cal BP**



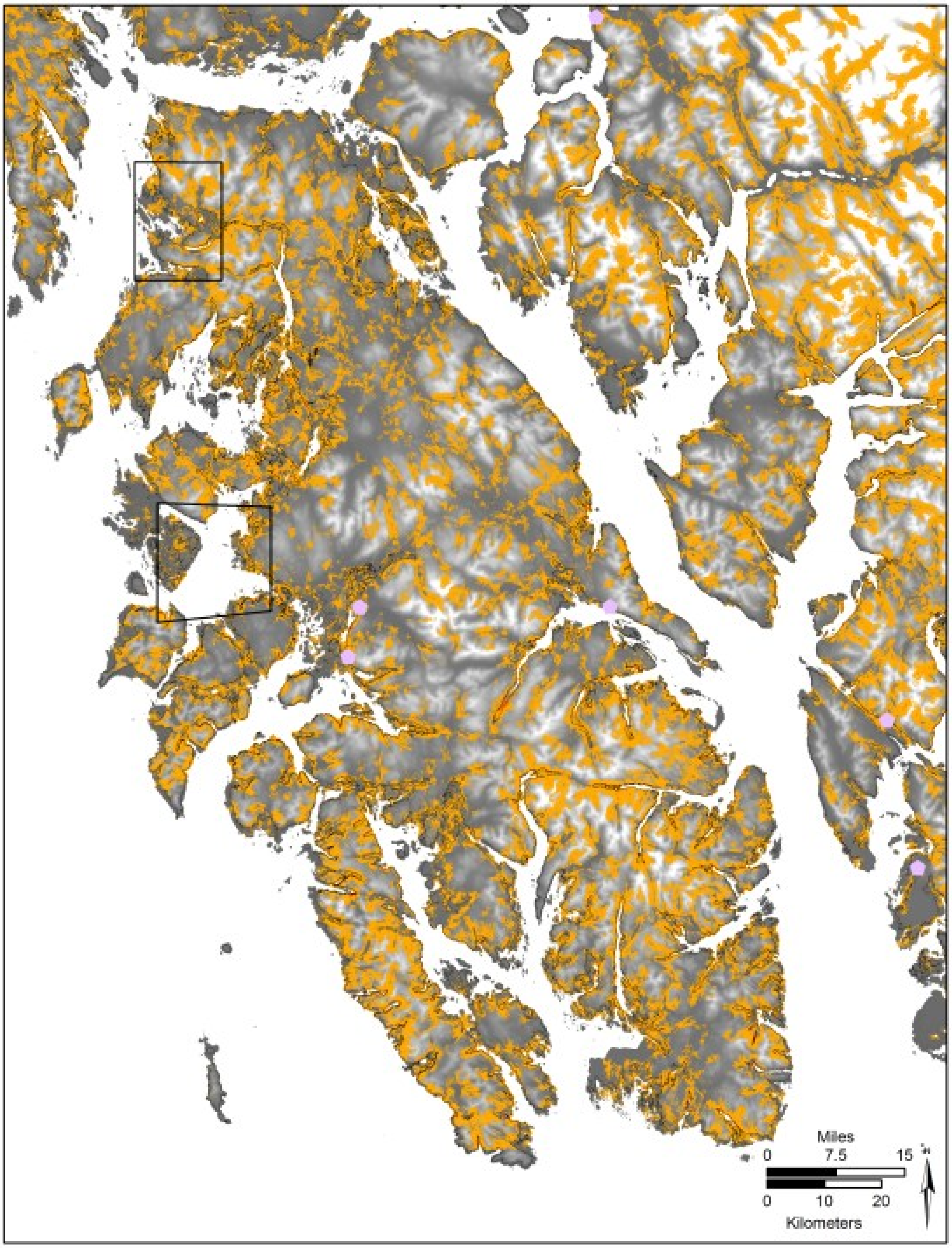
Weight 2a **11,000 cal BP**



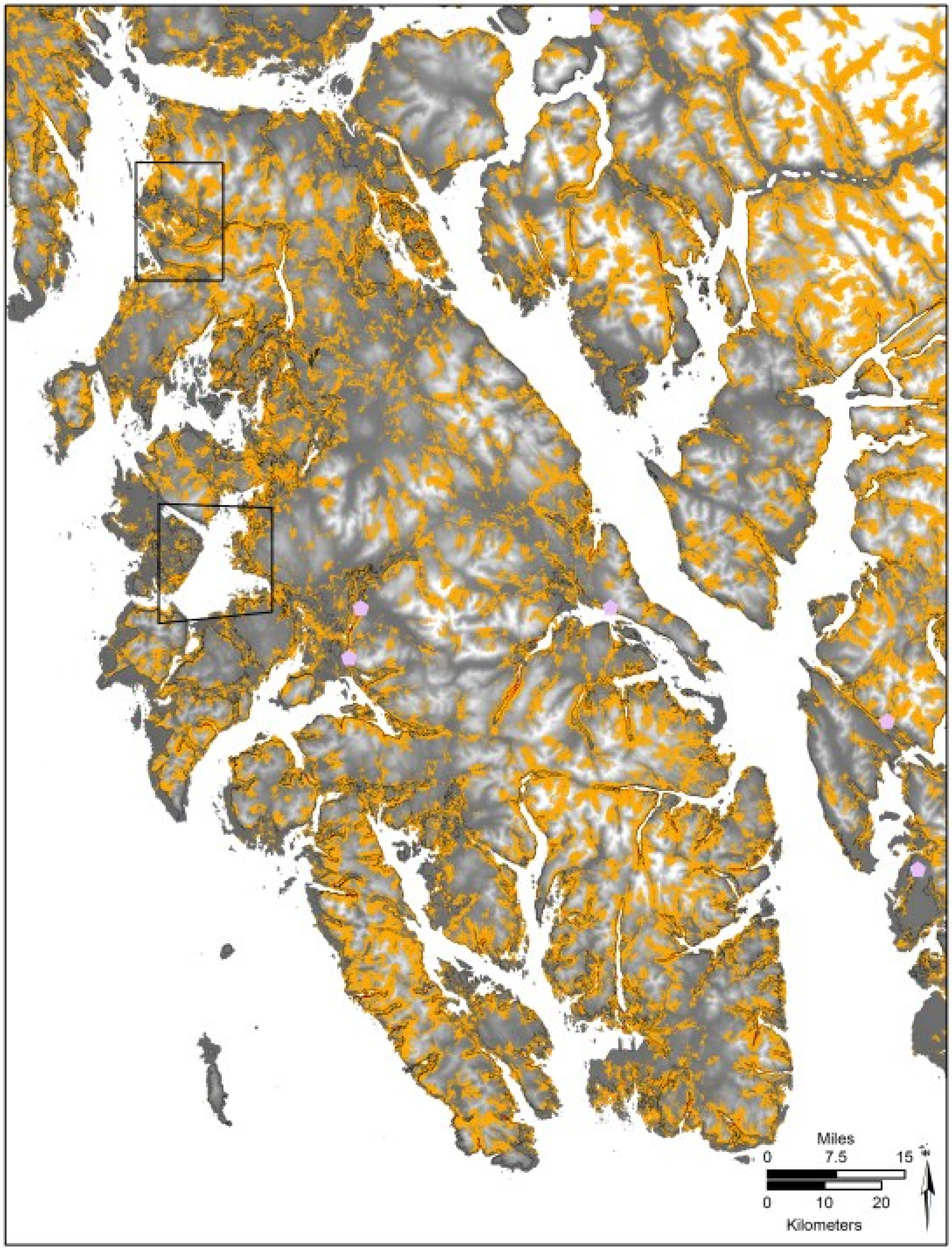
Weight 2a **11,500 cal BP**



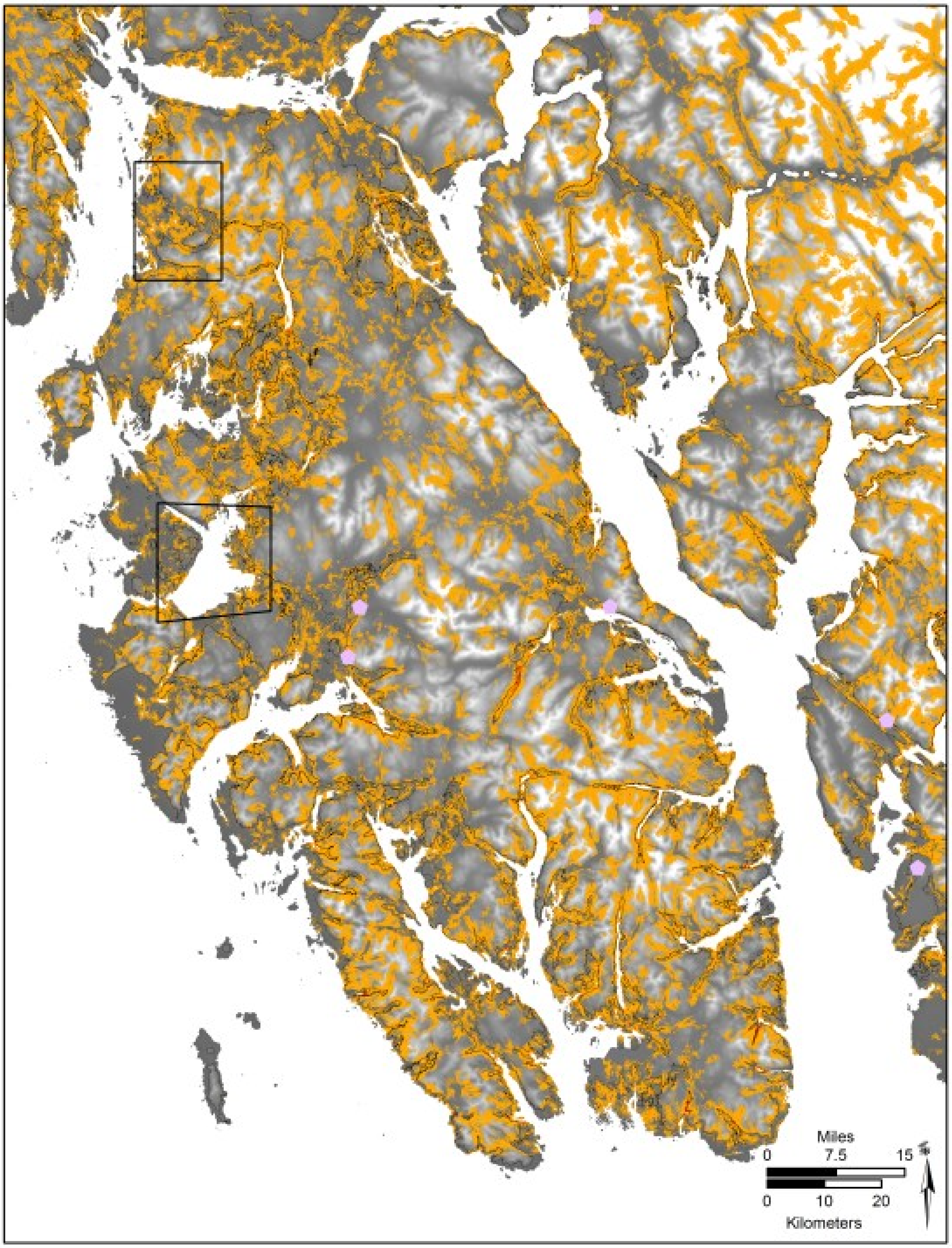
Weight 2a **12,000 cal BP**



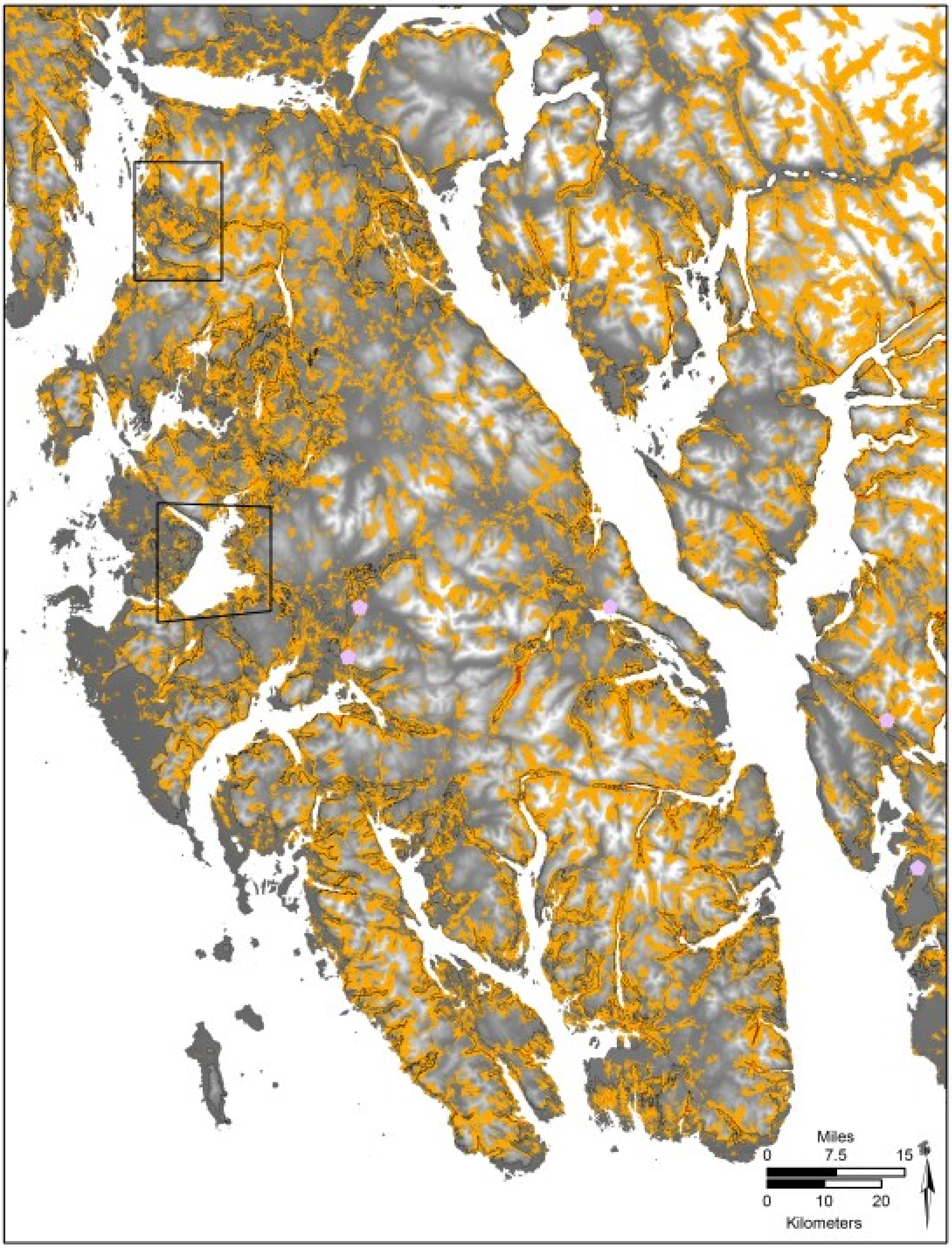
Weight 2a **12,500 cal BP**



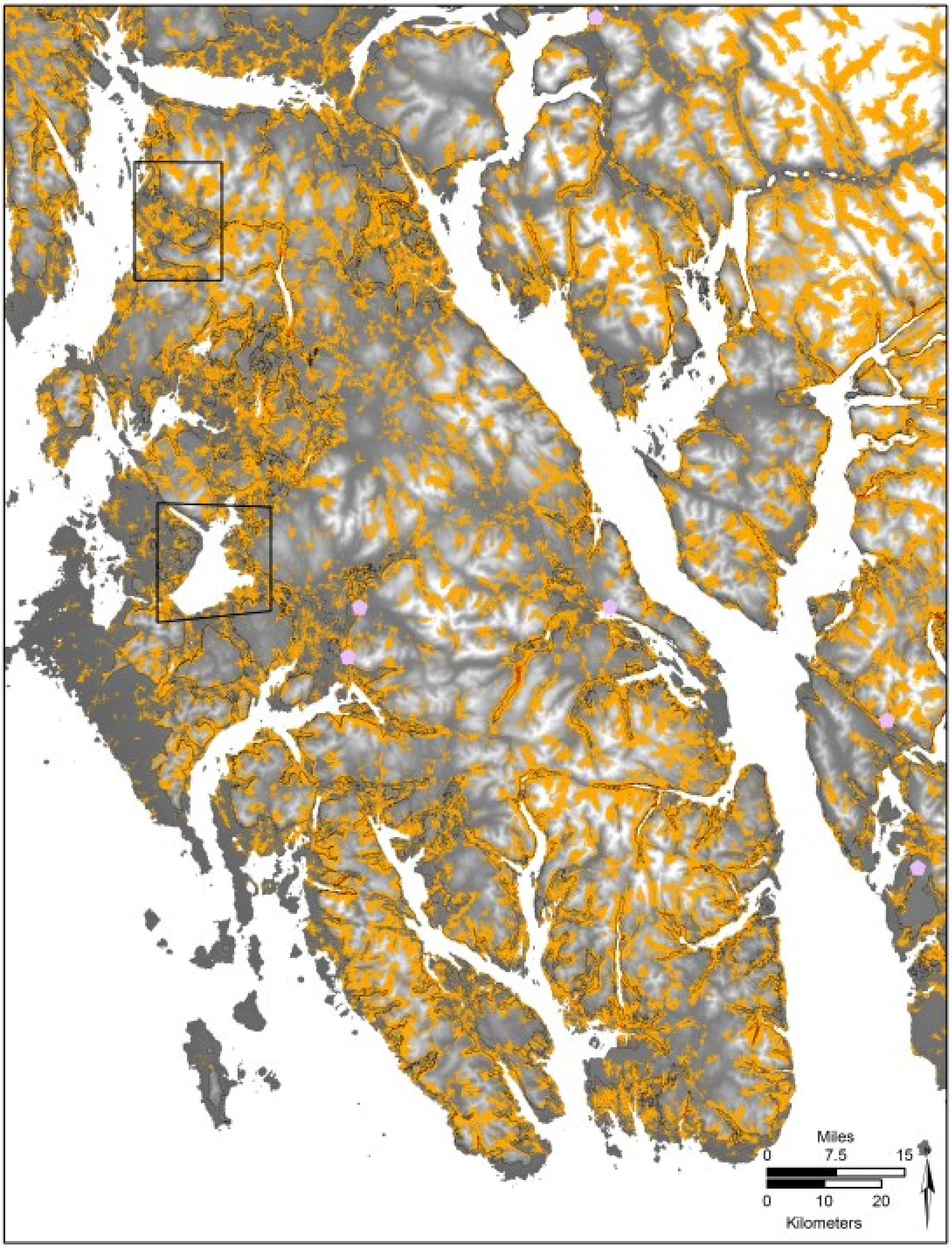
Weight 2a **13,000 cal BP**



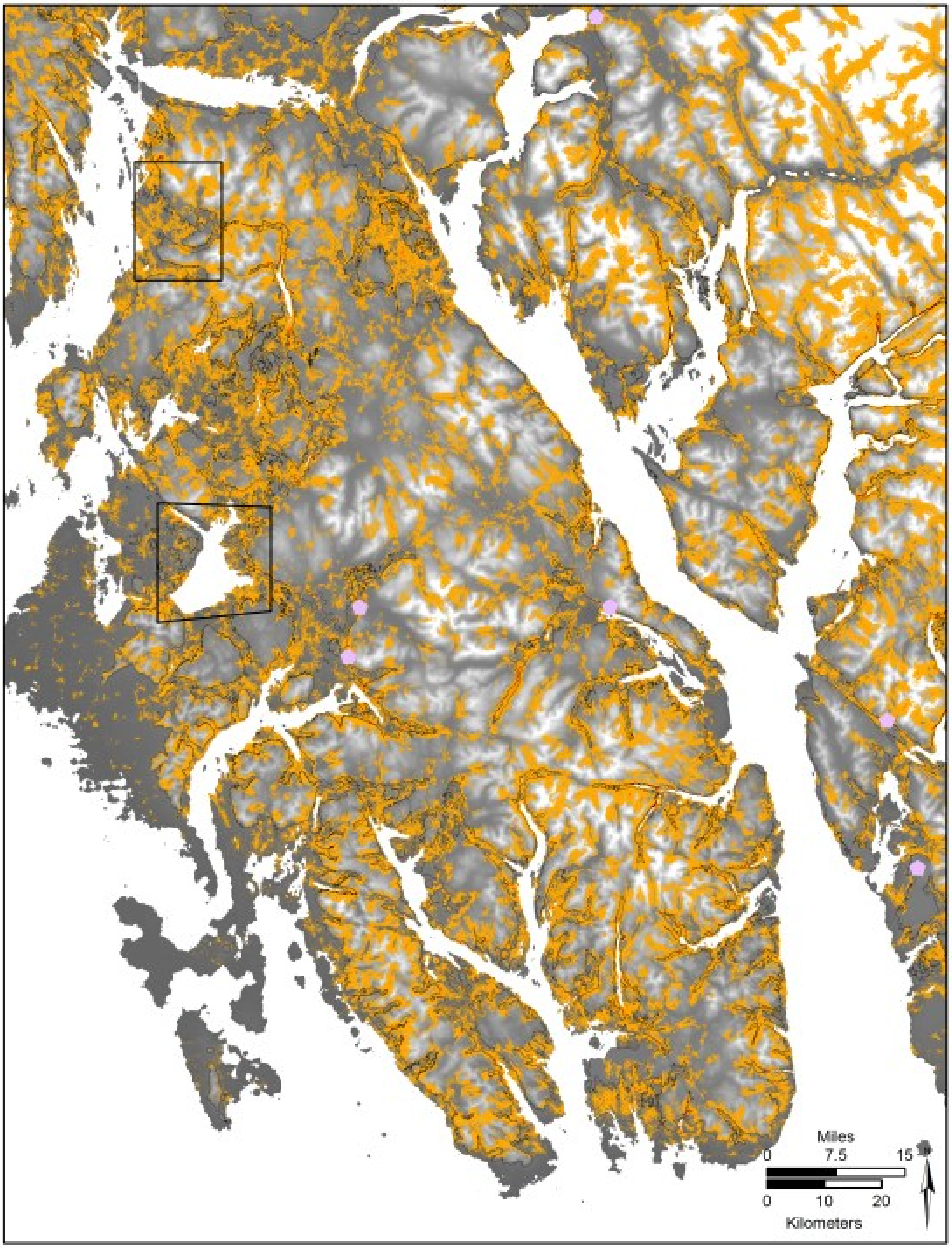
Weight 2a **13,500 cal BP**



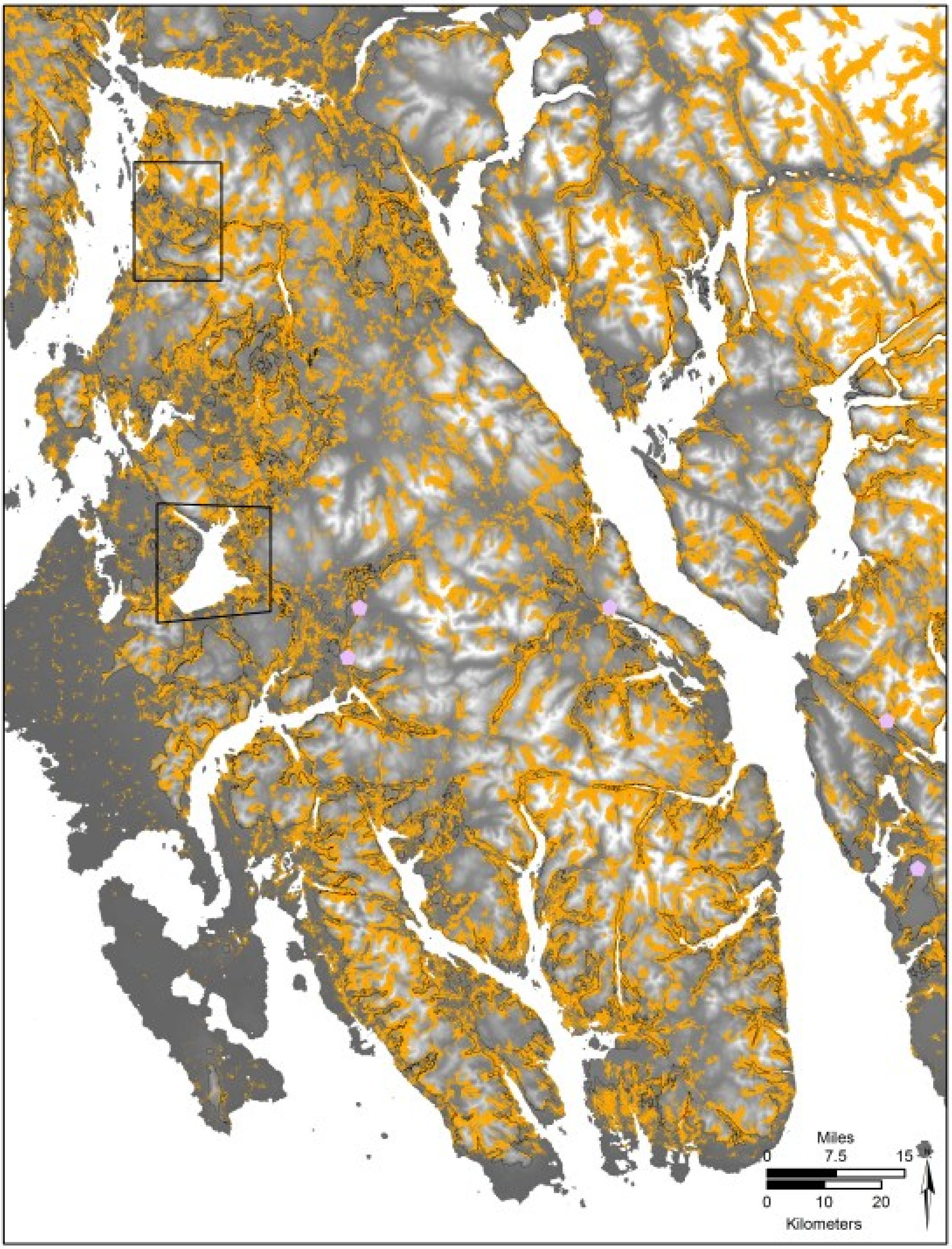
Weight 2a **14,000 cal BP**



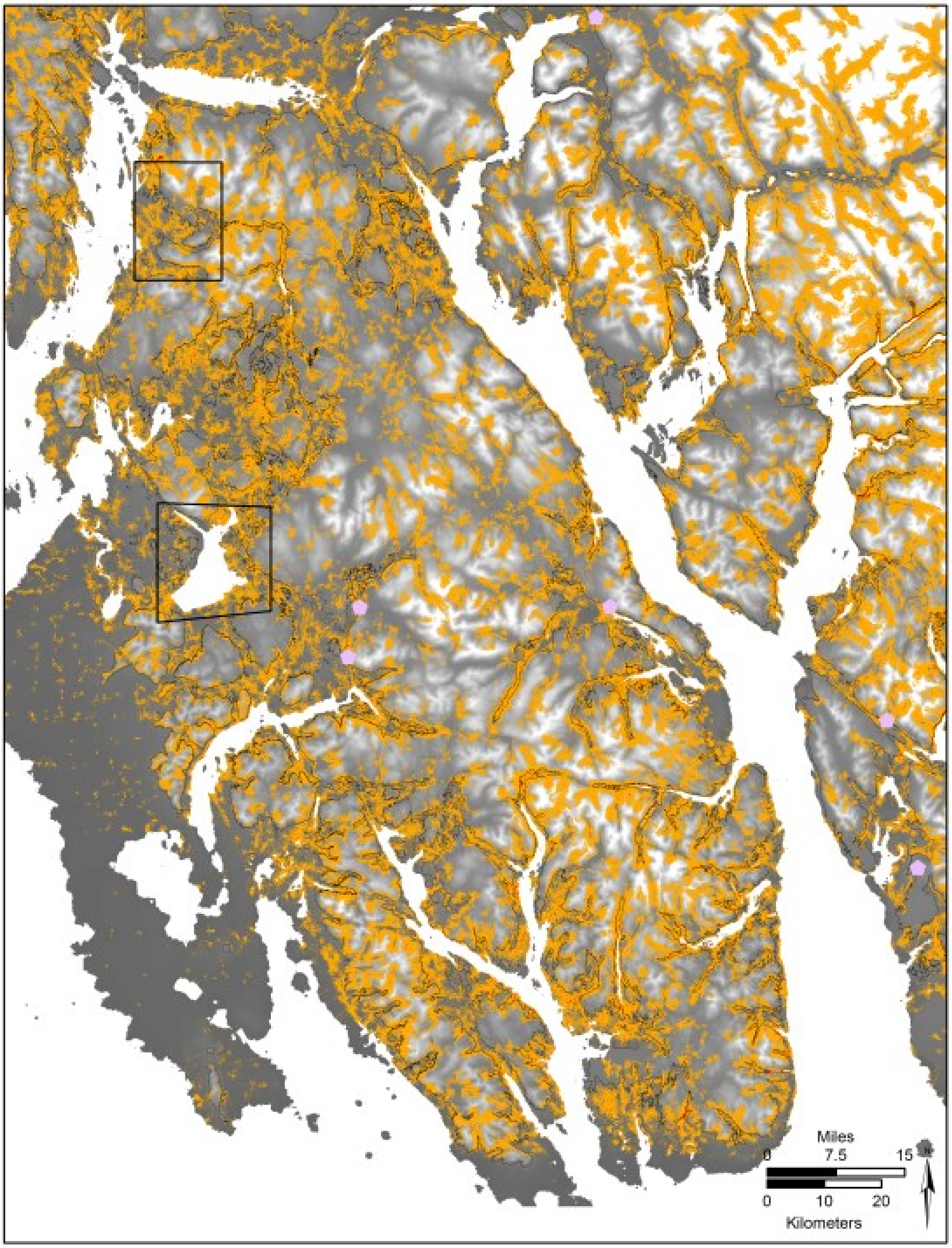
Weight 2a **14,500 cal BP**



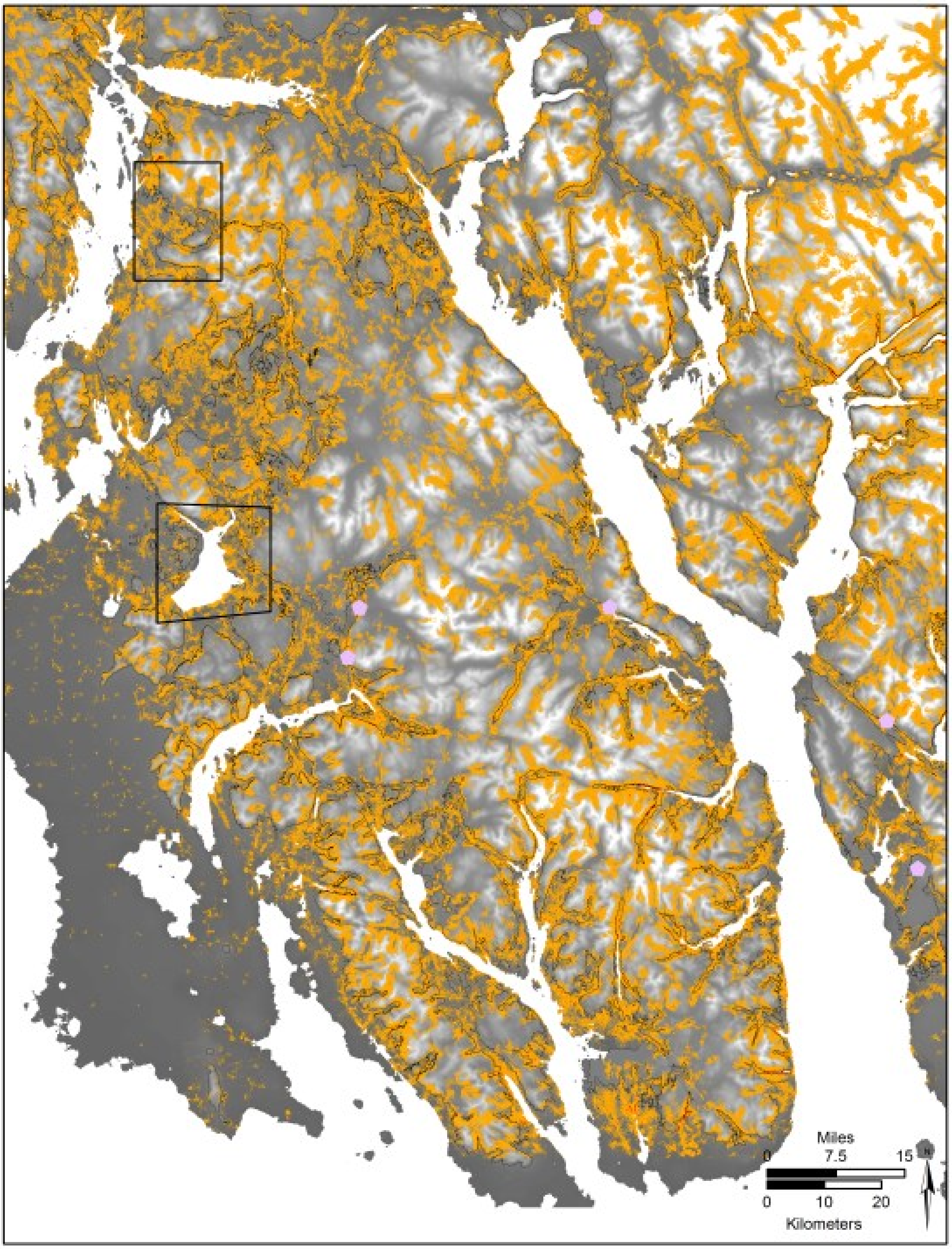
Weight 2a **15,000 cal BP**



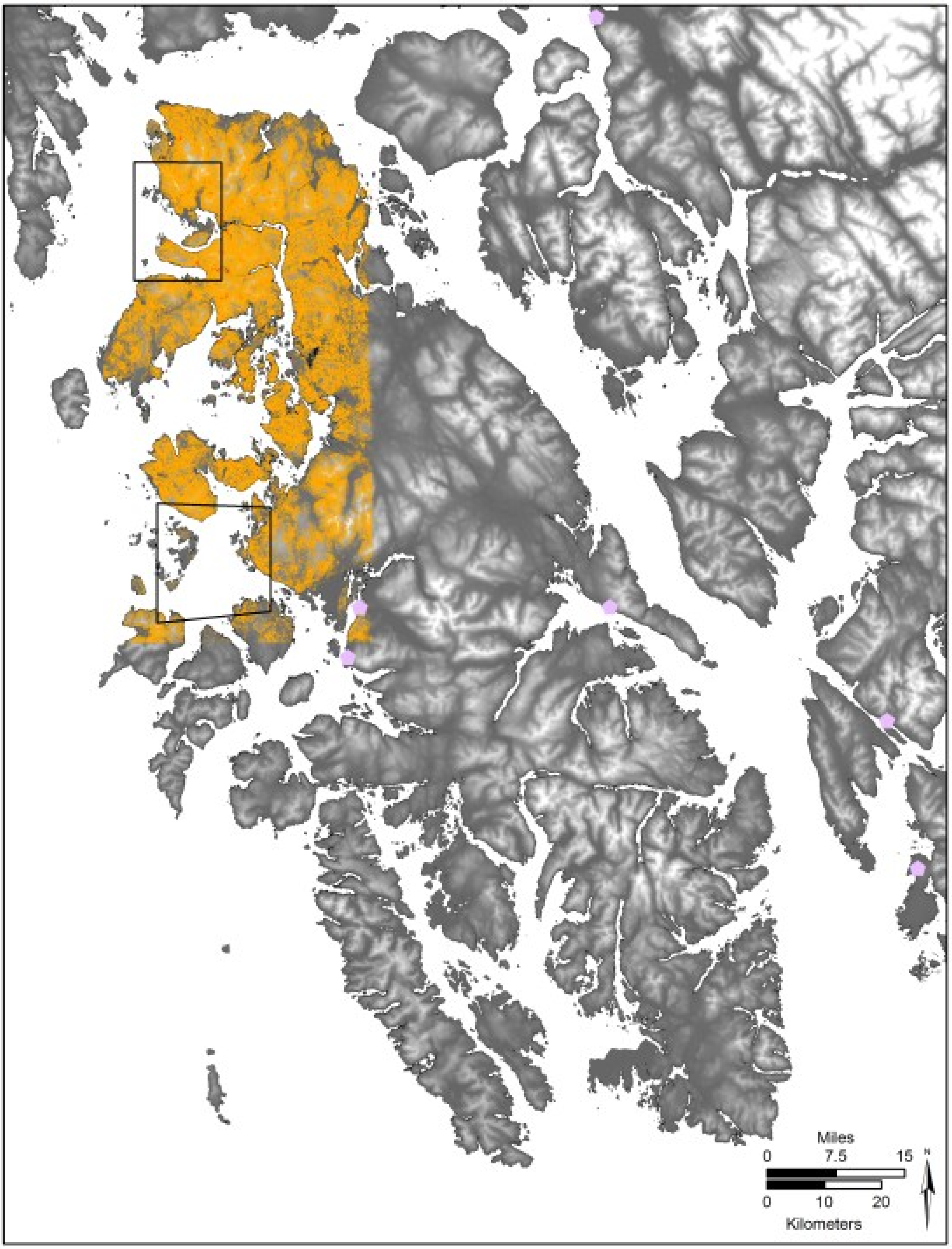
Weight 2a **15,500 cal BP**



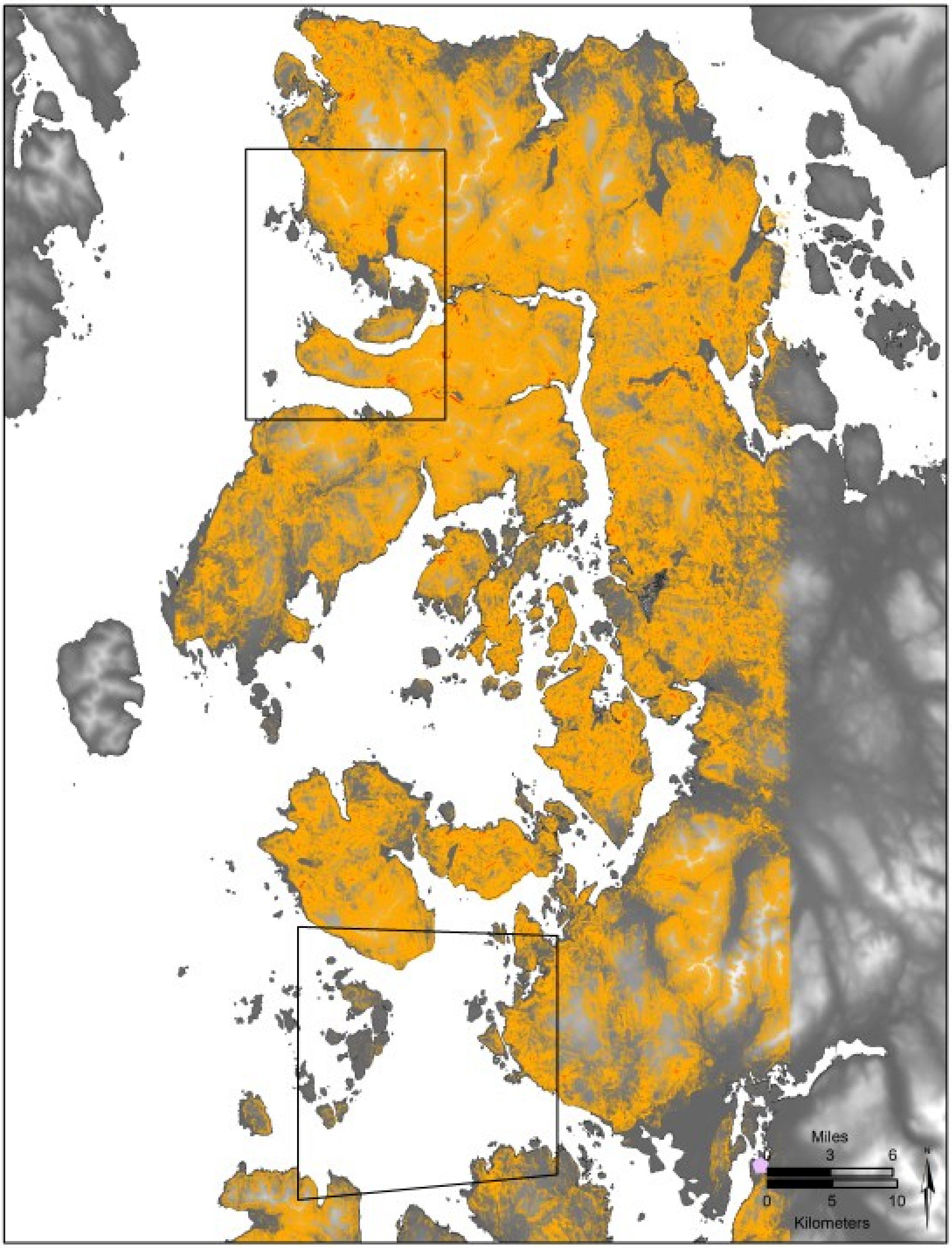
Weight 2a **16,000 cal BP**



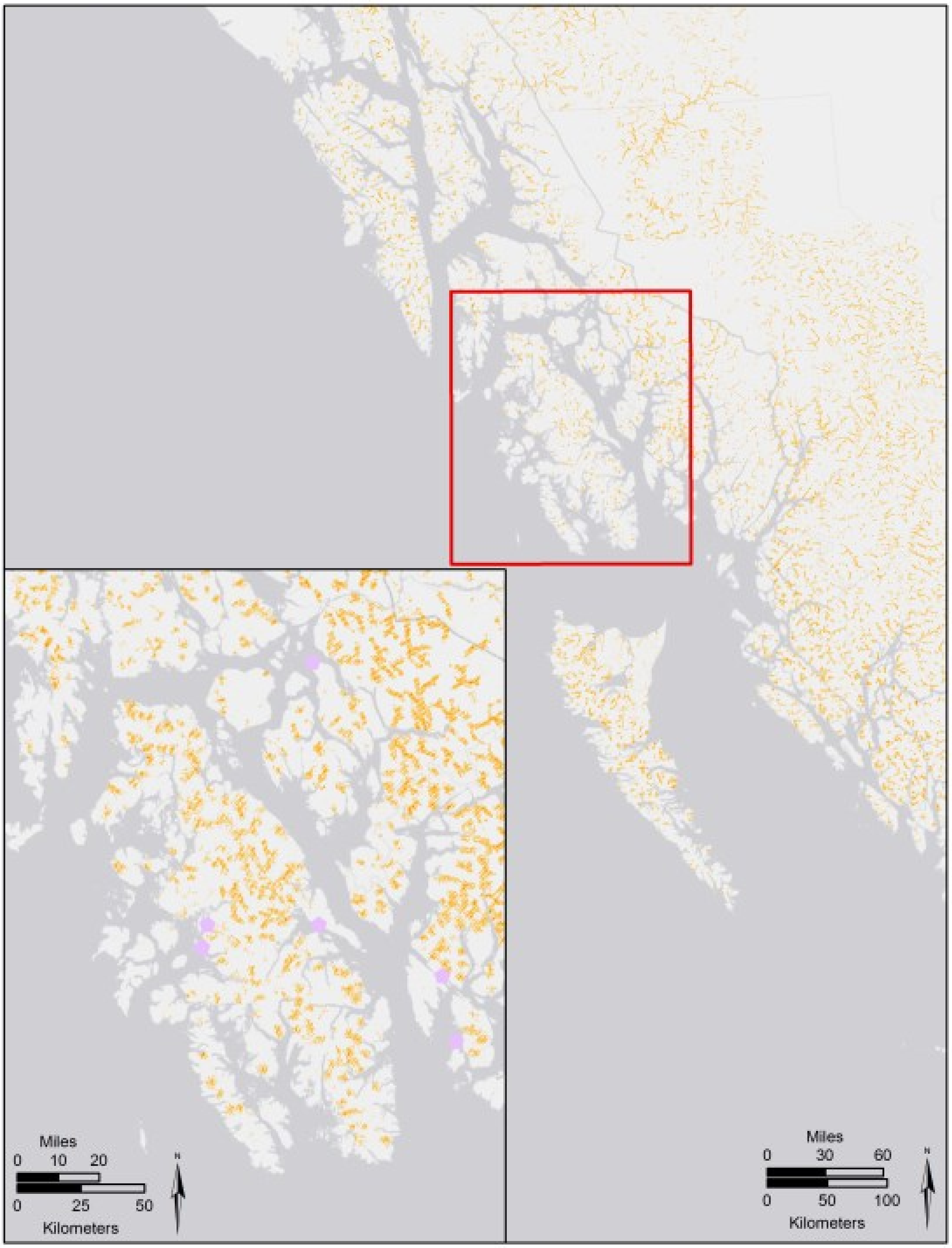
Weight 2a **Modern - Small Area**



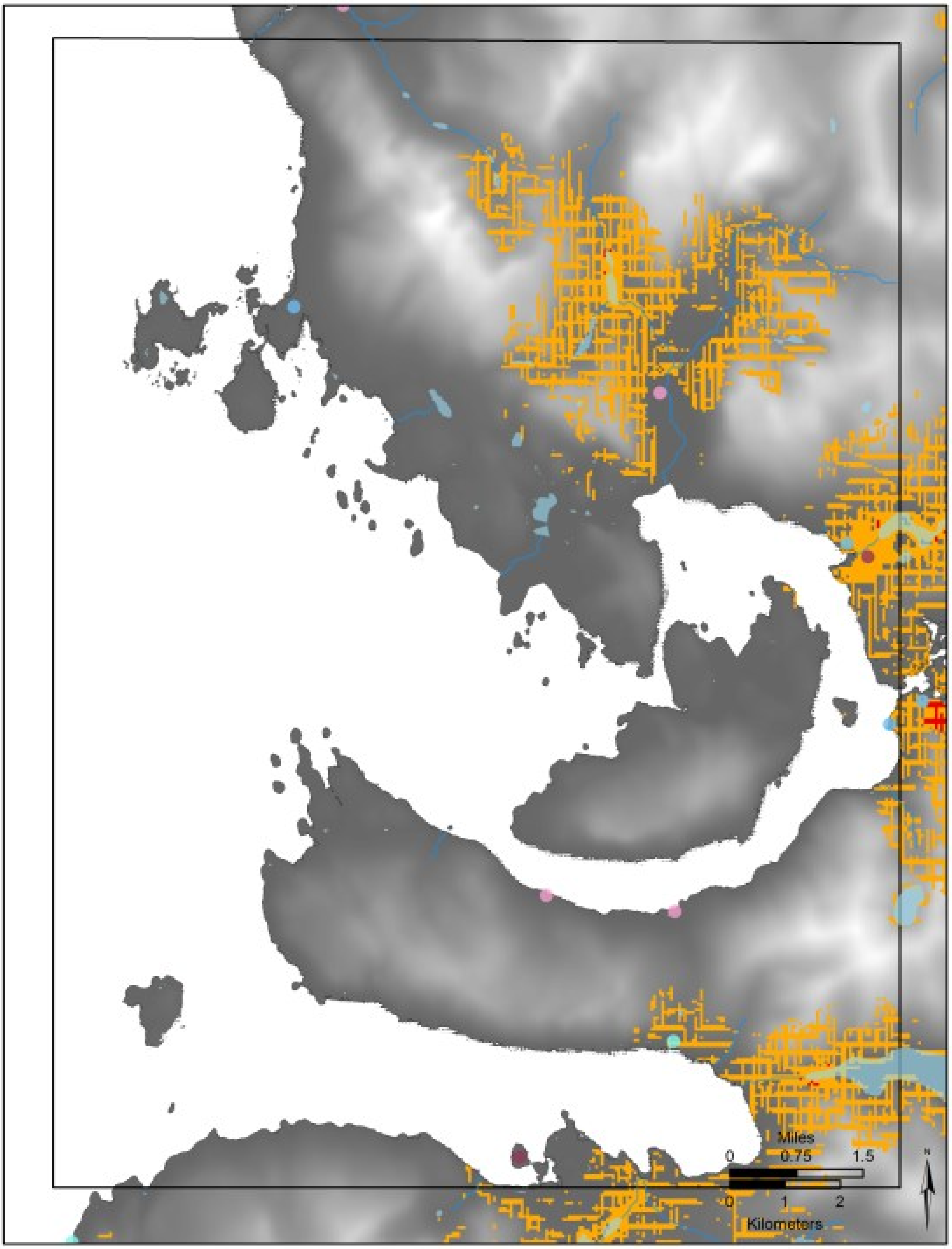
Weight 2a **Modern - Small Area**



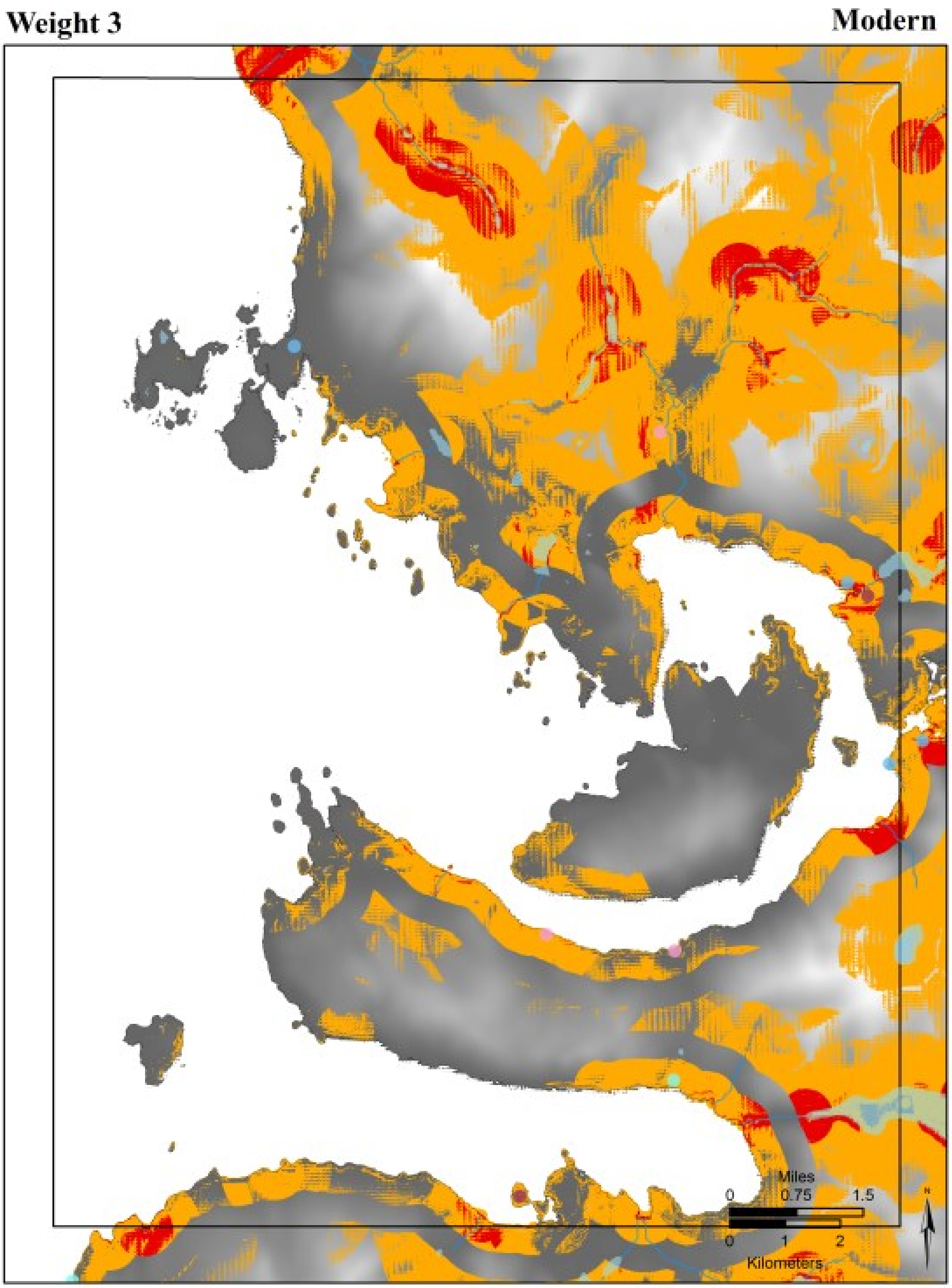
Weight 2a **NWC - modern**



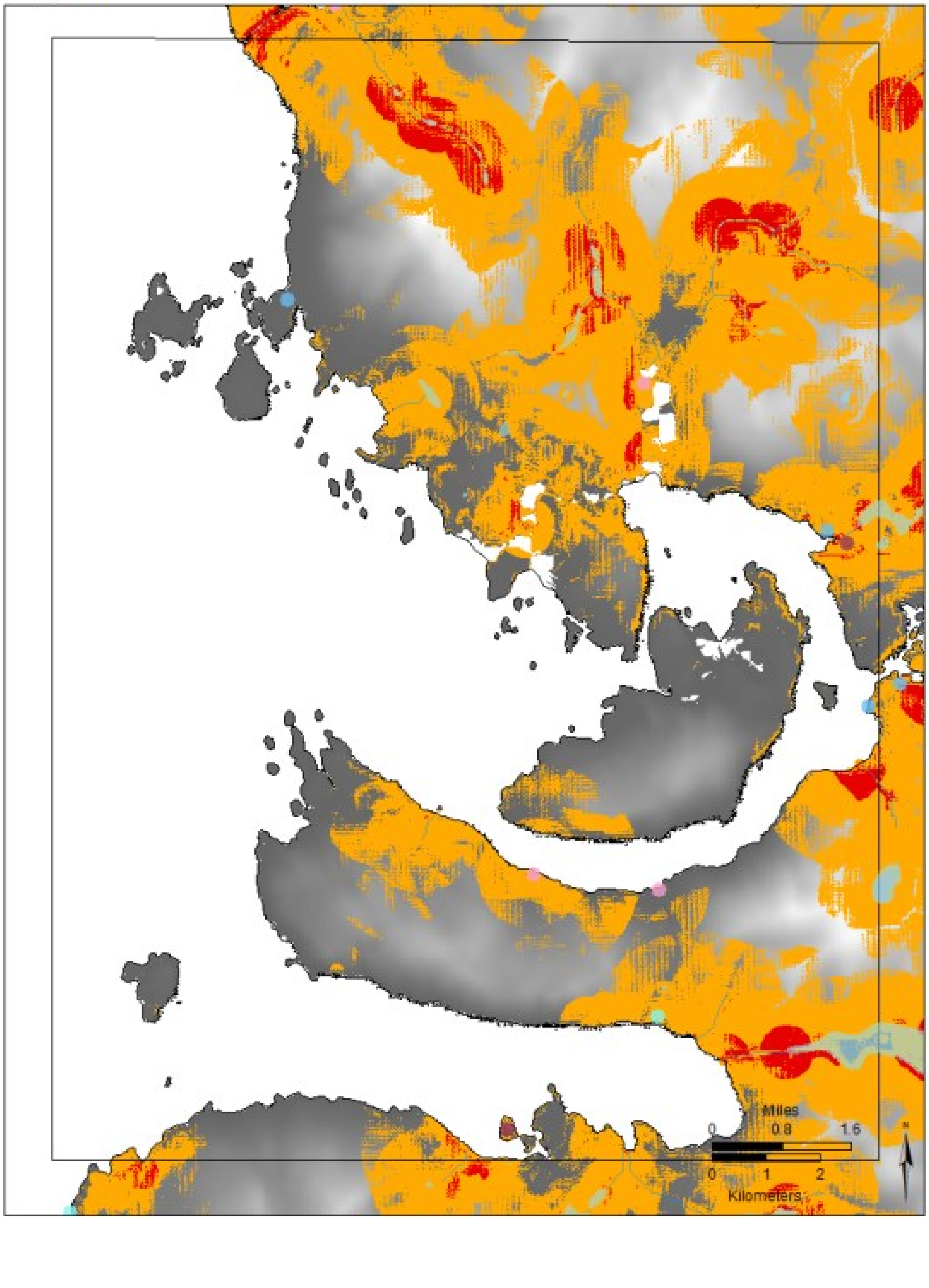
Weight 2a **NWC - modern**



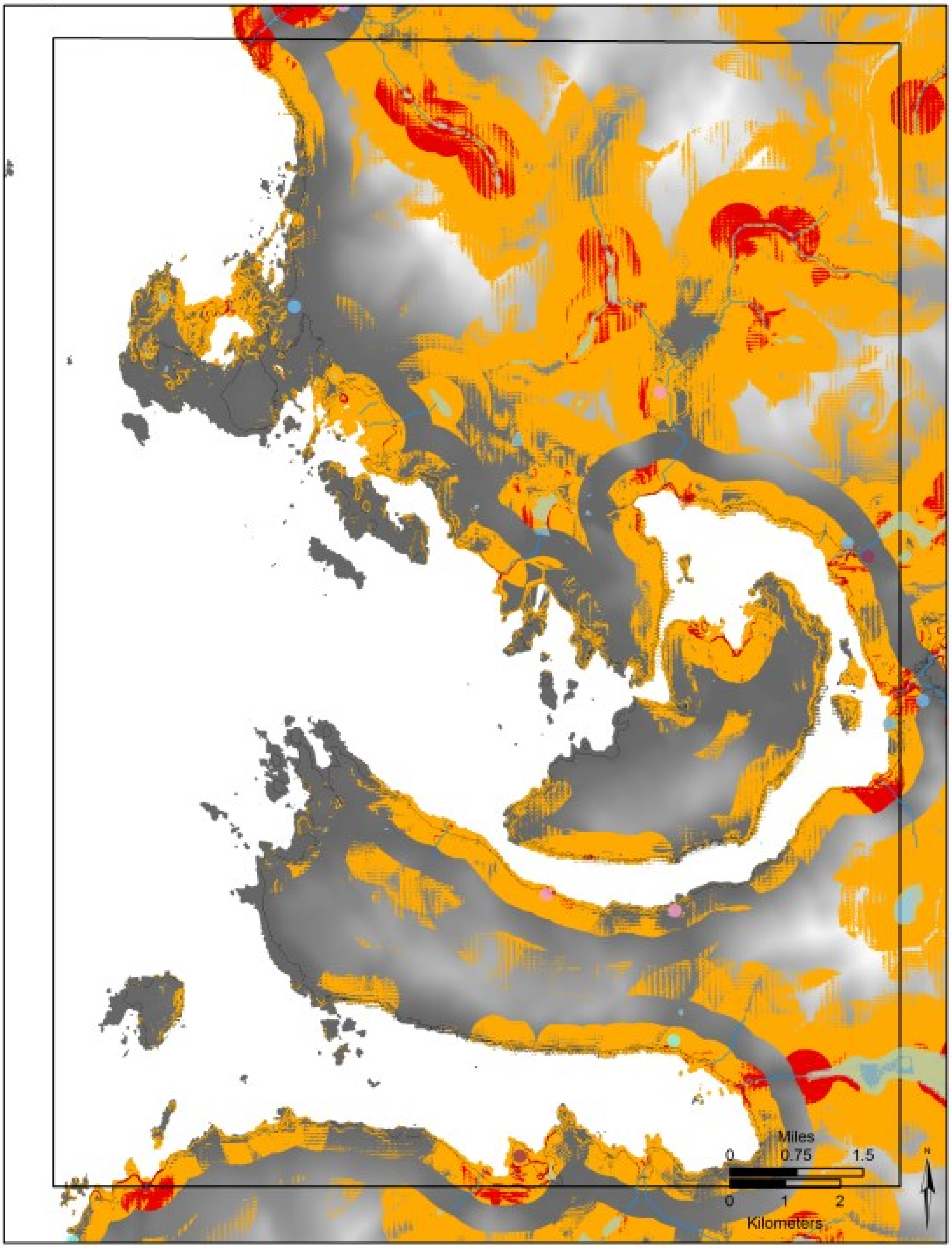
C.6 Weighted Overlay 3



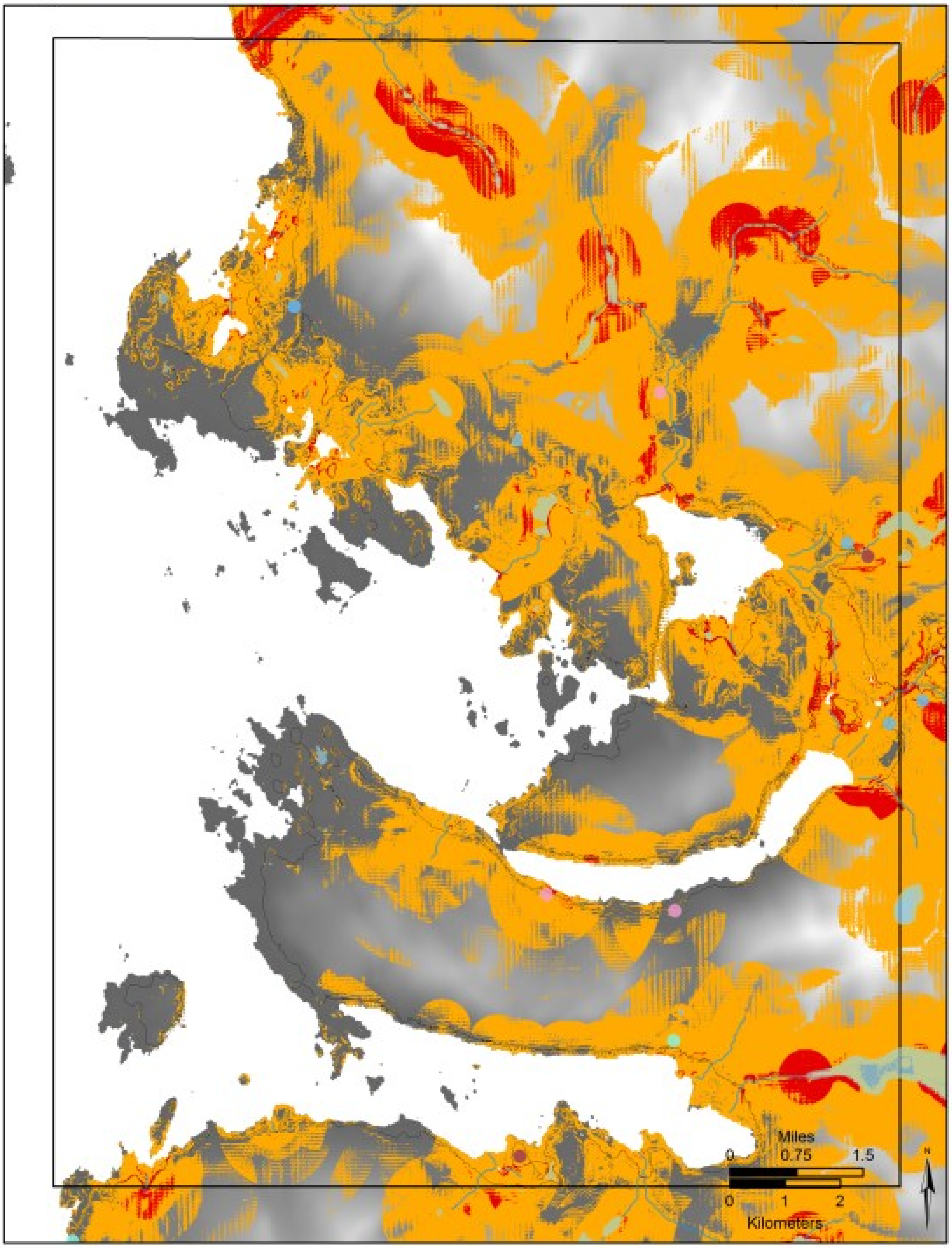
Weight 3 10,500 cal BP



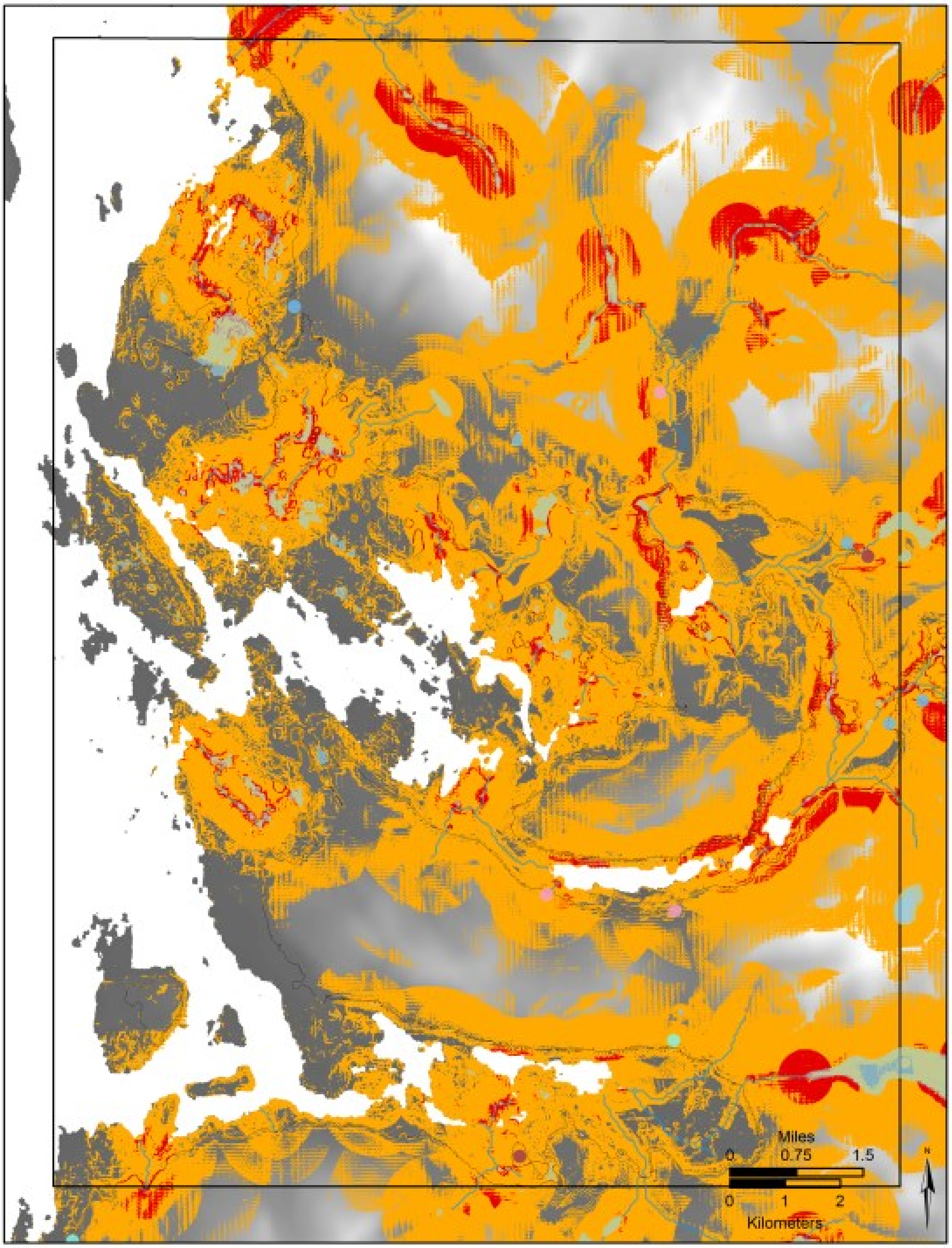
Weight 3 **11,000 cal BP**



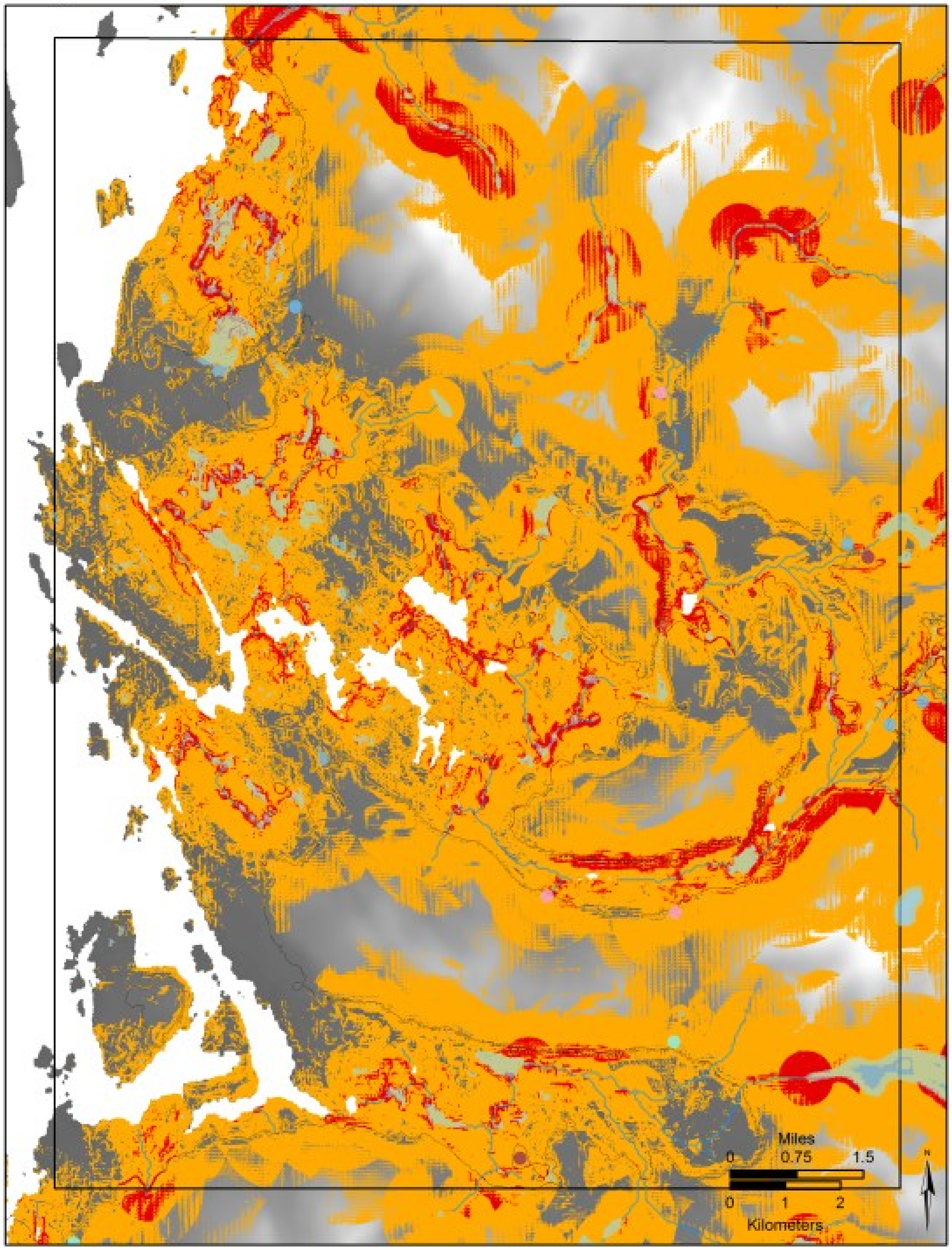
Weight 3 **11,500 cal BP**



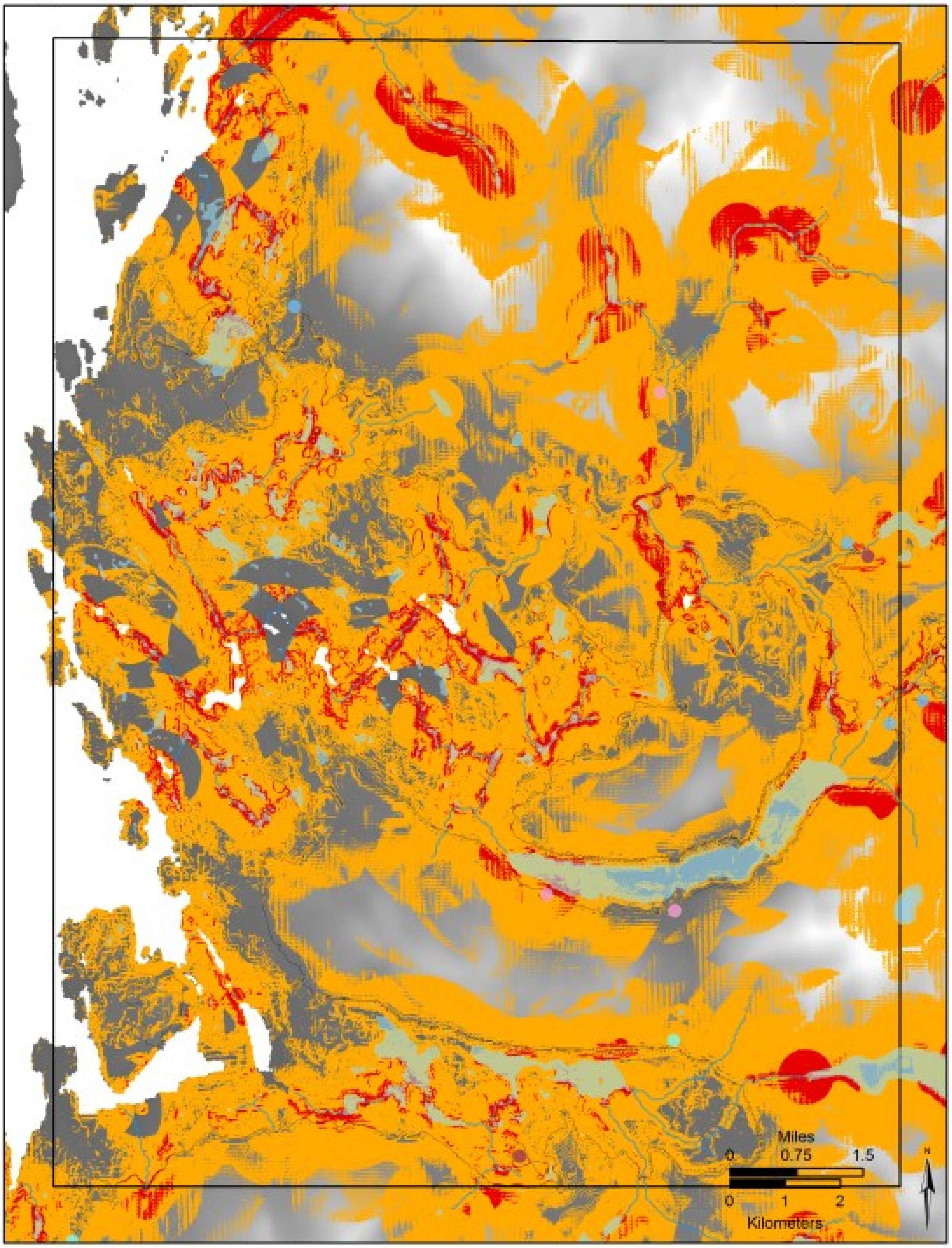
Weight 3 **12,000 cal BP**



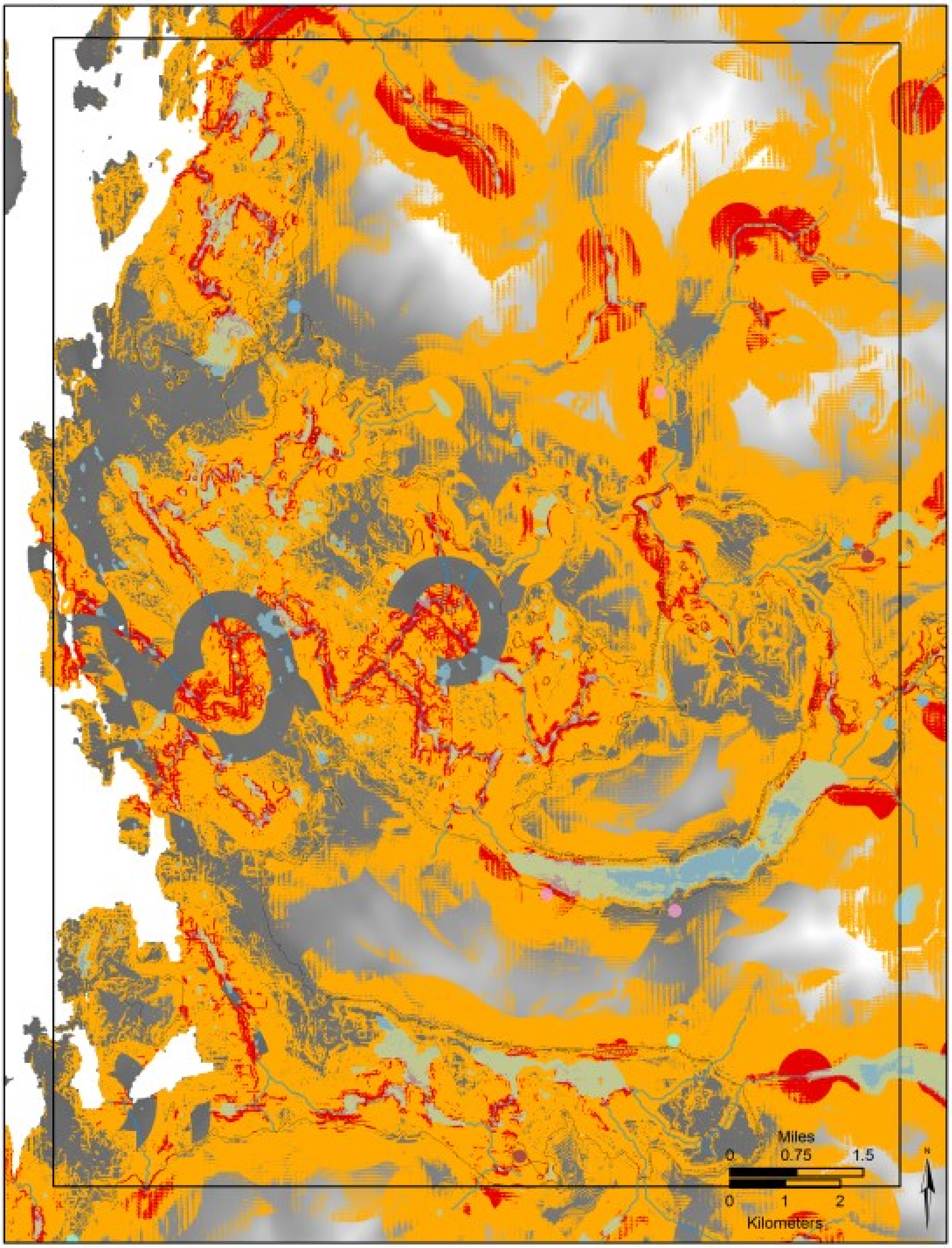
Weight 3 **12,500 cal BP**

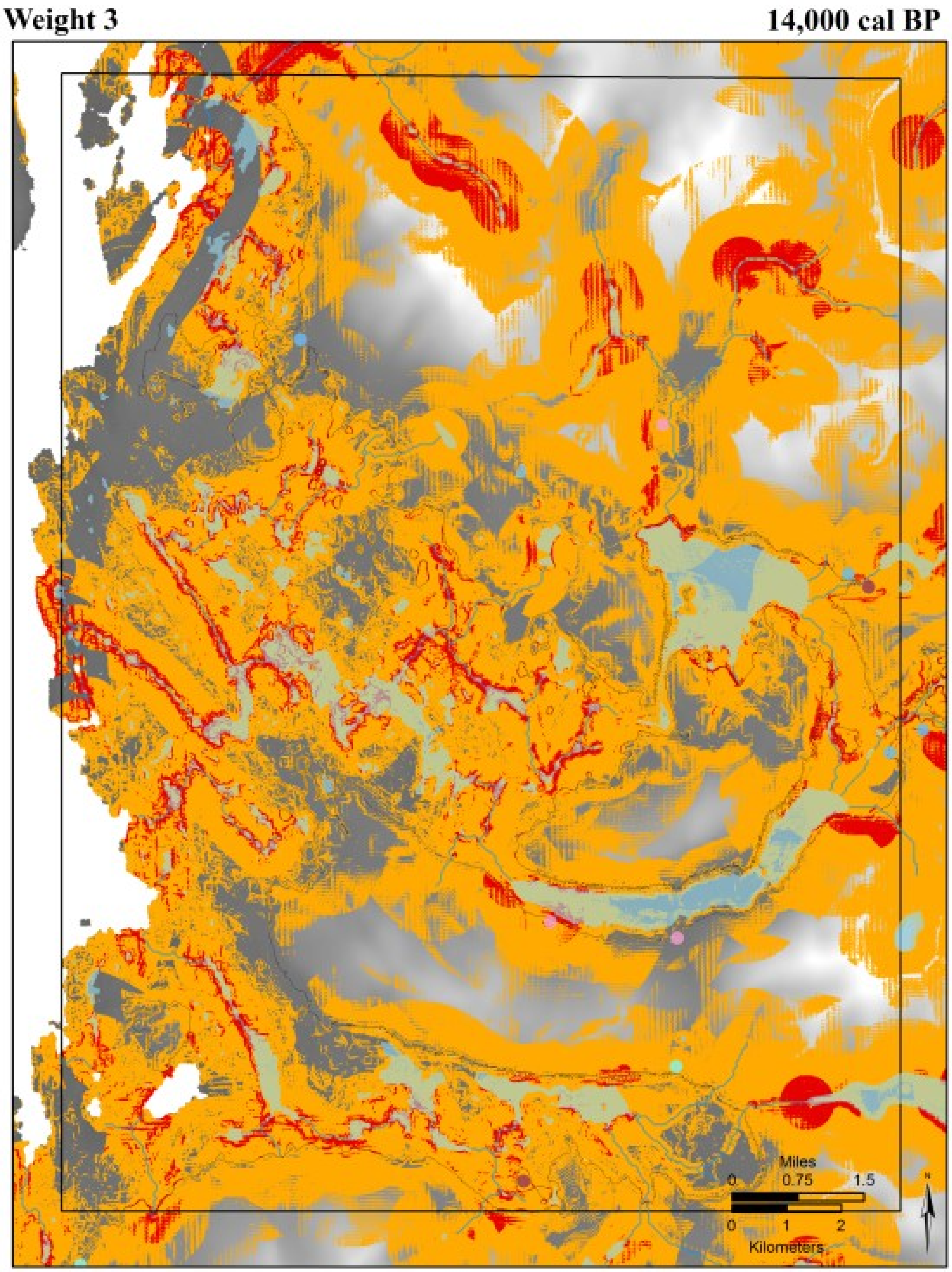


Weight 3 **13,000 cal BP**

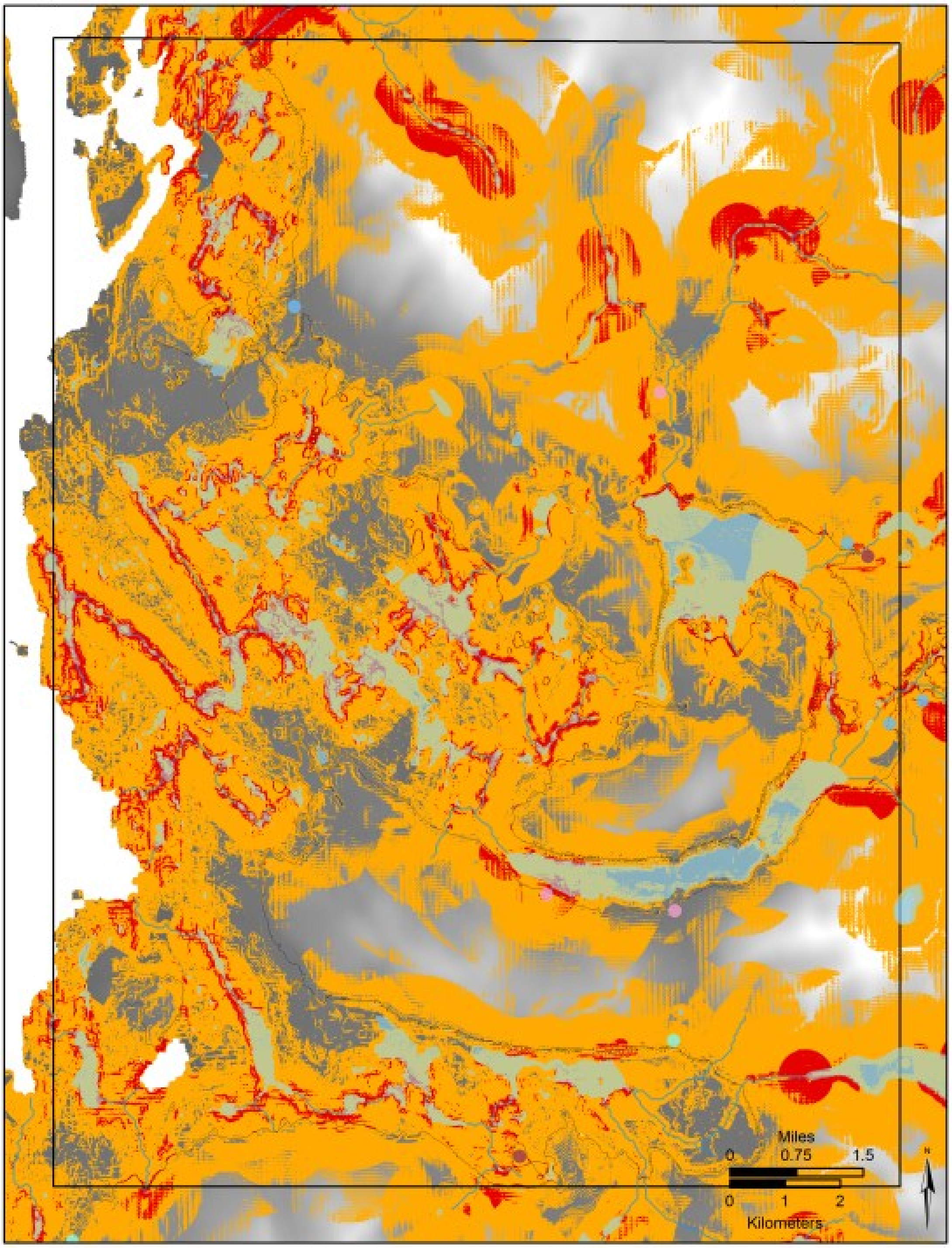


Weight 3 **13,500 cal BP**

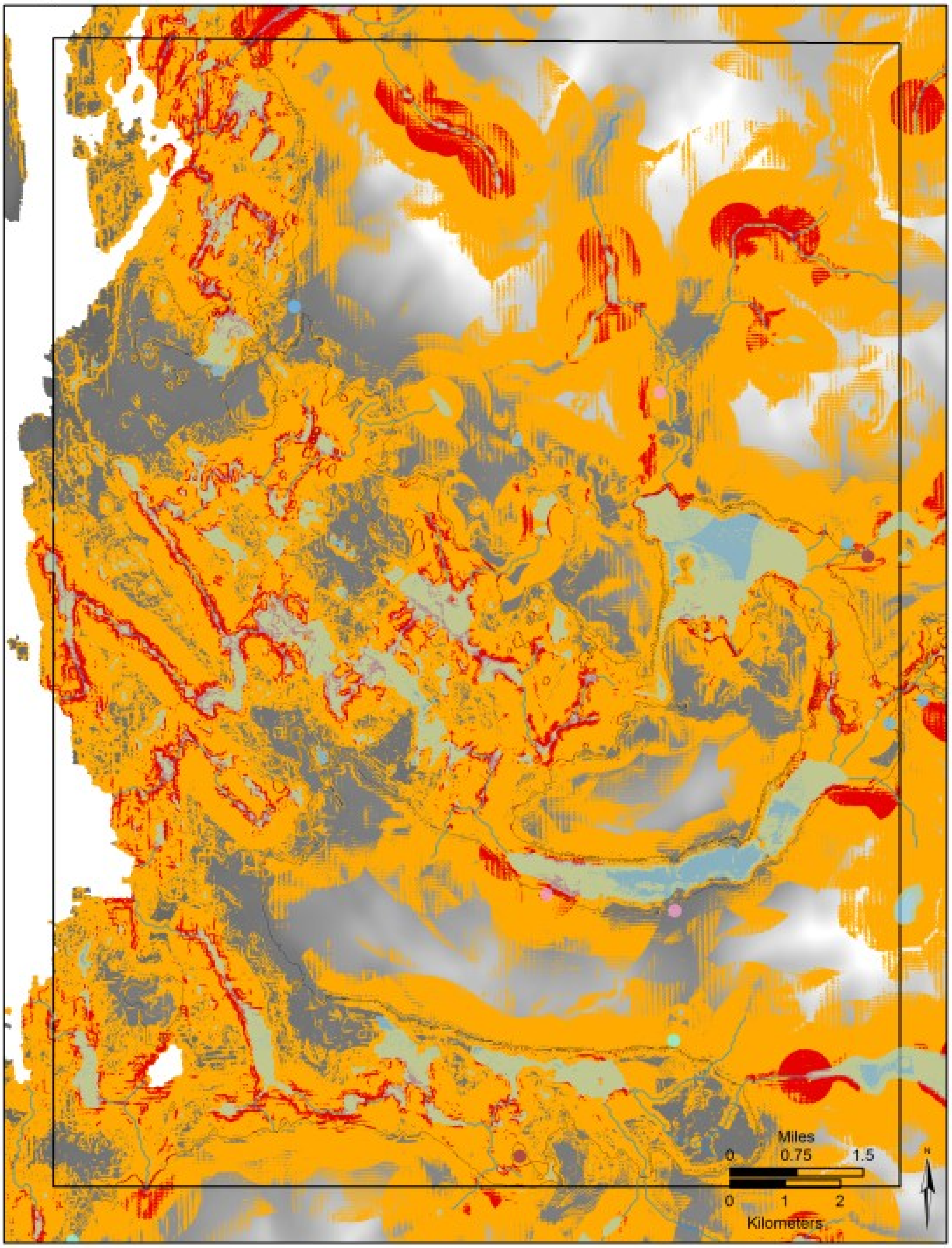



Weight 3
14,000 cal BP
Miles
0
0.75
1.5
0
1
2
Kilometers

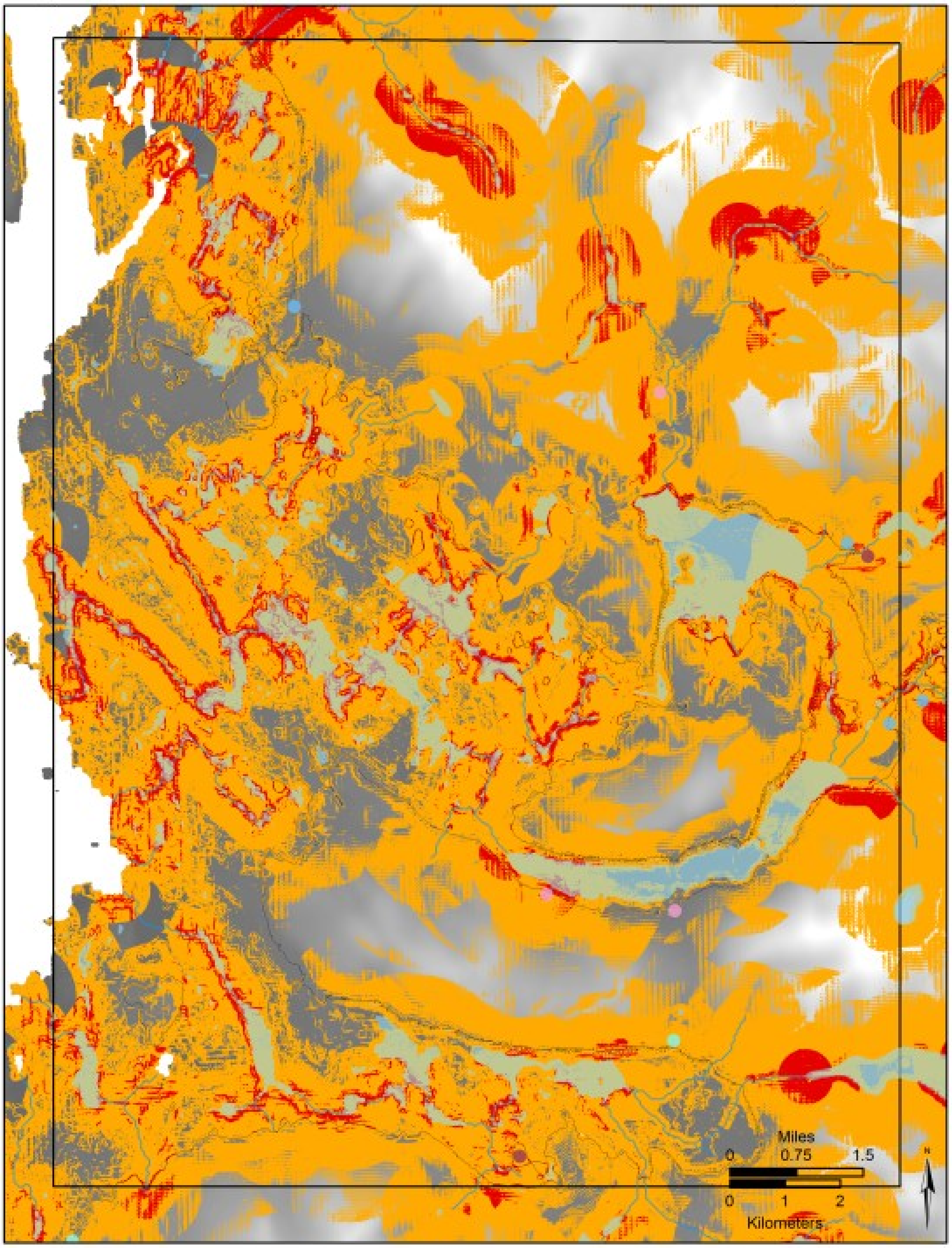
Weight 3 **14,500 cal BP**



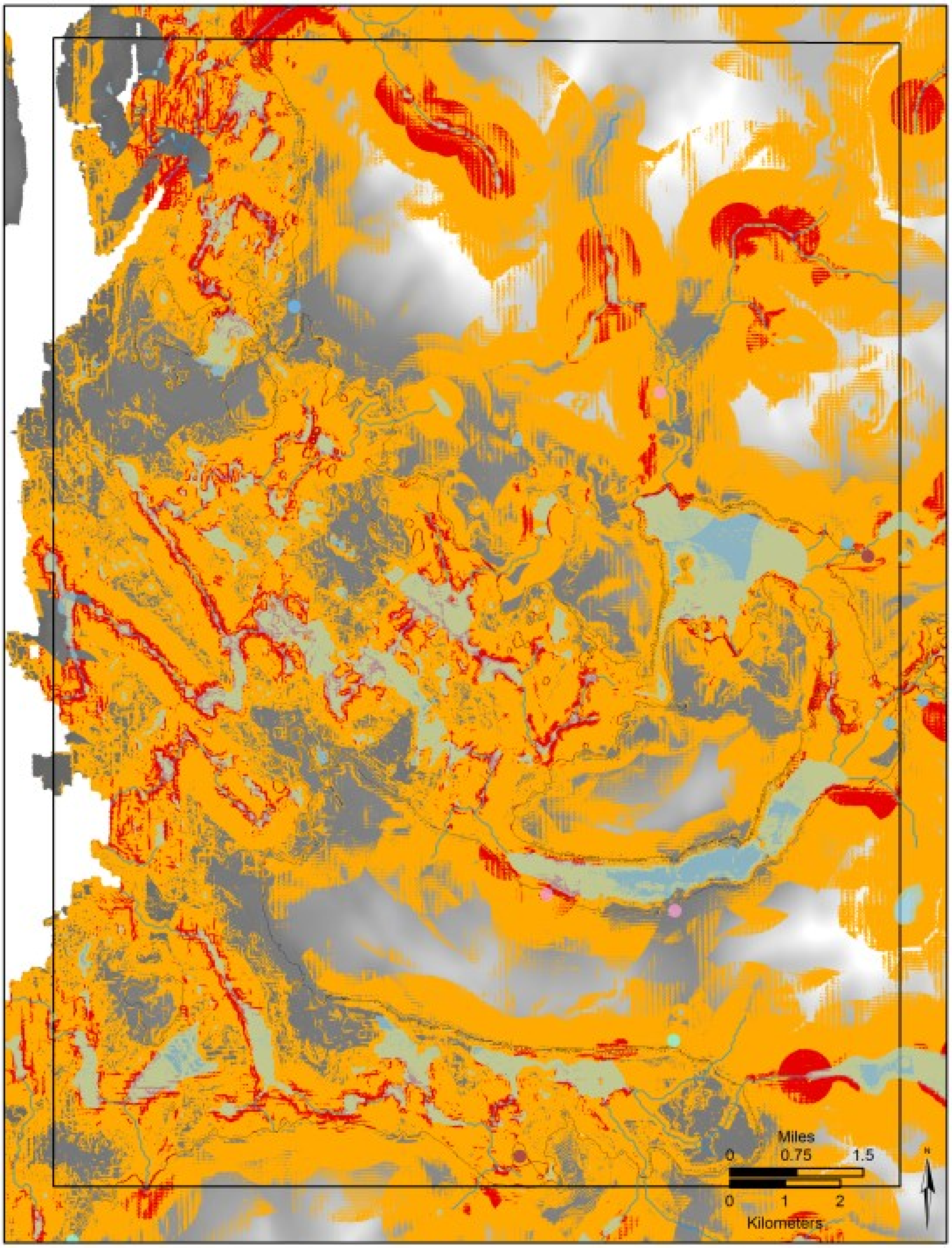
Weight 3 **15,000 cal BP**



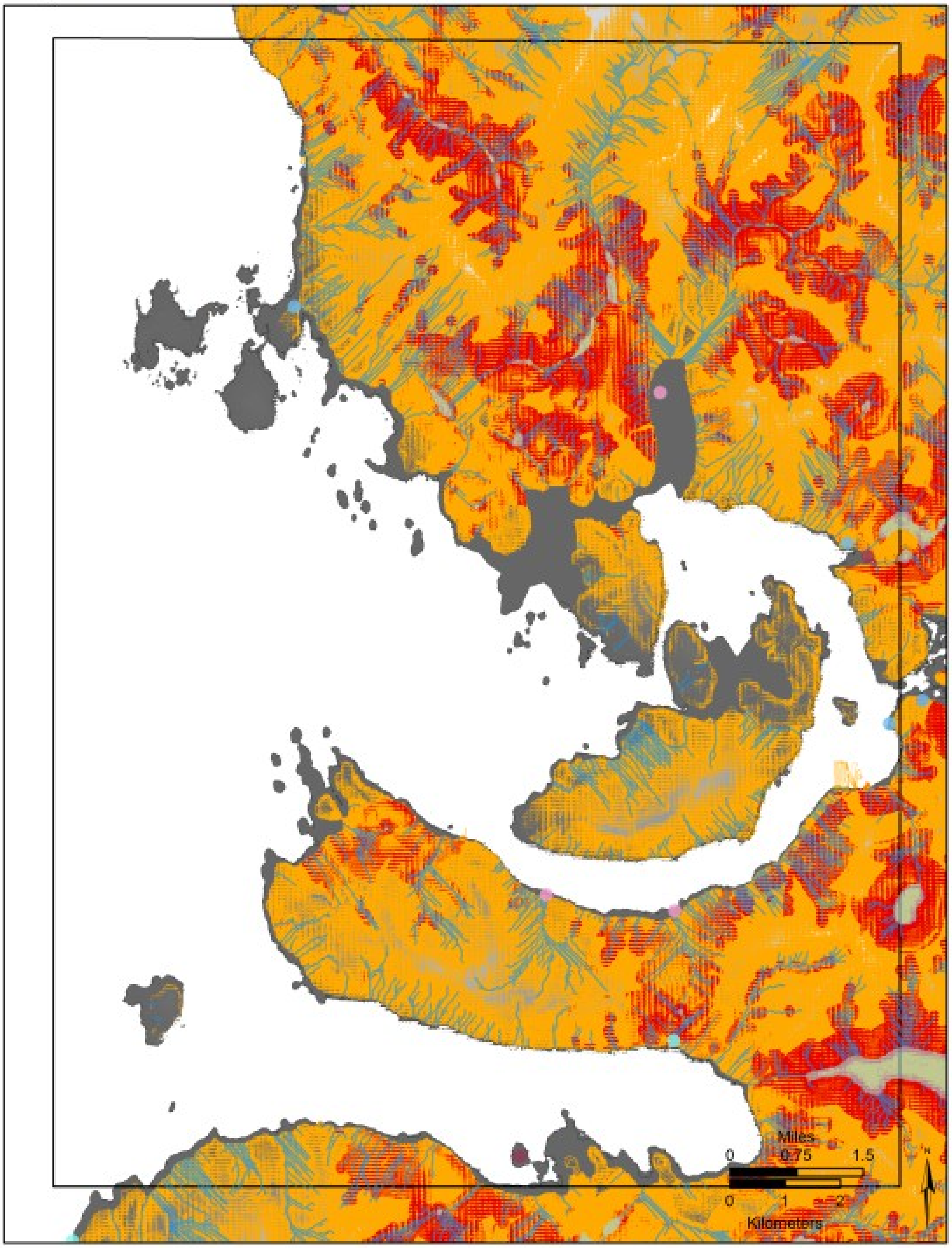
Weight 3 **15,500 cal BP**



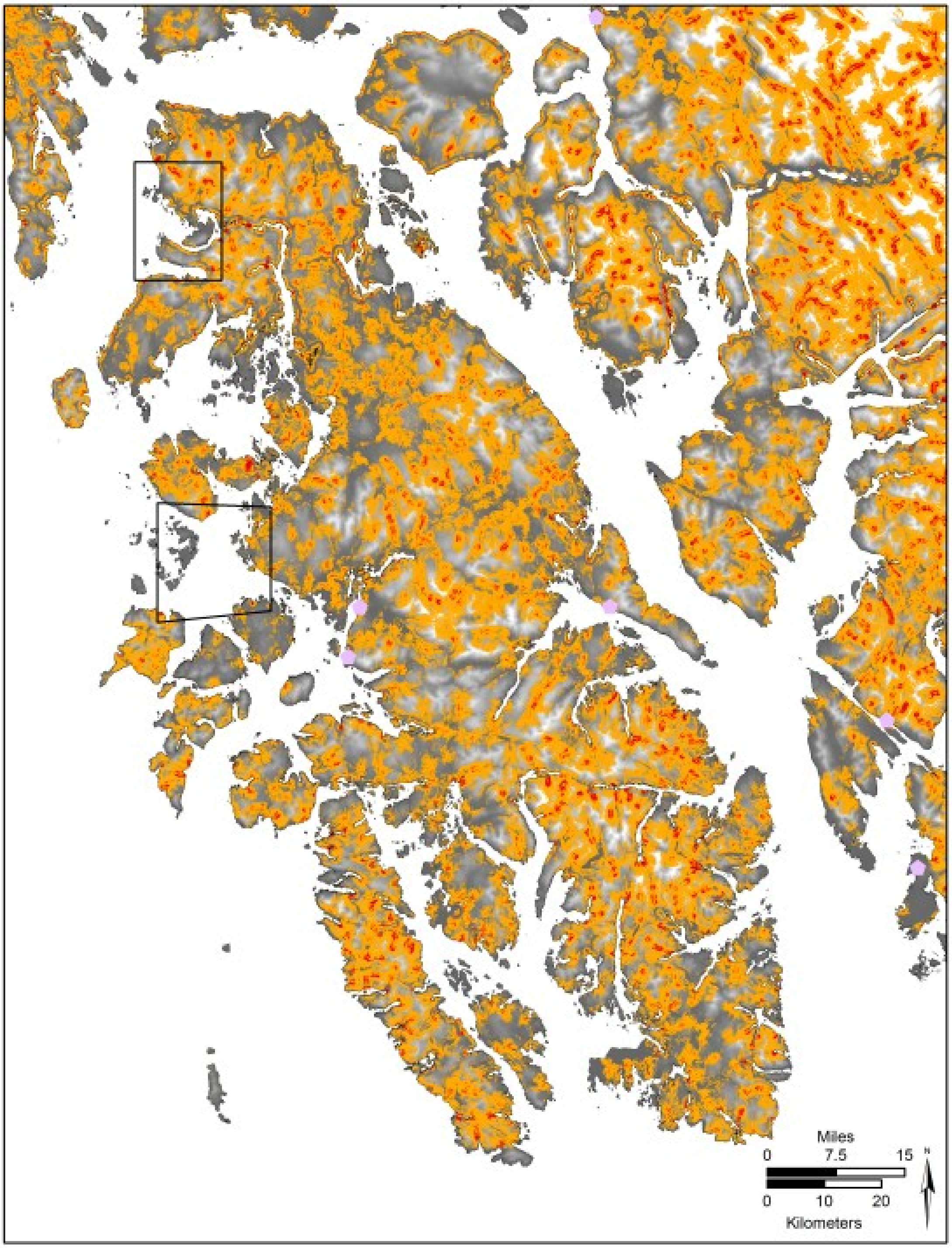
Weight 3 **16,000 cal BP**



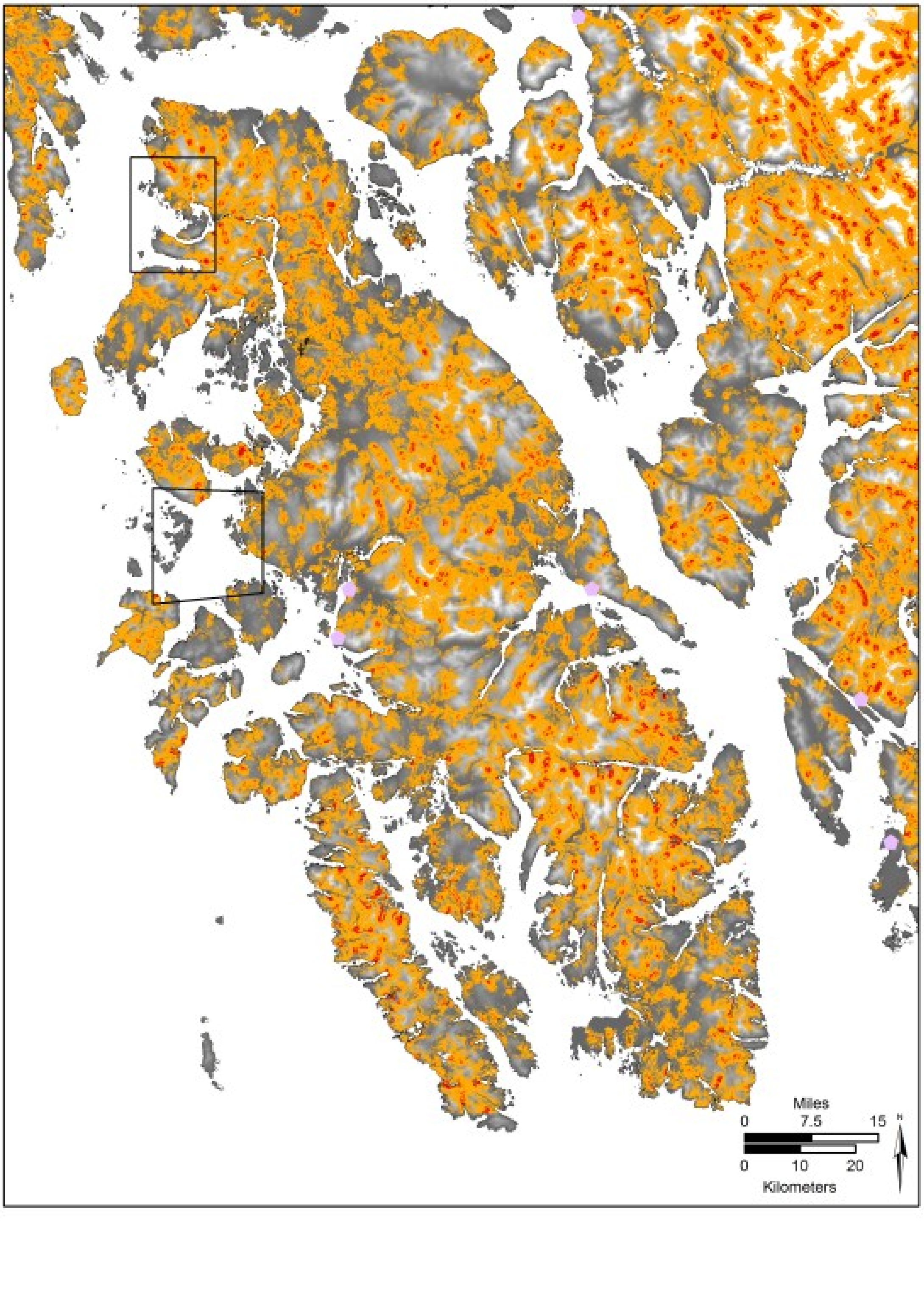
Weight 3 **Modern - Small Area**



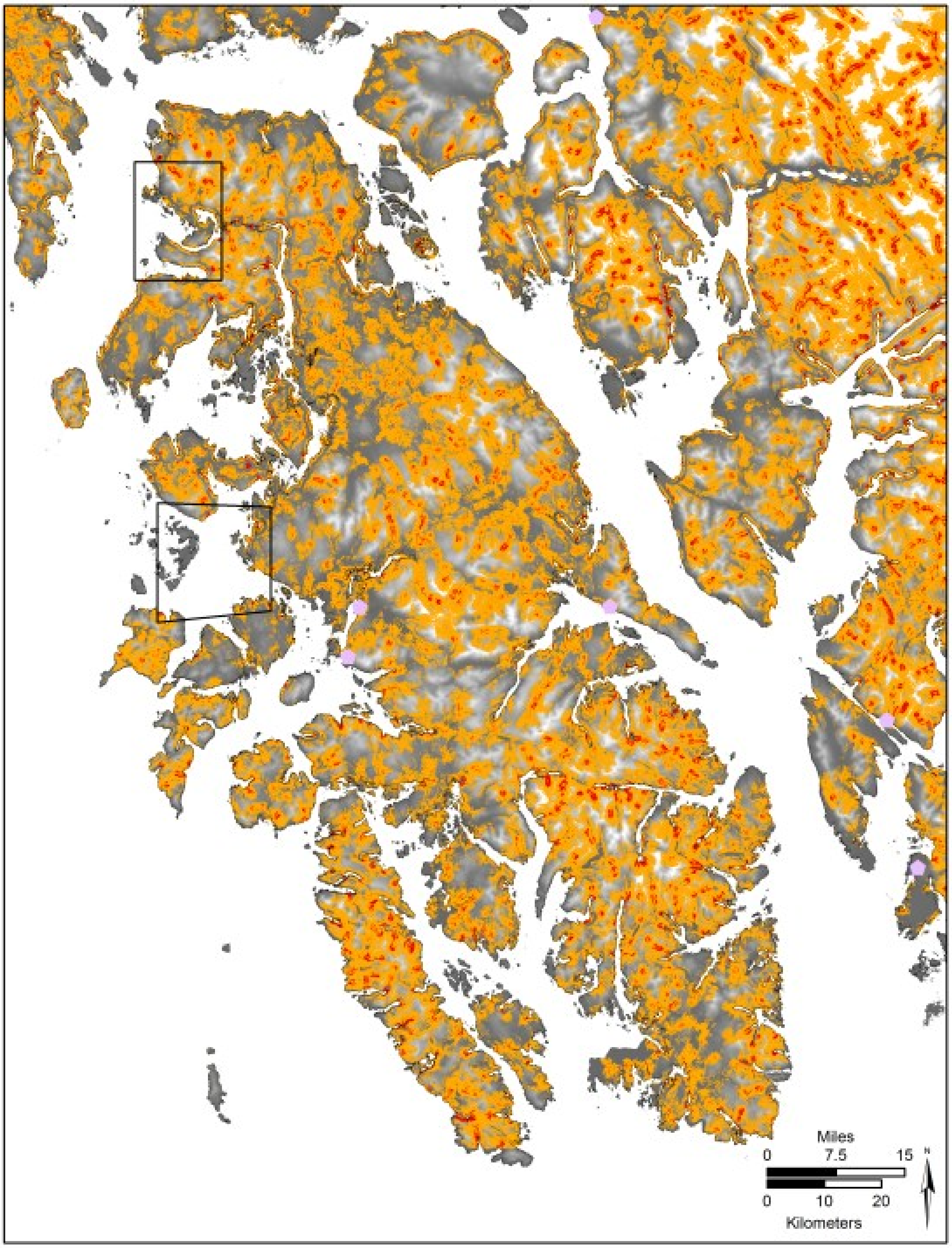
Weight 3 **Modern**



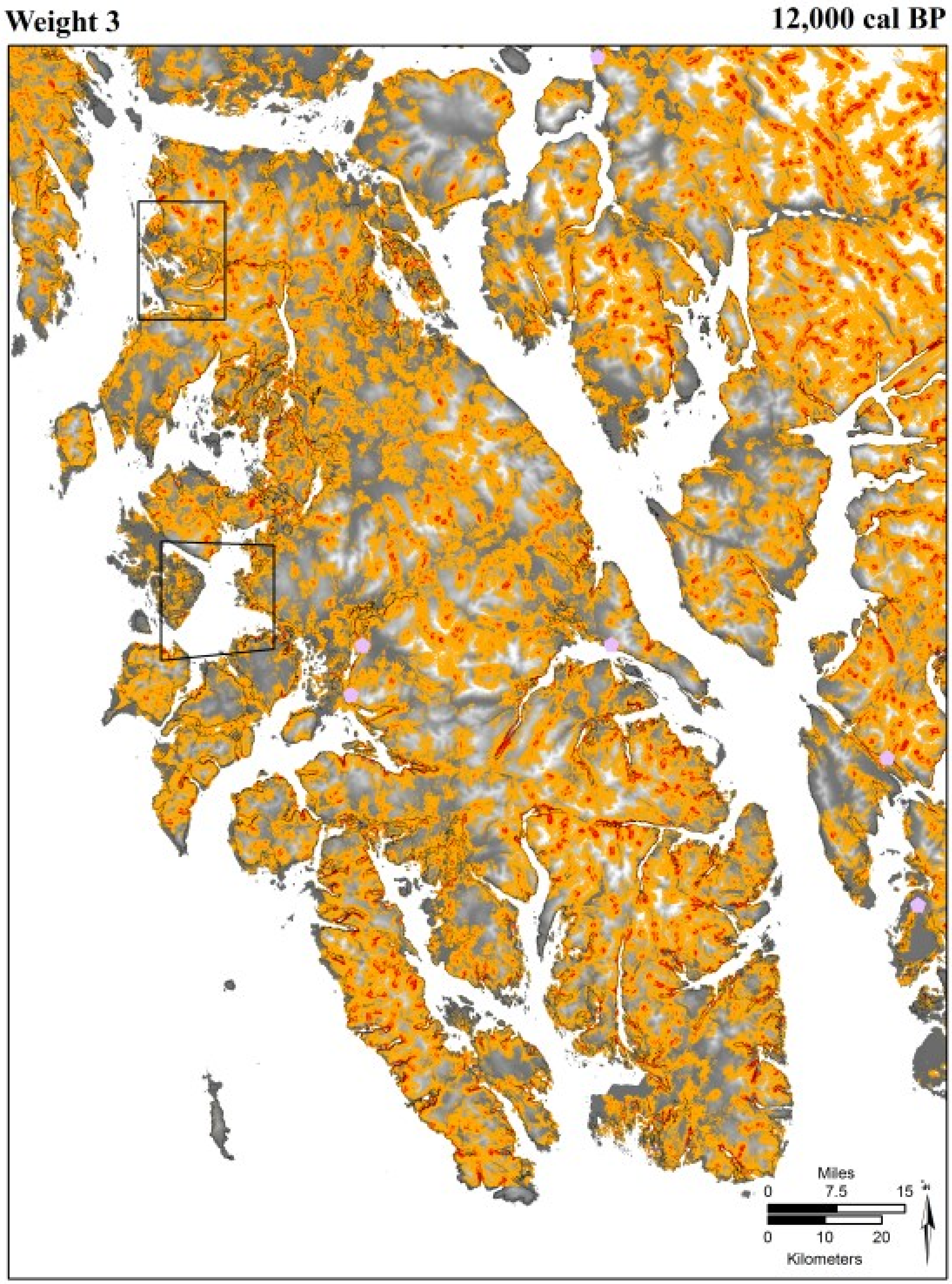
Weight 3 **10,500 cal BP**



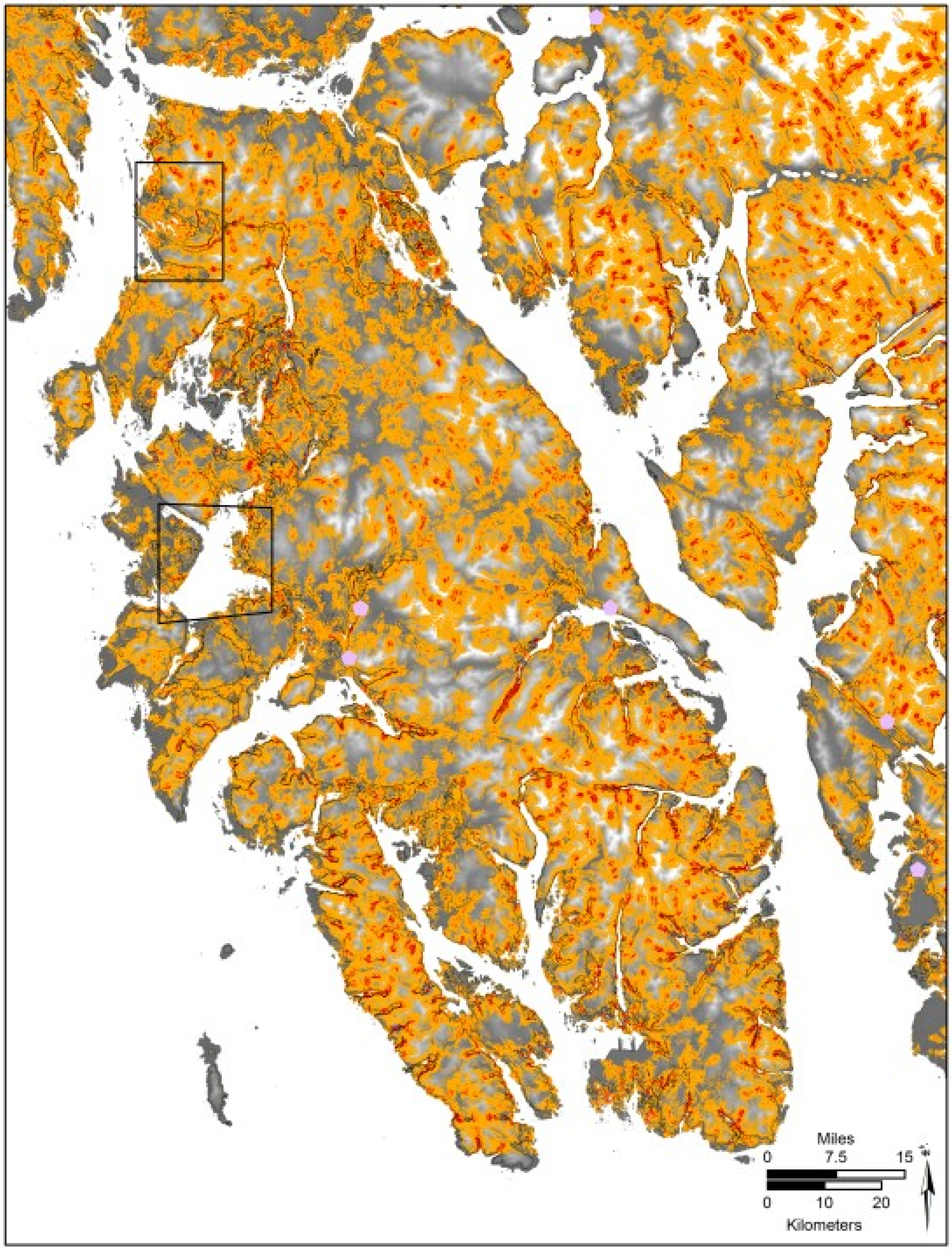
Weight 3 **11,000 cal BP**



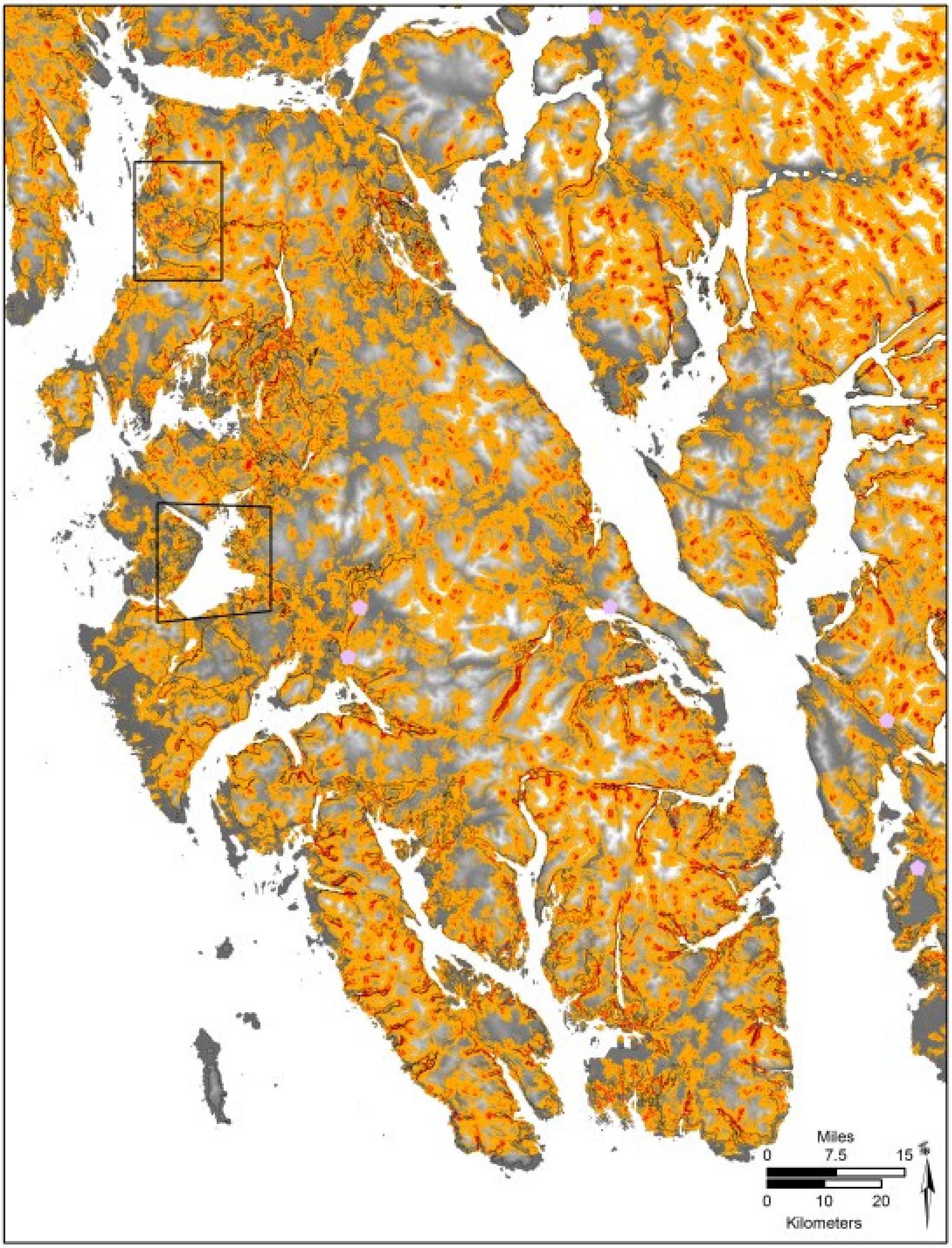
Weight 3 **11,500 cal BP**


Weight 3
12,000 cal BP
Miles
0
7.5
15
0
10
20
Kilometers

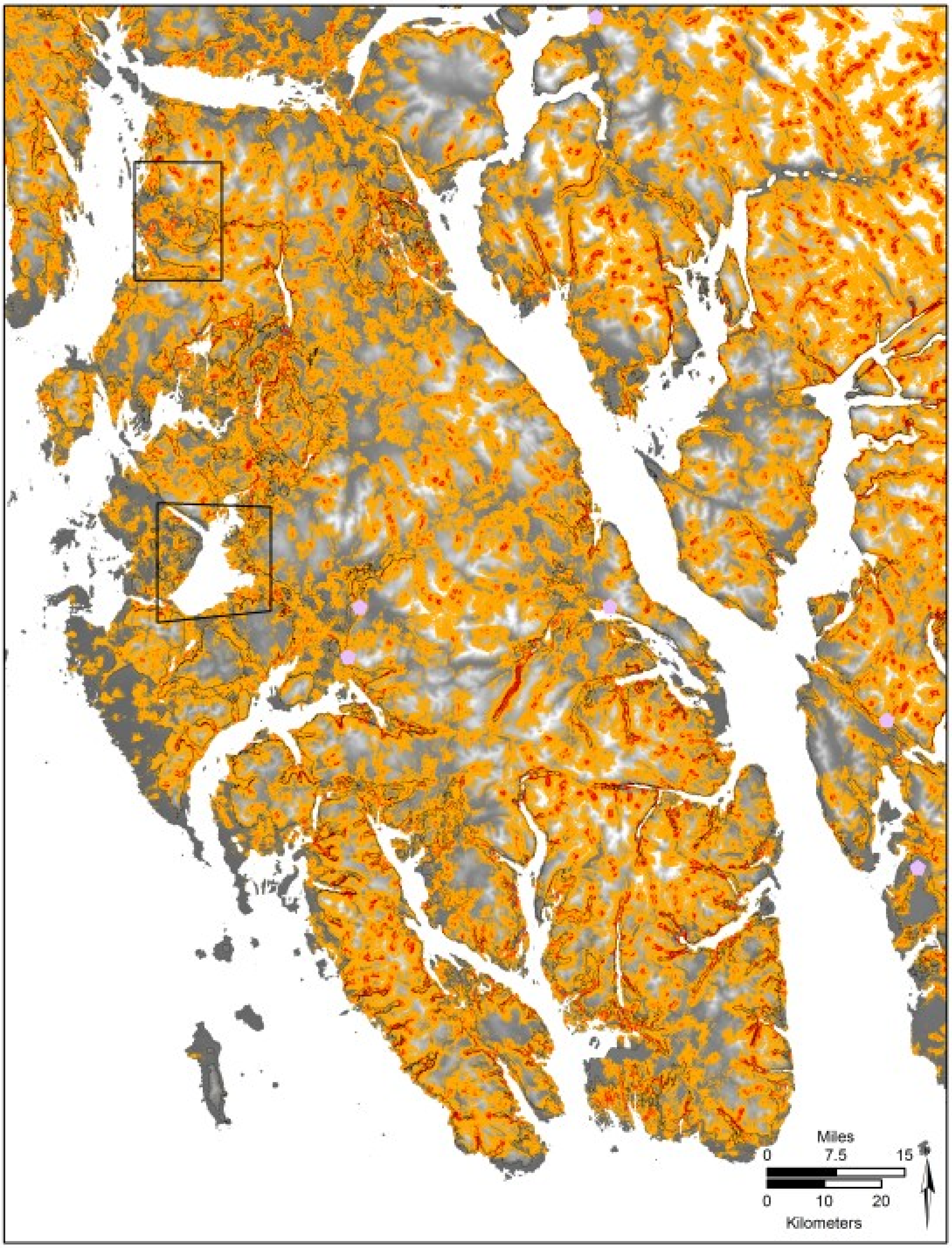
Weight 3 **12,500 cal BP**

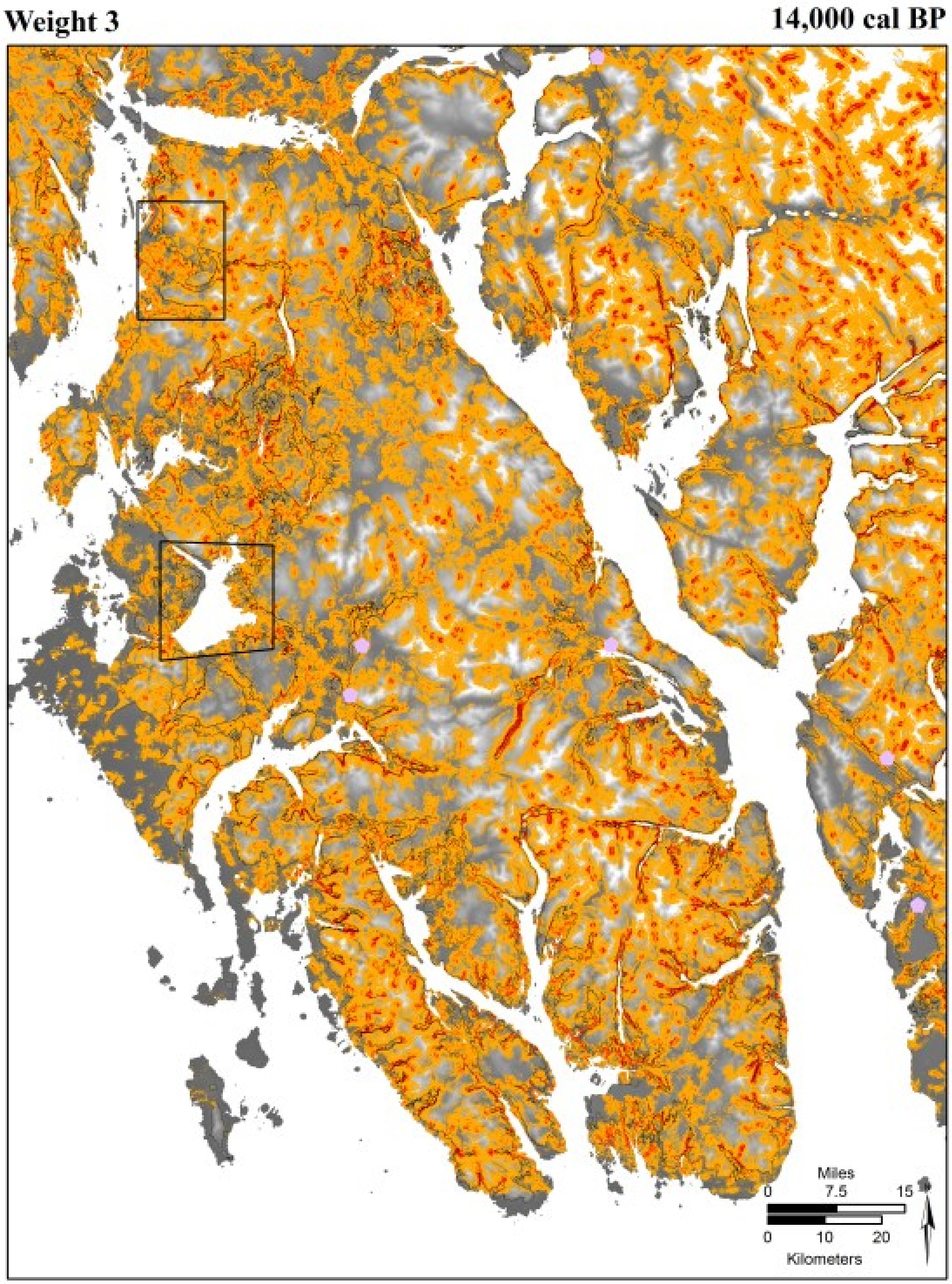


Weight 3 **13,000 cal BP**

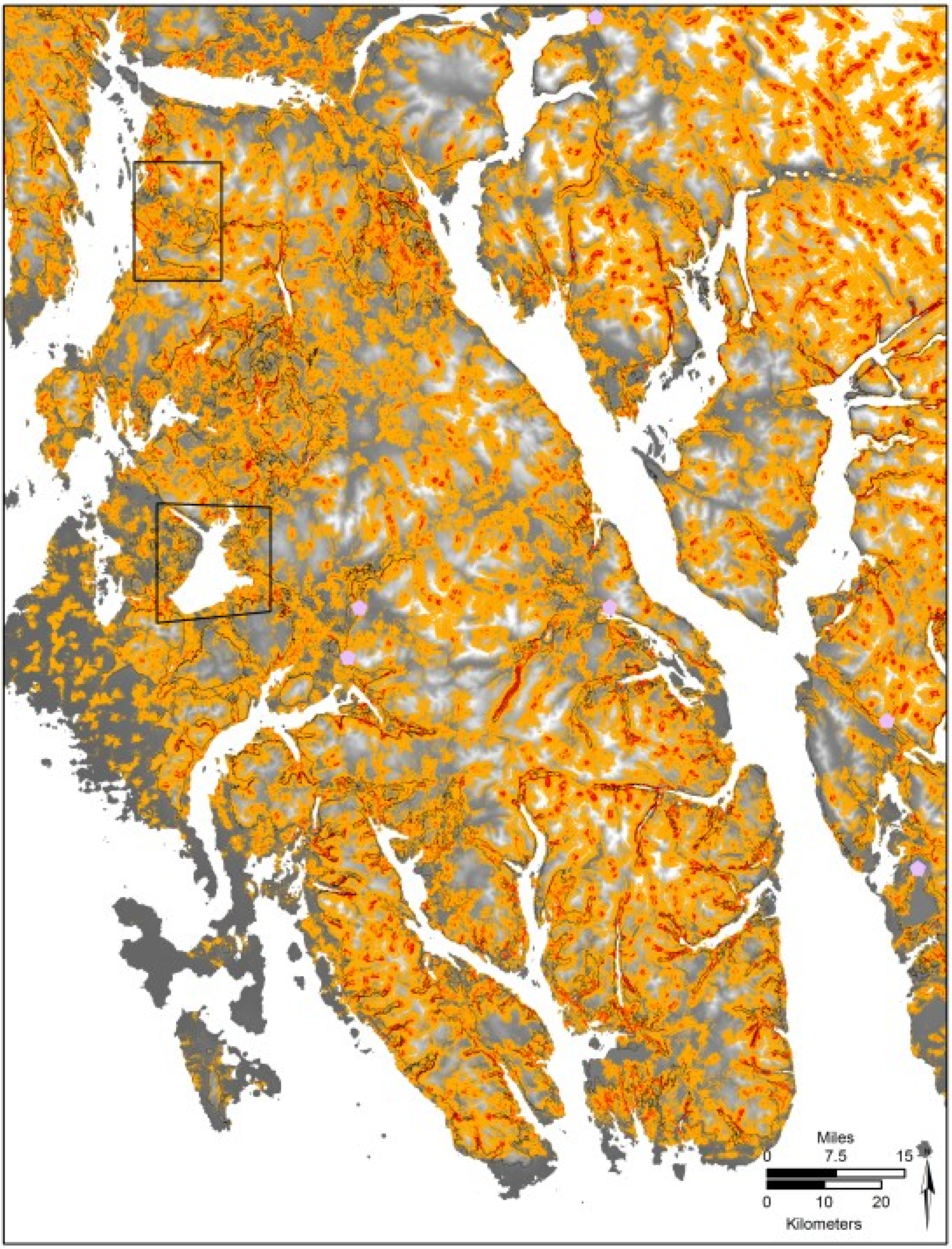


Weight 3 **13,500 cal BP**

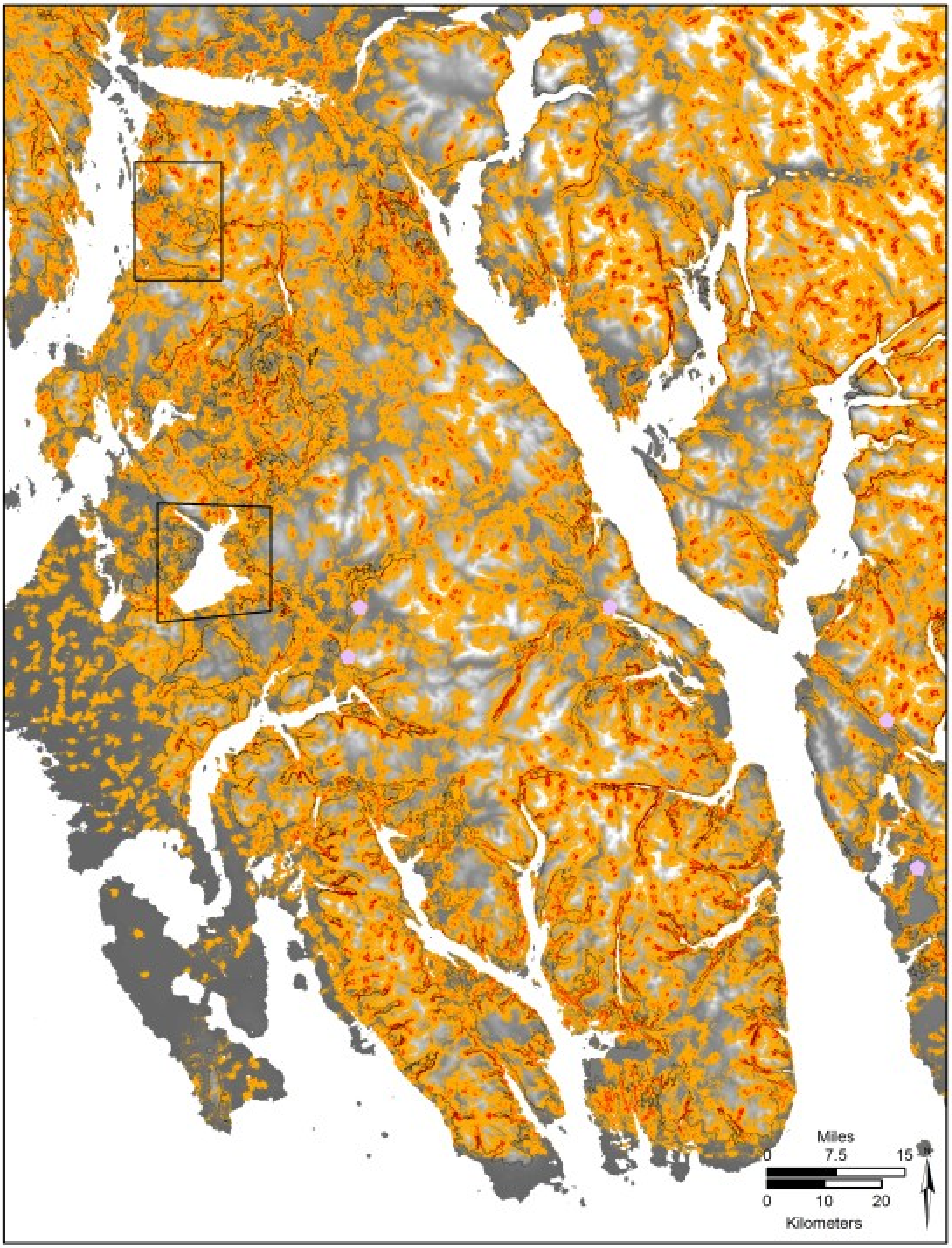



Weight 3
14,000 cal BP
Miles
0
7.5
15
0
10
20
Kilometers

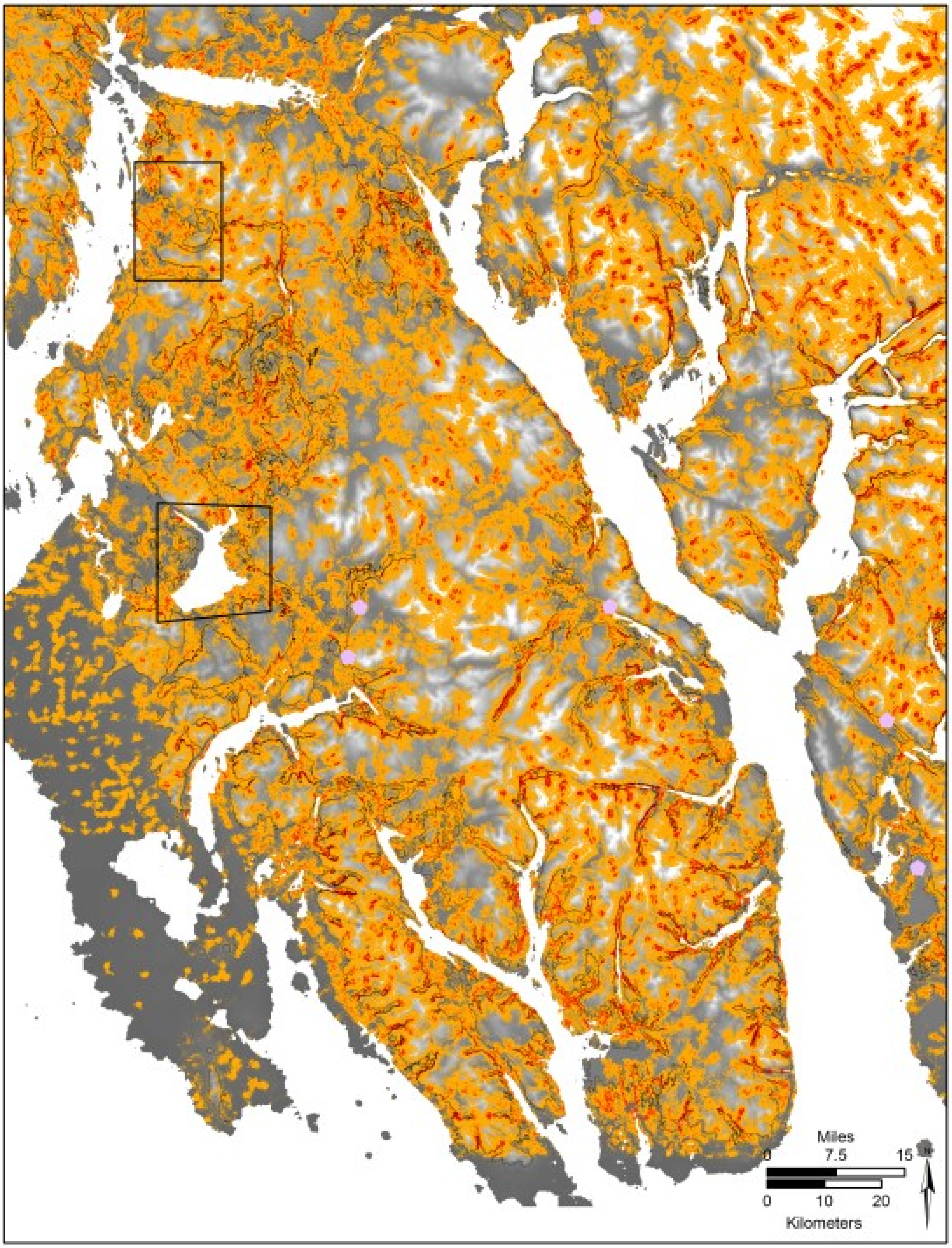
Weight 3 **14,500 cal BP**



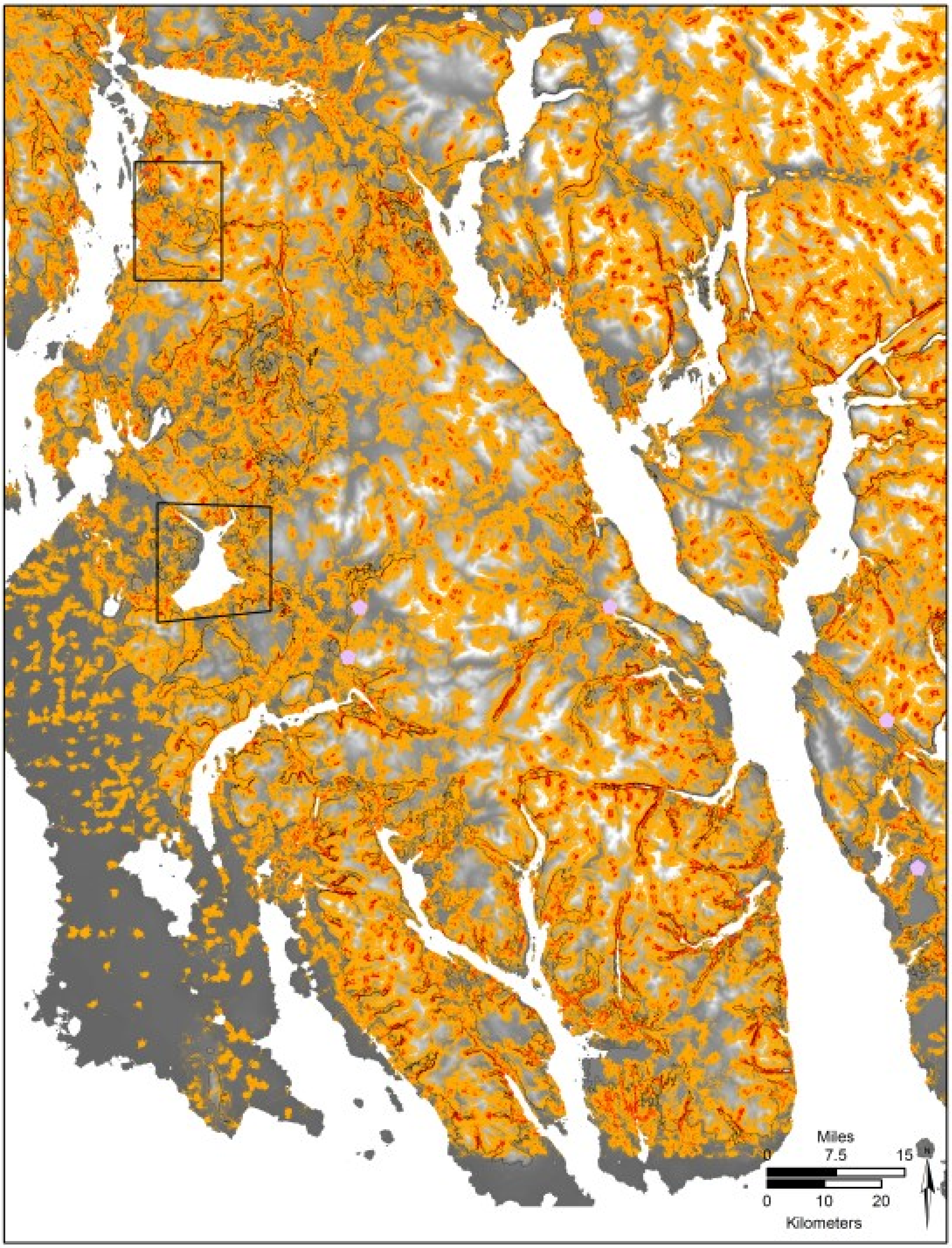
Weight 3 **15,000 cal BP**



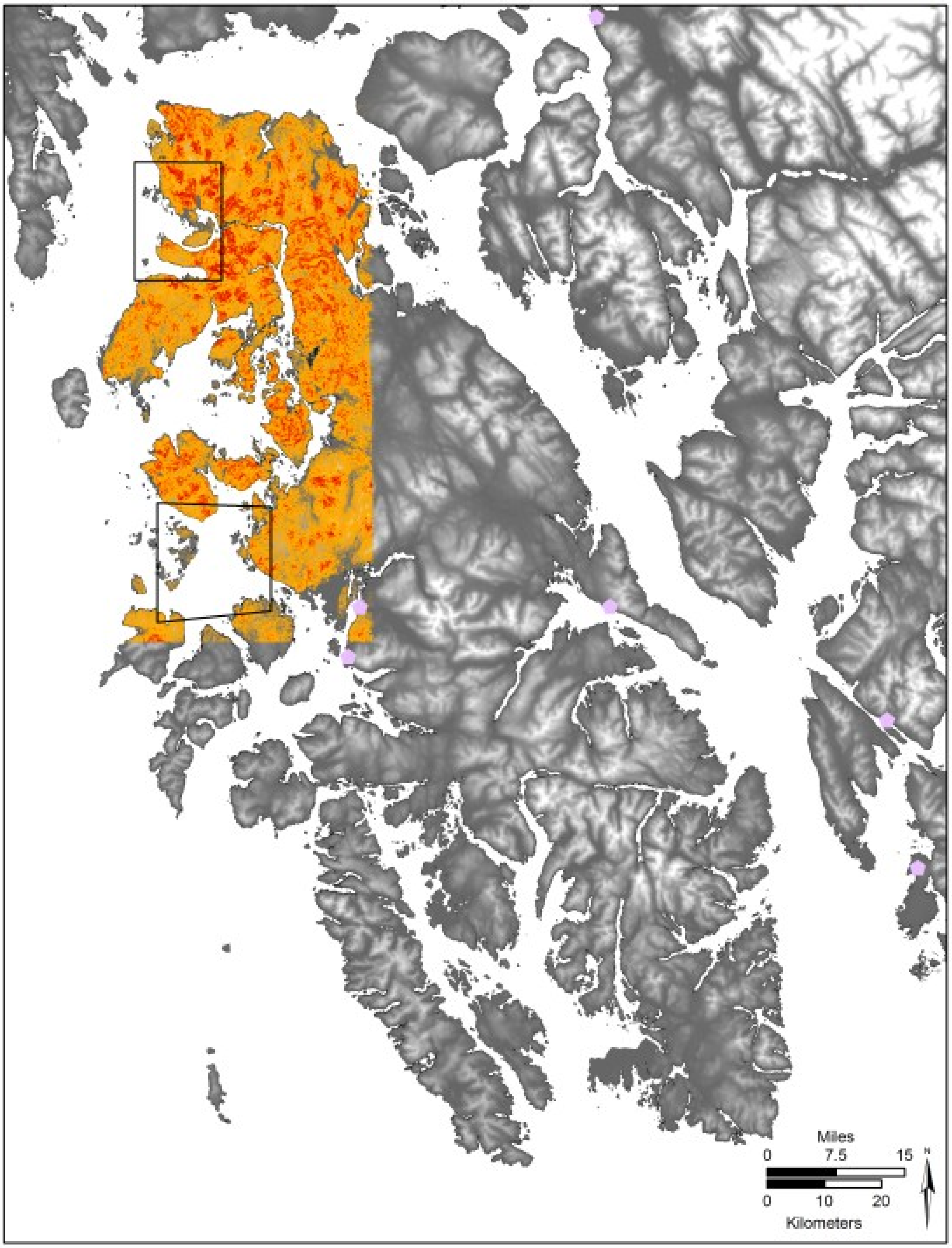
Weight 3 **15,500 cal BP**



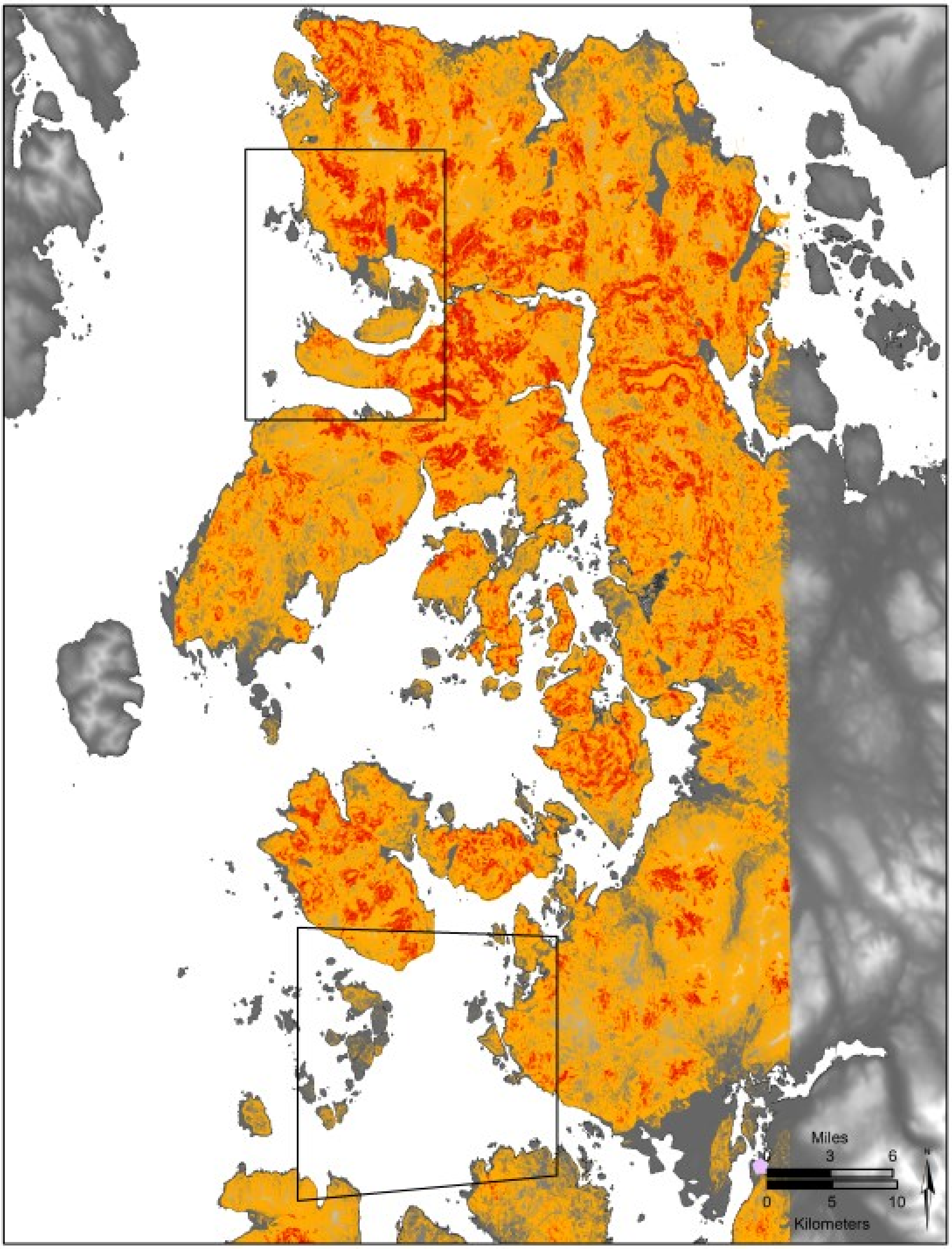
Weight 3 **16,000 cal BP**



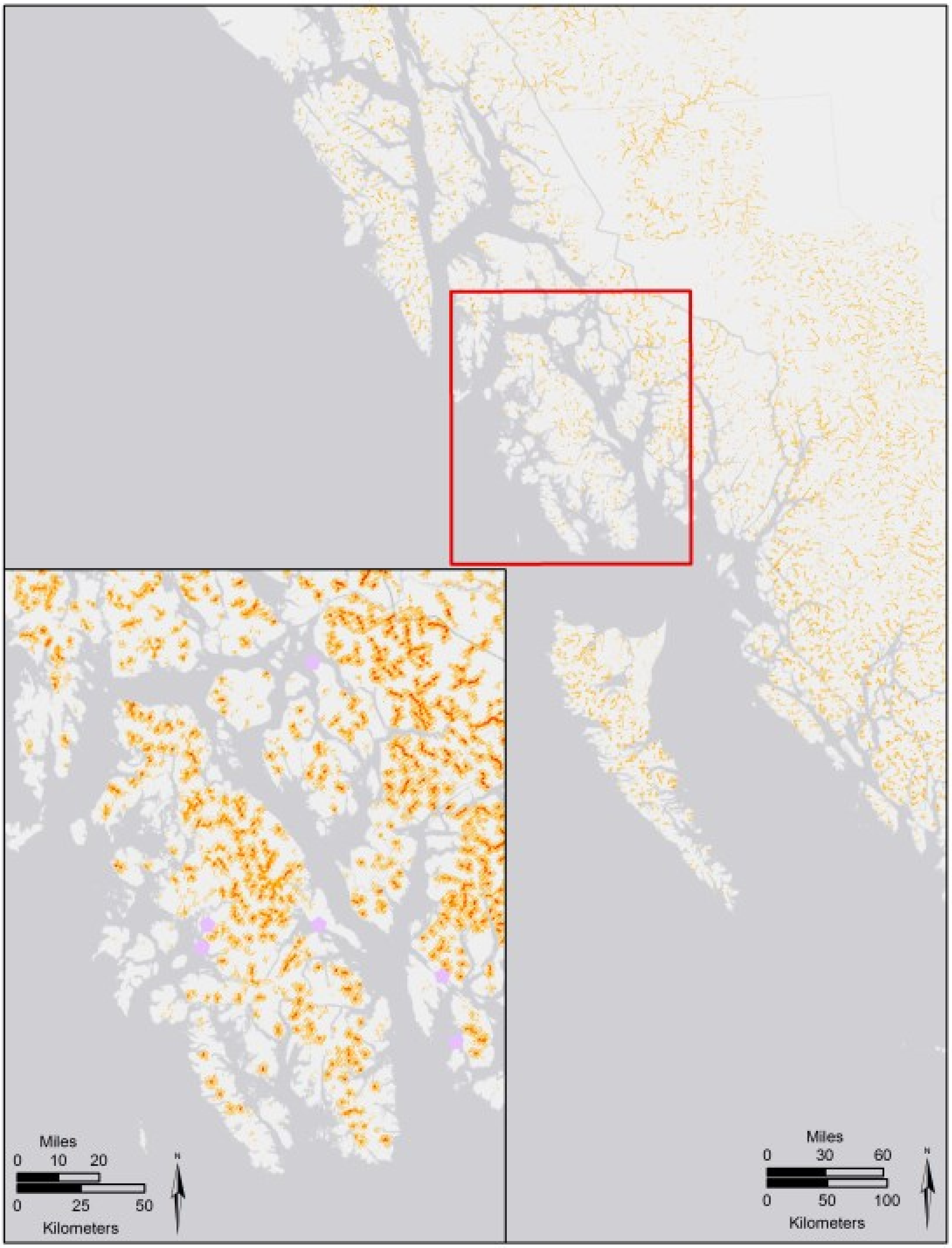
Weight 3 **Modern - Small Area**



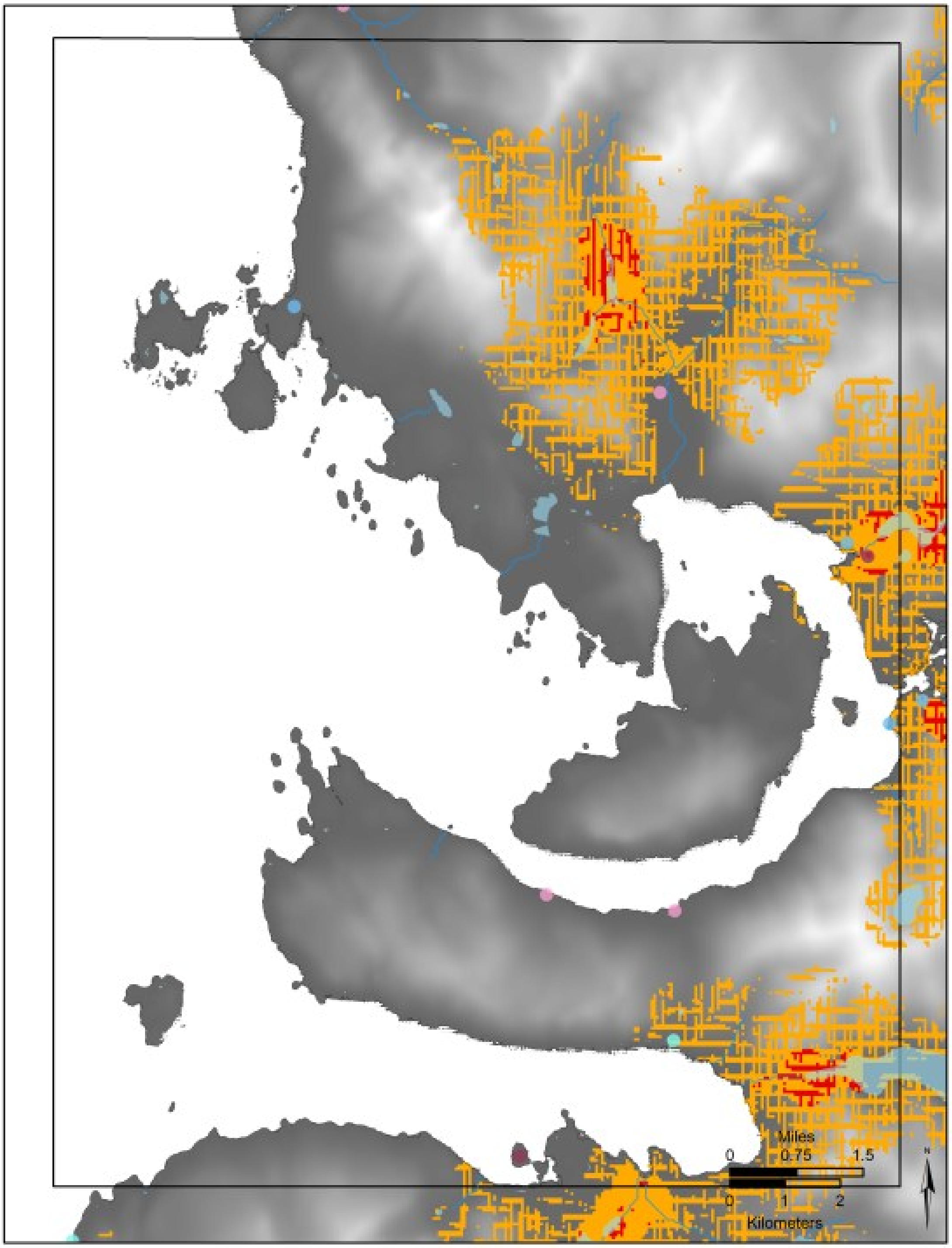
Weight 3 **Modern - Small Area**



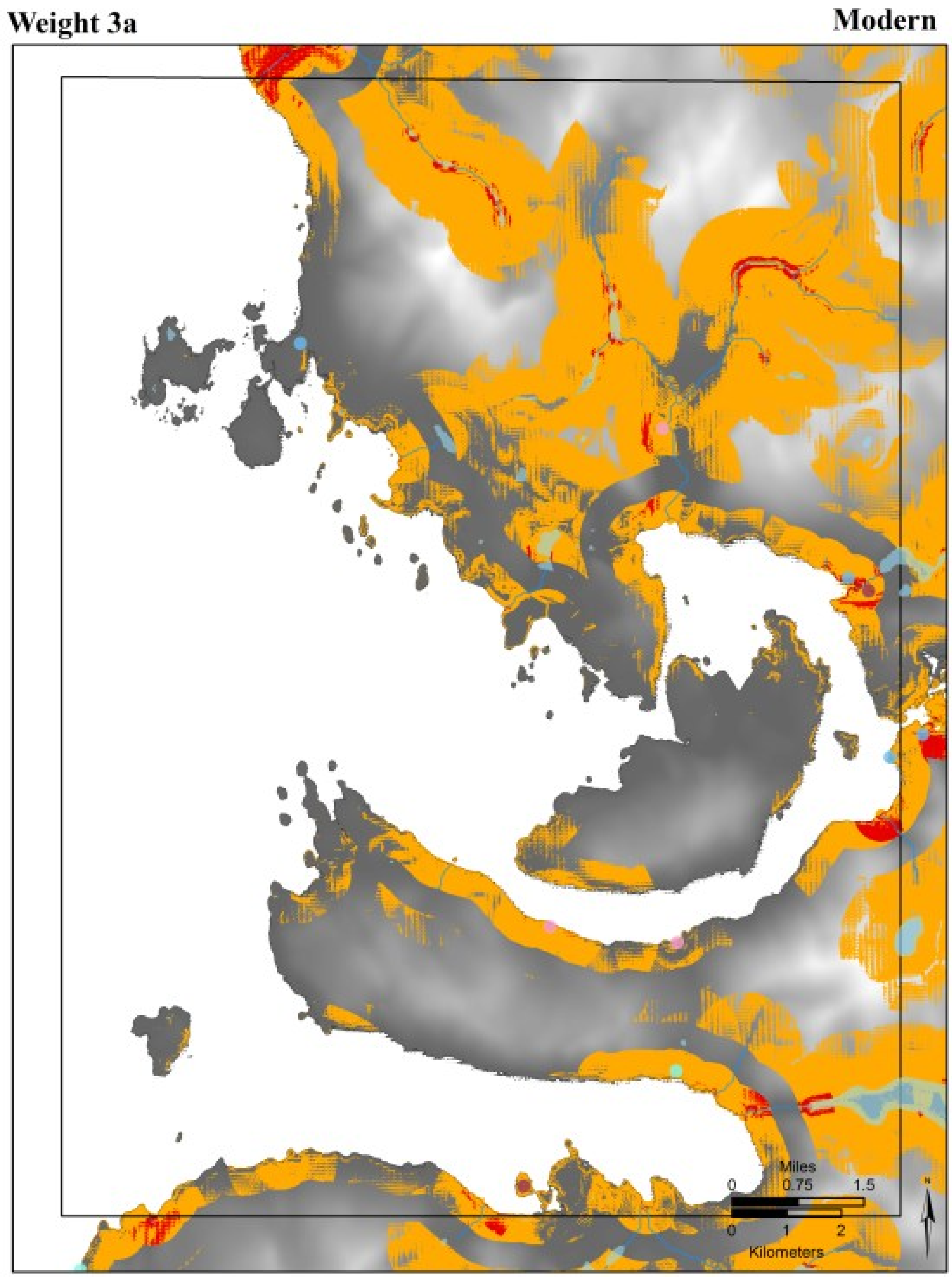
Weight 3 **NWC - modern**



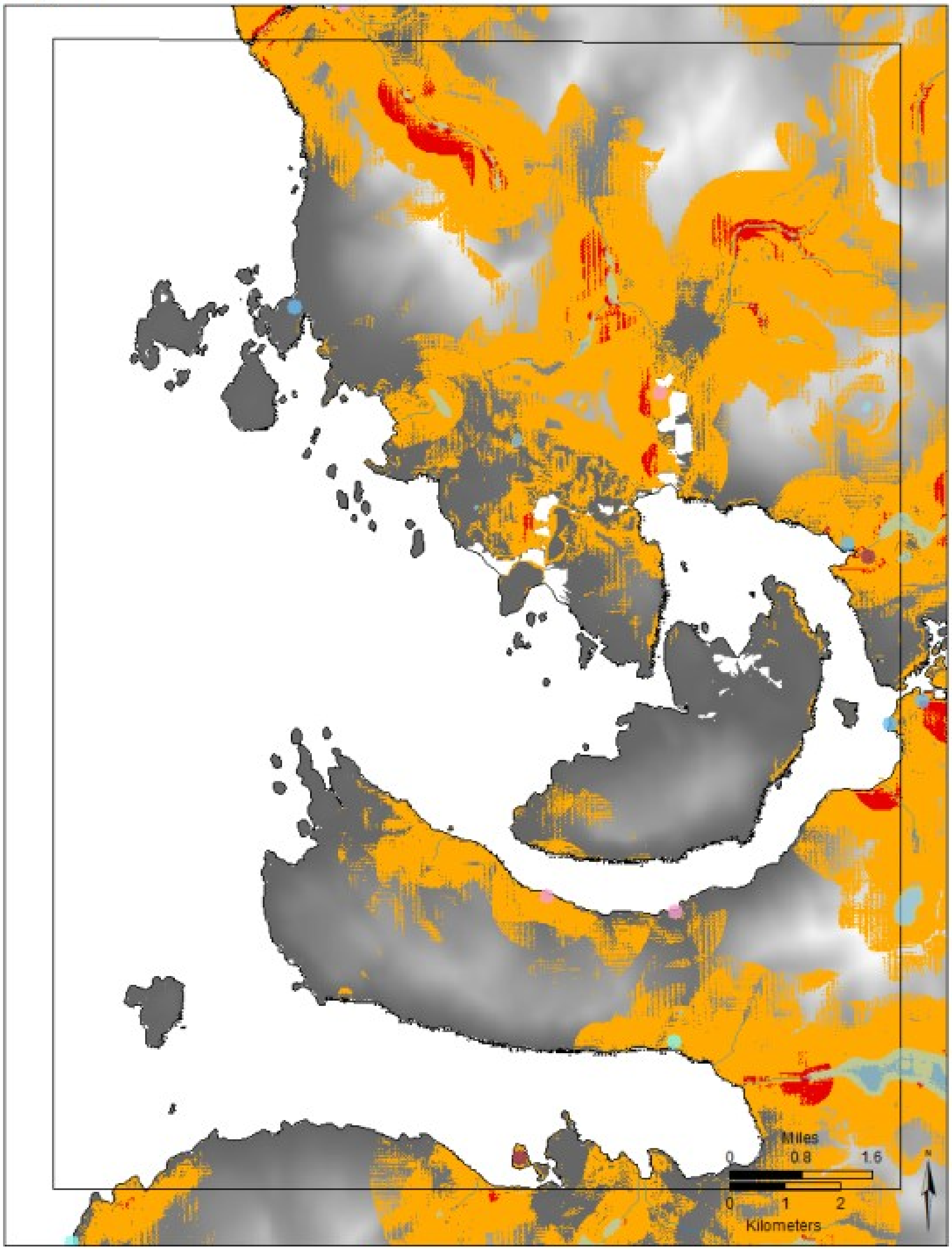
Weight 3 **NWC - modern**



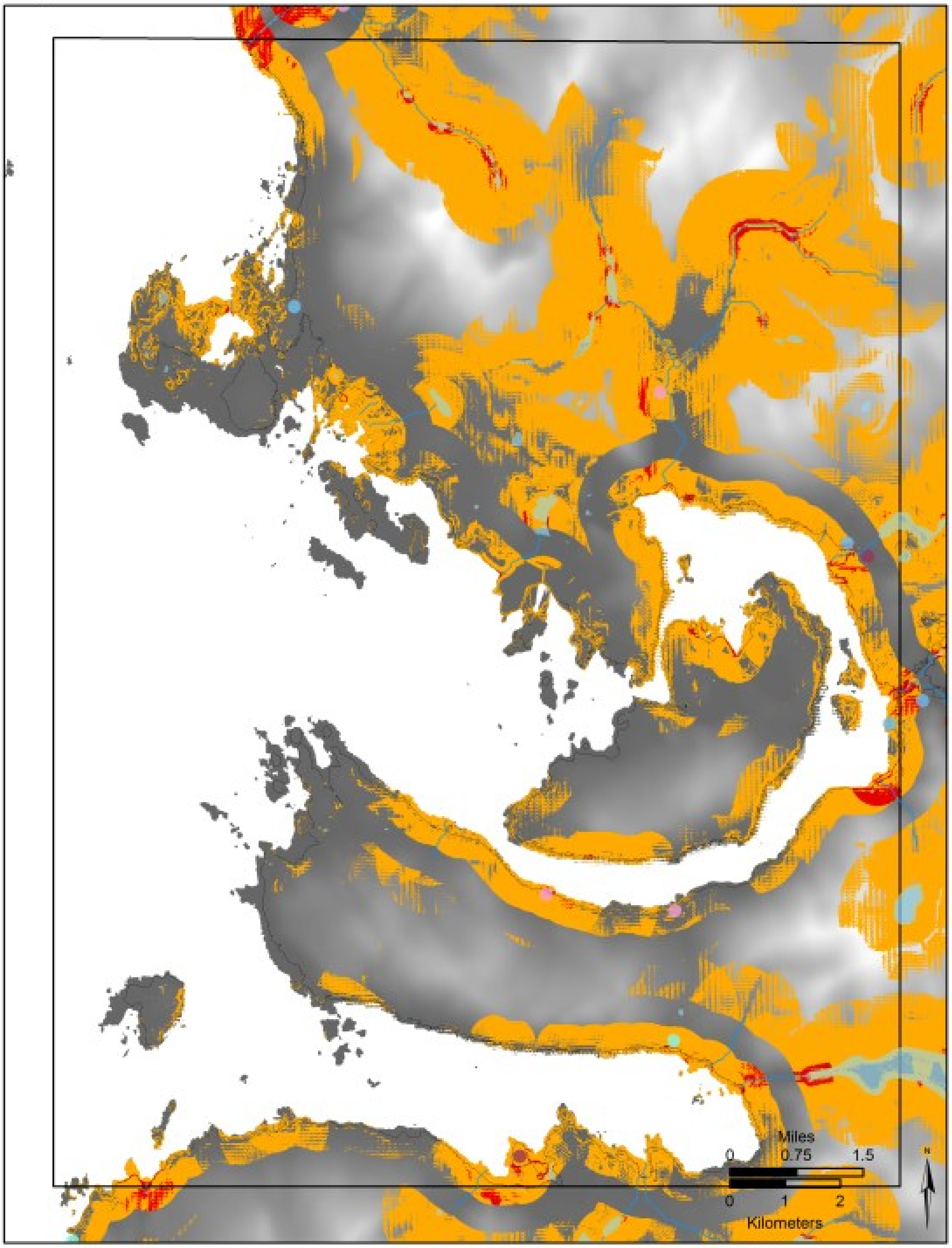
C.7 Weighted Overlay 3a



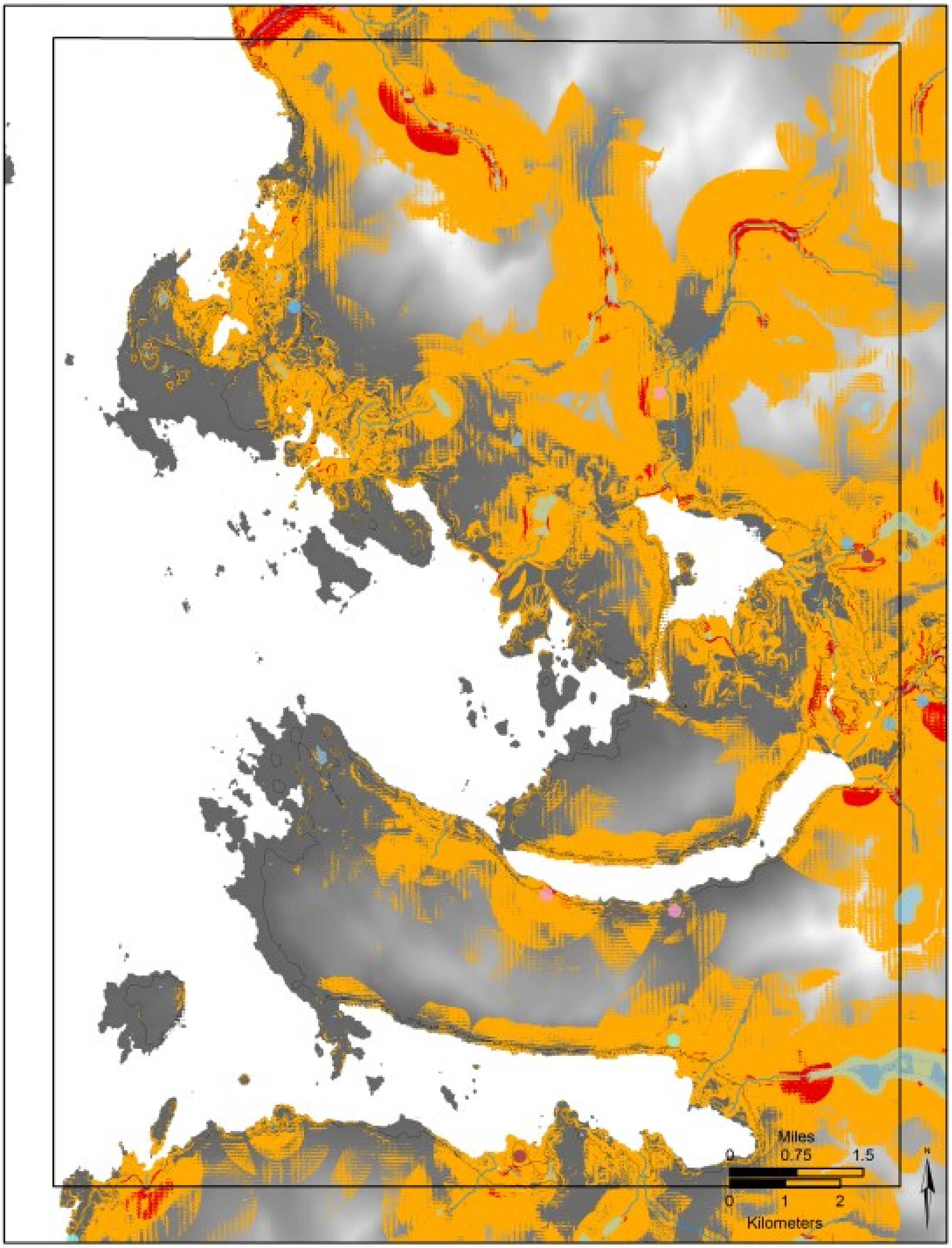
Weight 3a **10,500 cal BP**



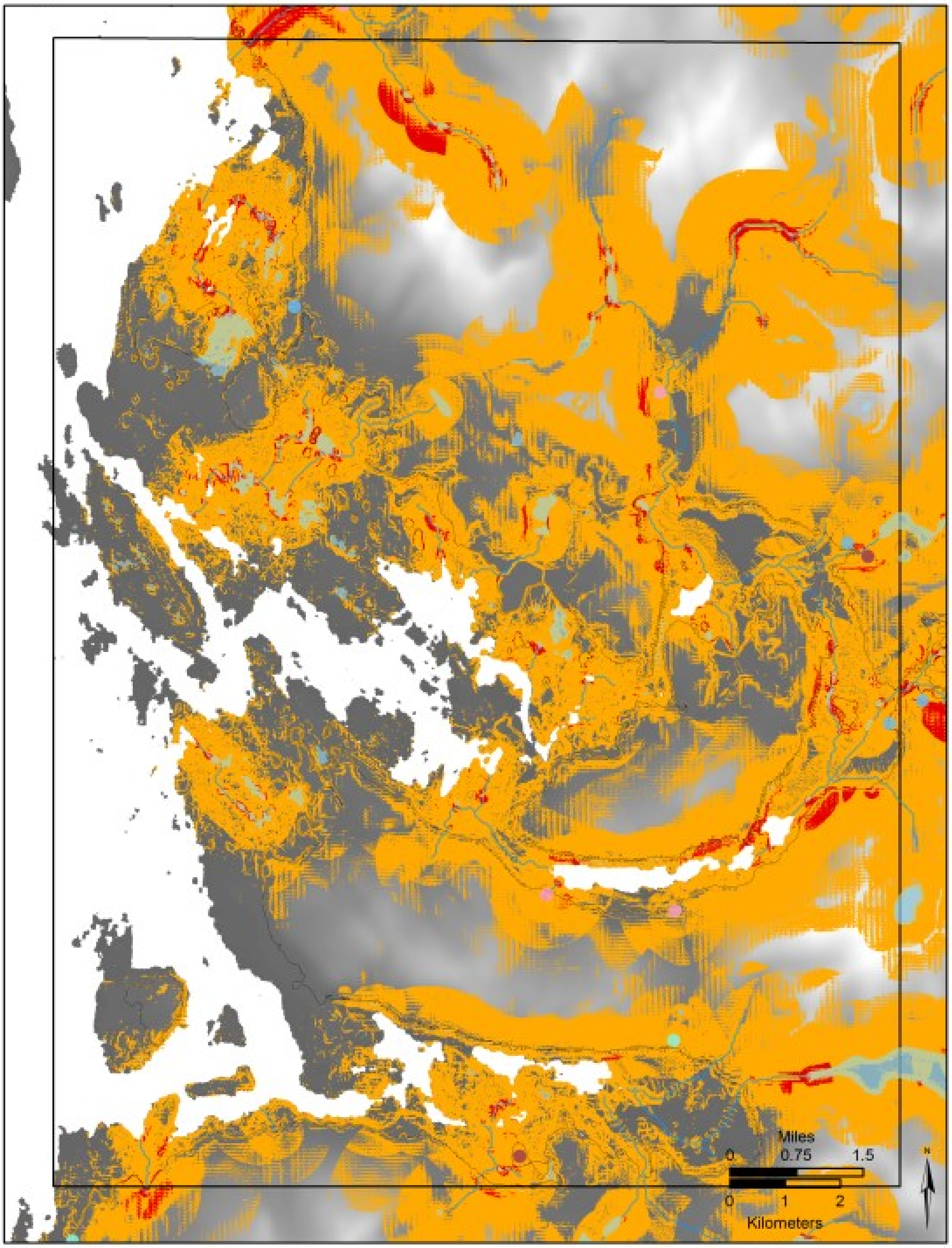
Weight 3a **11,000 cal BP**



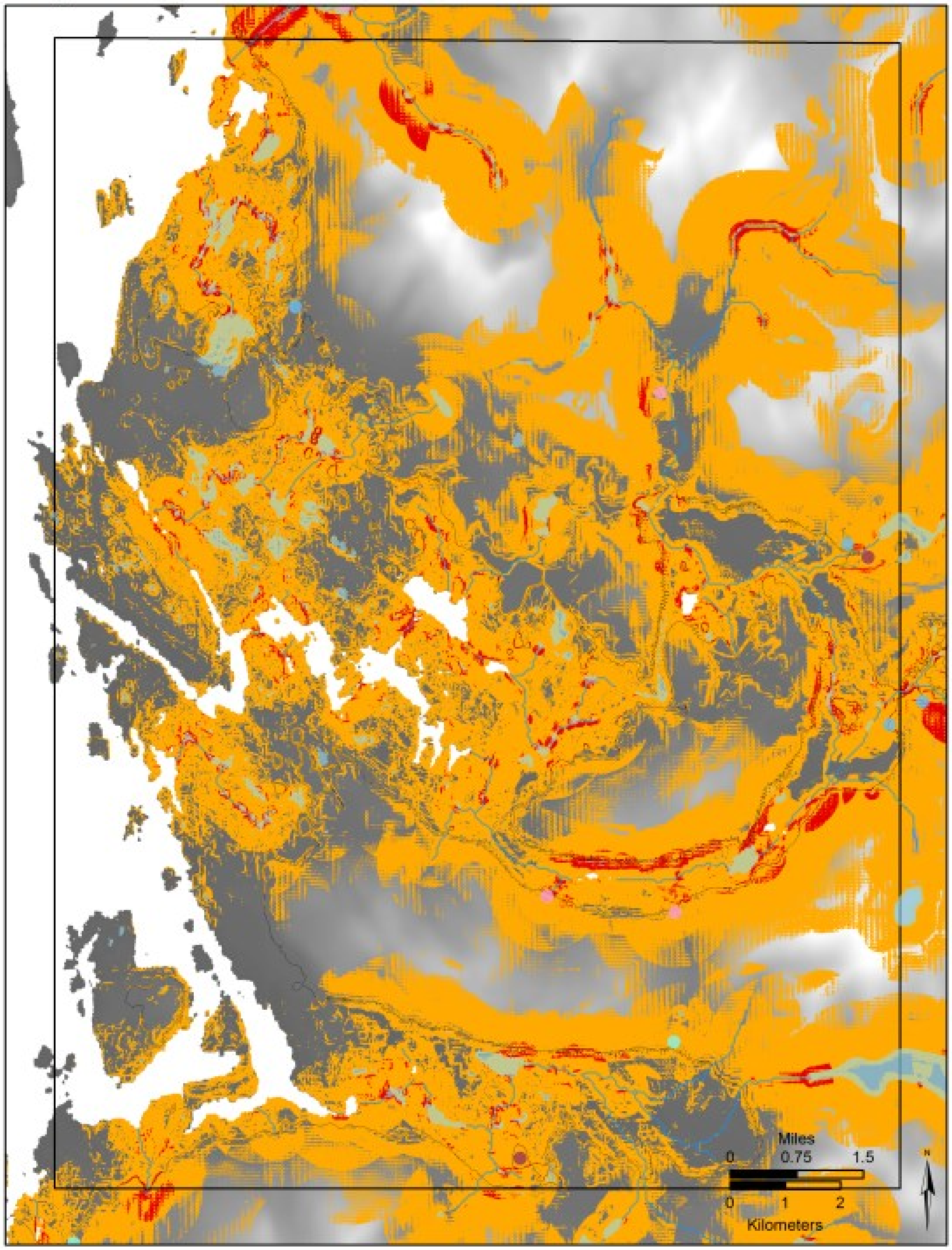
Weight 3a **11,500 cal BP**



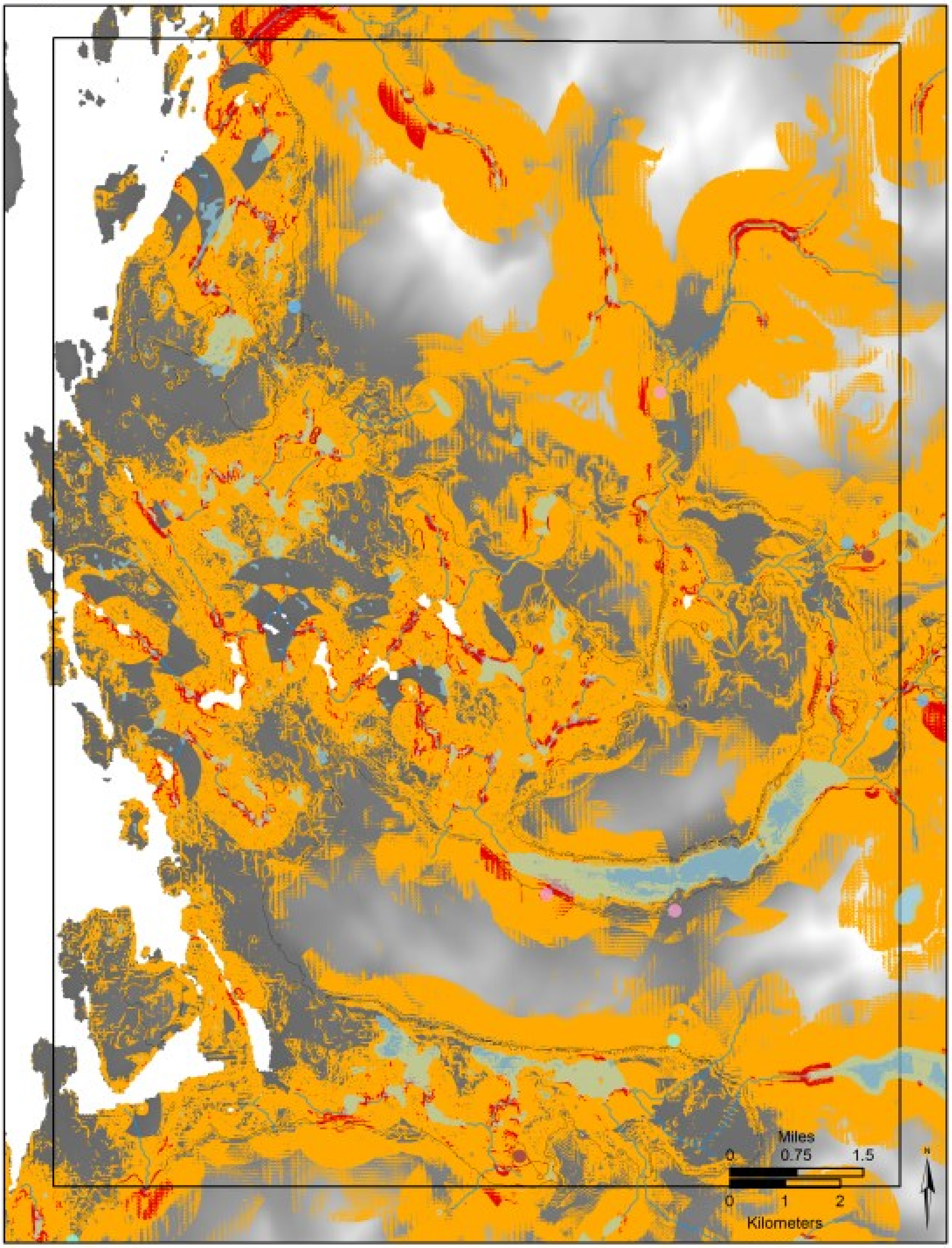
Weight 3a **12,000 cal BP**



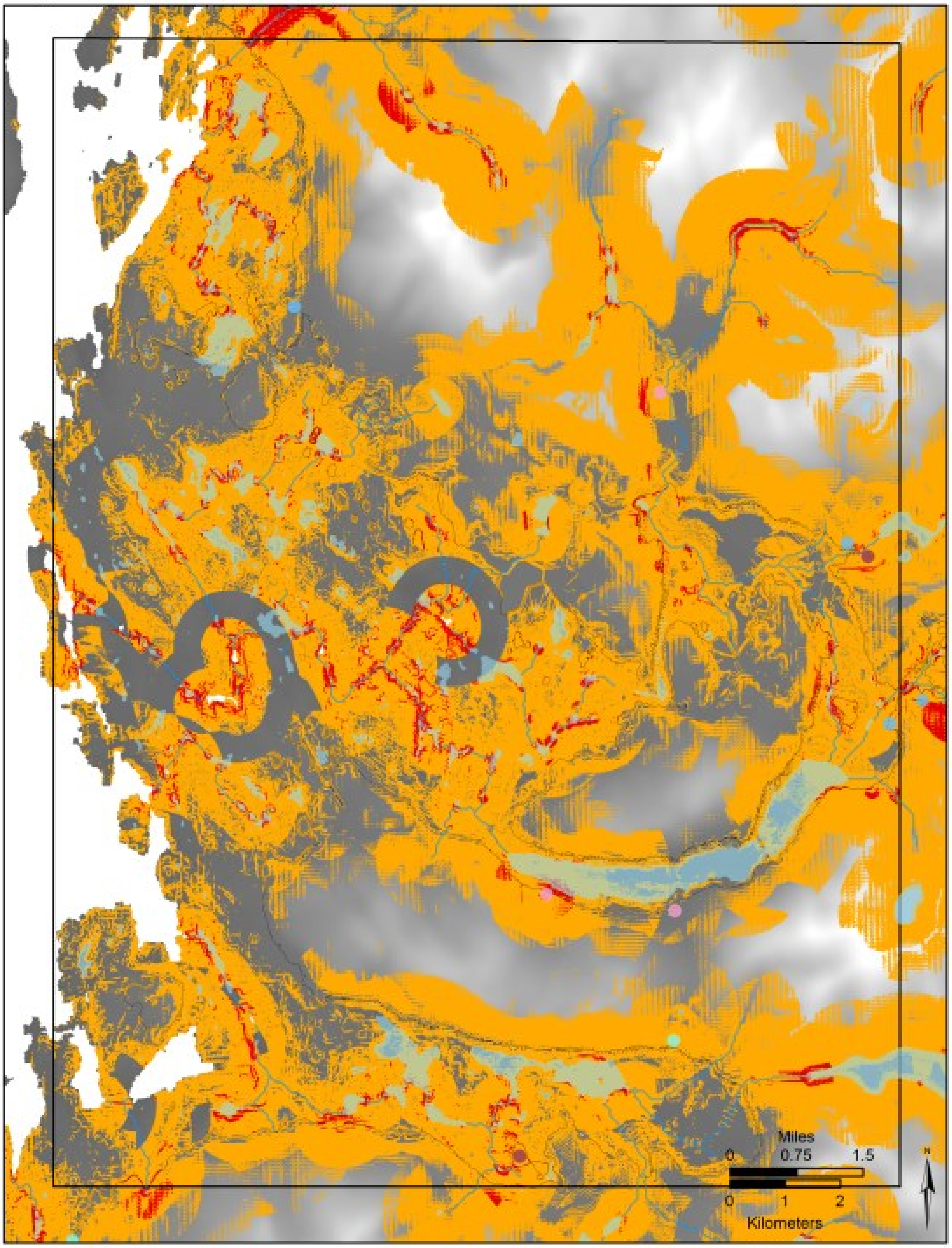
Weight 3a **12,500 cal BP**



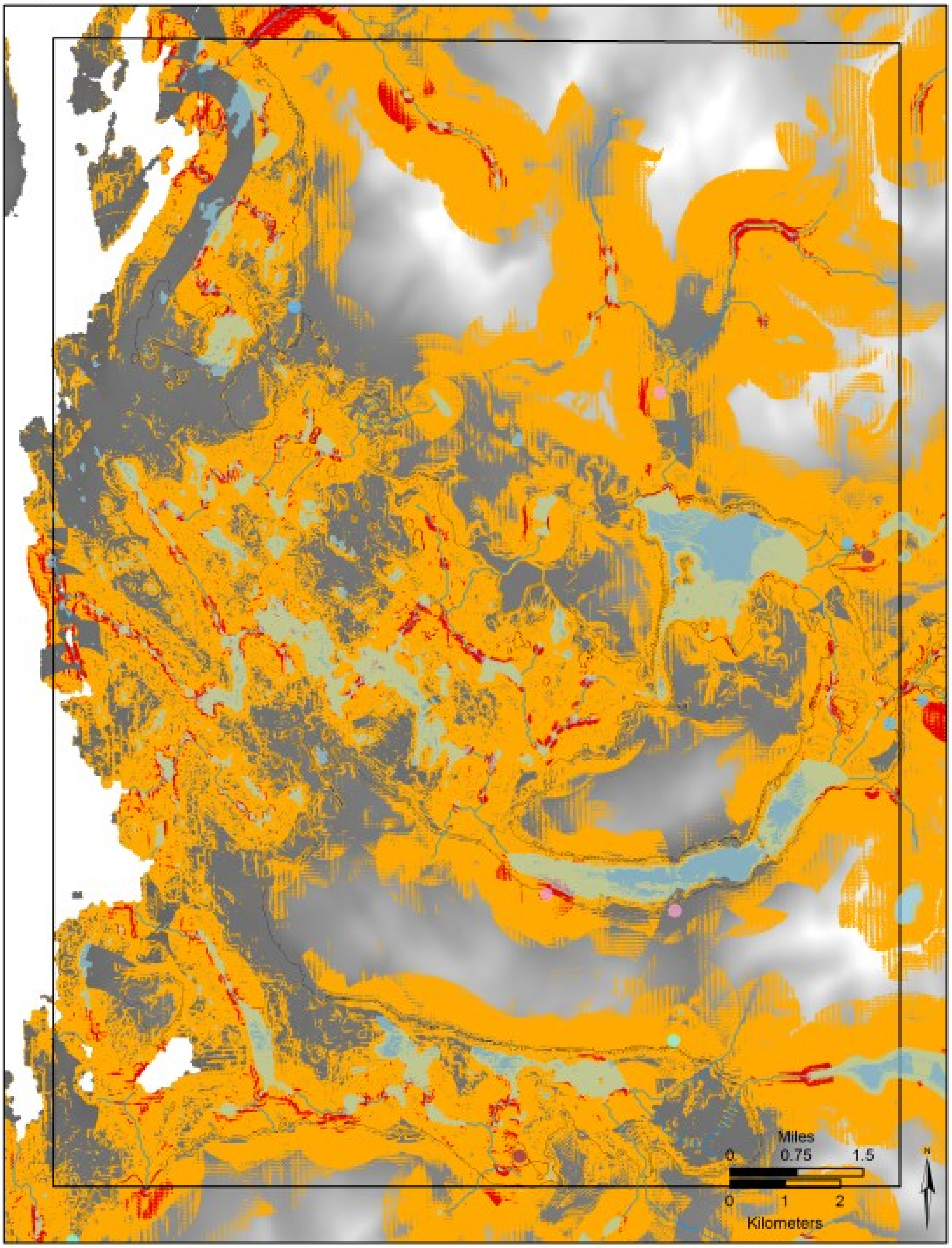
Weight 3a **13,000 cal BP**



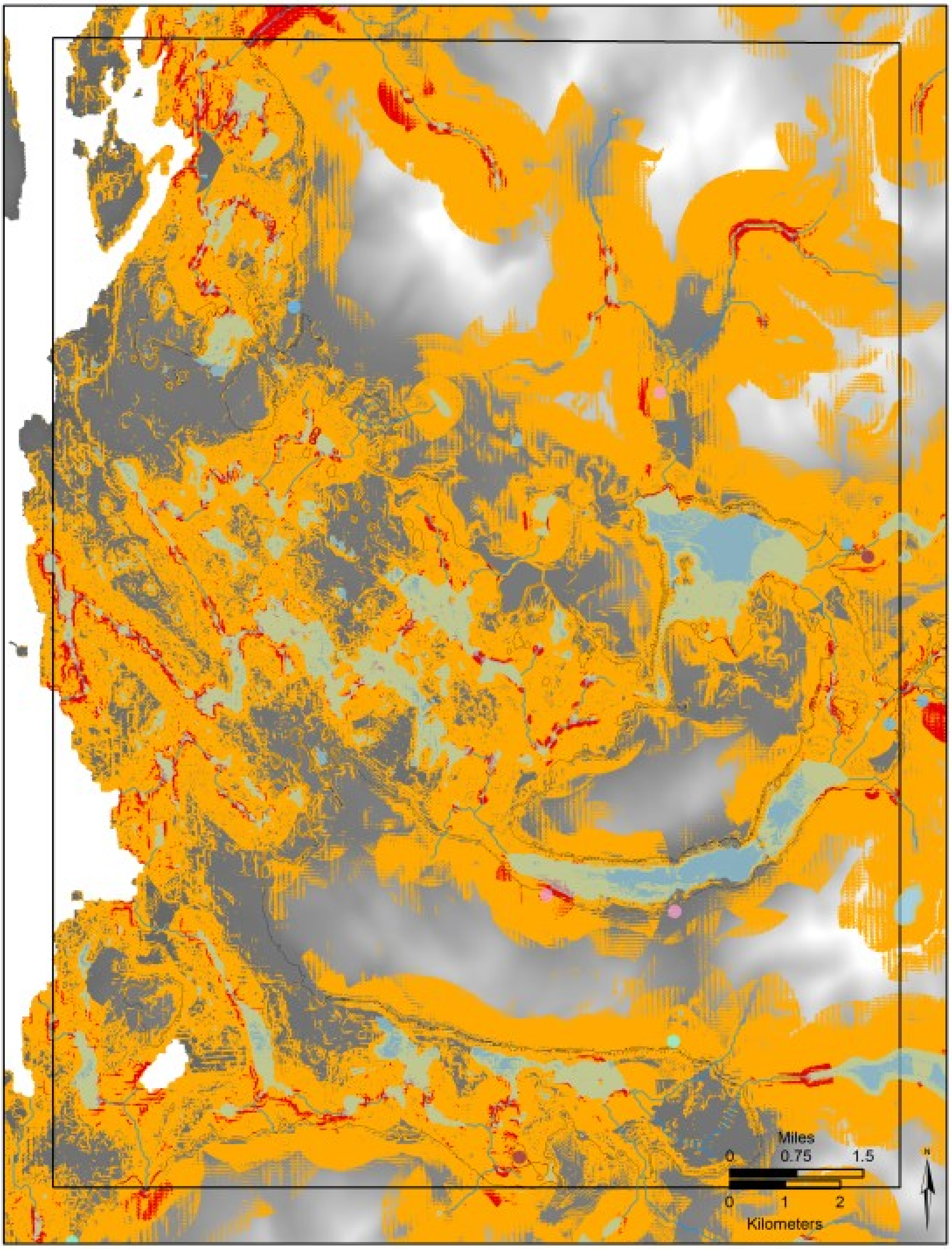
Weight 3a **13,500 cal BP**



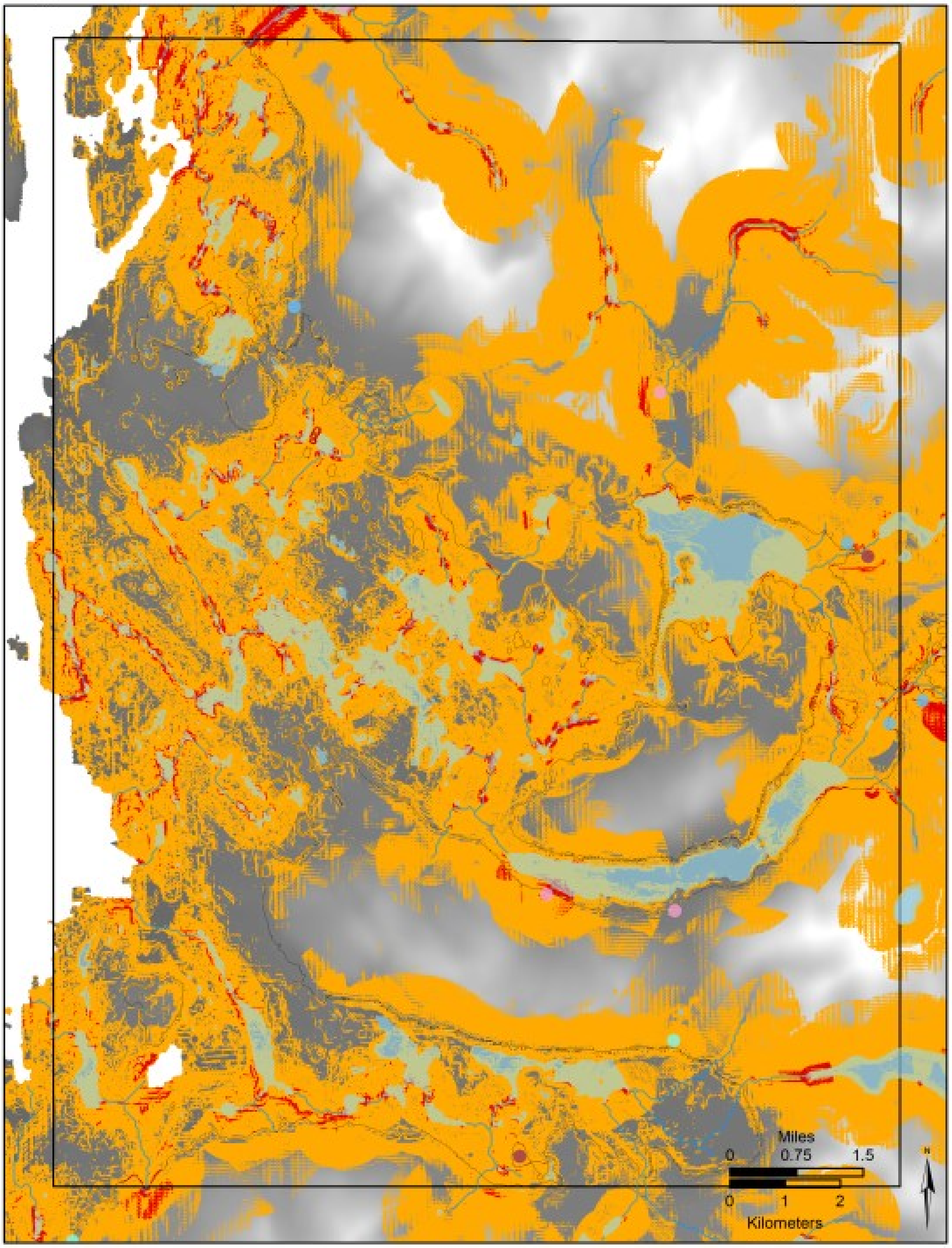
Weight 3a **14,000 cal BP**



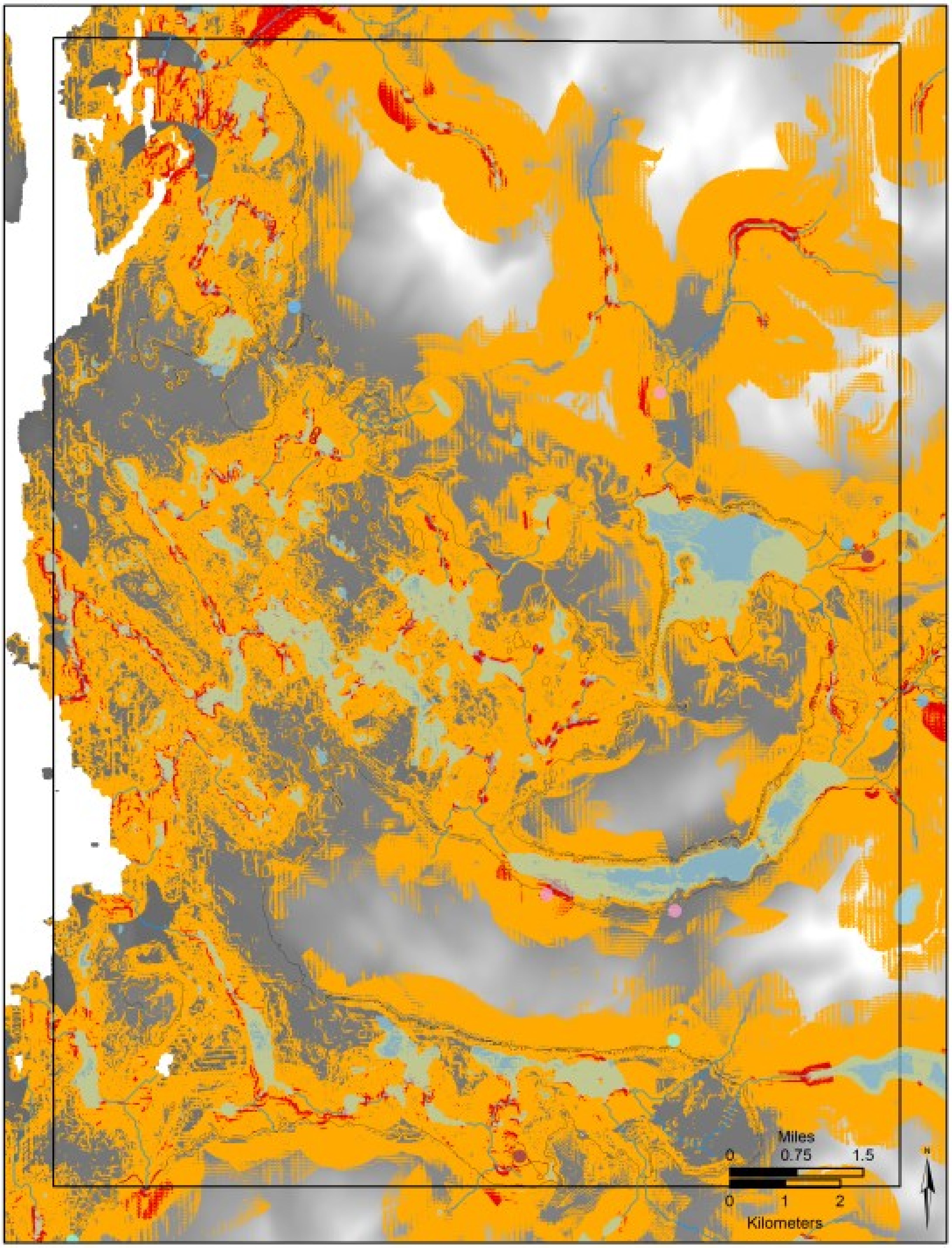
Weight 3a **14,500 cal BP**



Weight 3a **15,000 cal BP**

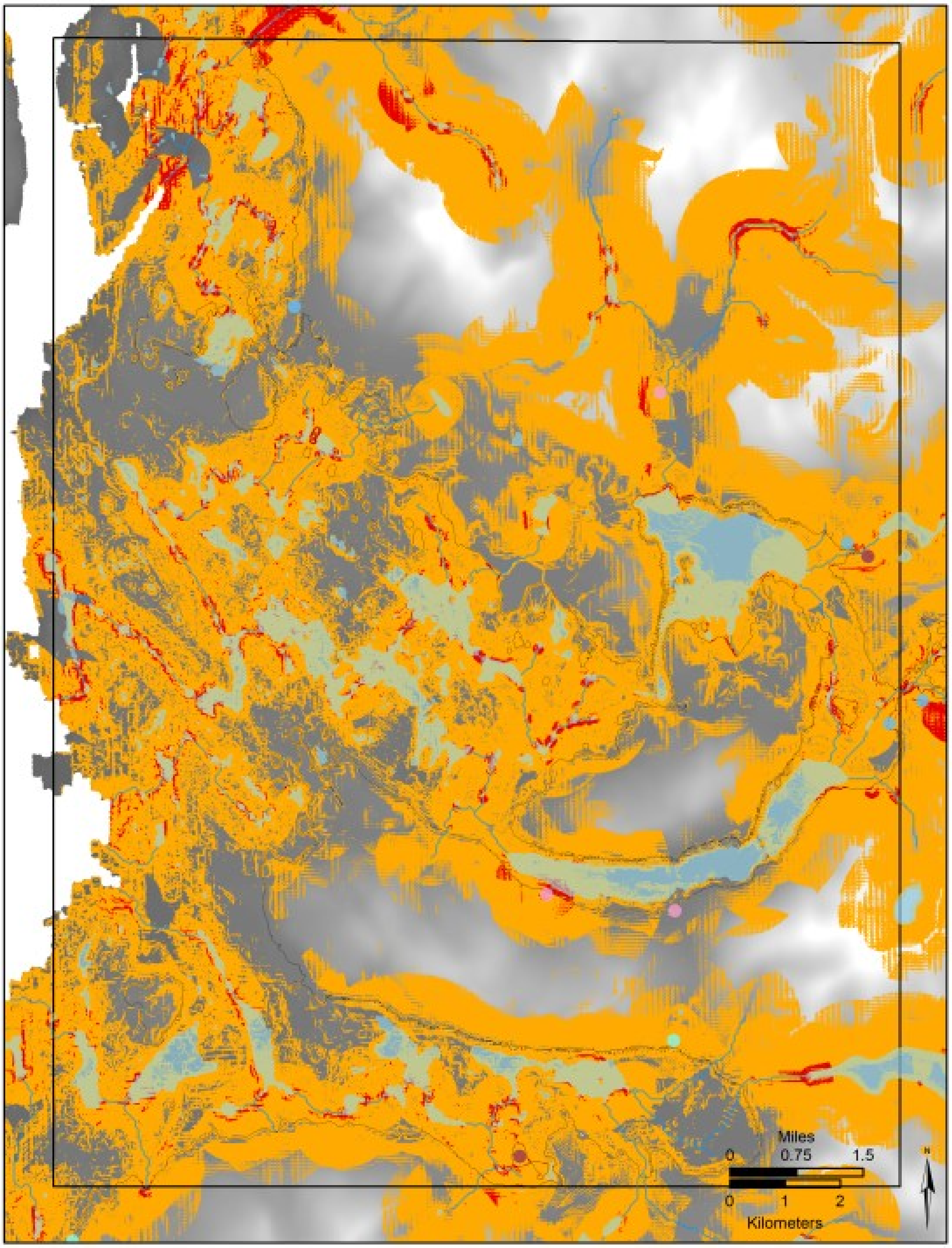


Weight 3a **15,500 cal BP**

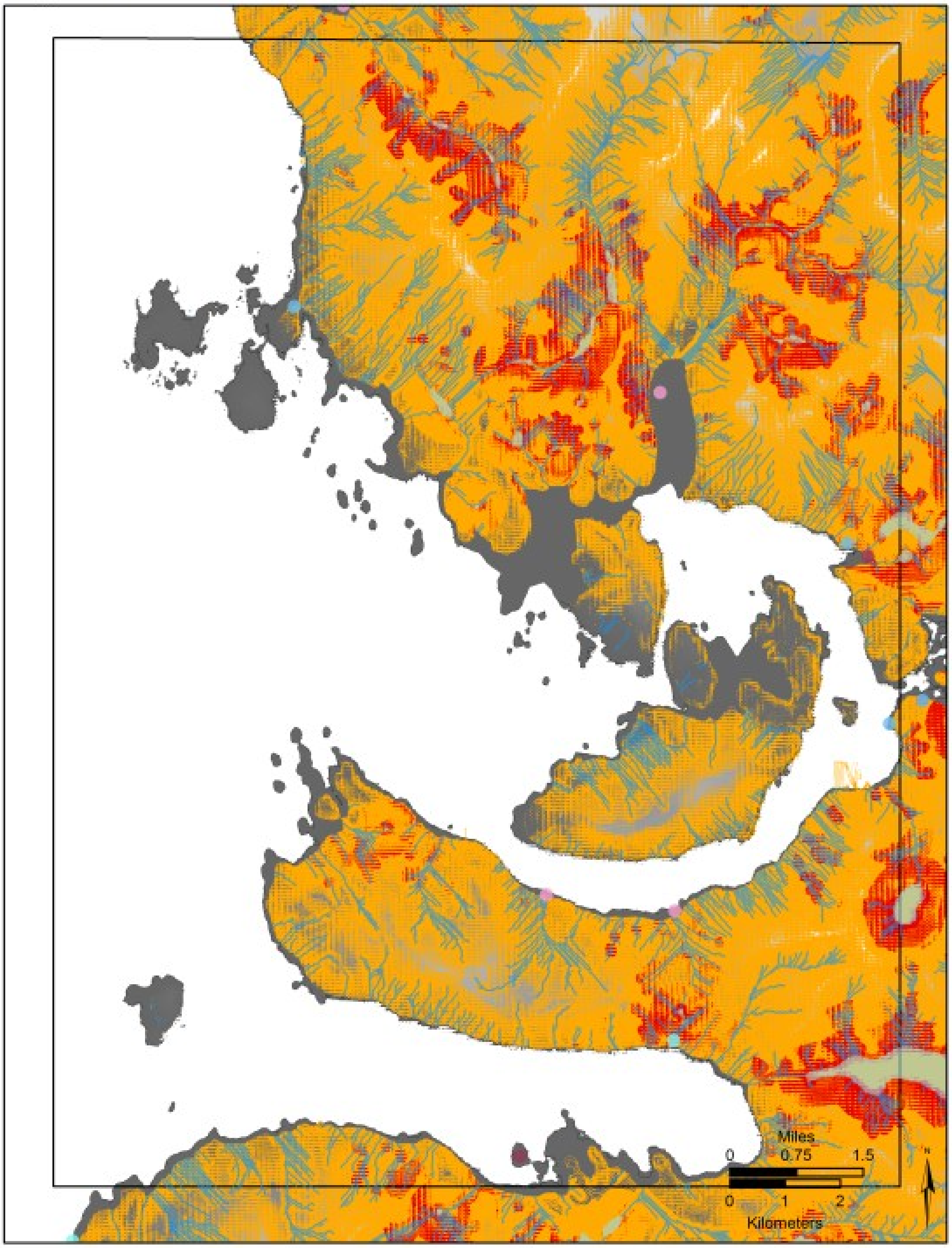


Weight 3a

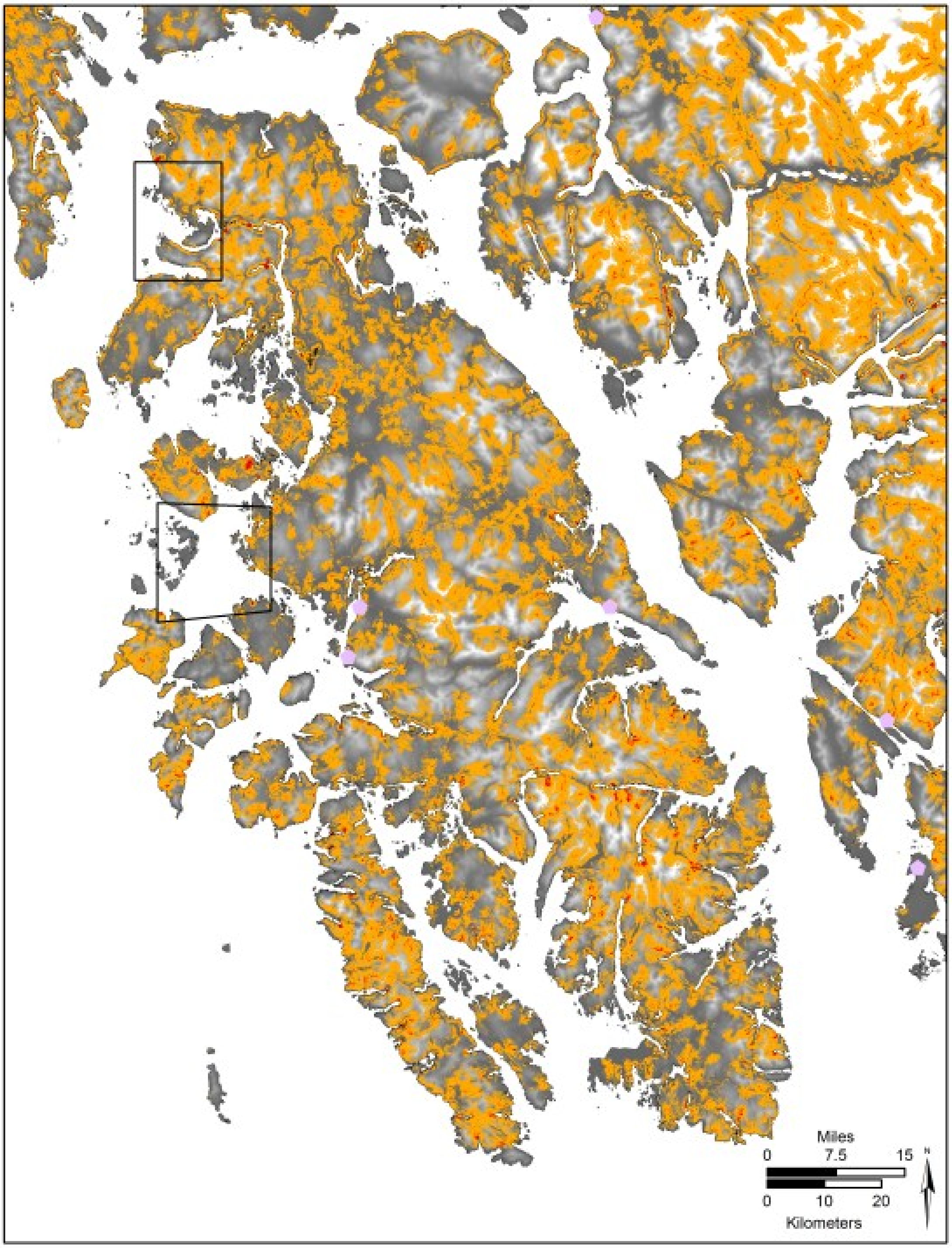
16,000 cal BP



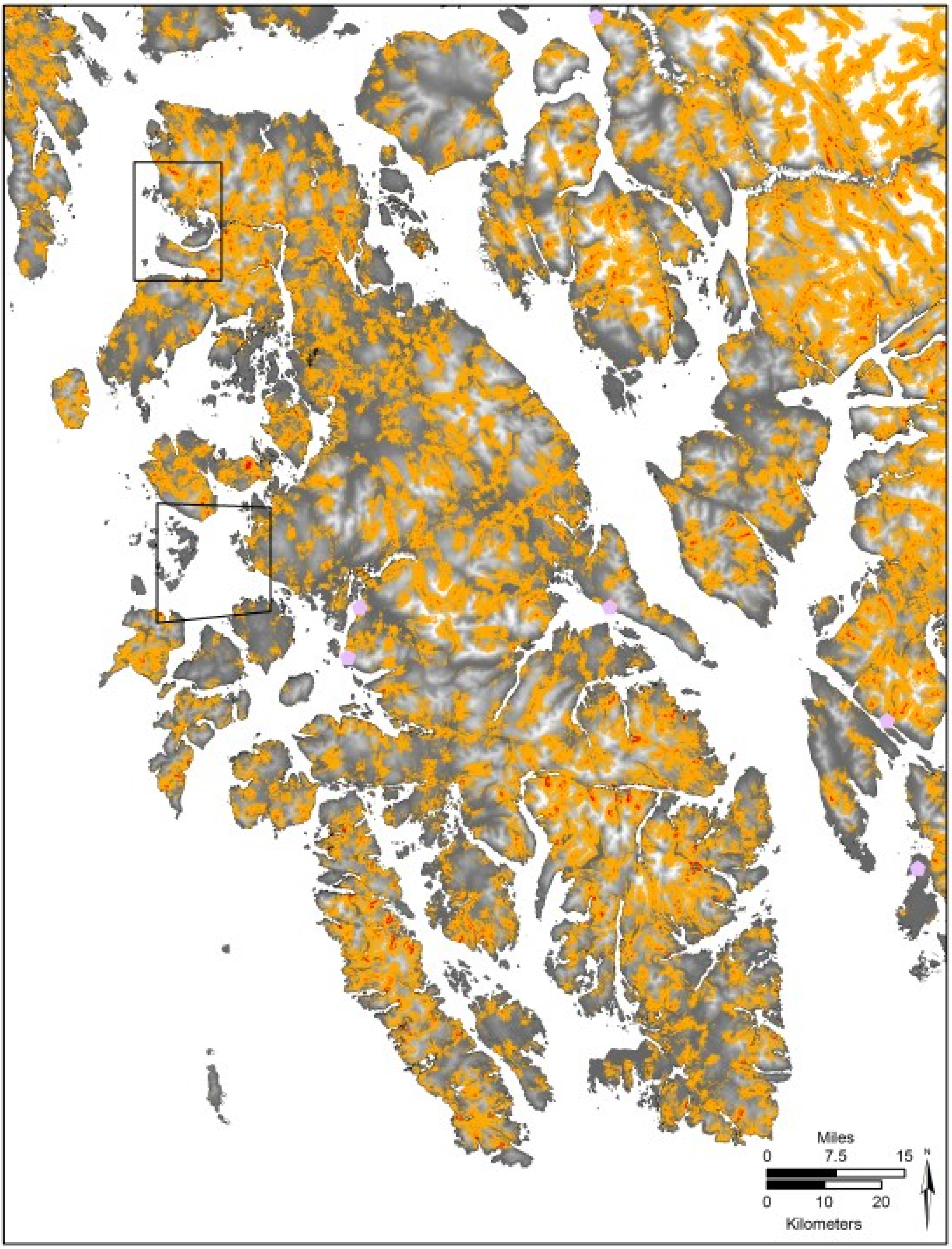
Weight 3a **Modern - Small Area**

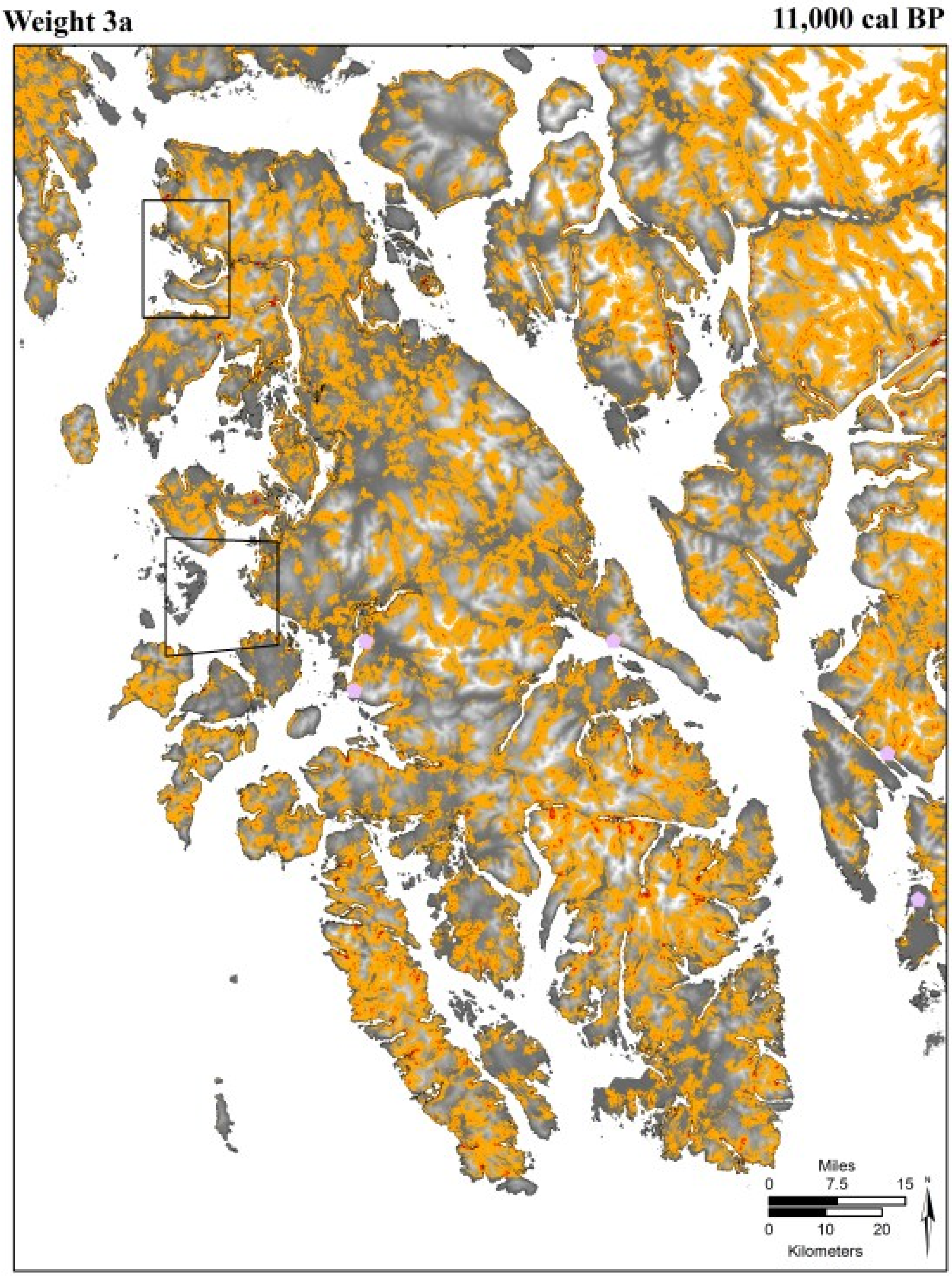


Weight 3a **Modern**

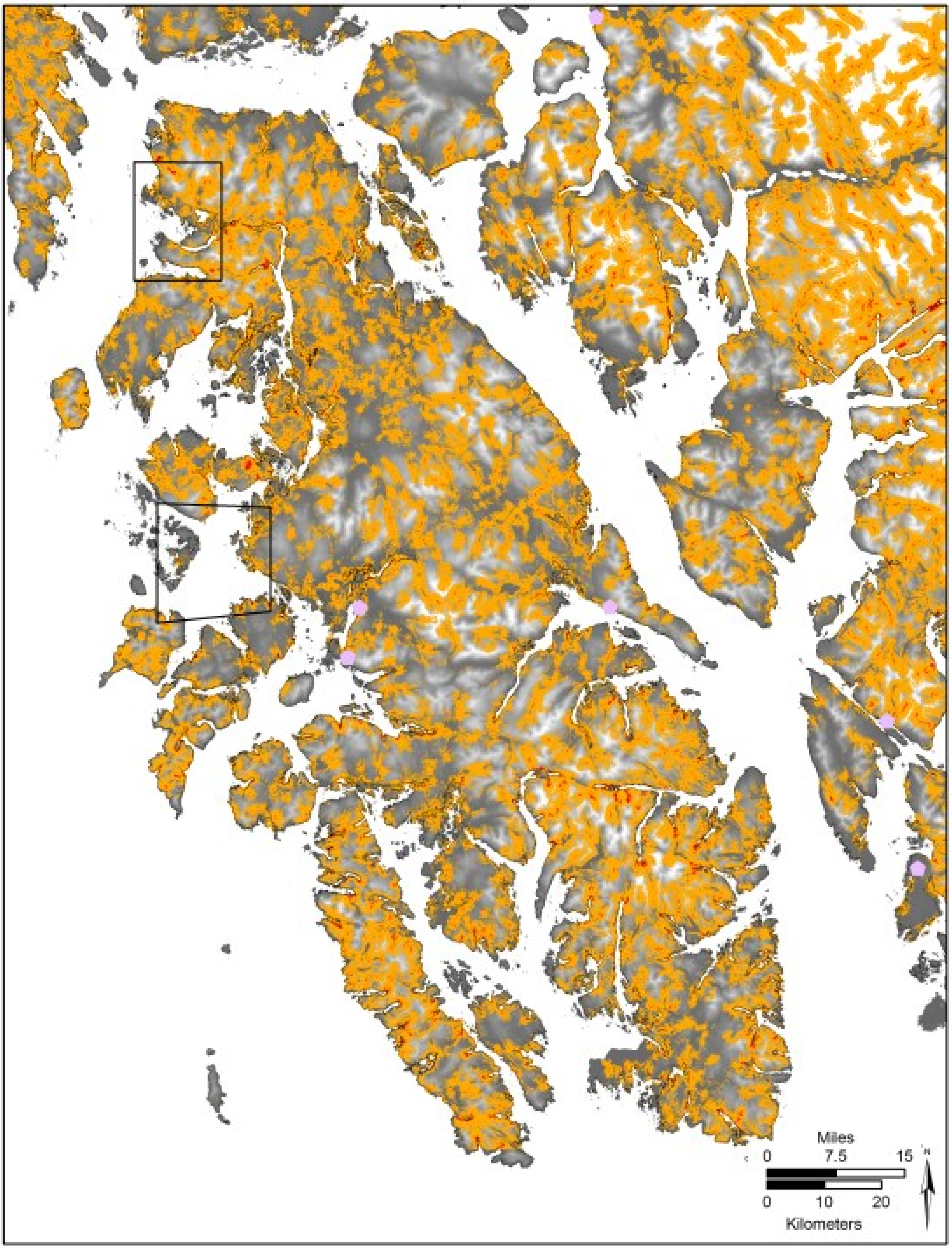


Weight 3a **10,500 cal BP**



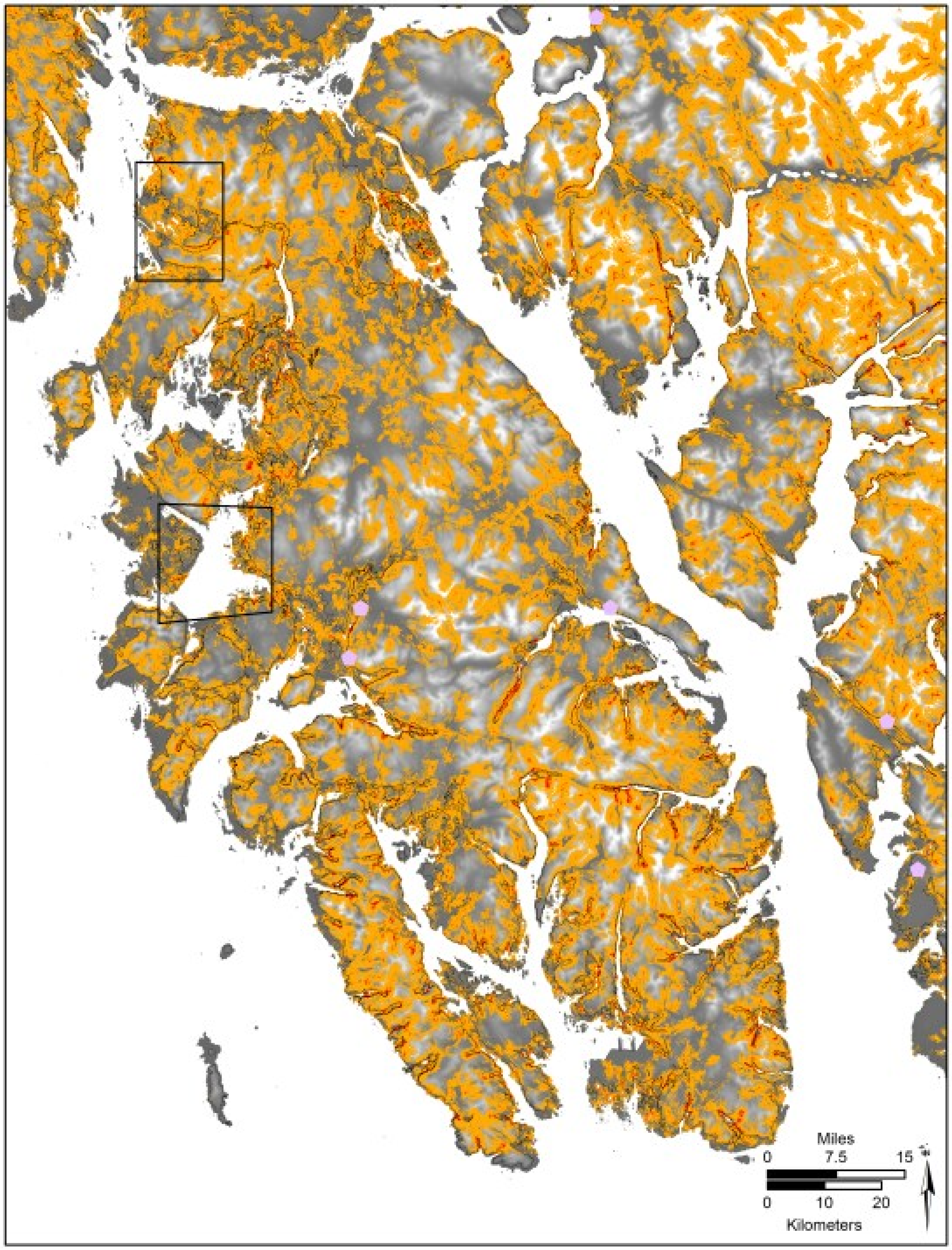

Weight 3a
11,000 cal BP
Miles
0
7.5
15
0
10
20
Kilometers
N

Weight 3a **11,500 cal BP**



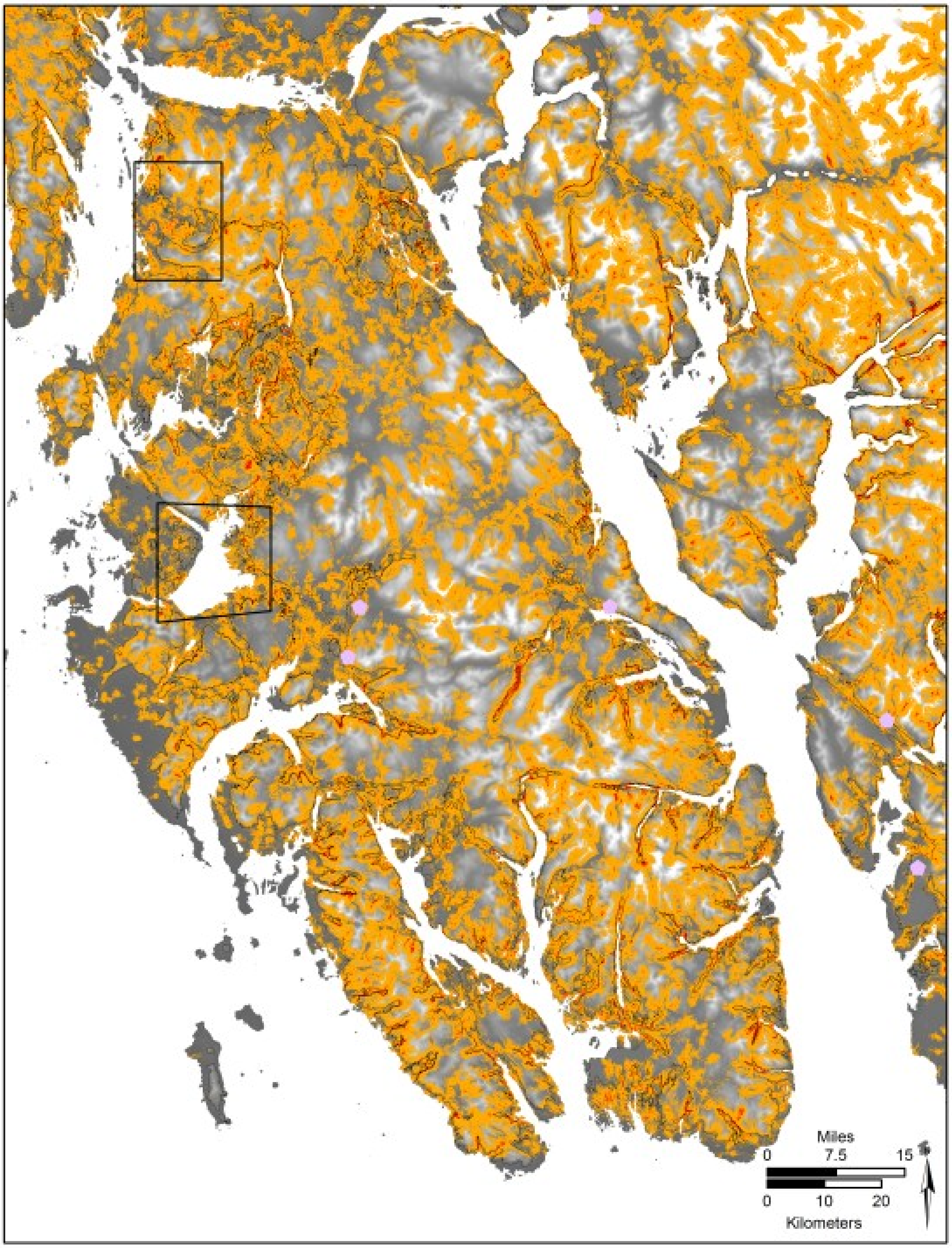
Weight 3a **12,000 cal BP**

Weight 3a **12,500 cal BP**

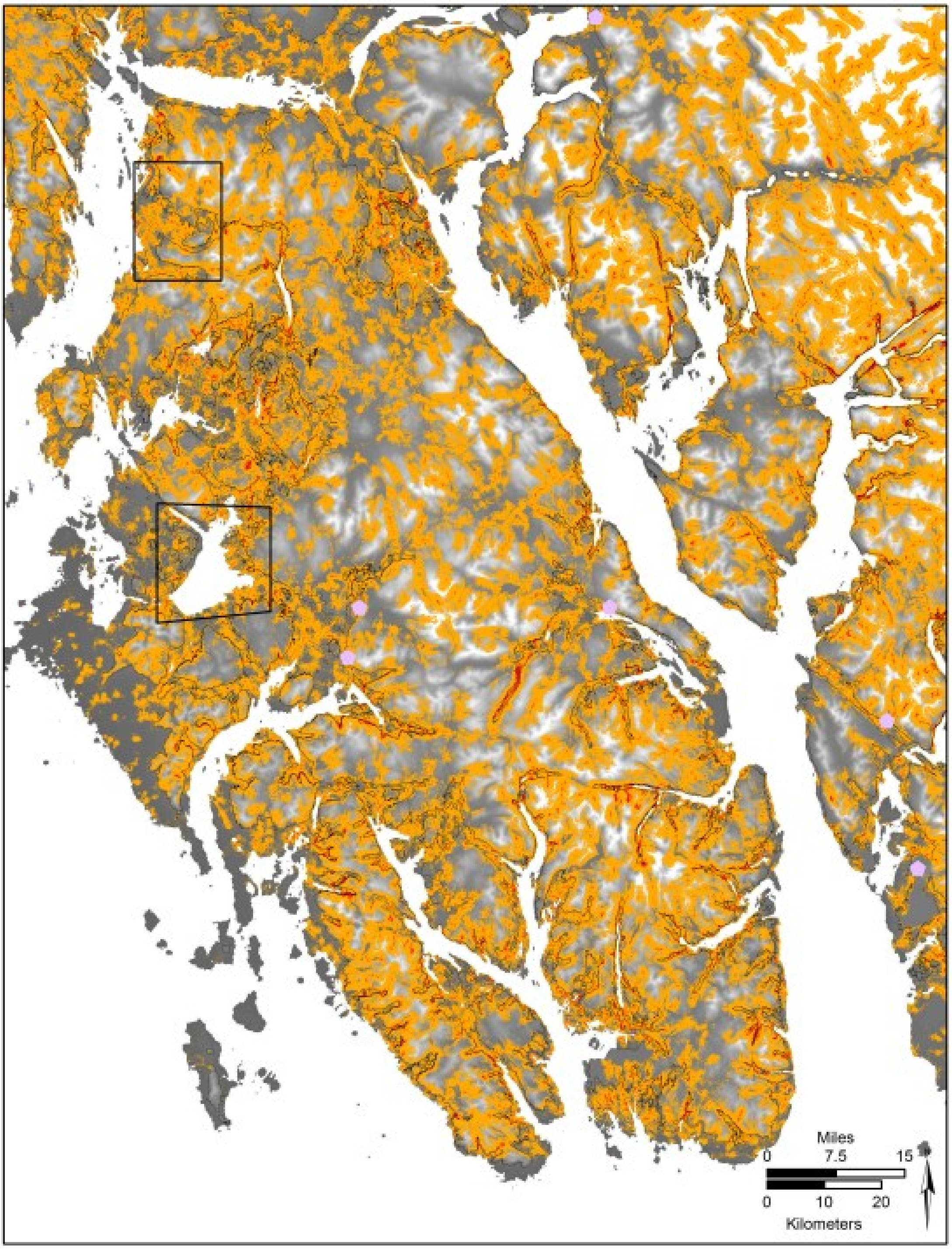


Weight 3a **13,000 cal BP**

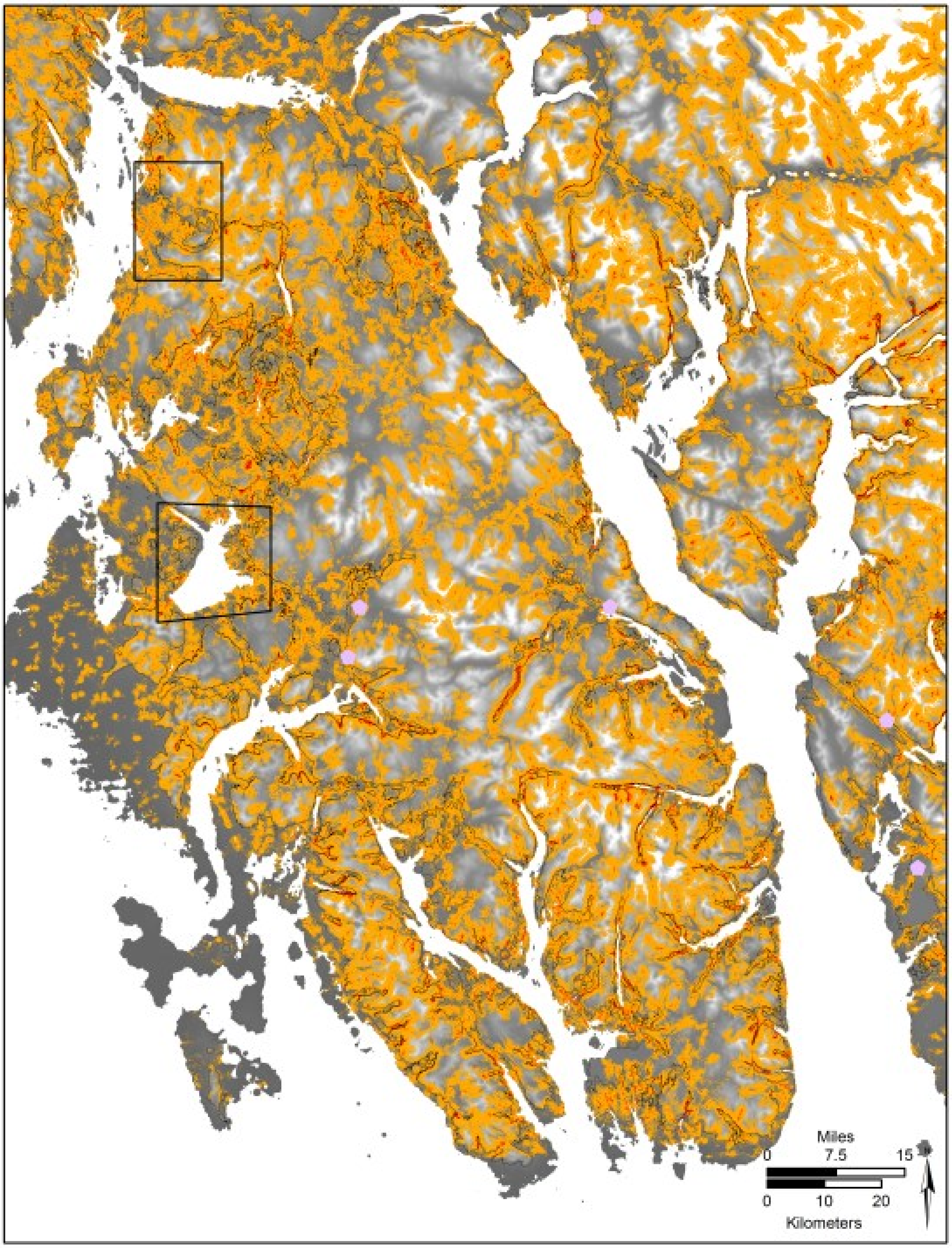
Weight 3a **13,500 cal BP**



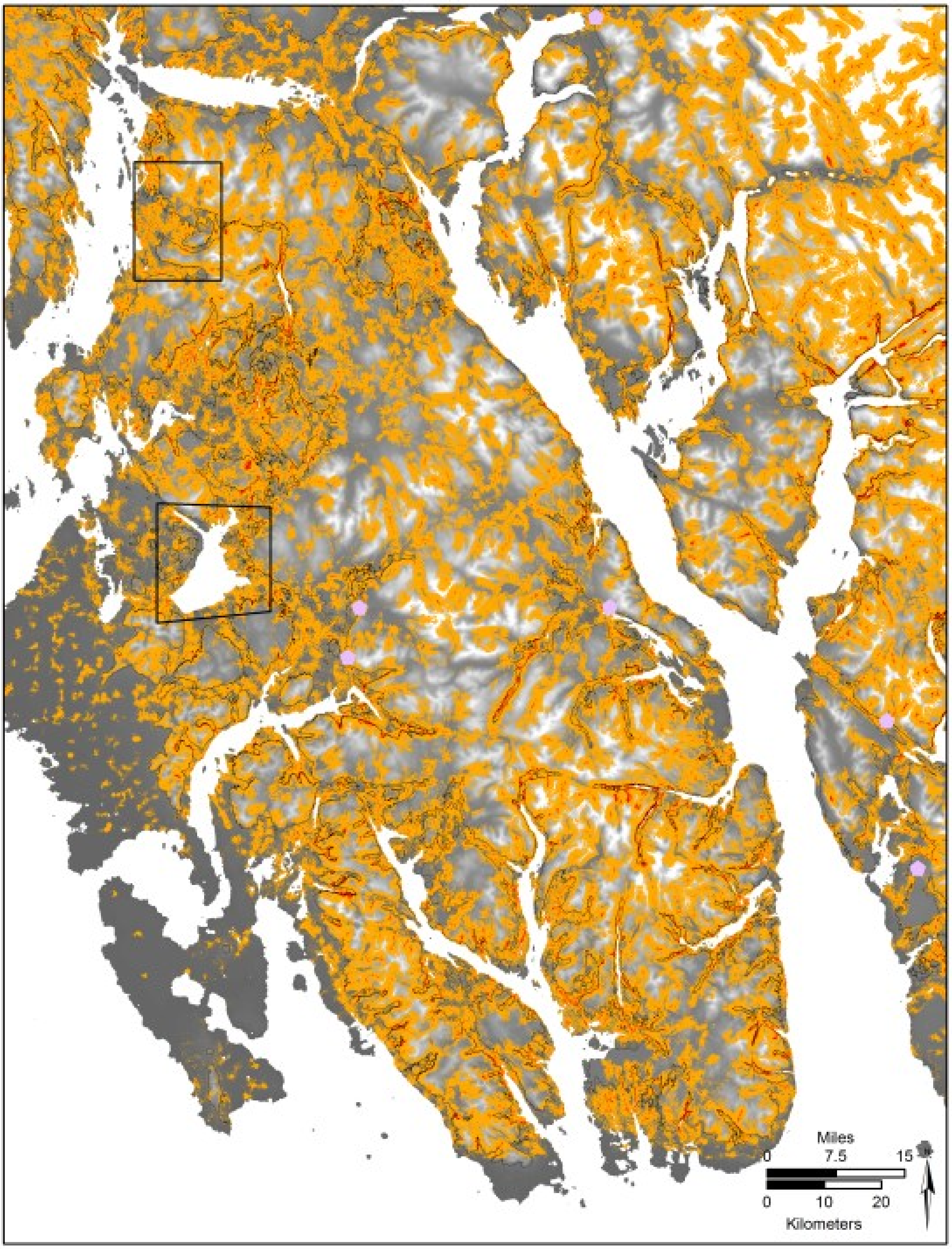
Weight 3a **14,000 cal BP**



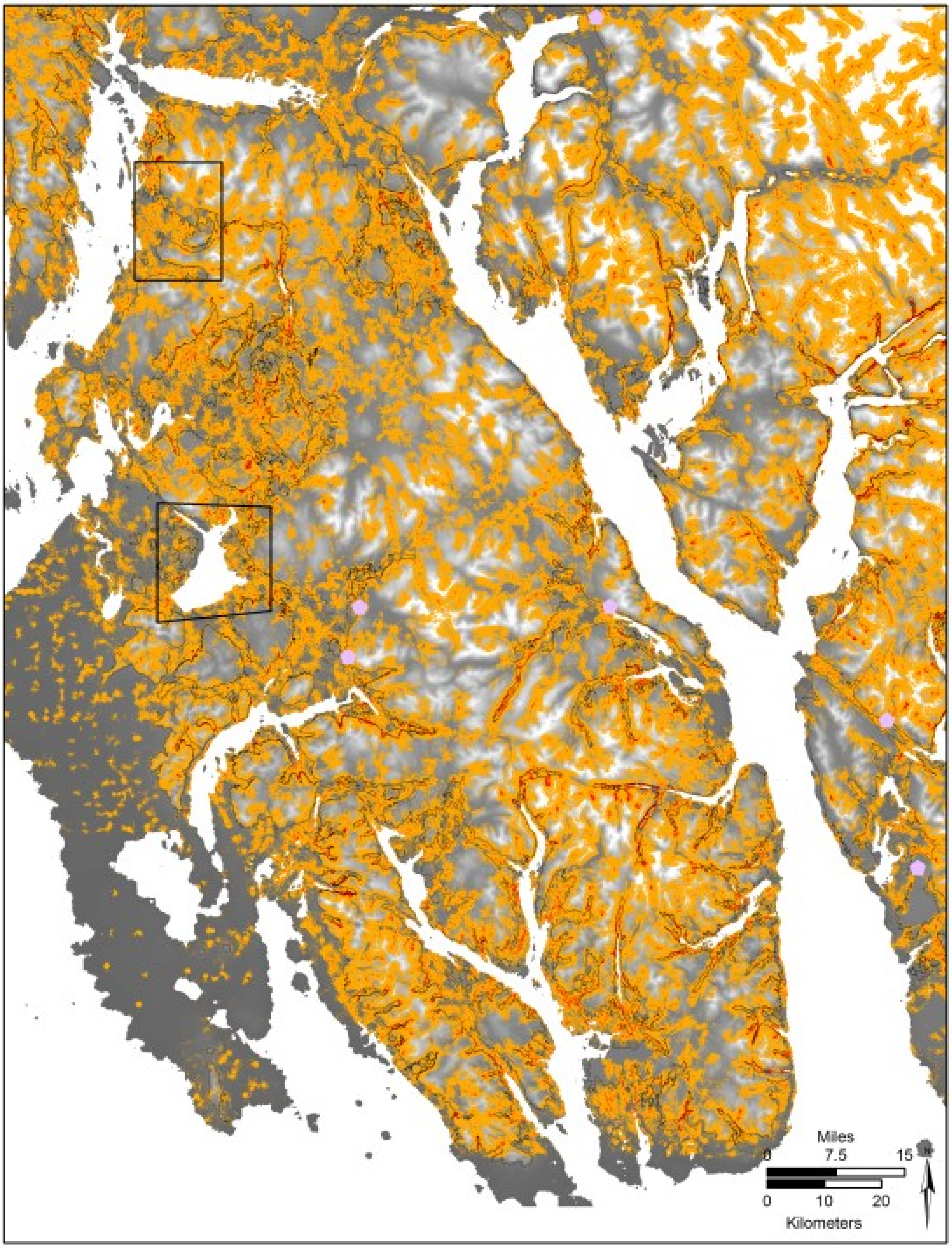
Weight 3a **14,500 cal BP**



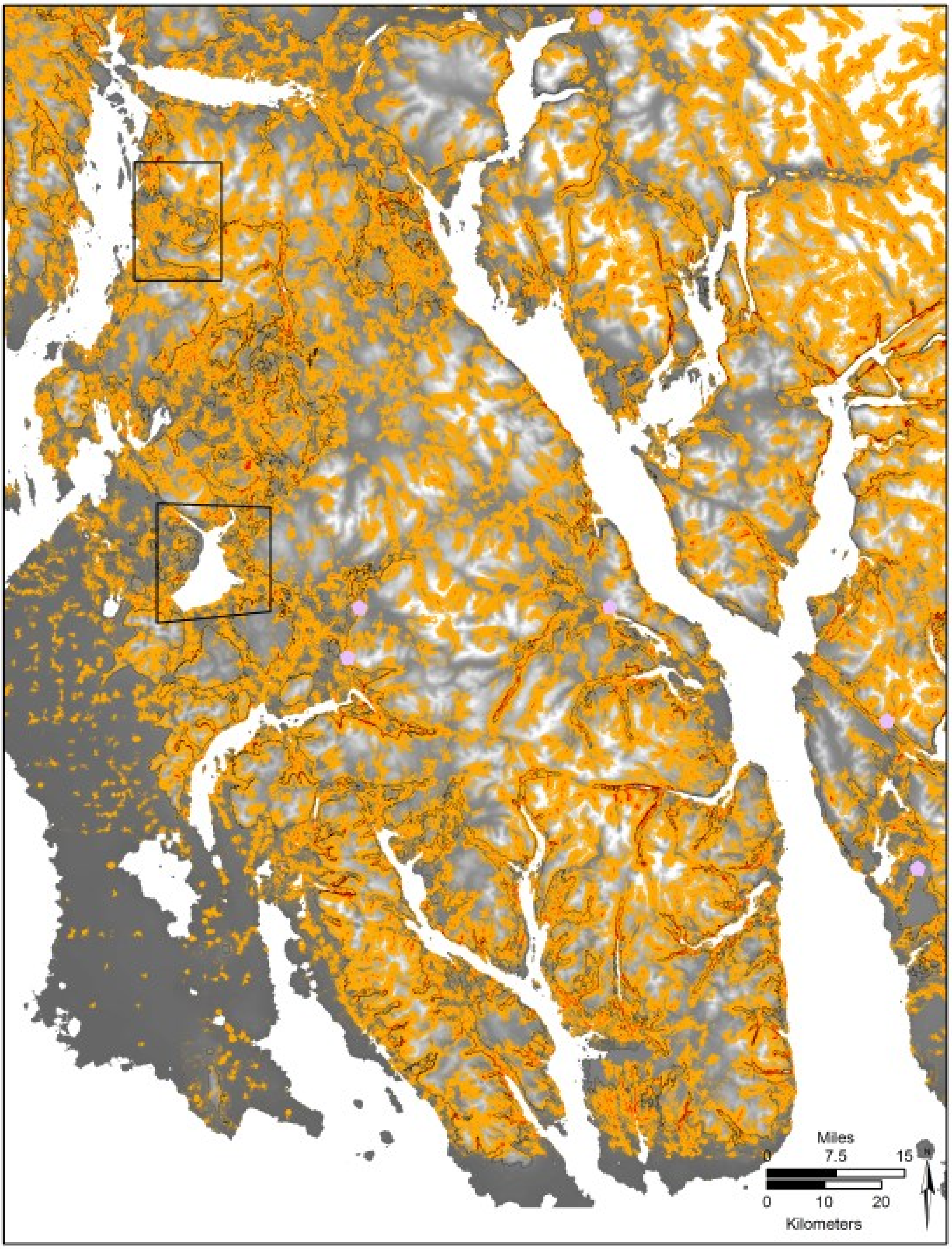
Weight 3a **15,000 cal BP**



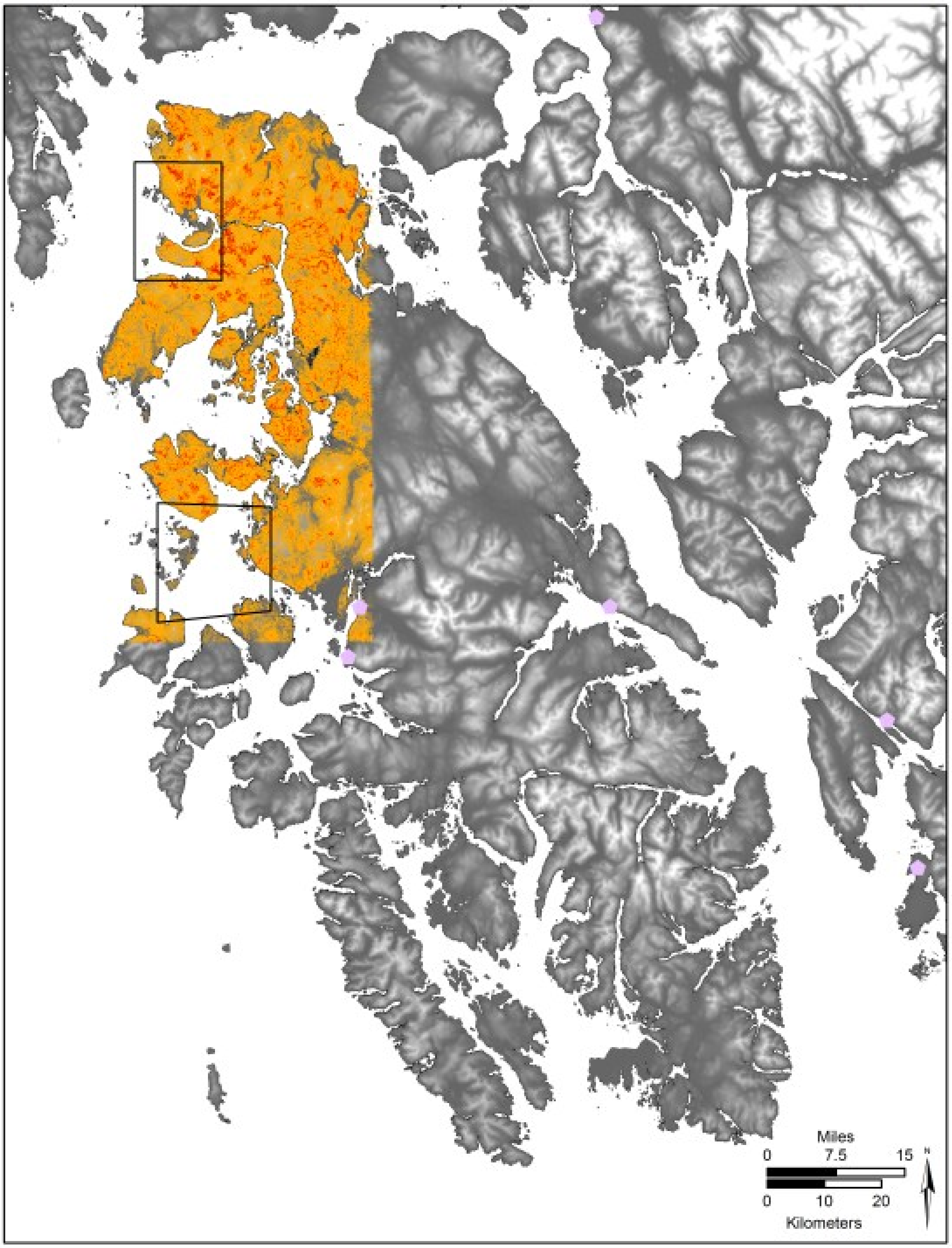
Weight 3a **15,500 cal BP**



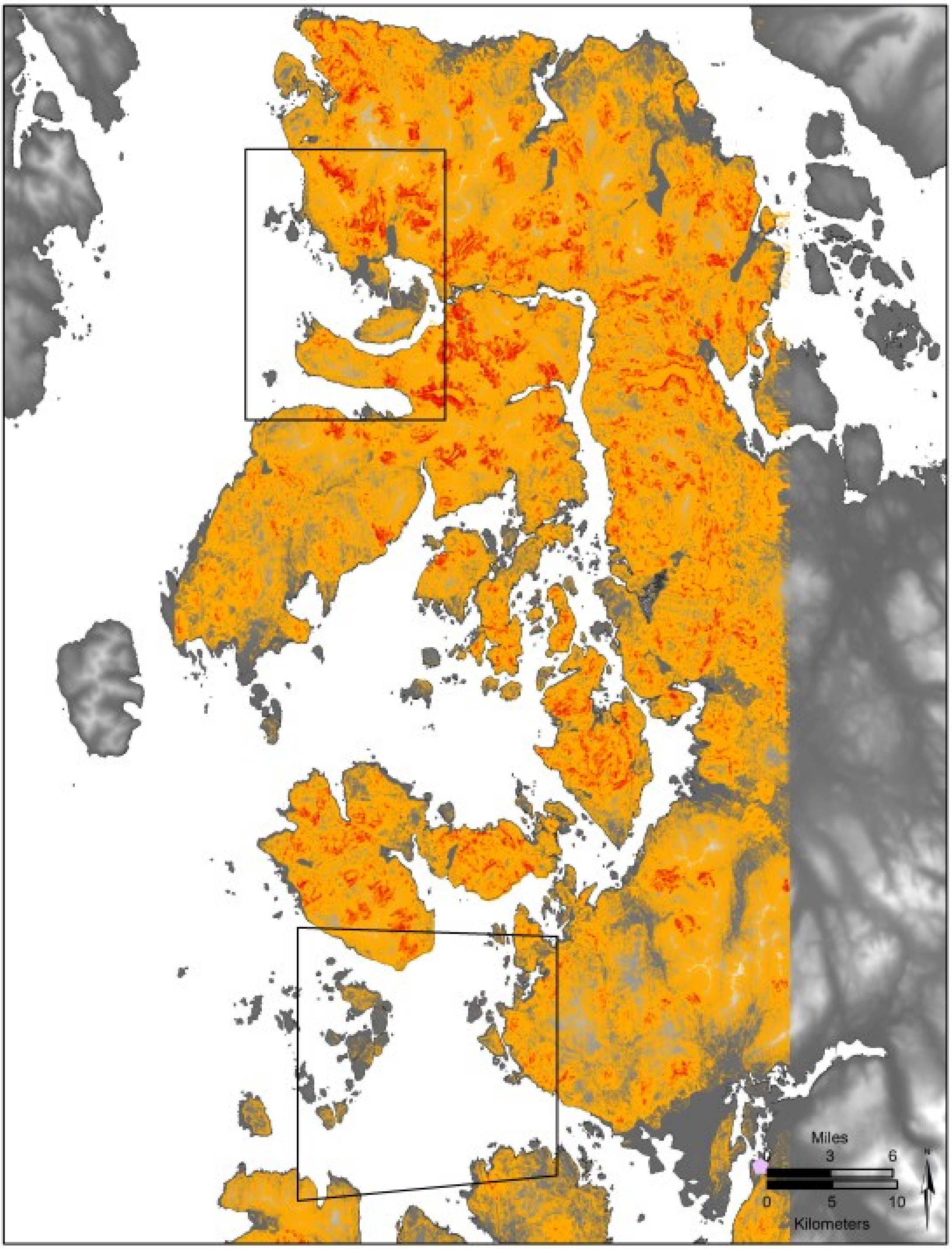
Weight 3a **16,000 cal BP**



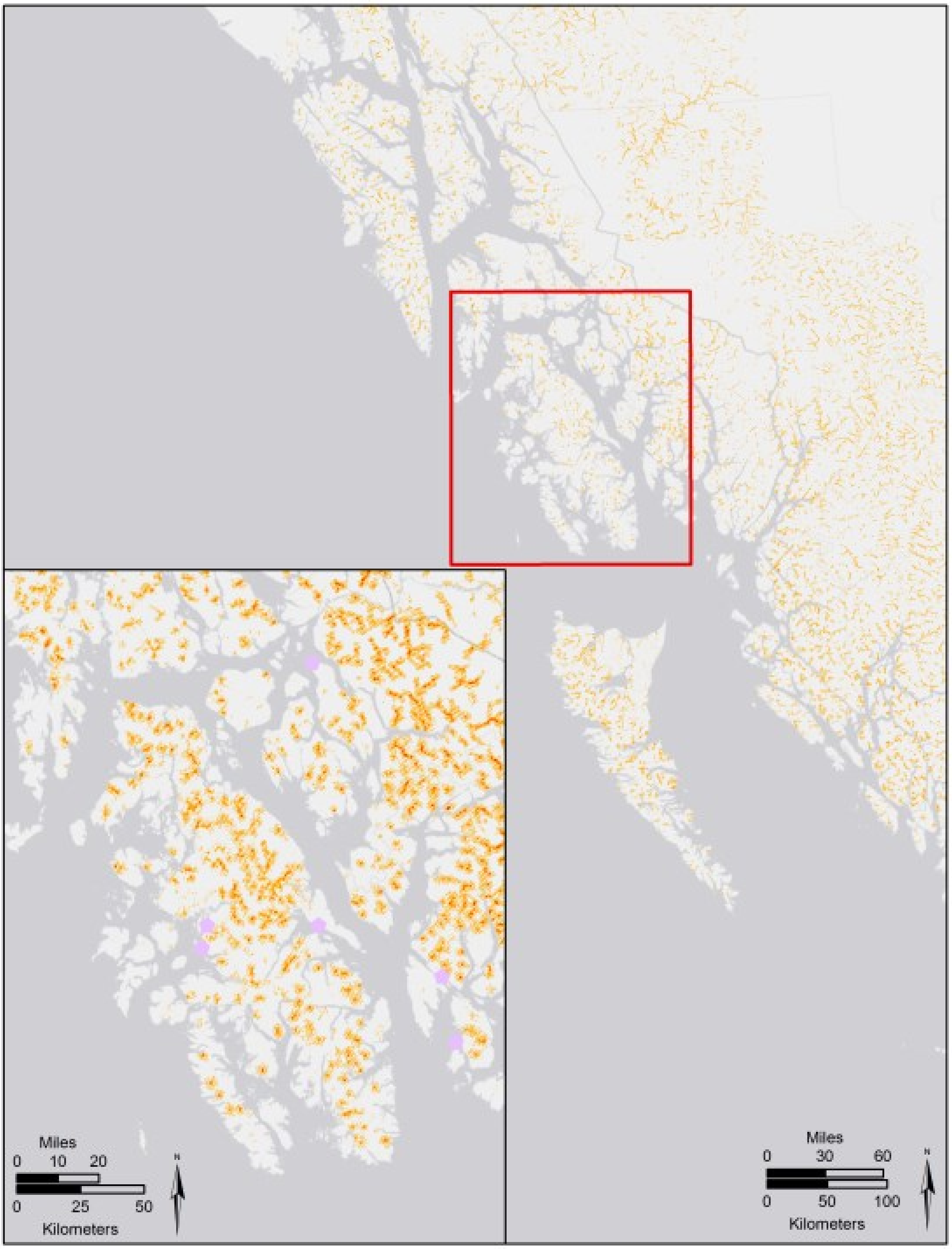
Weight 3a **Modern - Small Area**



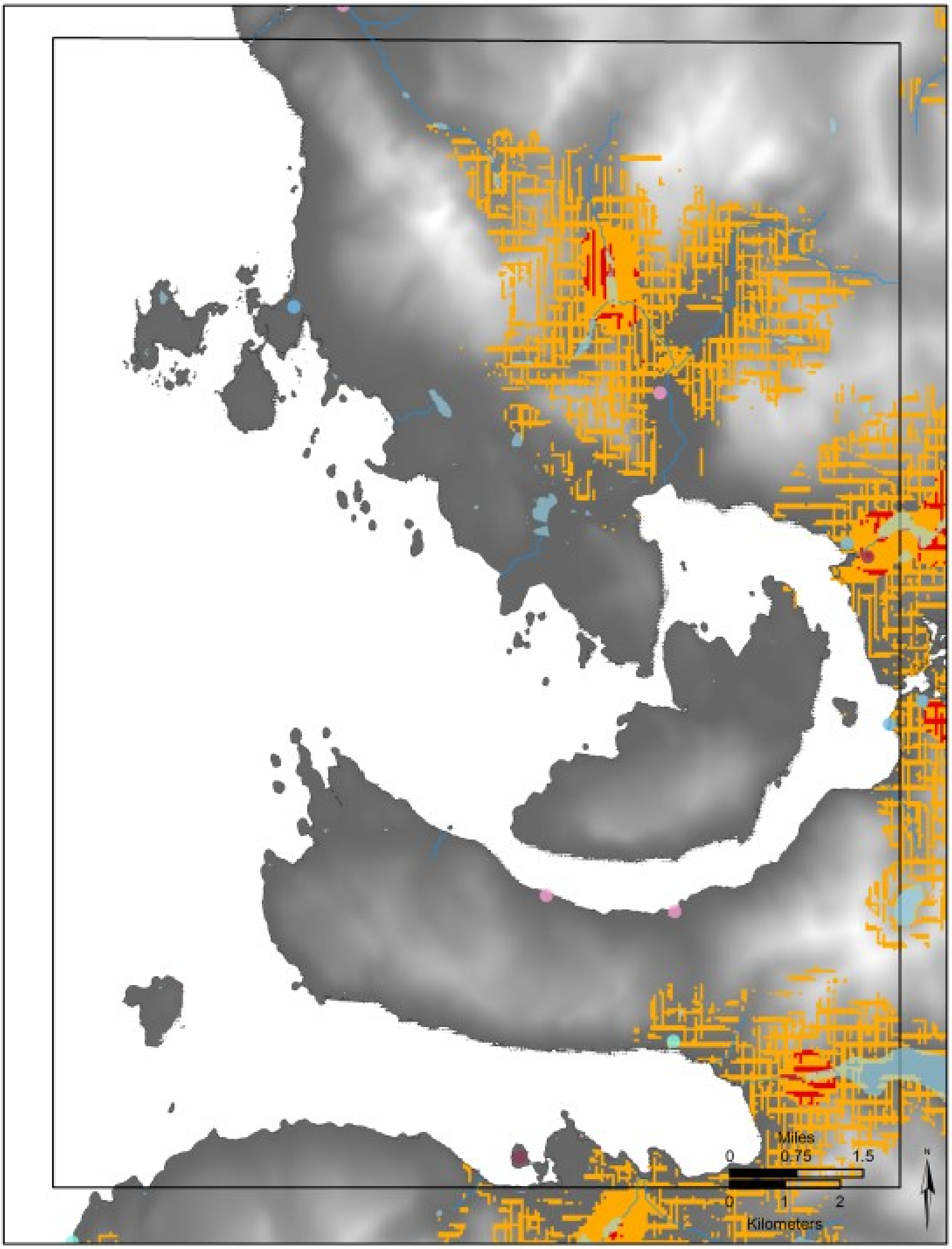
Weight 3a **Modern - Small Area**



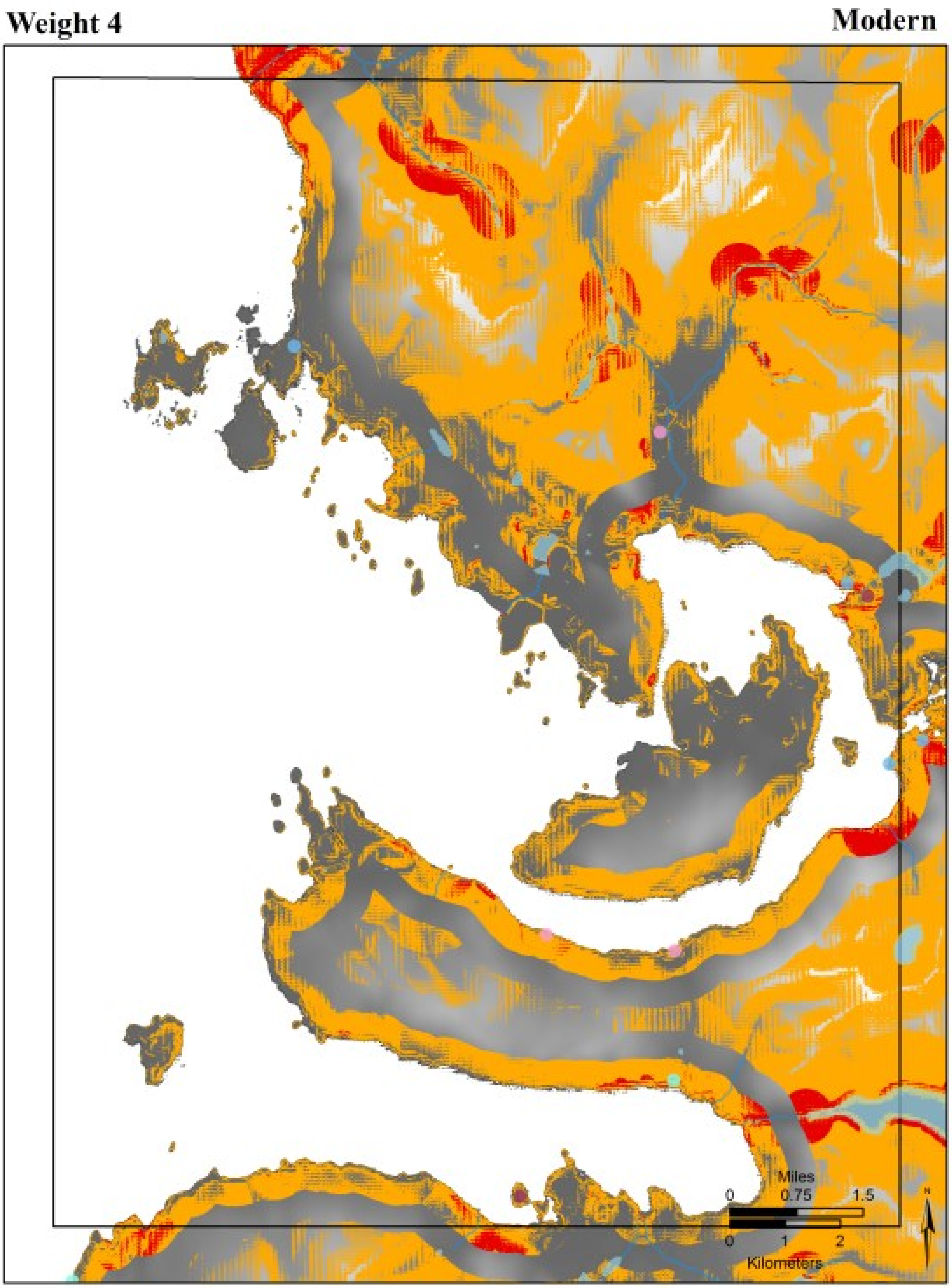
Weight 3a **NWC - modern**



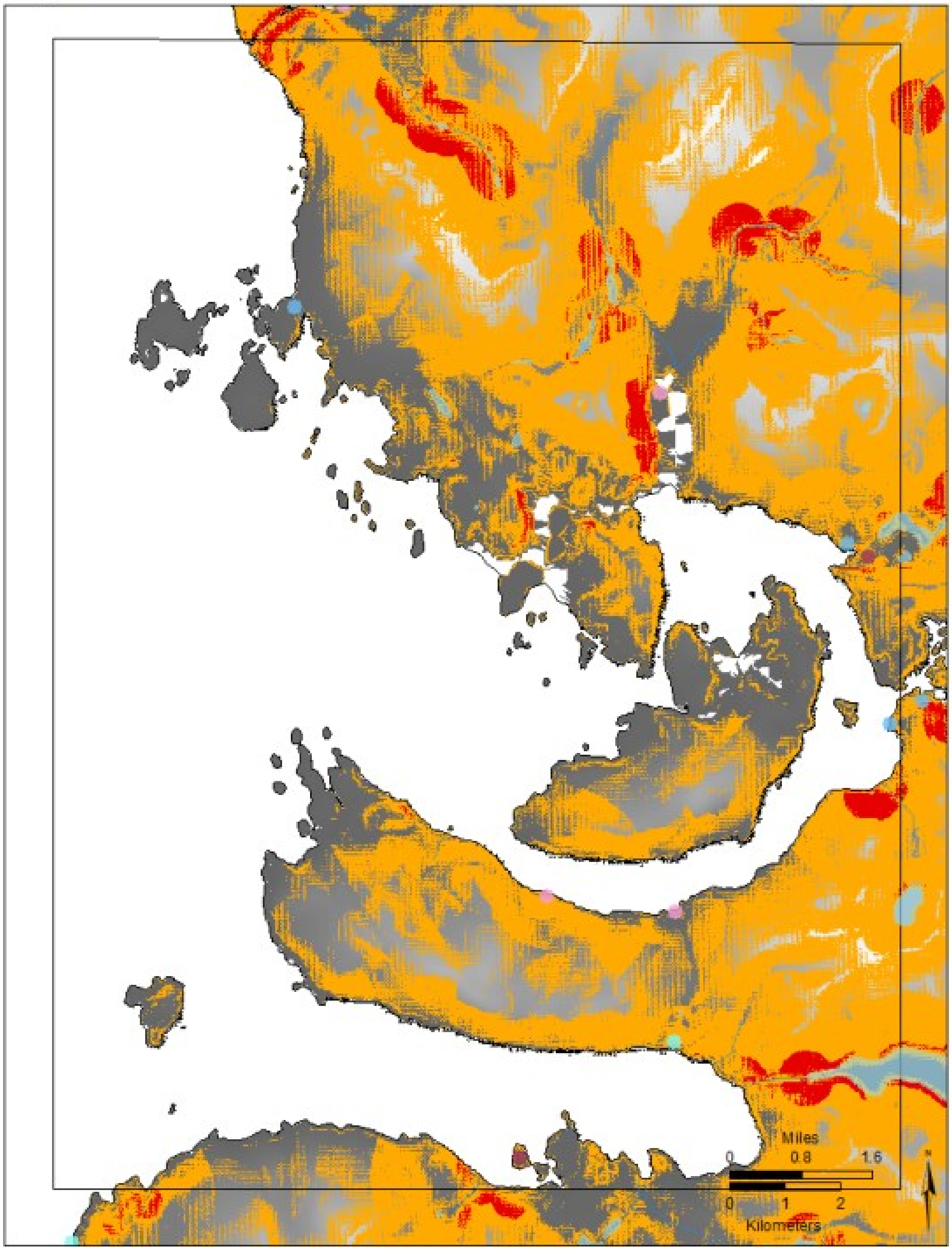
Weight 3a **NWC - modern**



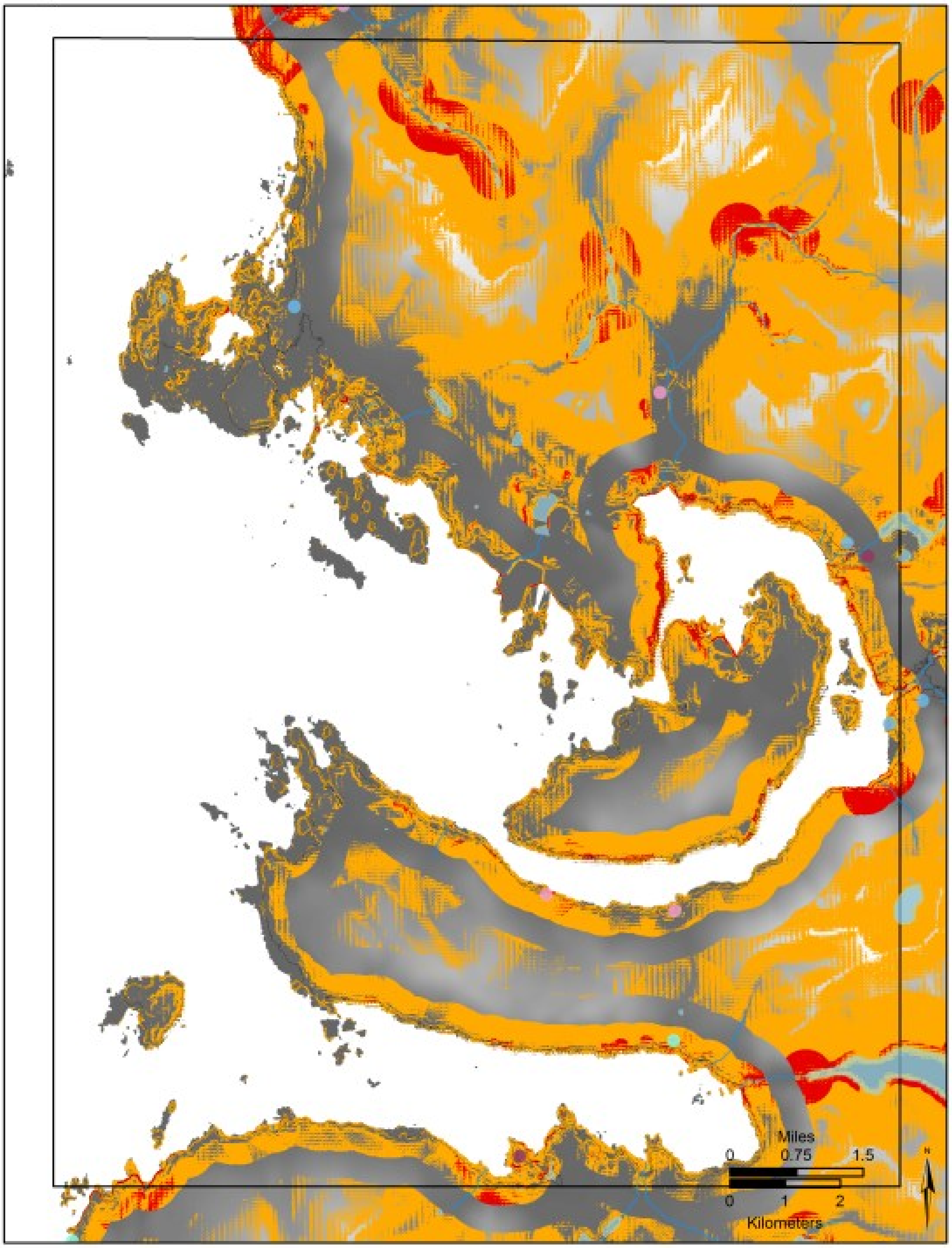
C.8 Weighted Overlay 4



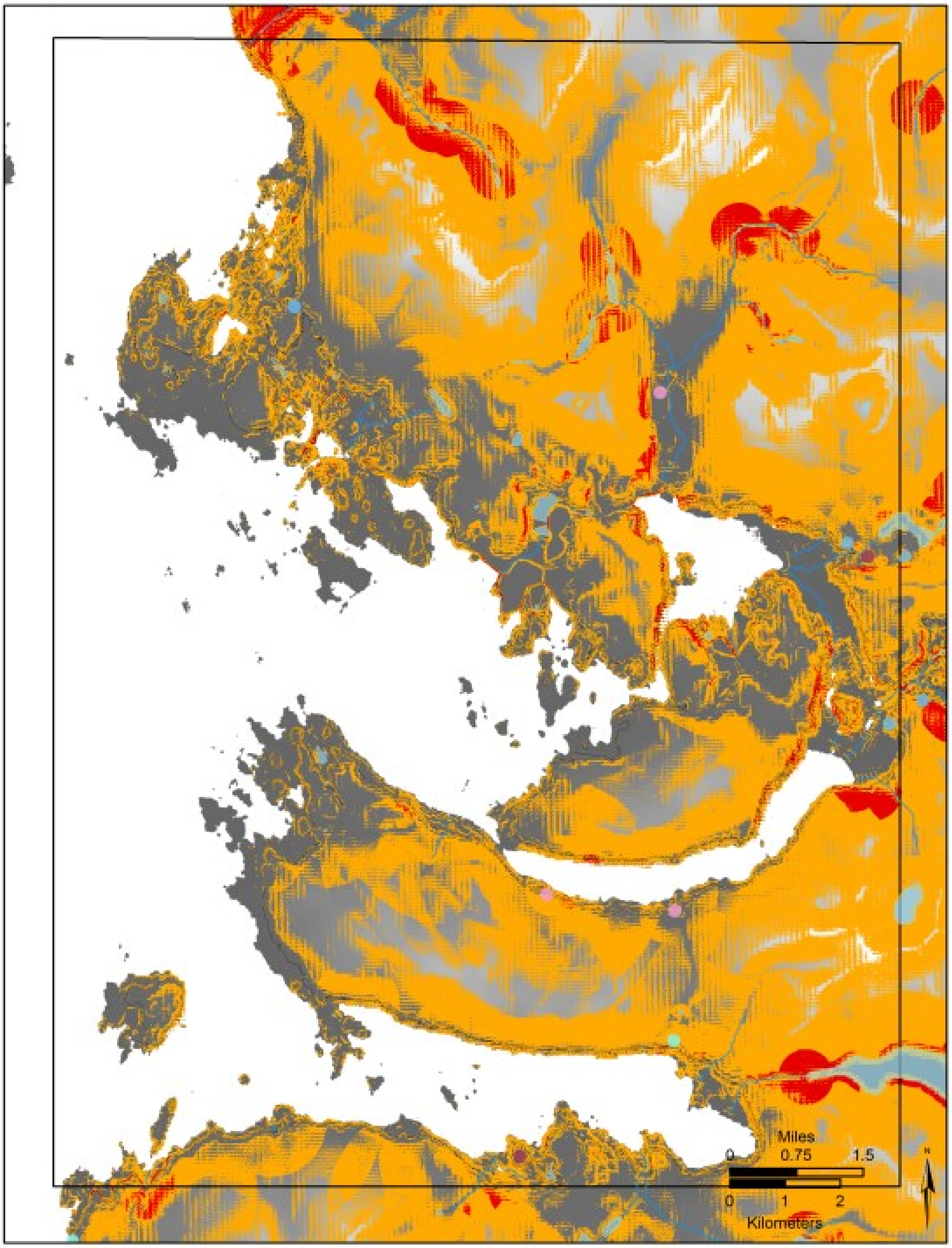
Weight 4 **10,500 cal BP**



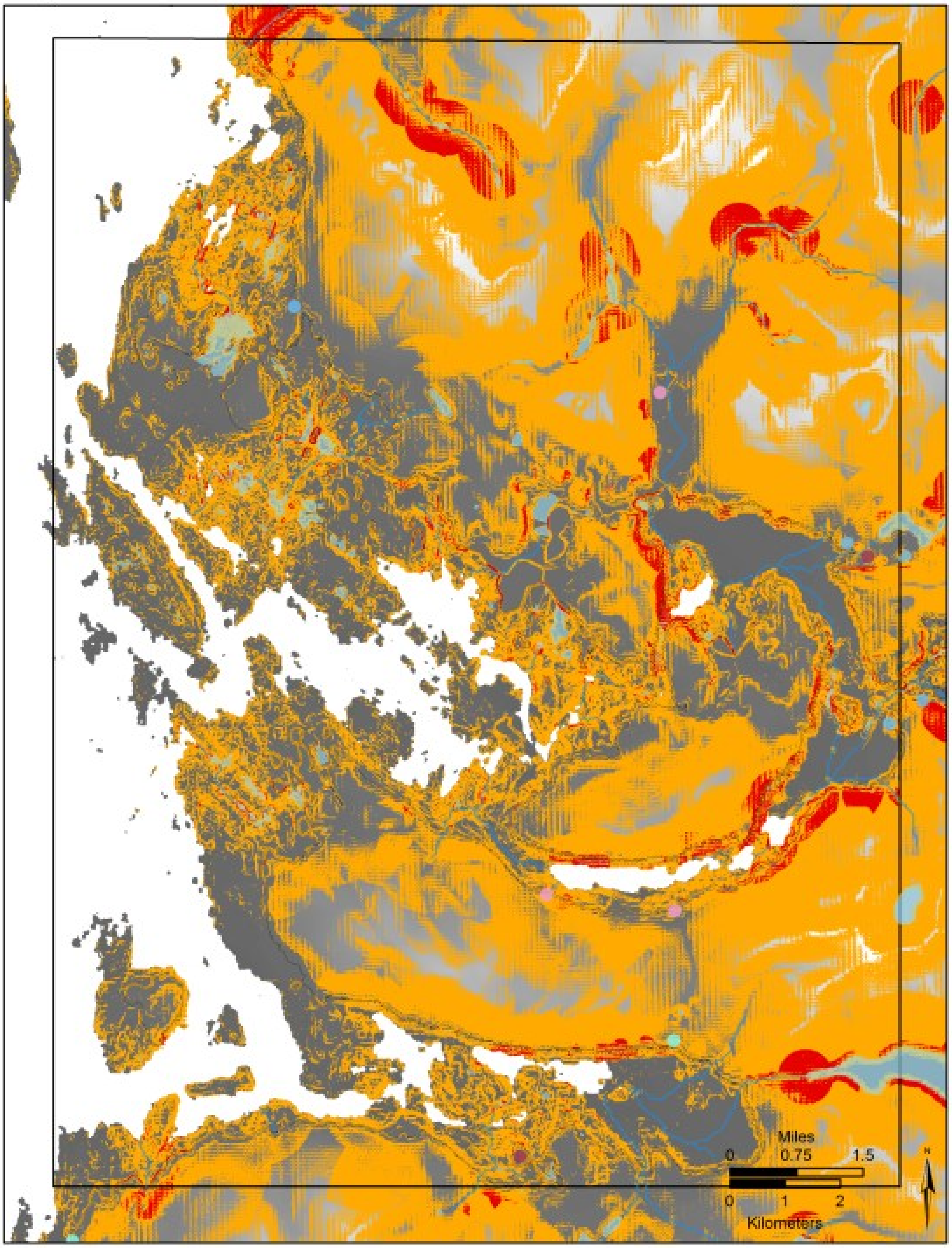
Weight 4 **11,000 cal BP**



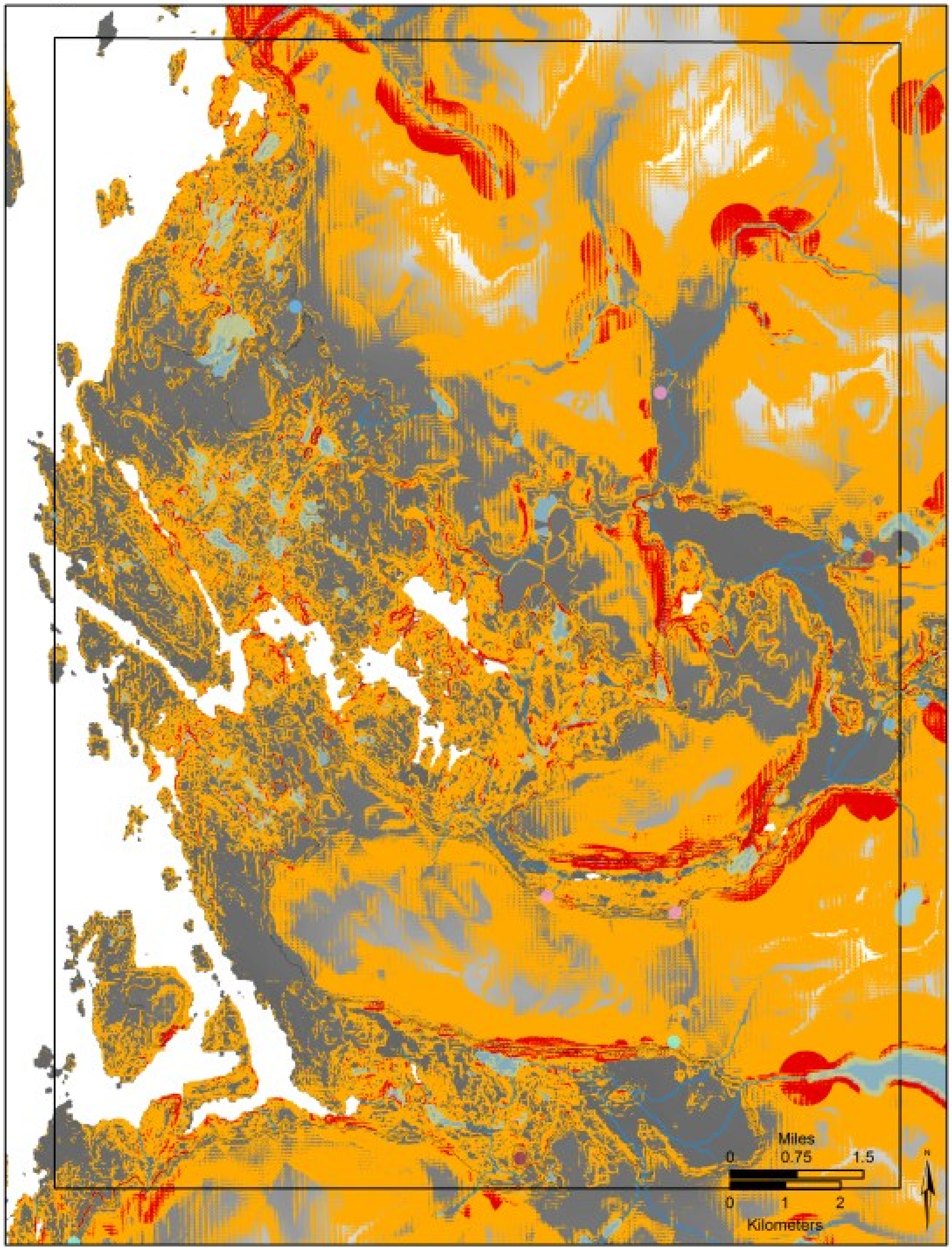
Weight 4 **11,500 cal BP**



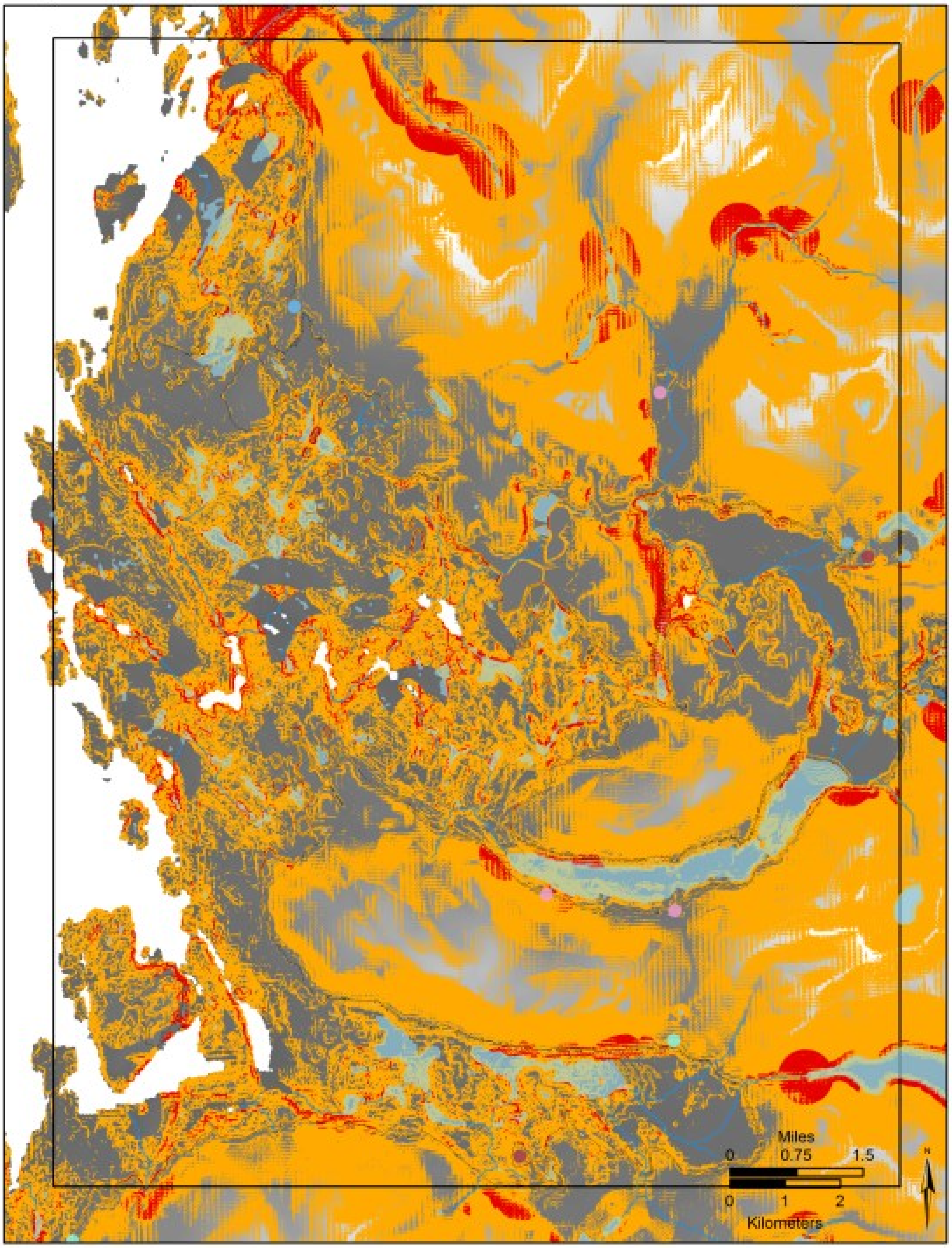
Weight 4 **12,000 cal BP**



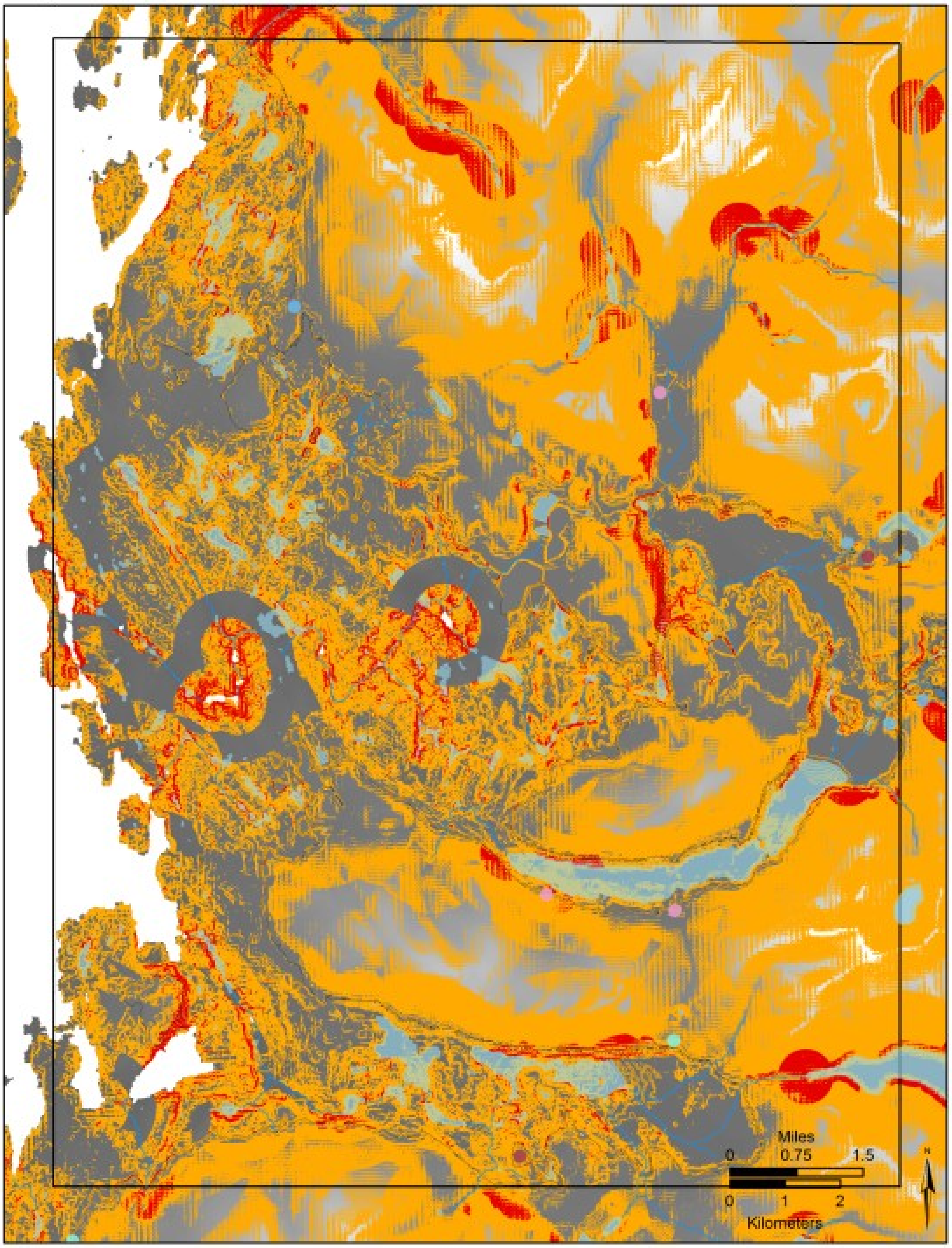
Weight 4 **12,500 cal BP**



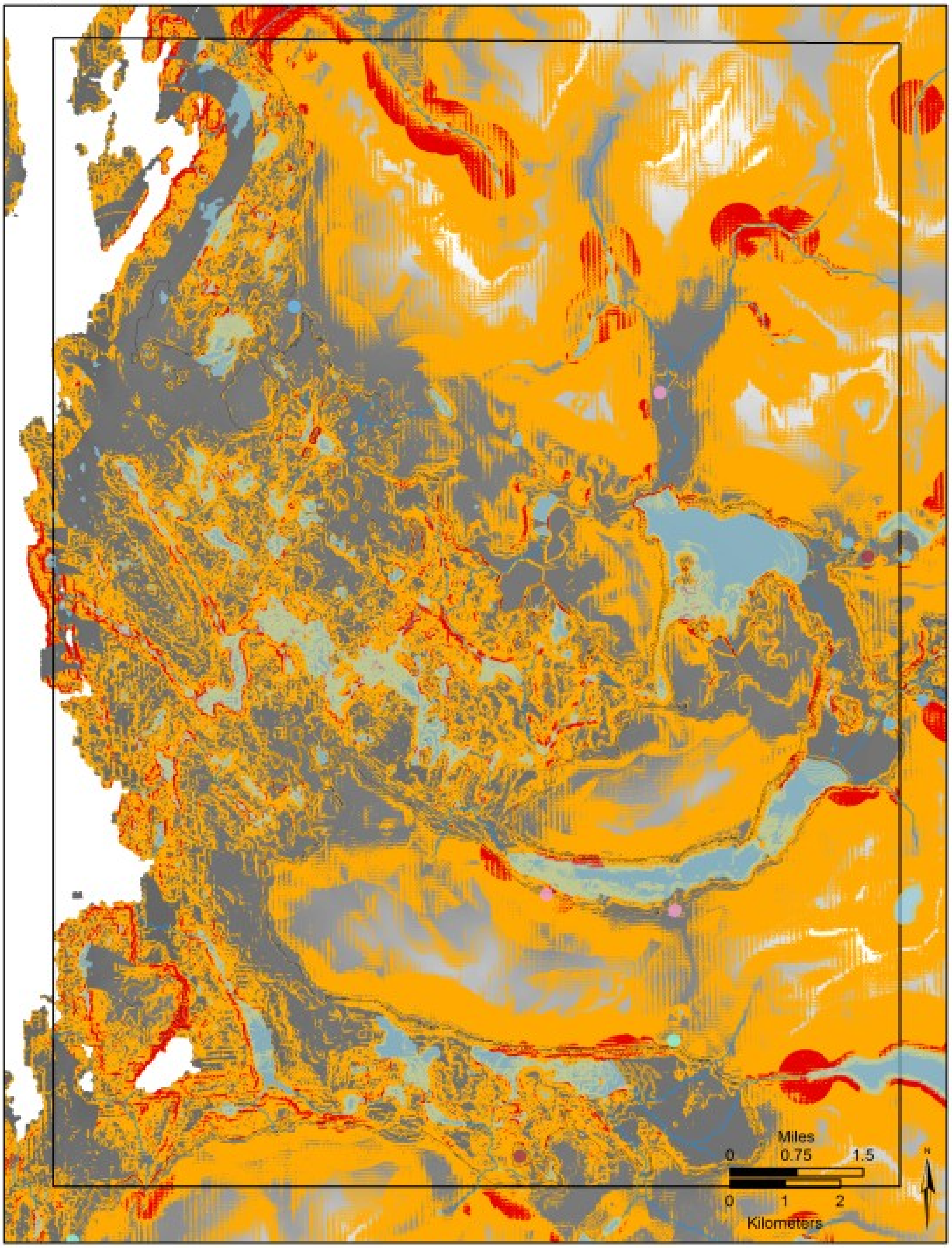
Weight 4 **13,000 cal BP**



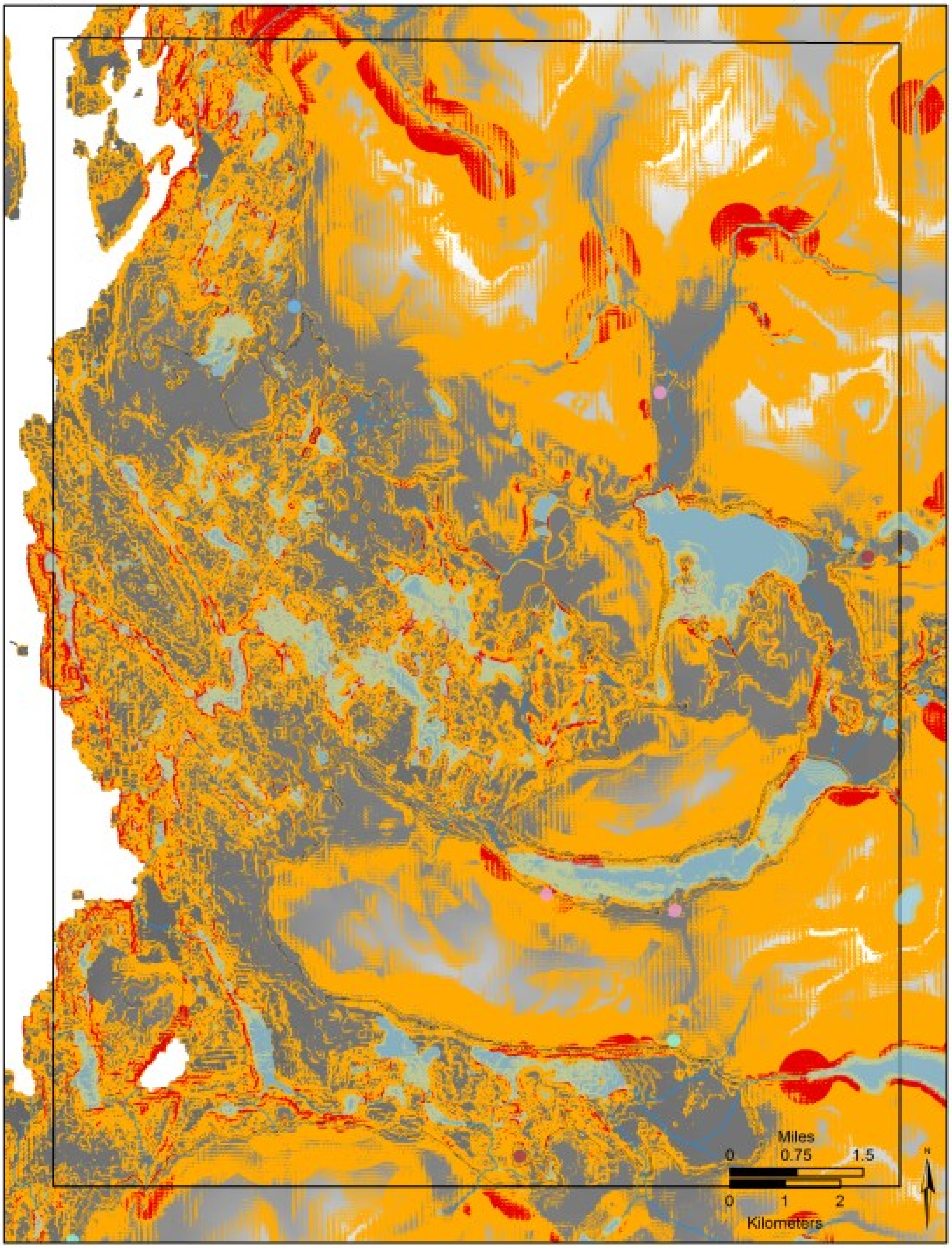
Weight 4 **13,500 cal BP**



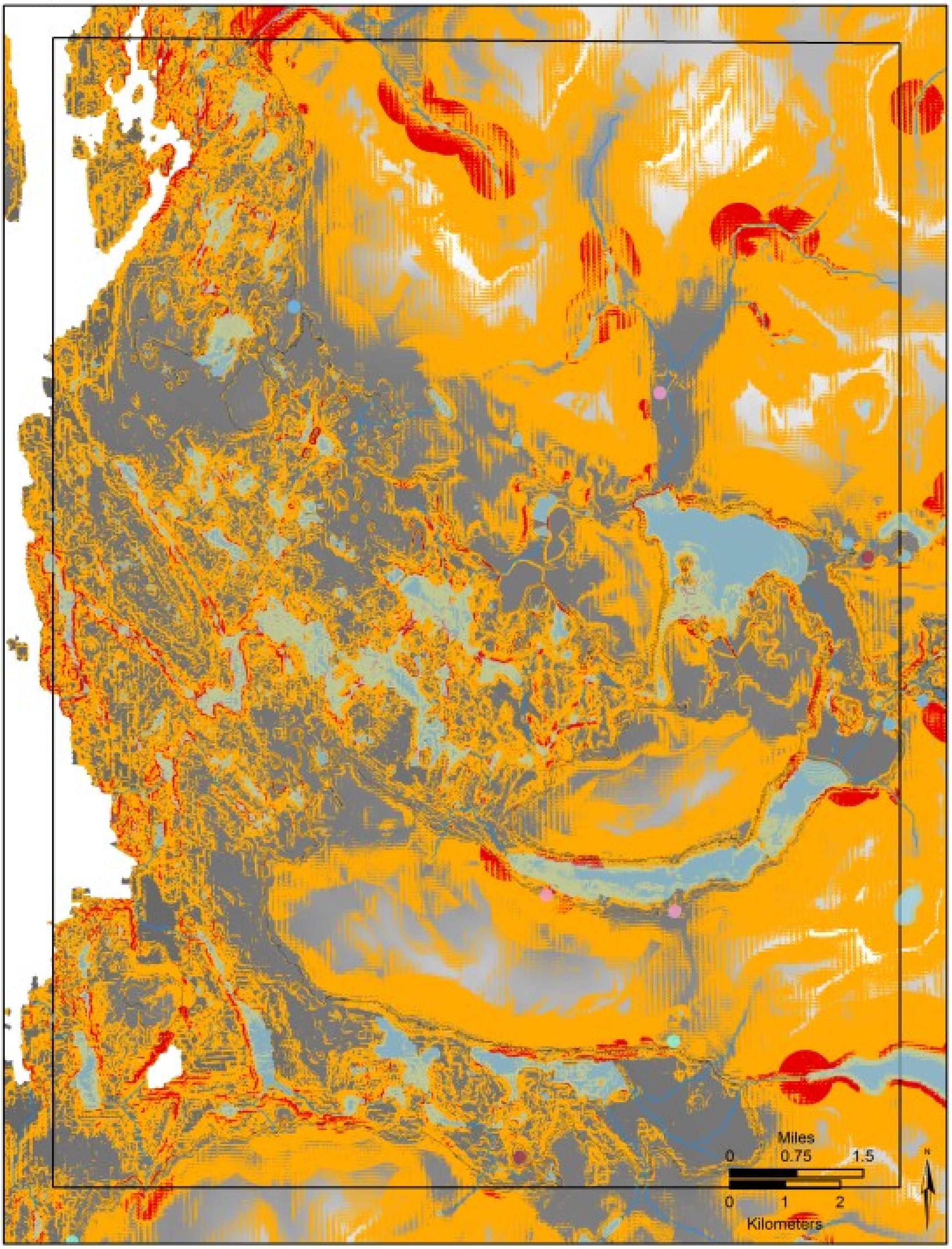
Weight 4 **14,000 cal BP**



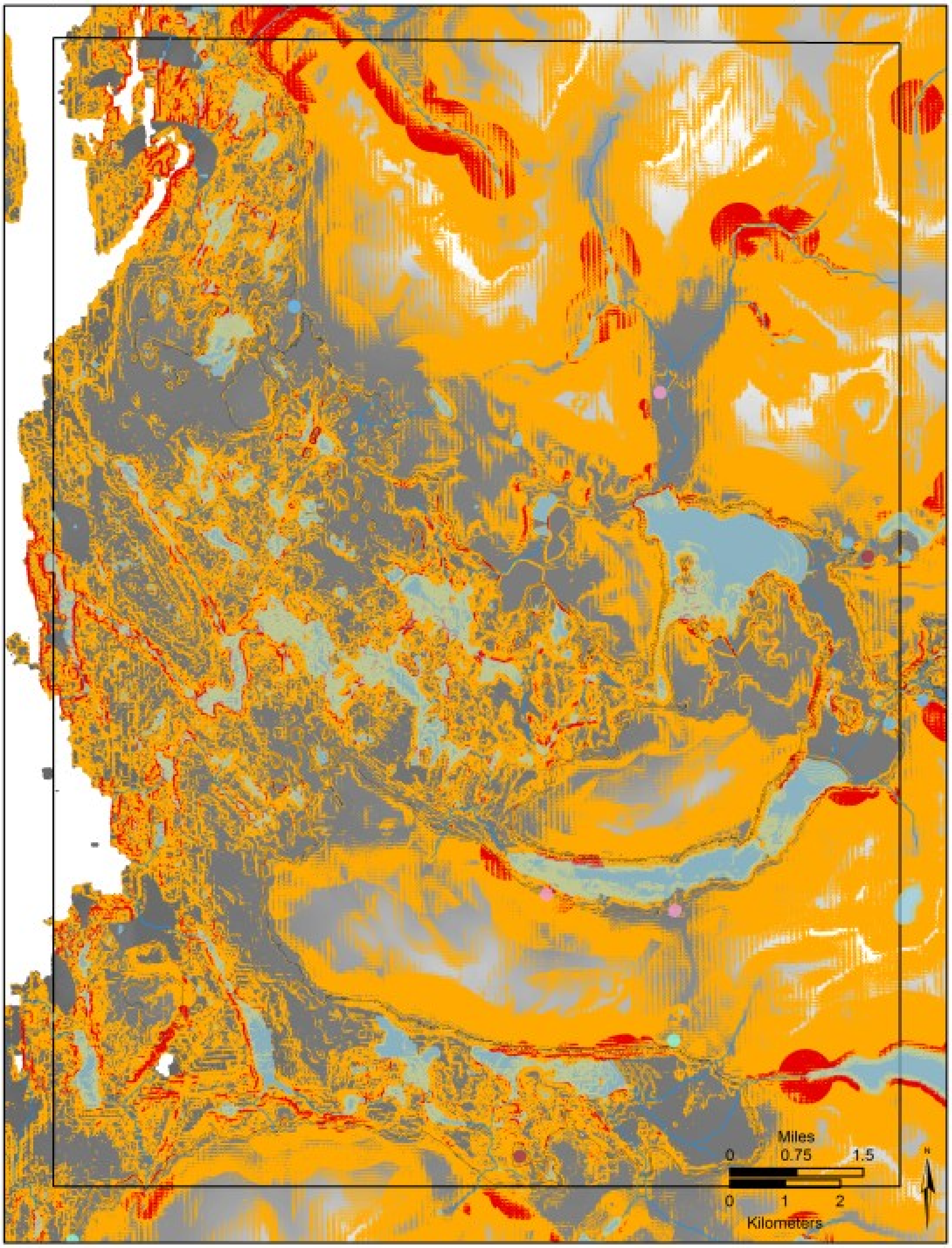
Weight 4 **14,500 cal BP**



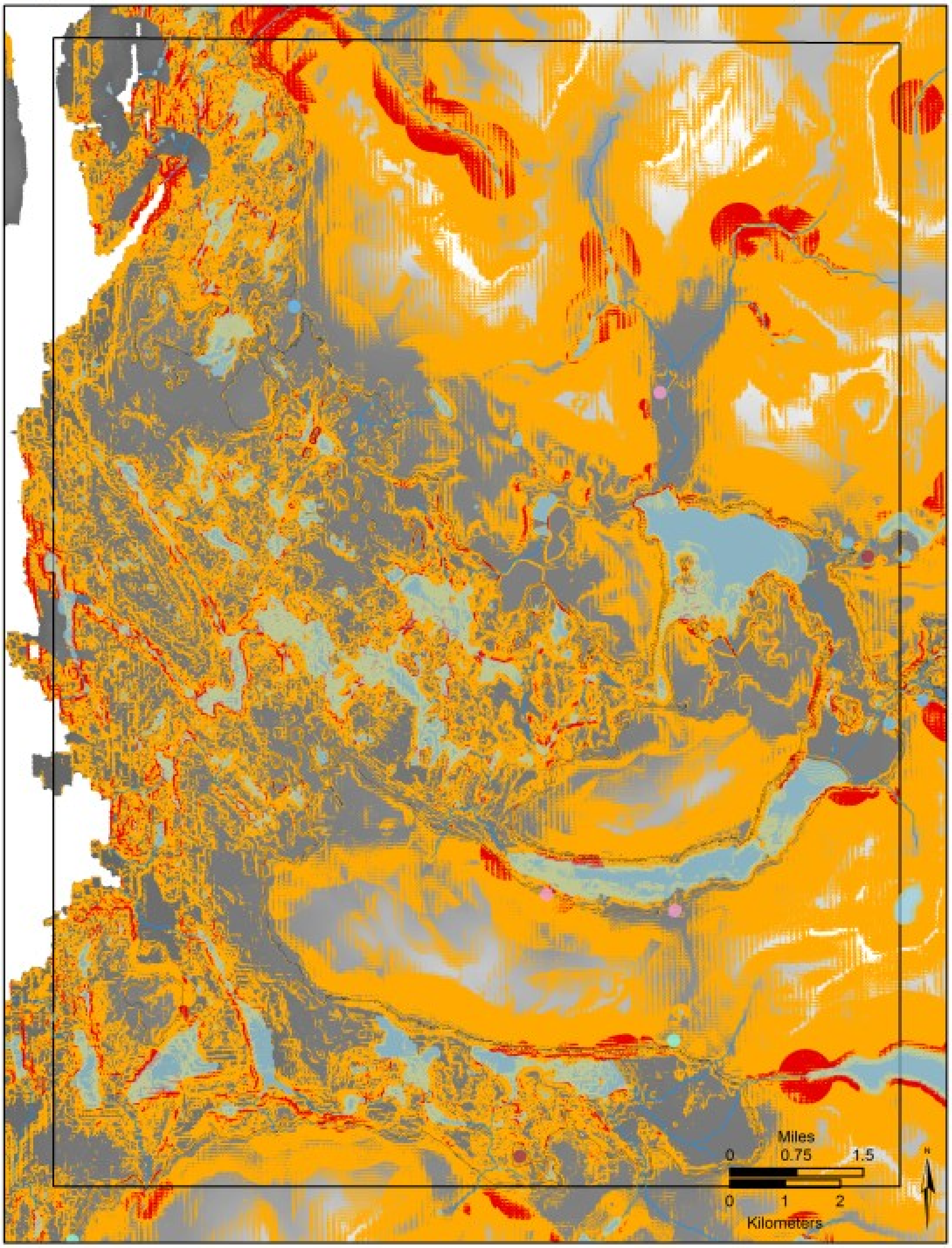
Weight 4 **15,000 cal BP**



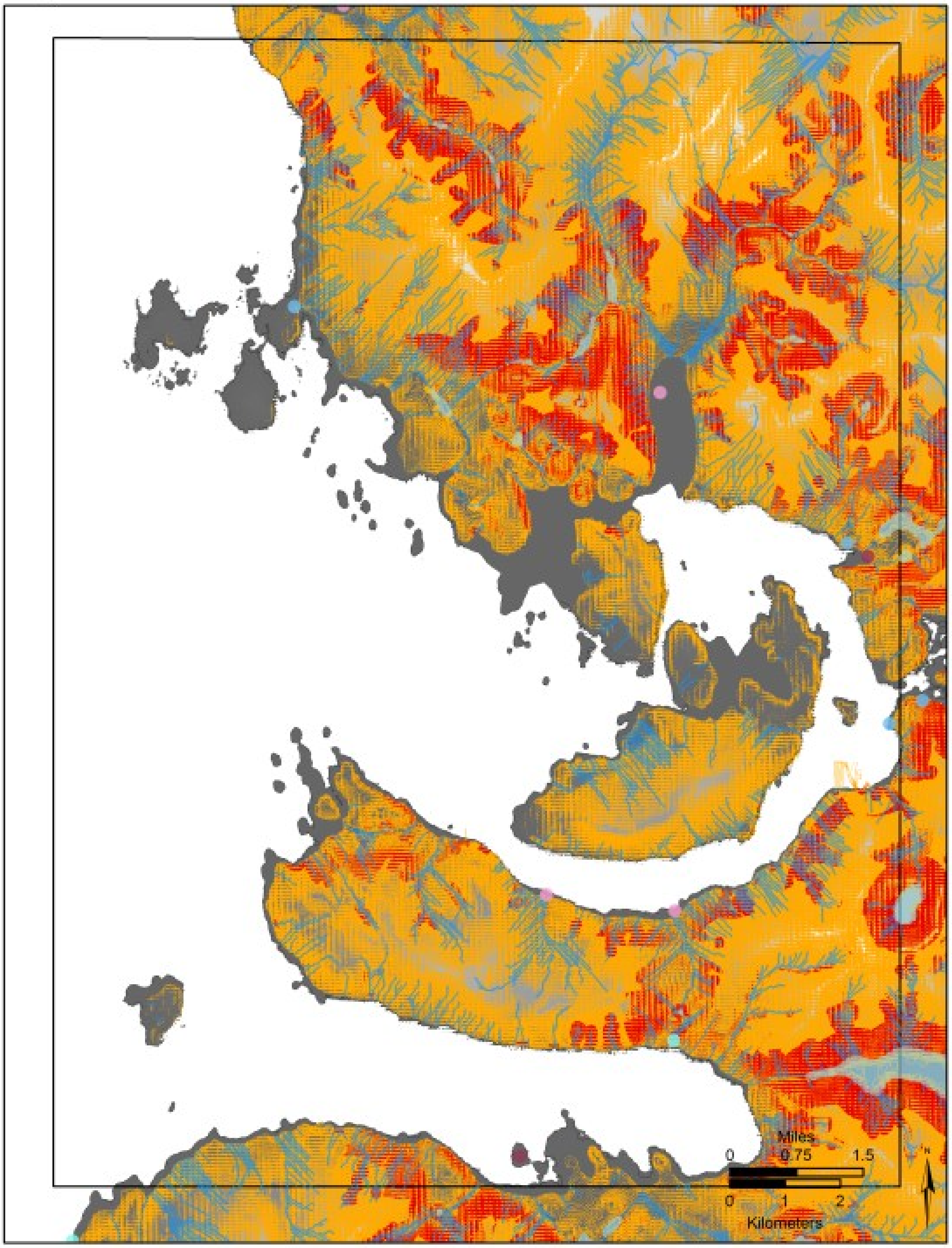
Weight 4 **15,500 cal BP**



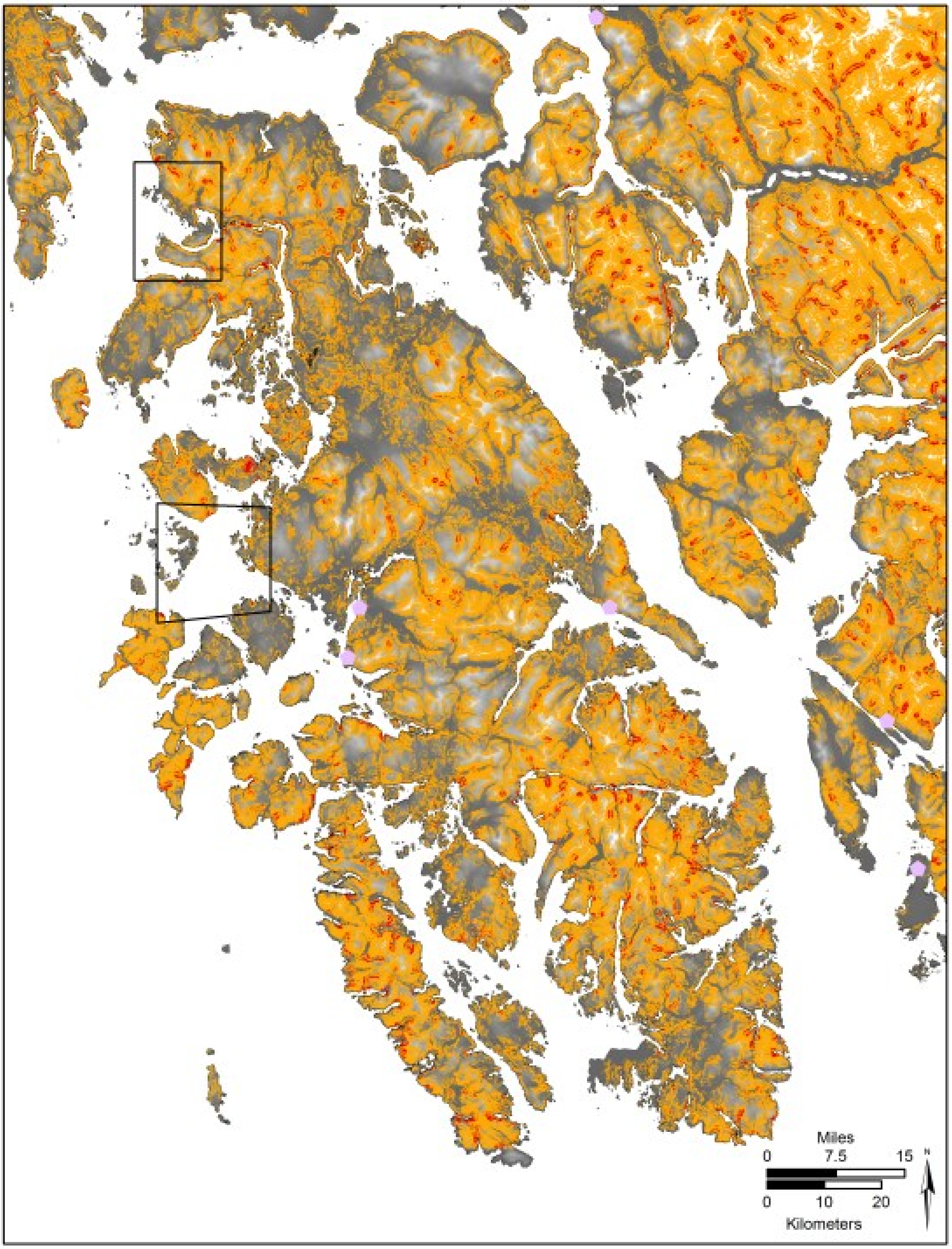
Weight 4 **16,000 cal BP**



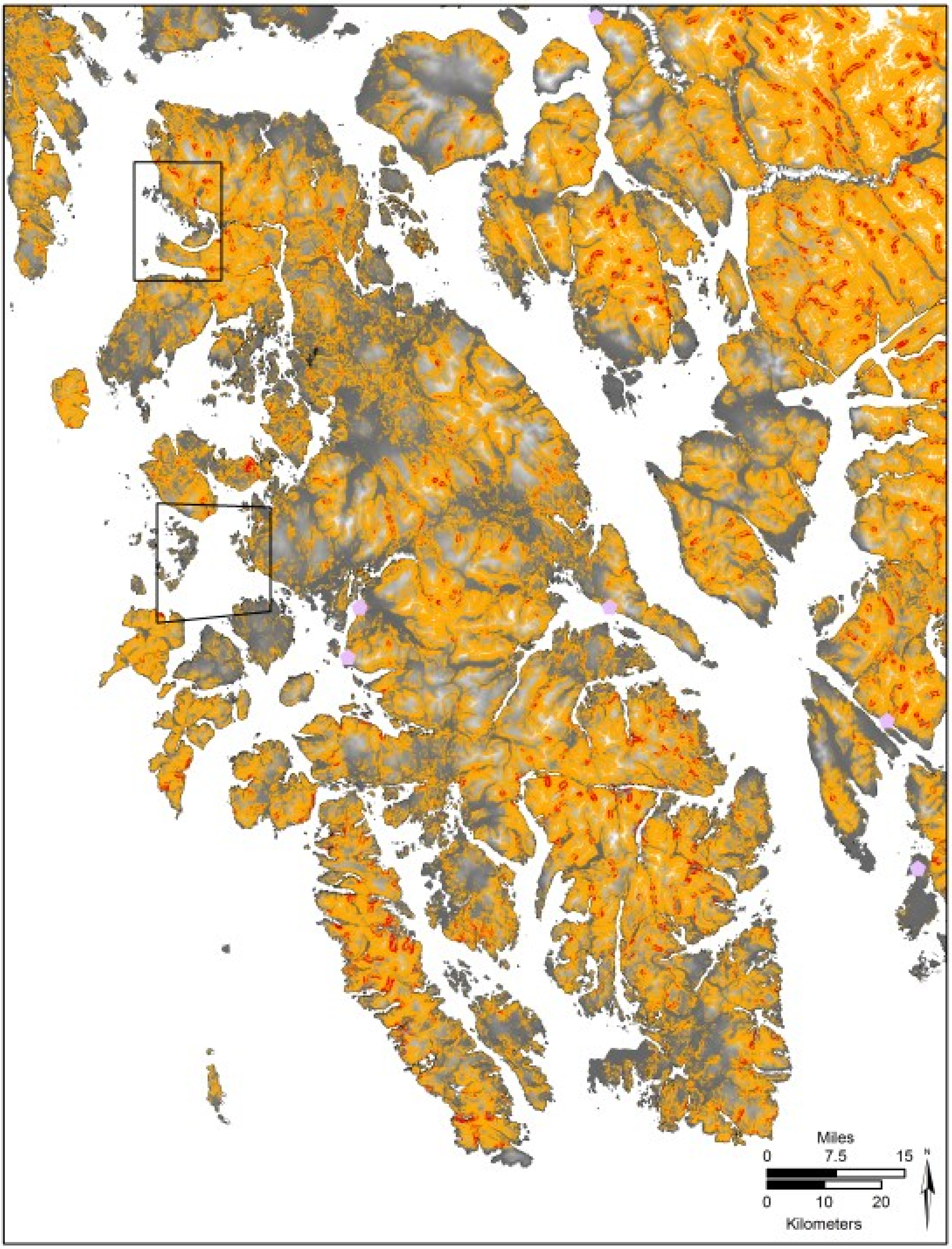
Weight 4 **Modern - Small Area**



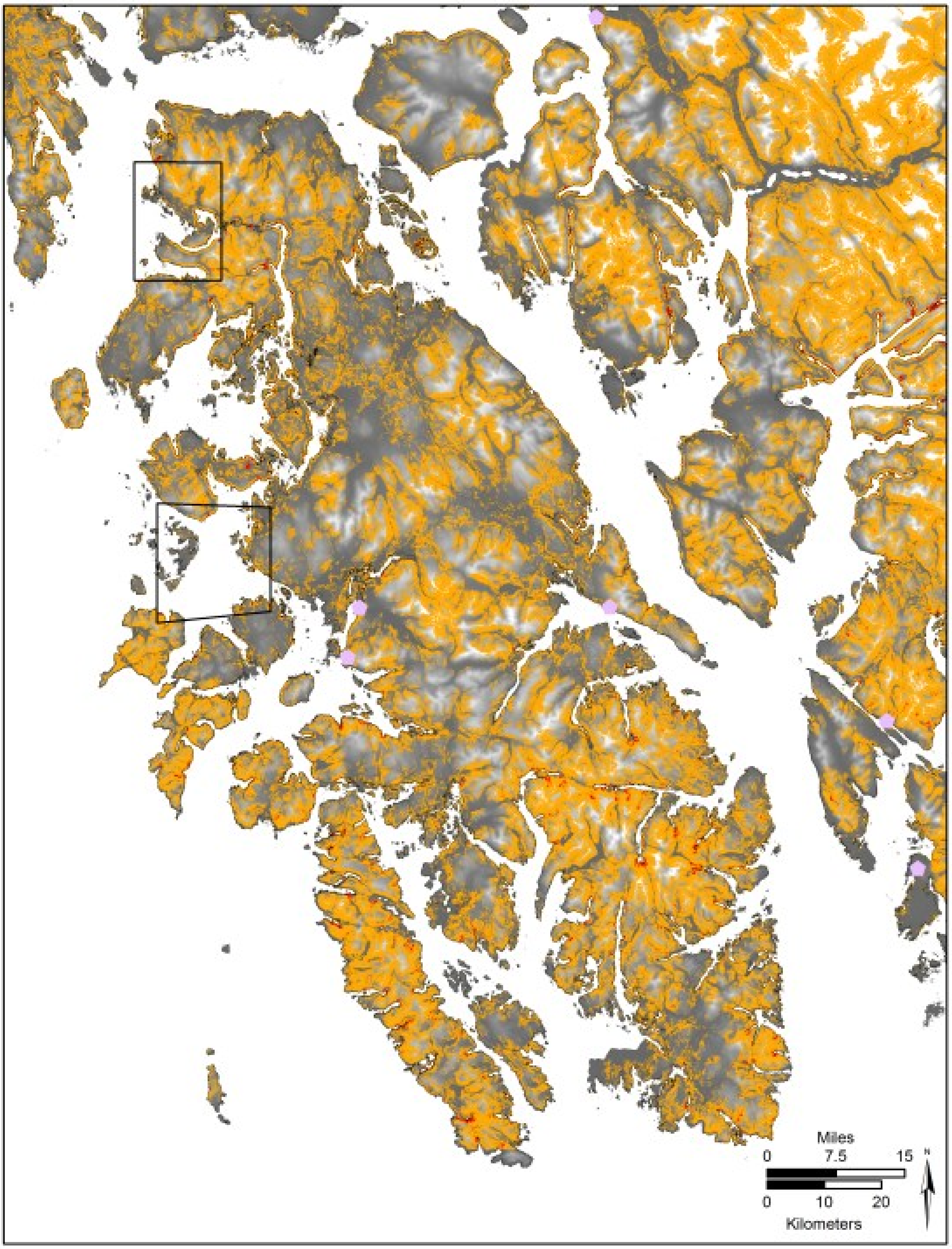
Weight 4 **Modern**



Weight 4 **10,500 cal BP**

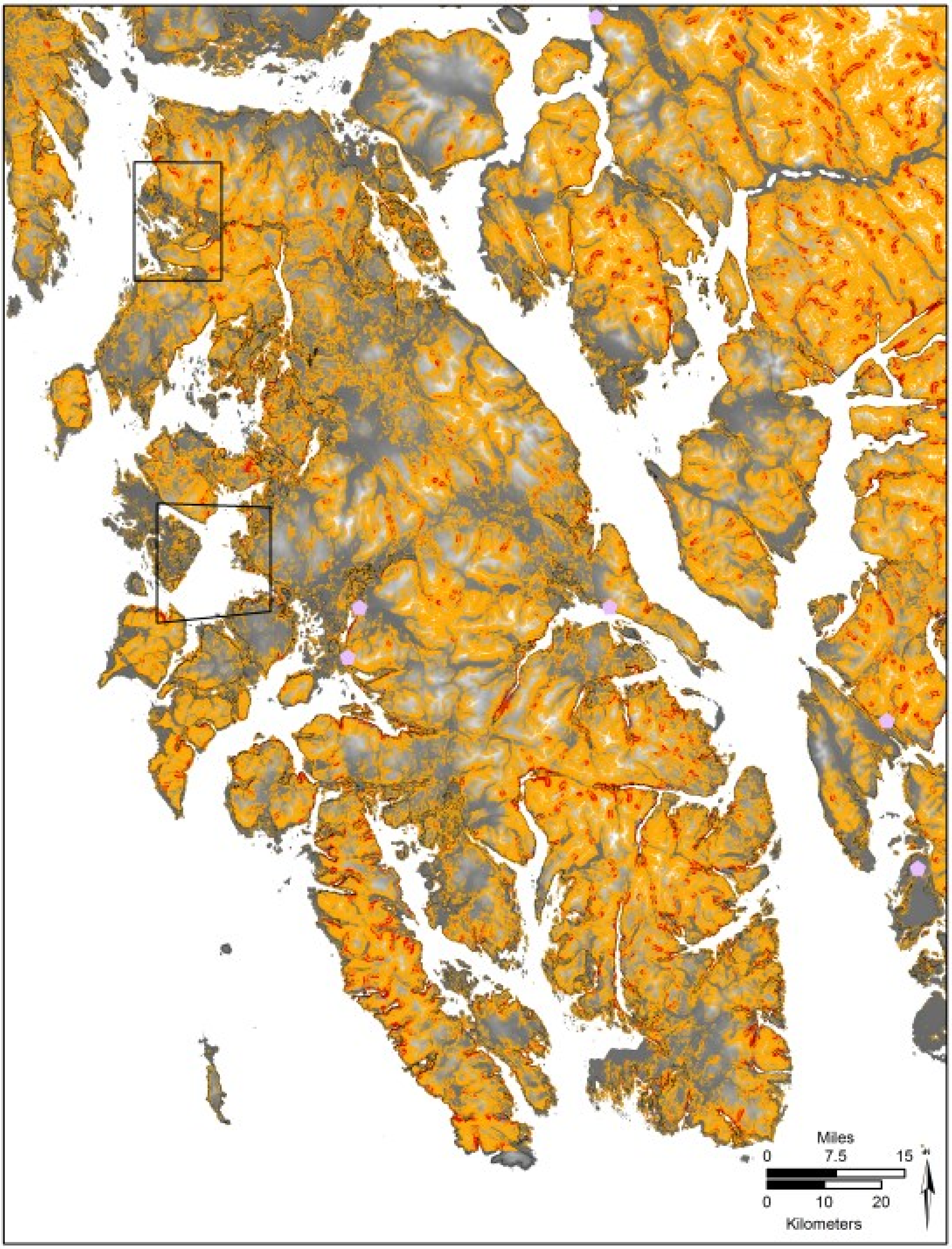


Weight 4a **11,000 cal BP**

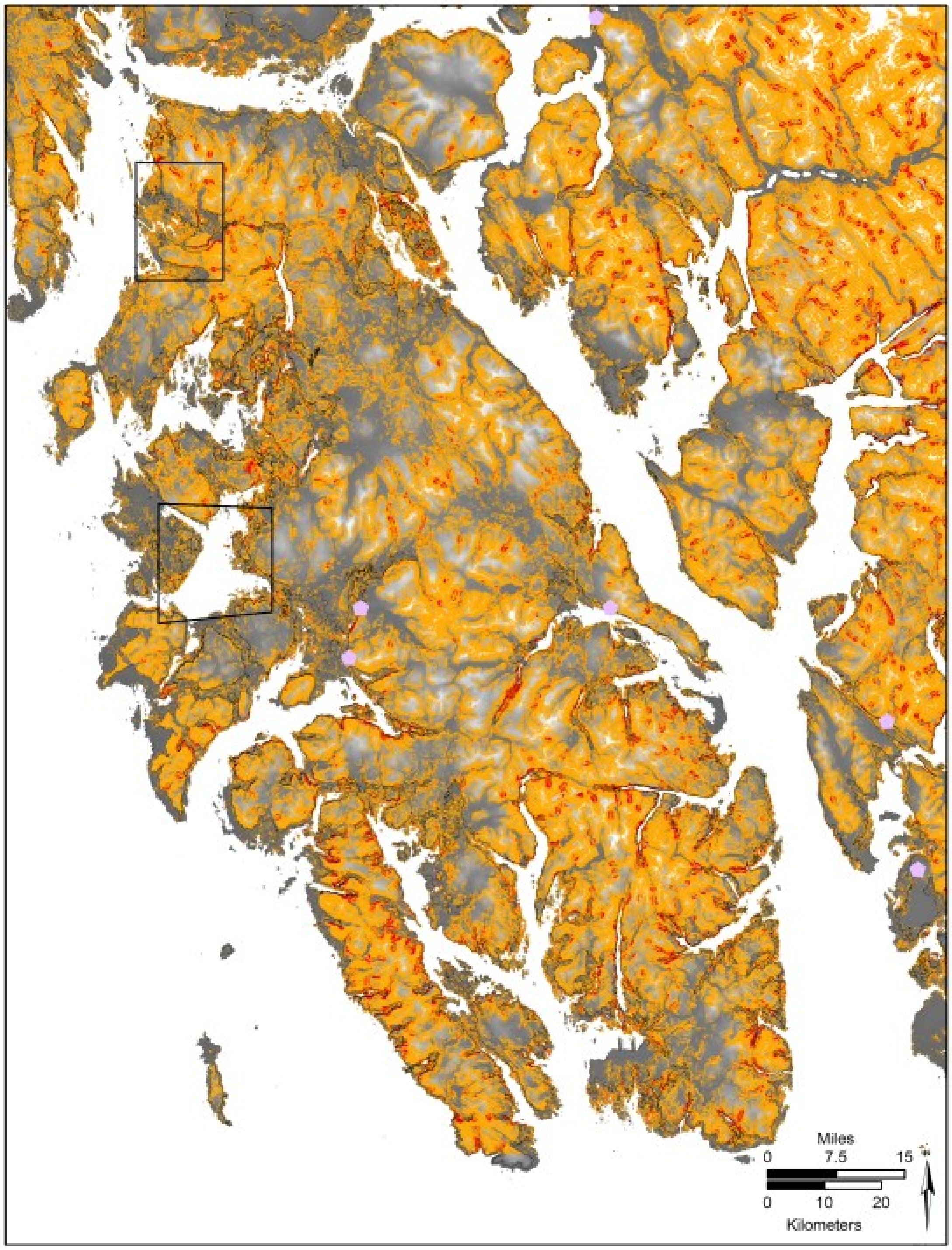


Weight 4 **11,500 cal BP**

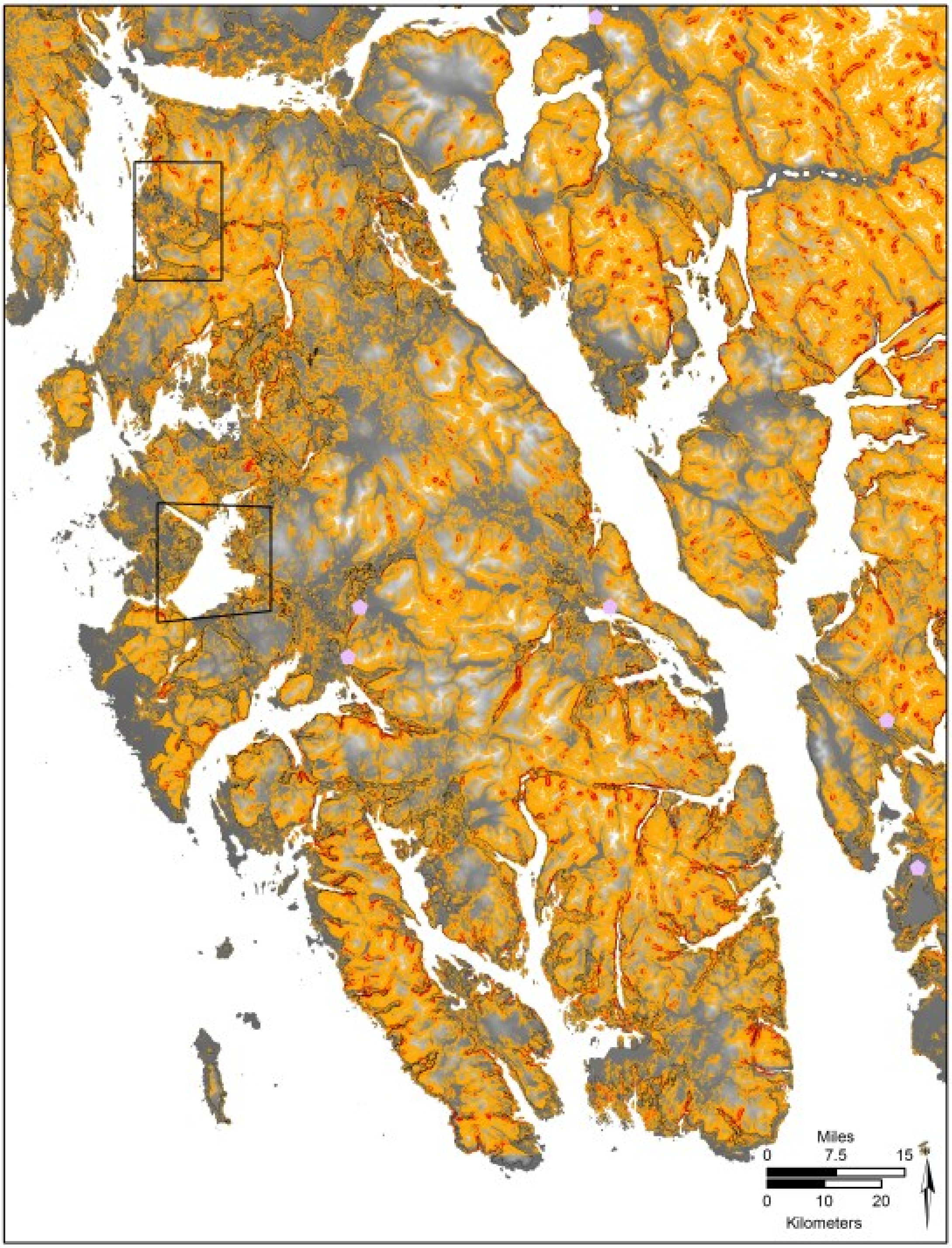
Weight 4 **12,000 cal BP**



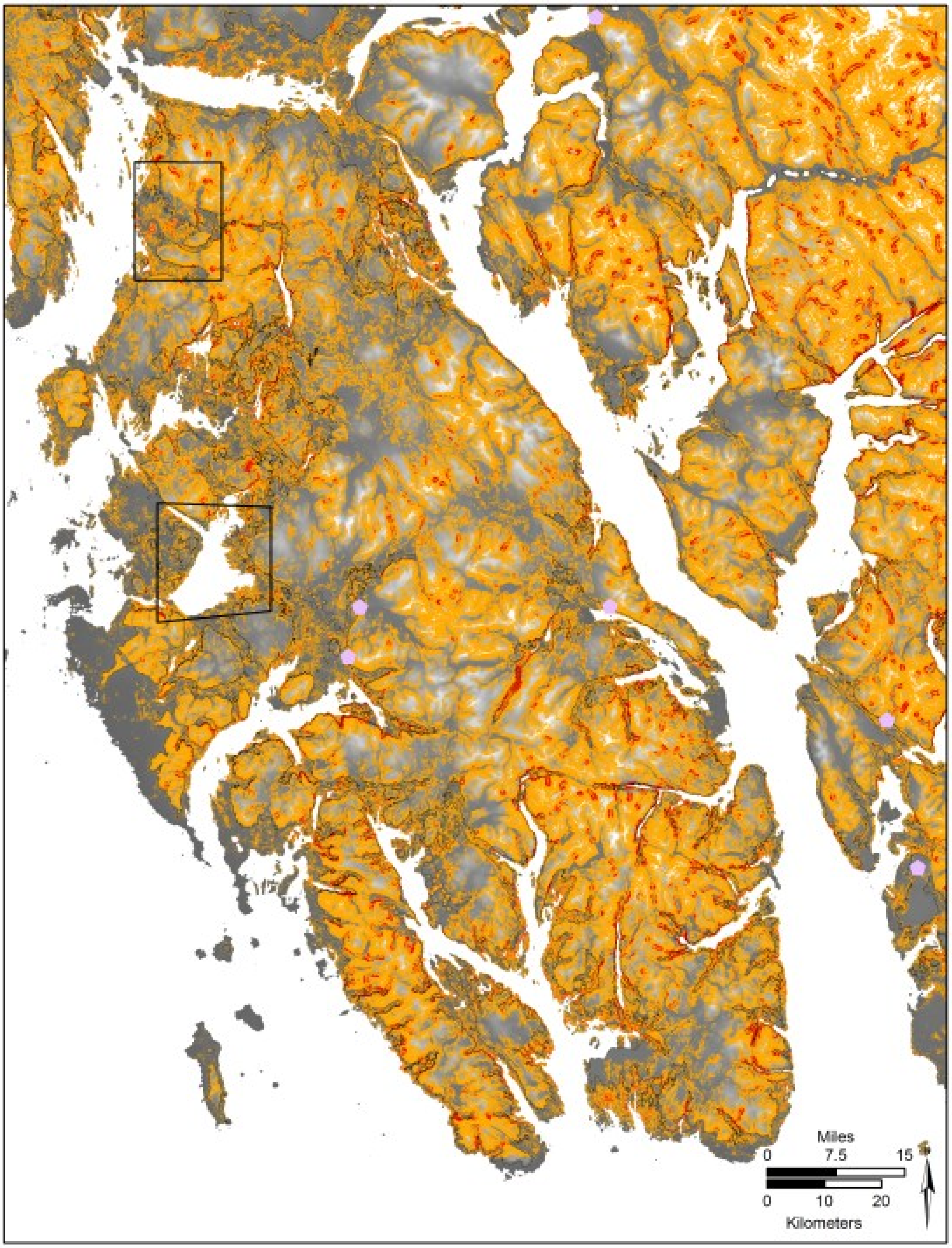
Weight 4 **12,500 cal BP**



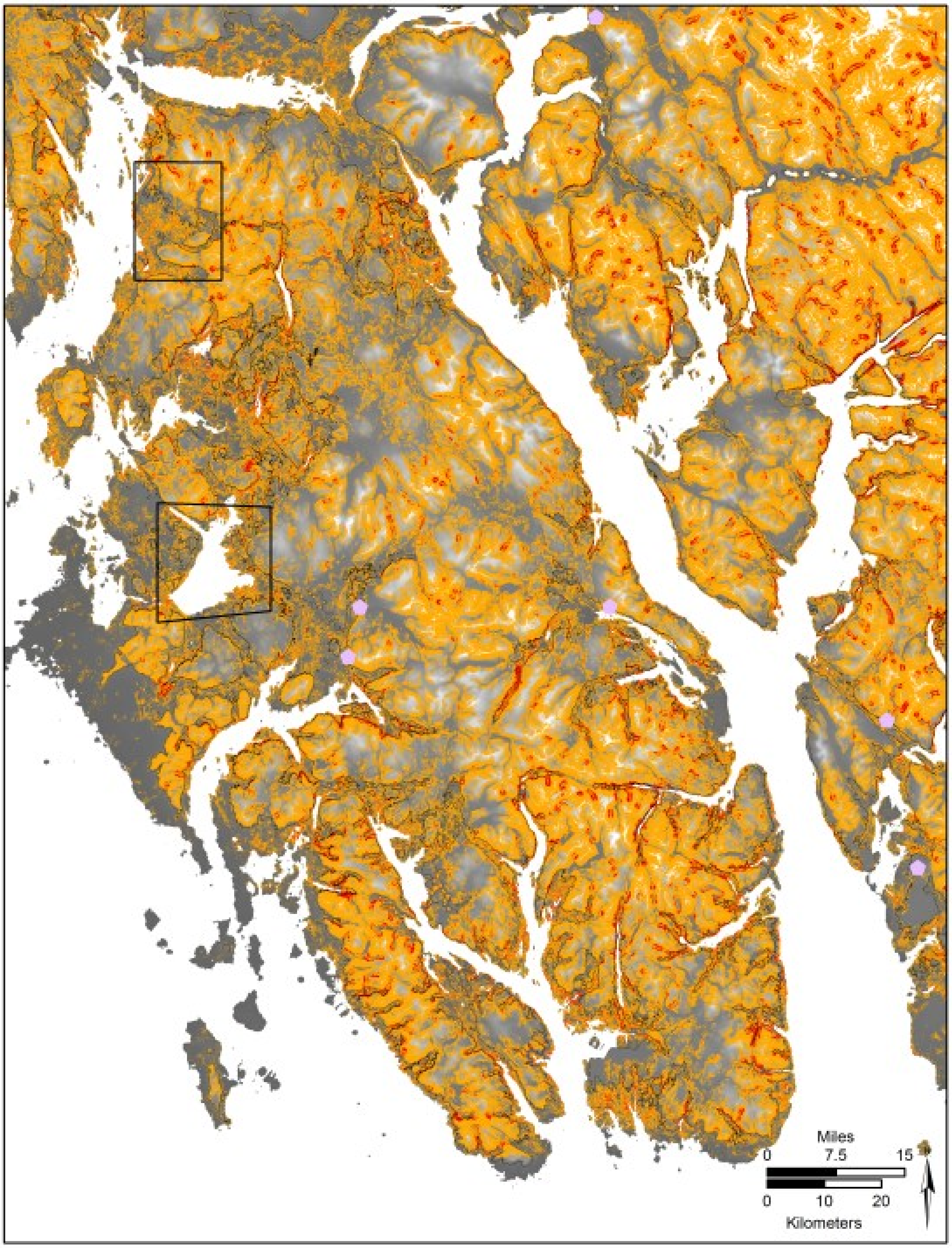
Weight 4 **13,000 cal BP**



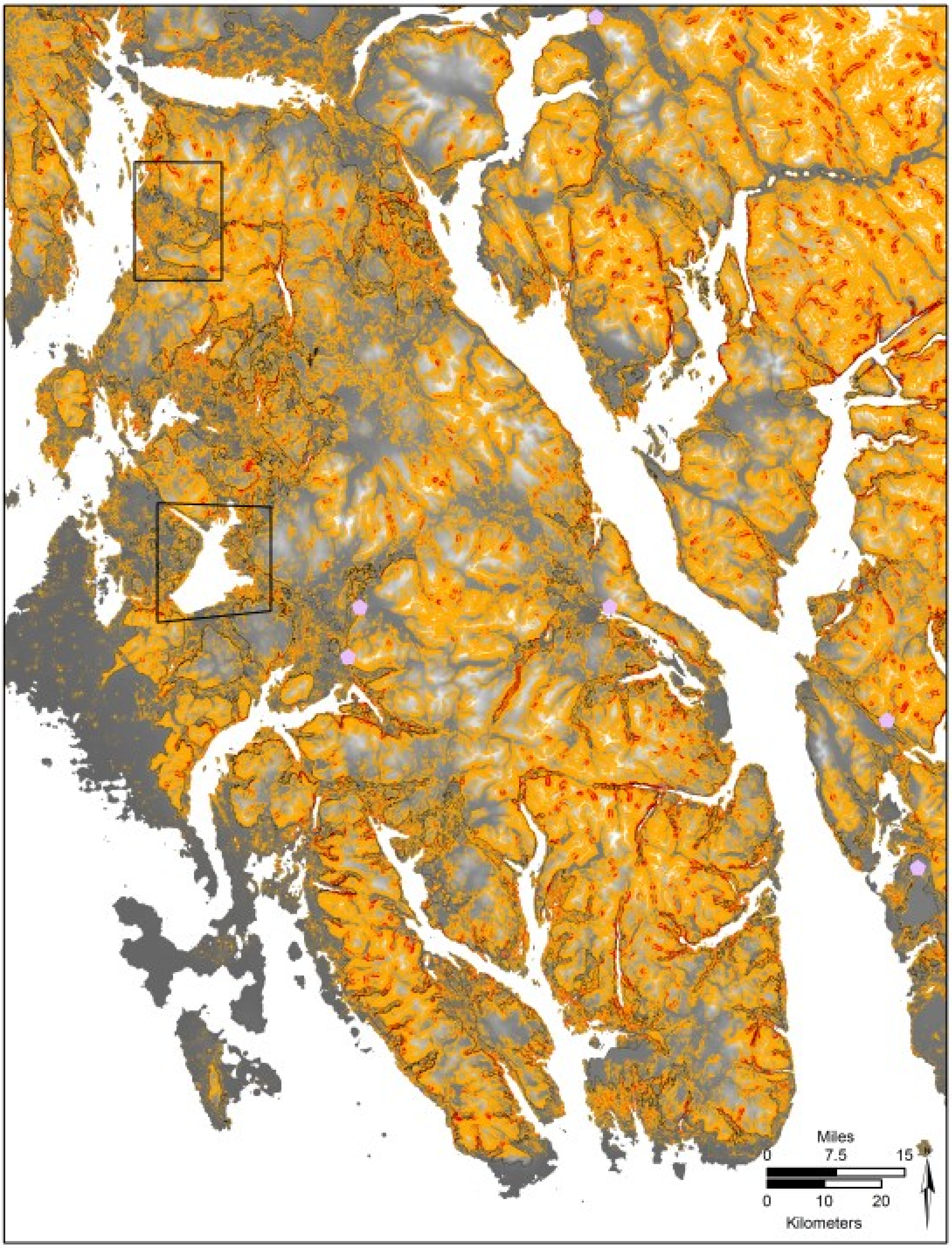
Weight 4 **13,500 cal BP**



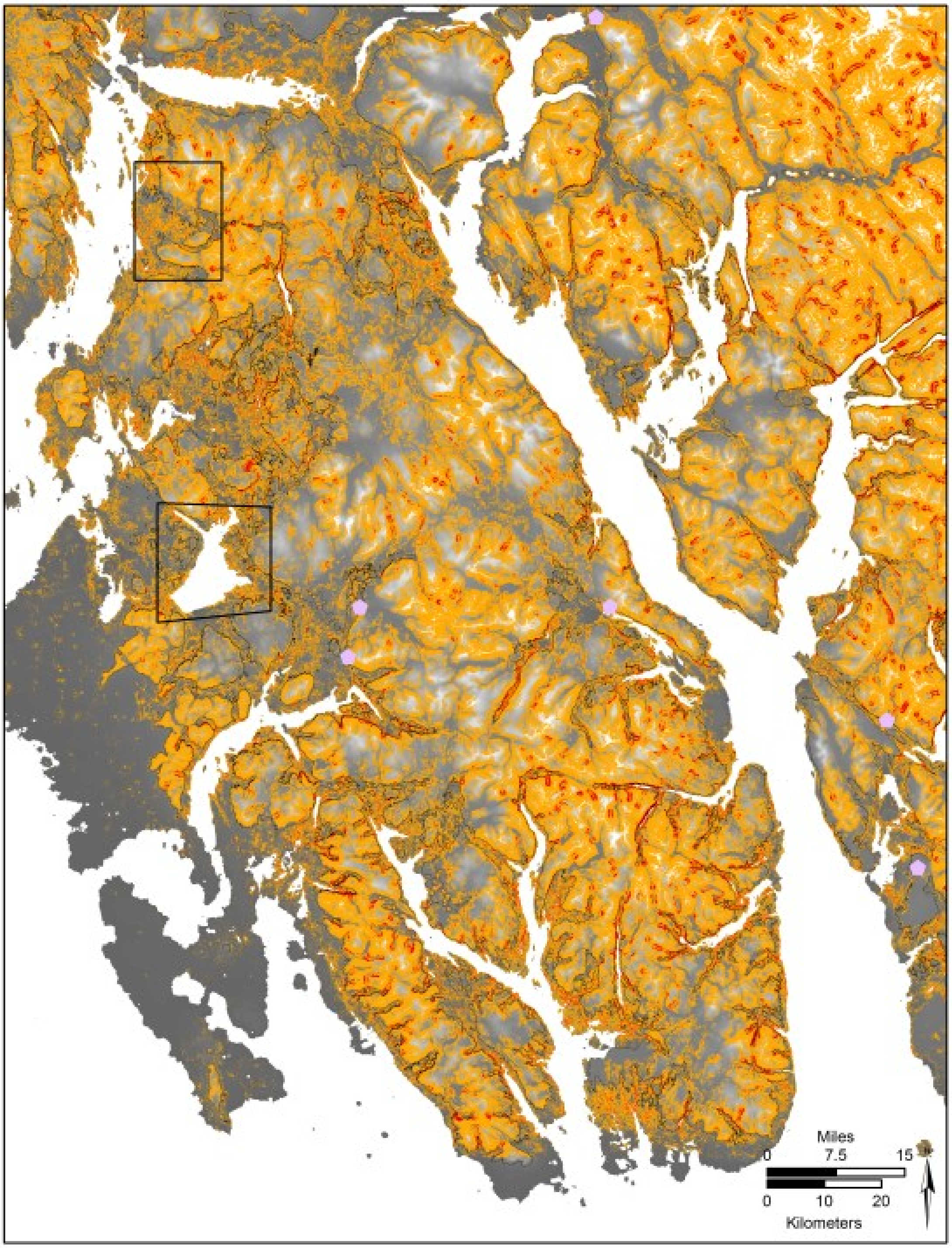
Weight 4 **14,000 cal BP**



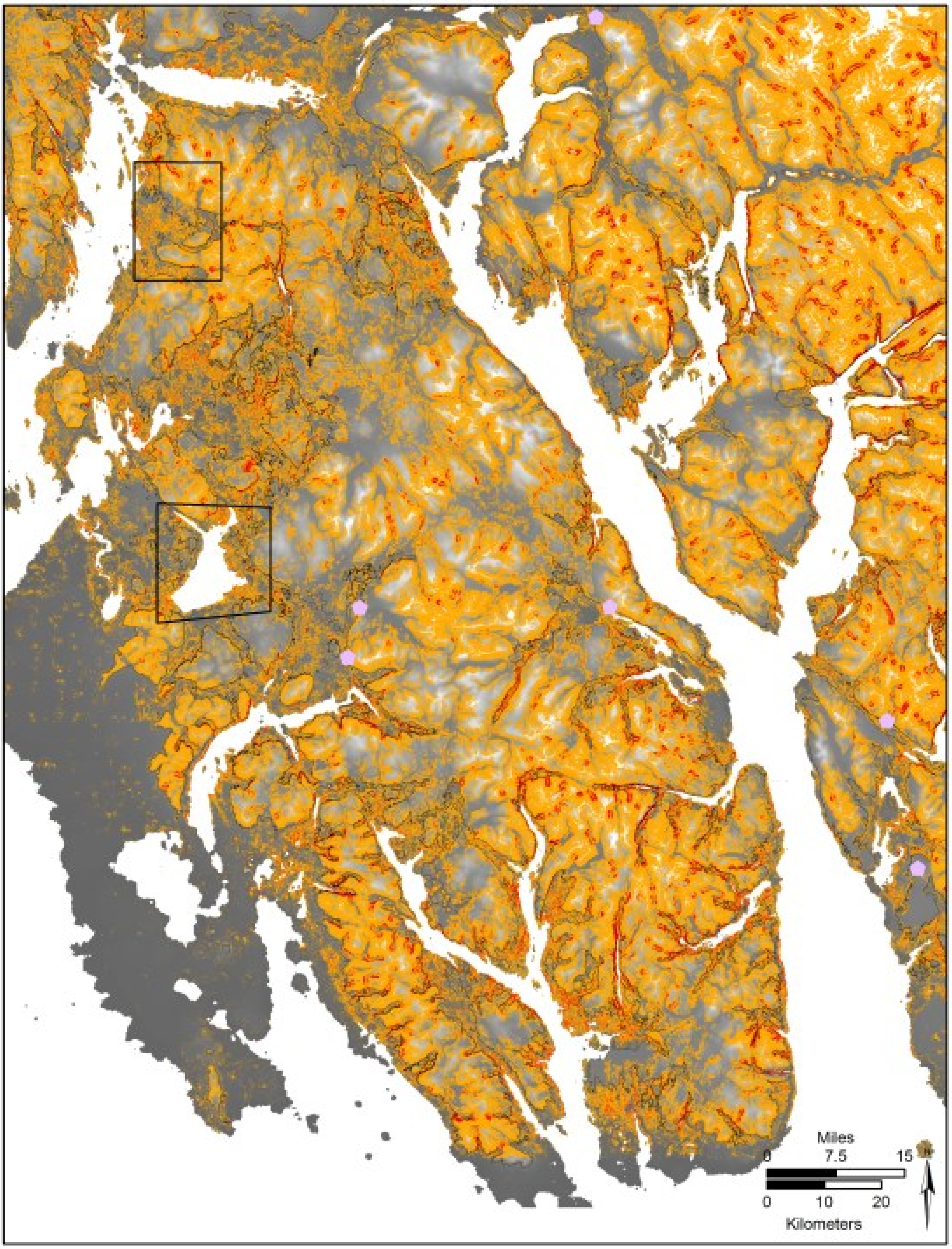
Weight 4 **14,500 cal BP**



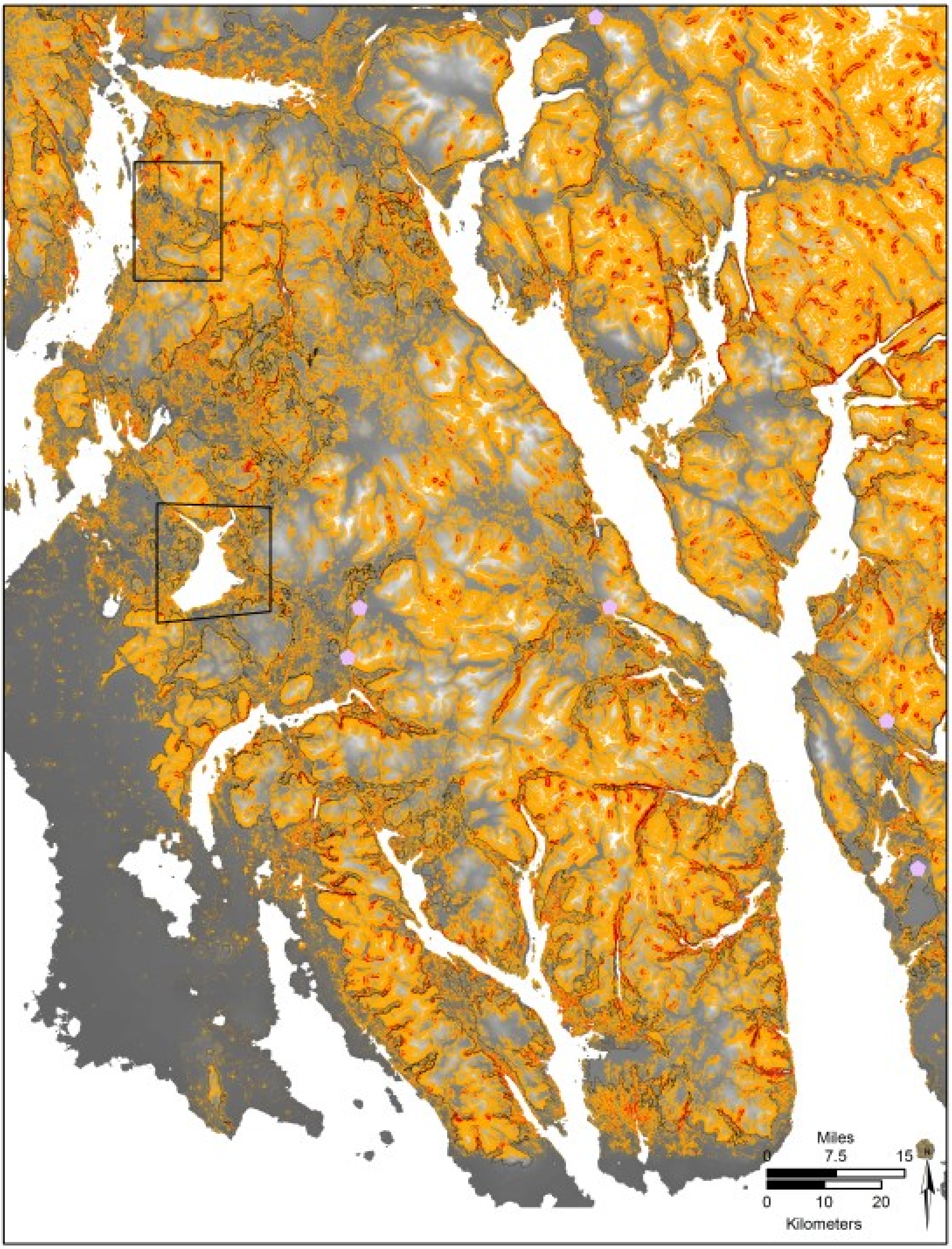
Weight 4 **15,000 cal BP**



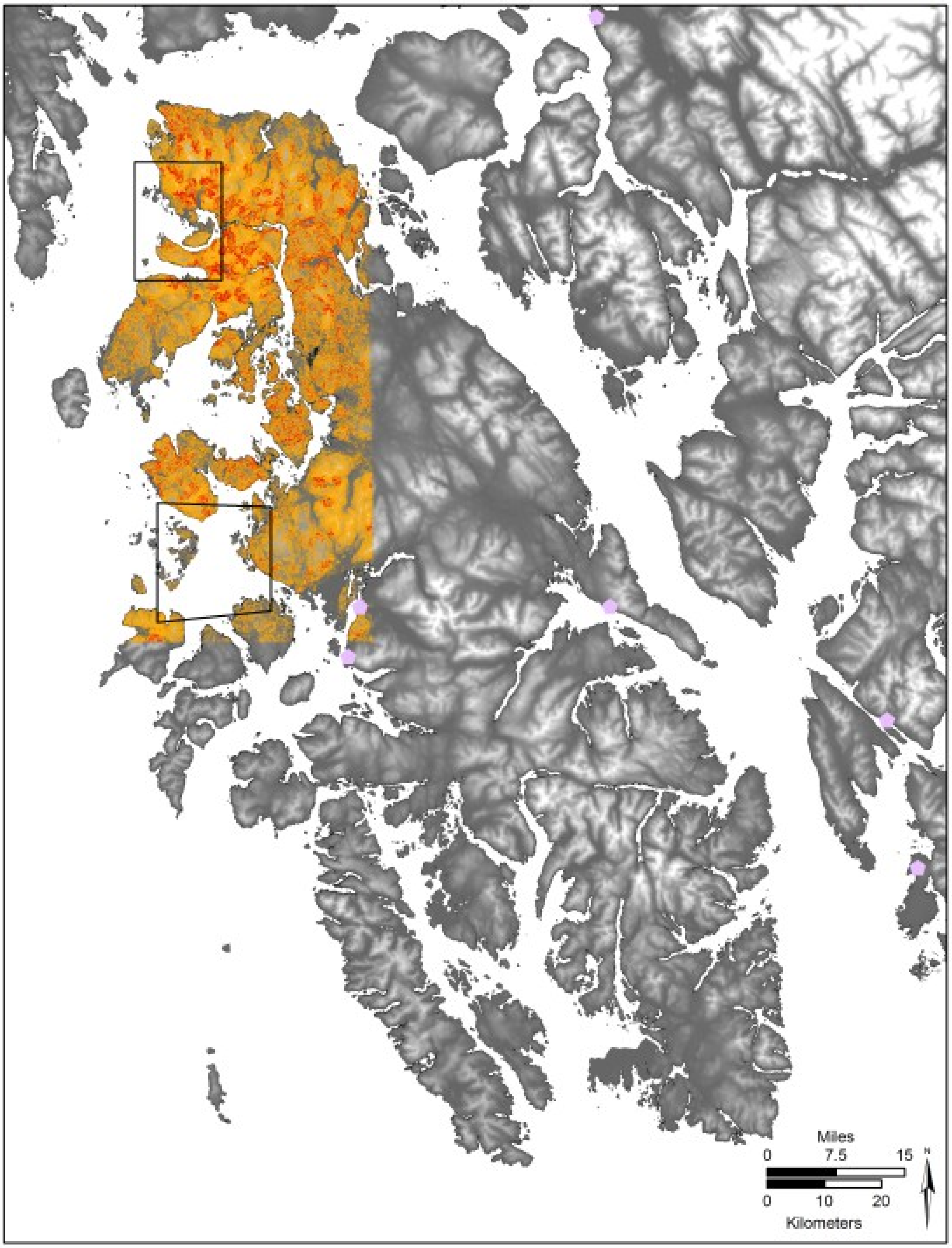
Weight 4 **15,500 cal BP**



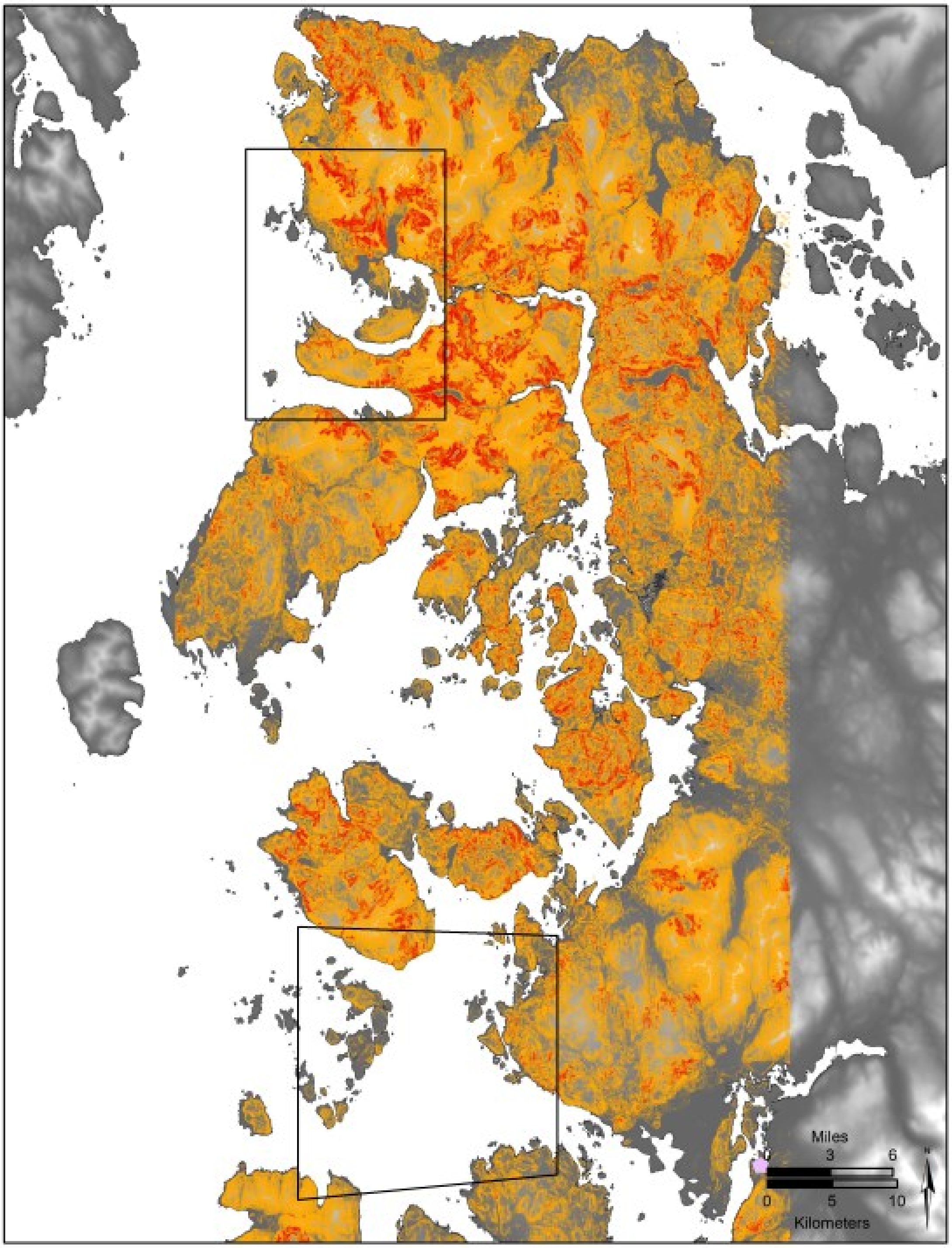
Weight 4 **16,000 cal BP**



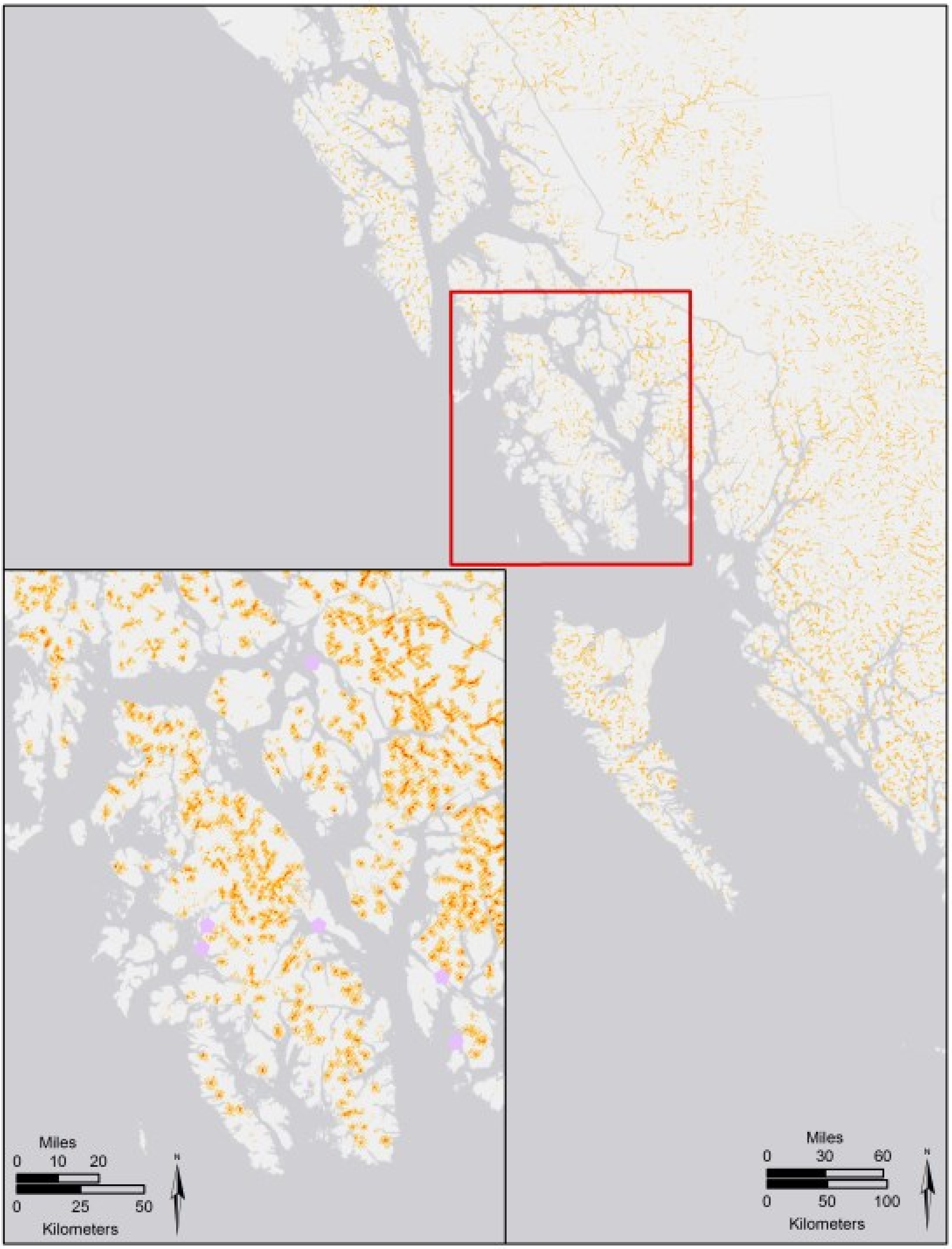
Weight 4 **Modern - Small Area**



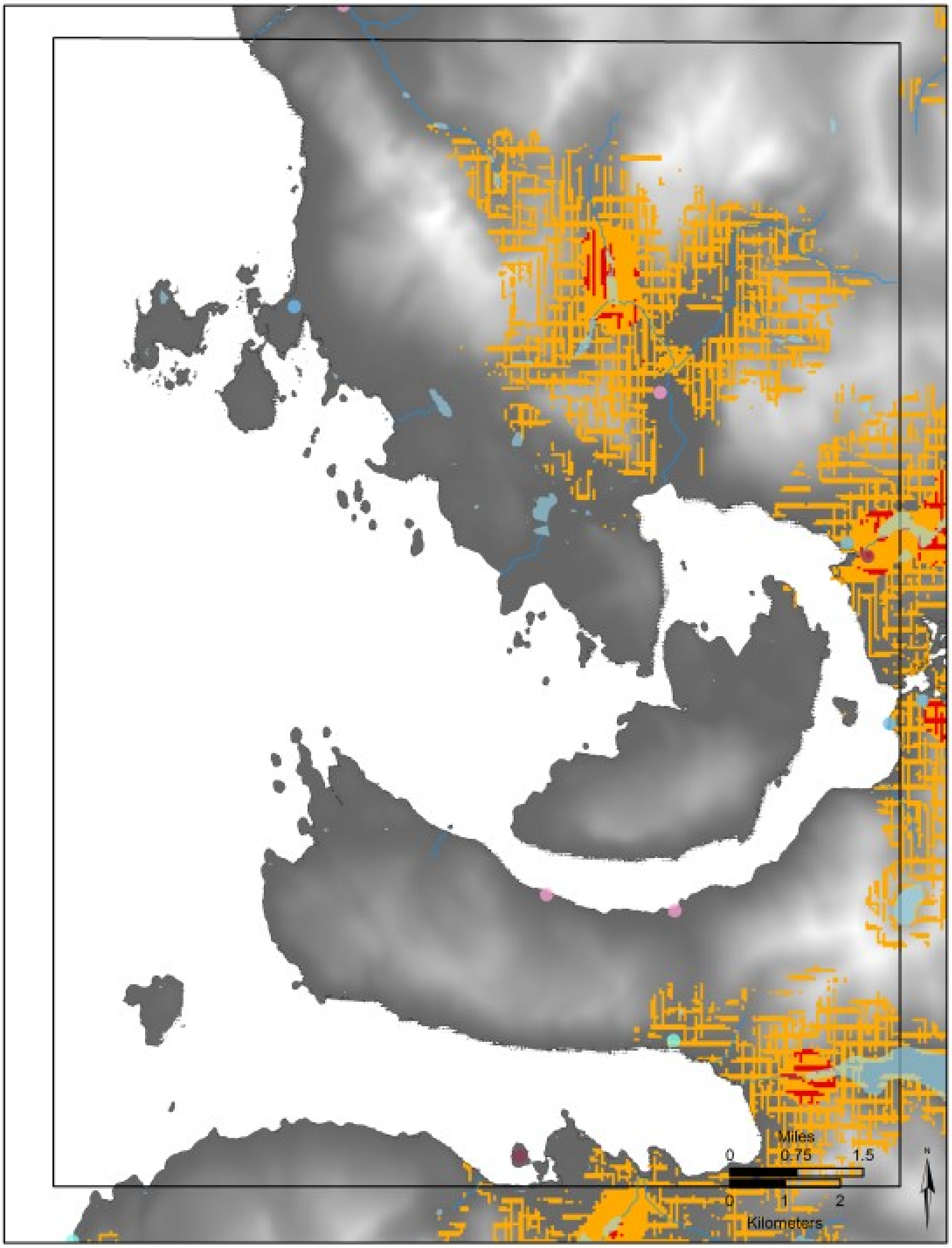
Weight 4 **Modern - Small Area**



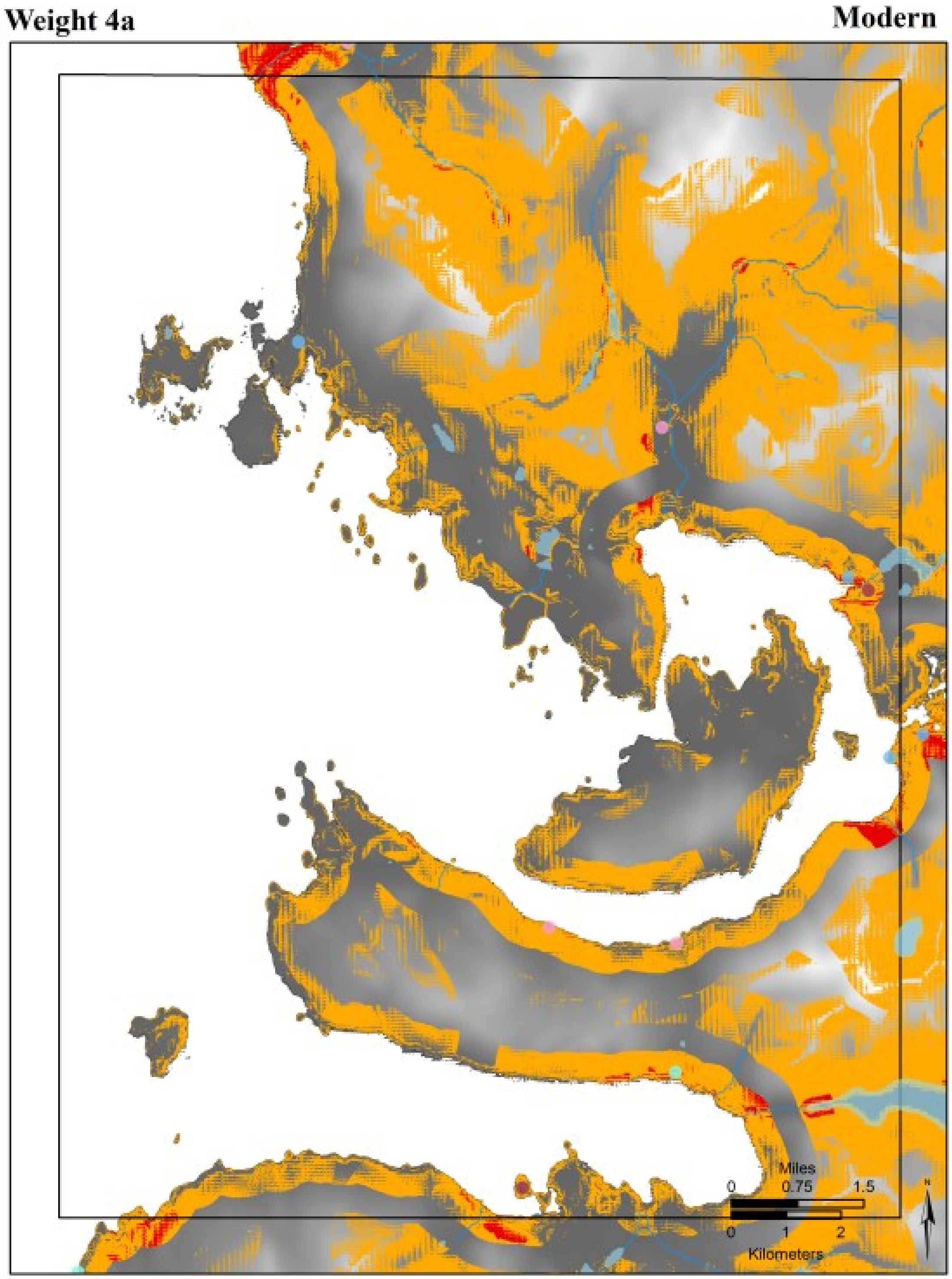
Weight 4 **NWC - modern**



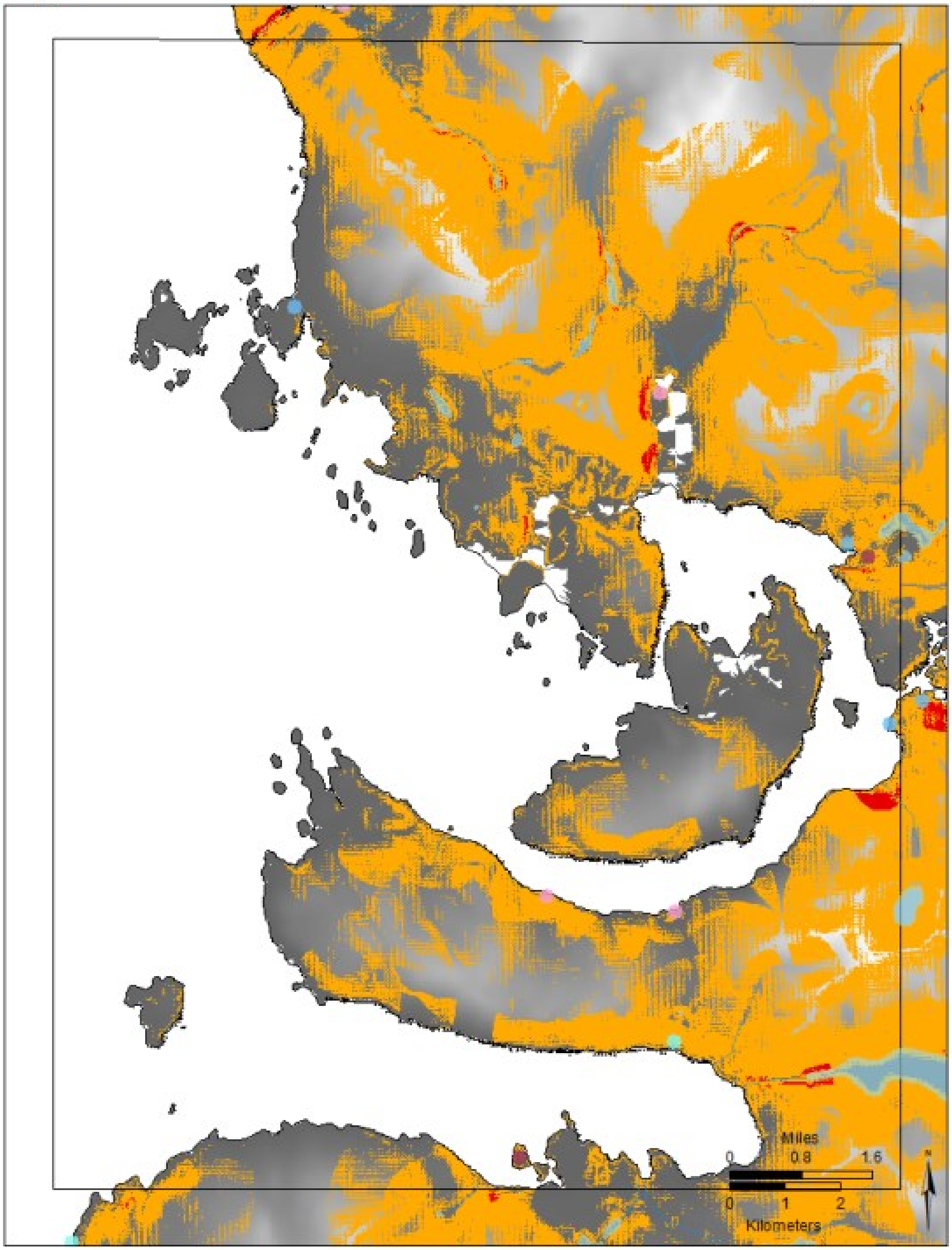
Weight 4 **NWC - modern**



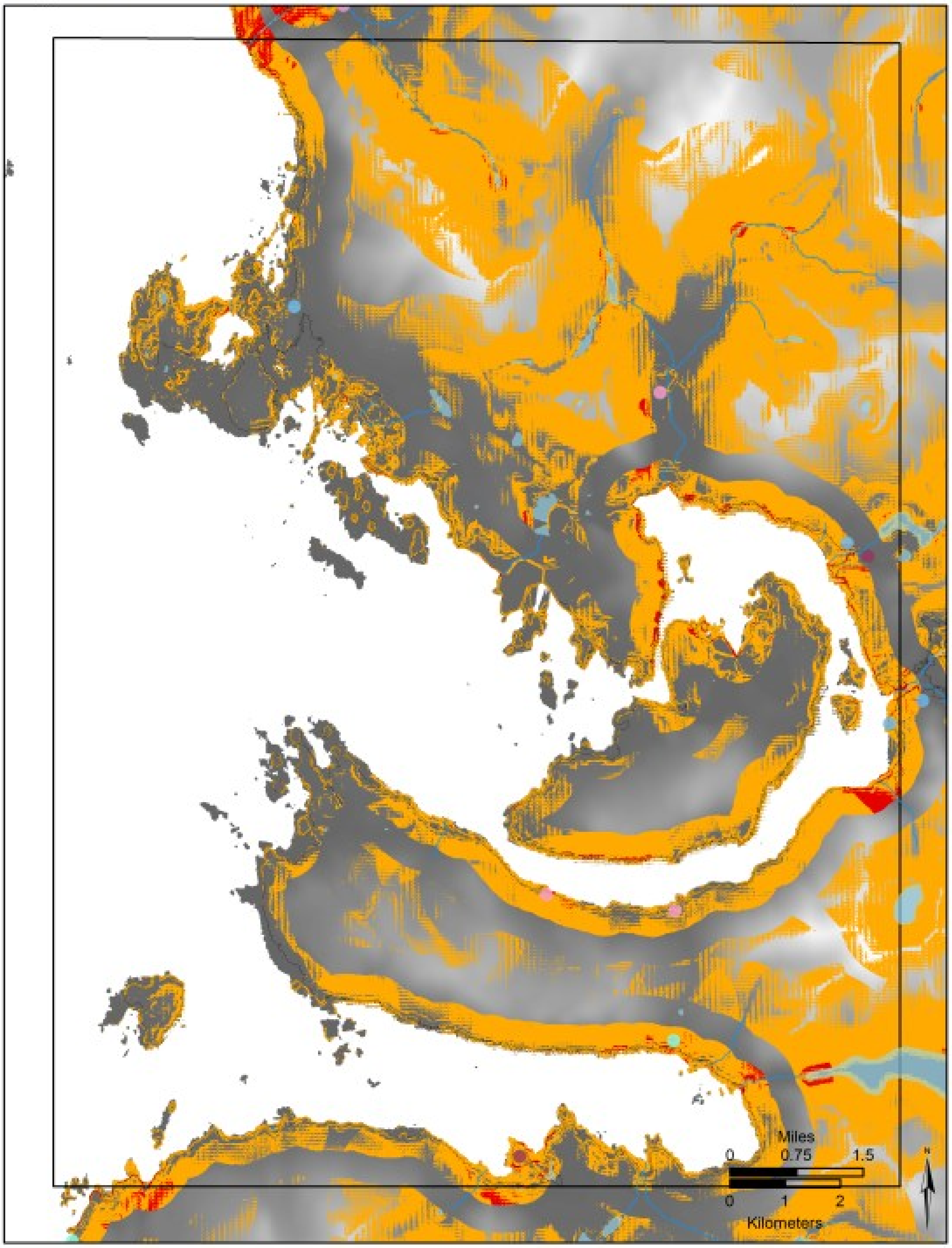
C.9 Weighted Overlay 4a



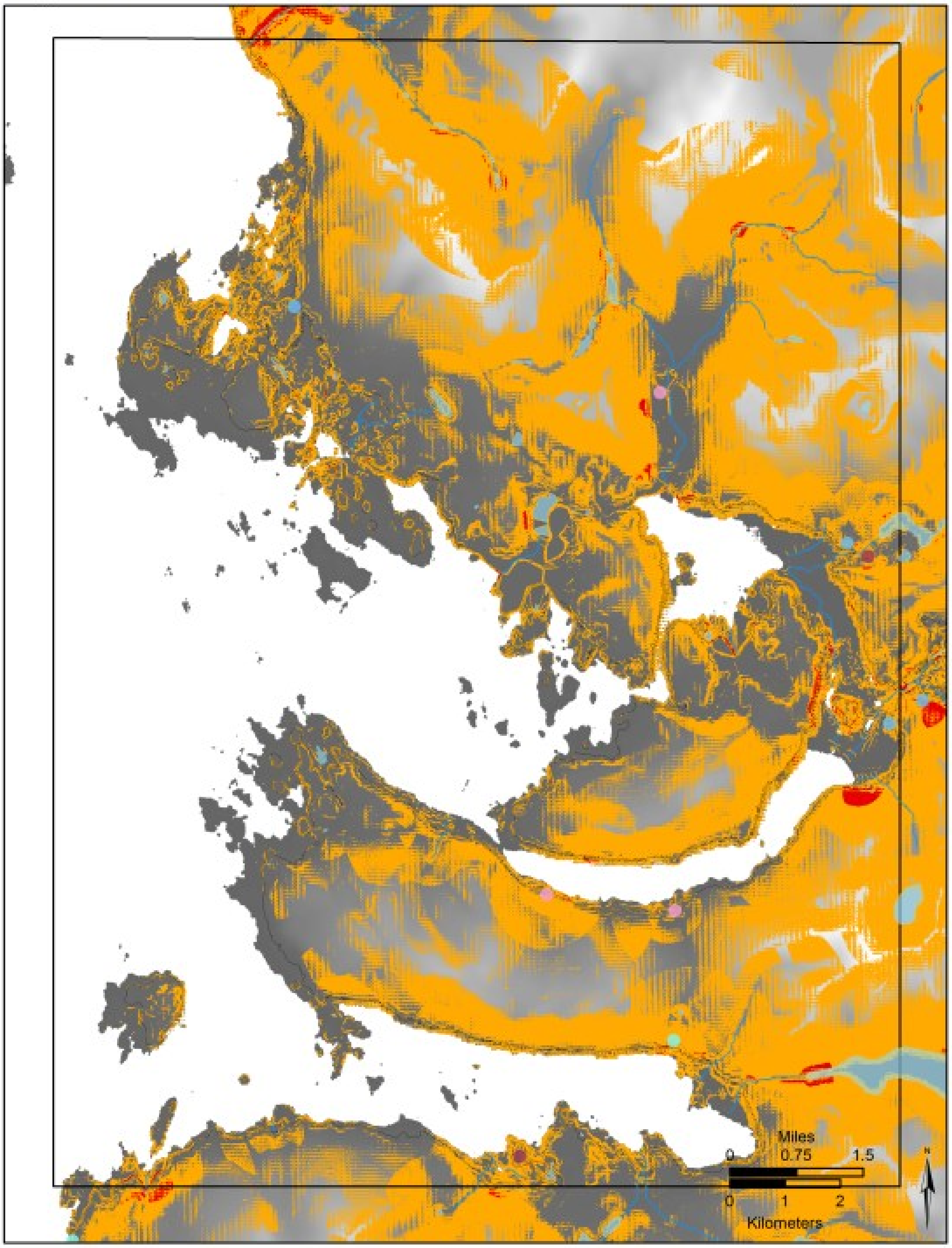
Weight 4a **10,500 cal BP**



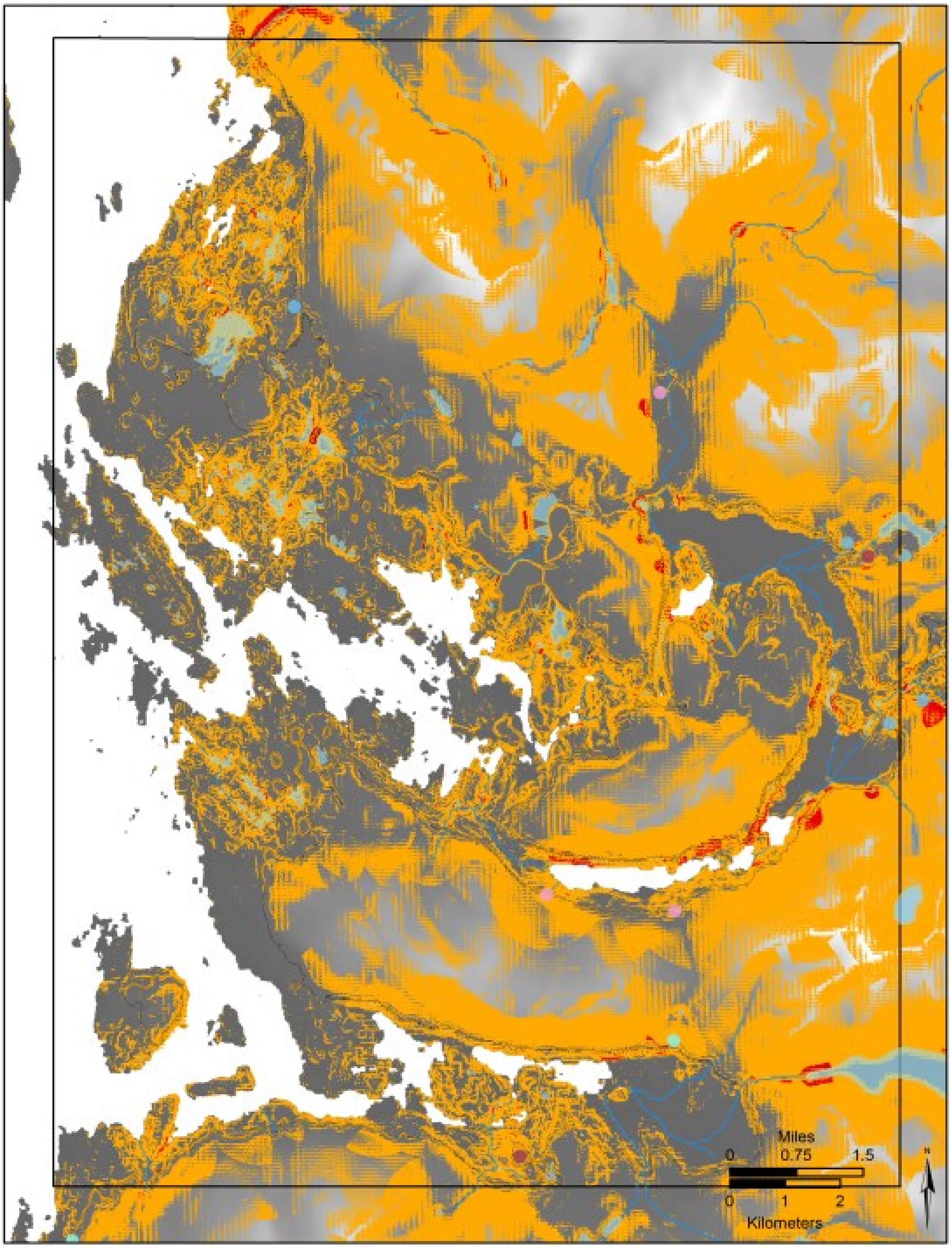
Weight 4a **11,000 cal BP**



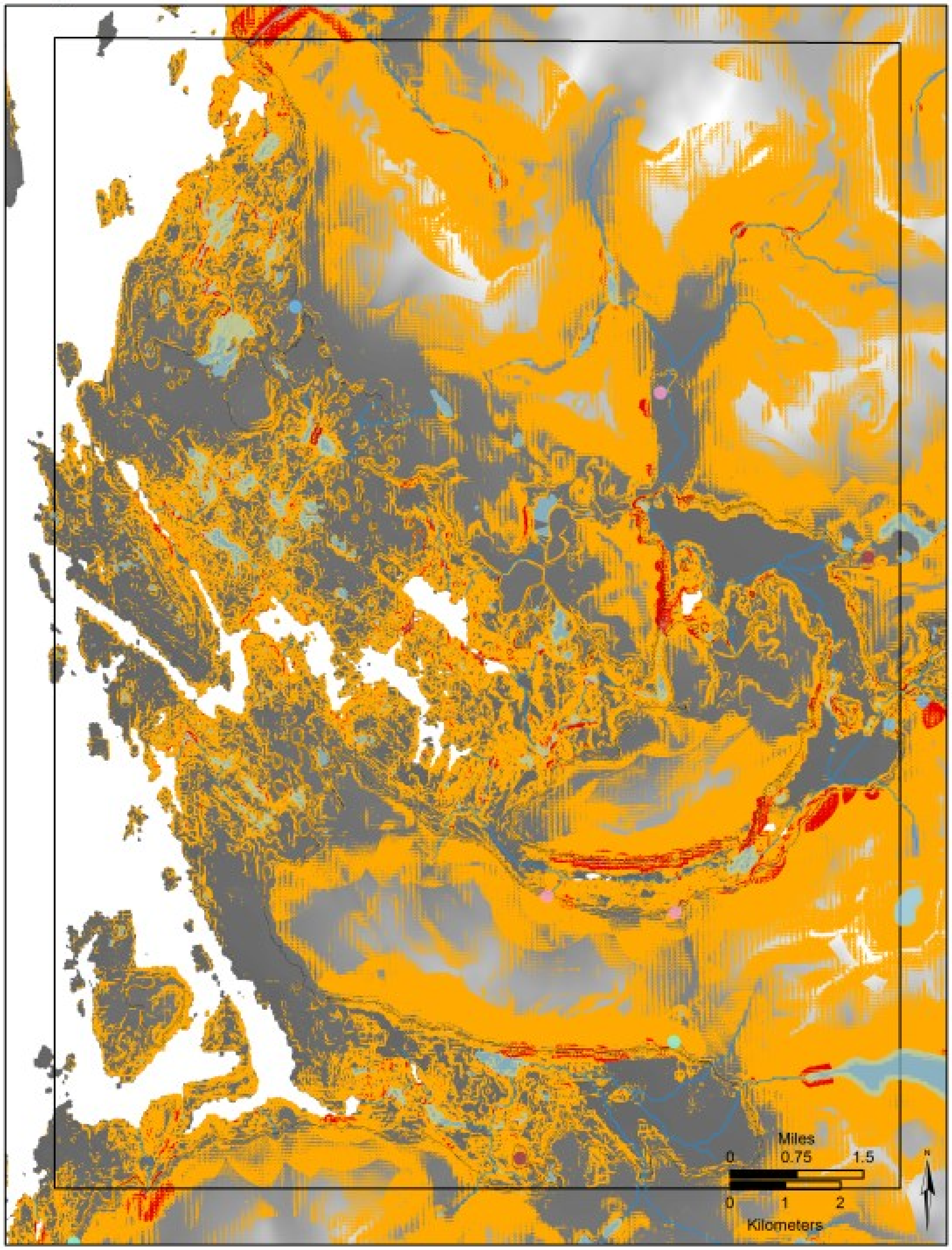
Weight 4a **11,500 cal BP**



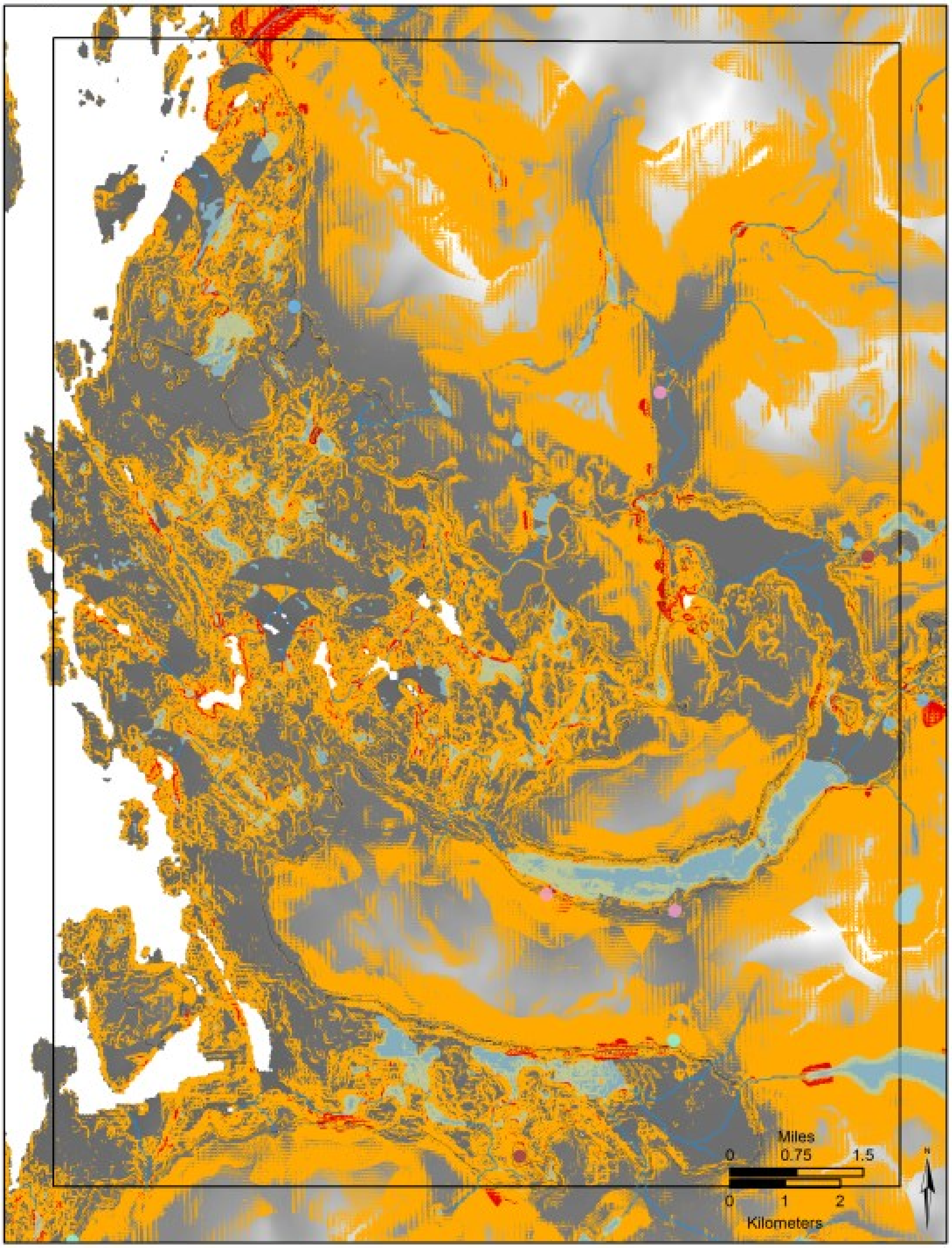
Weight 4a **12,000 cal BP**



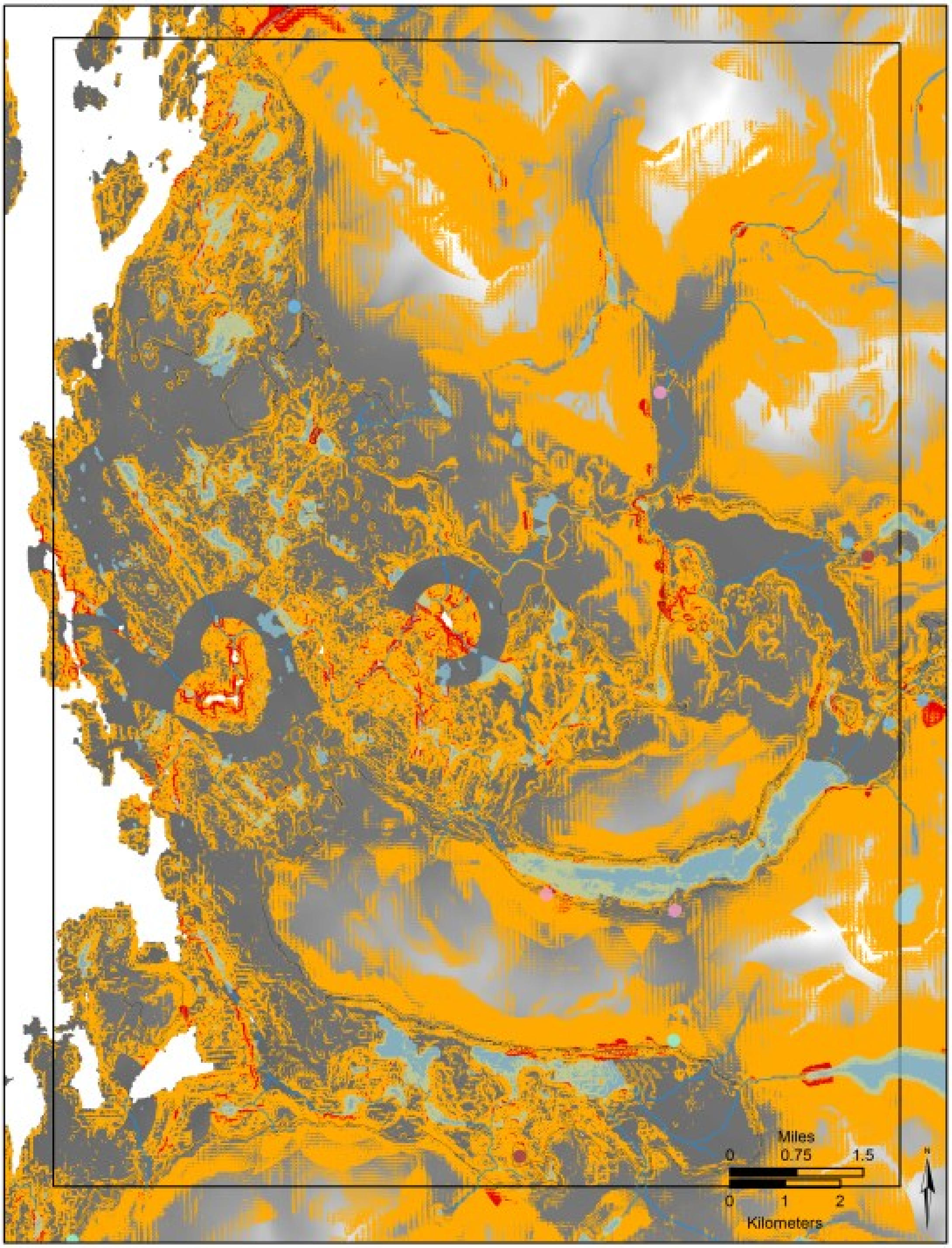
Weight 4a **12,500 cal BP**



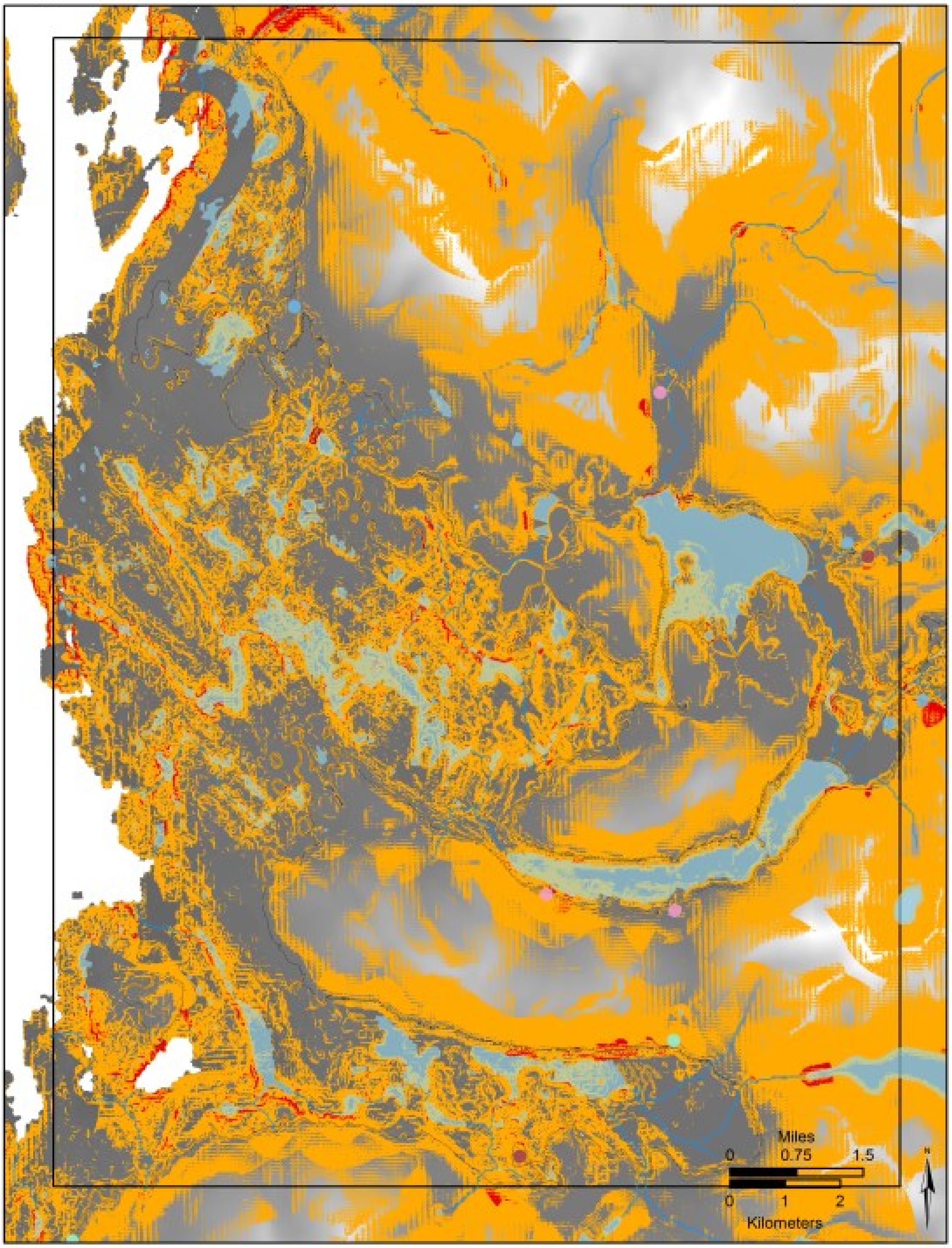
Weight 4a **13,000 cal BP**



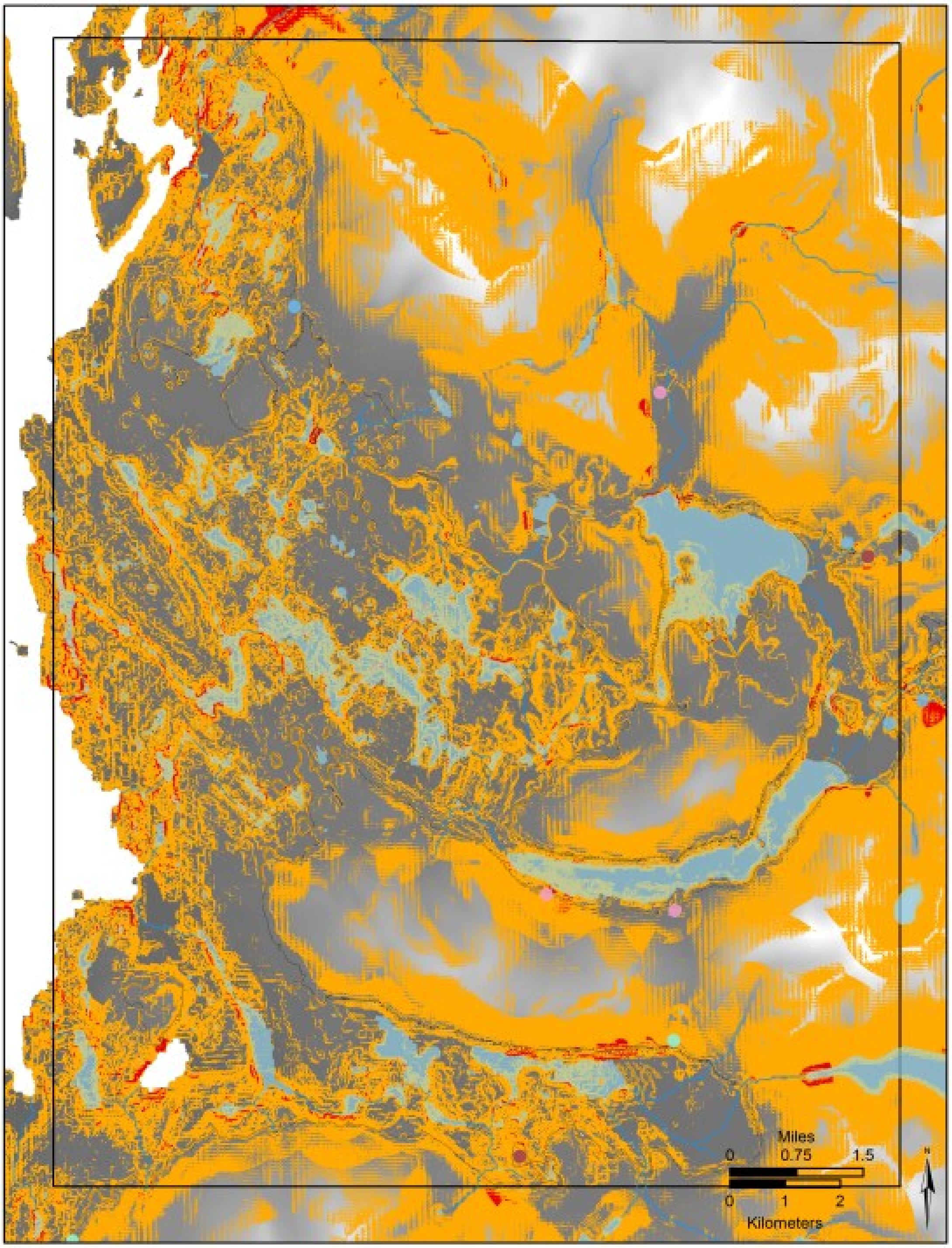
Weight 4a **13,500 cal BP**



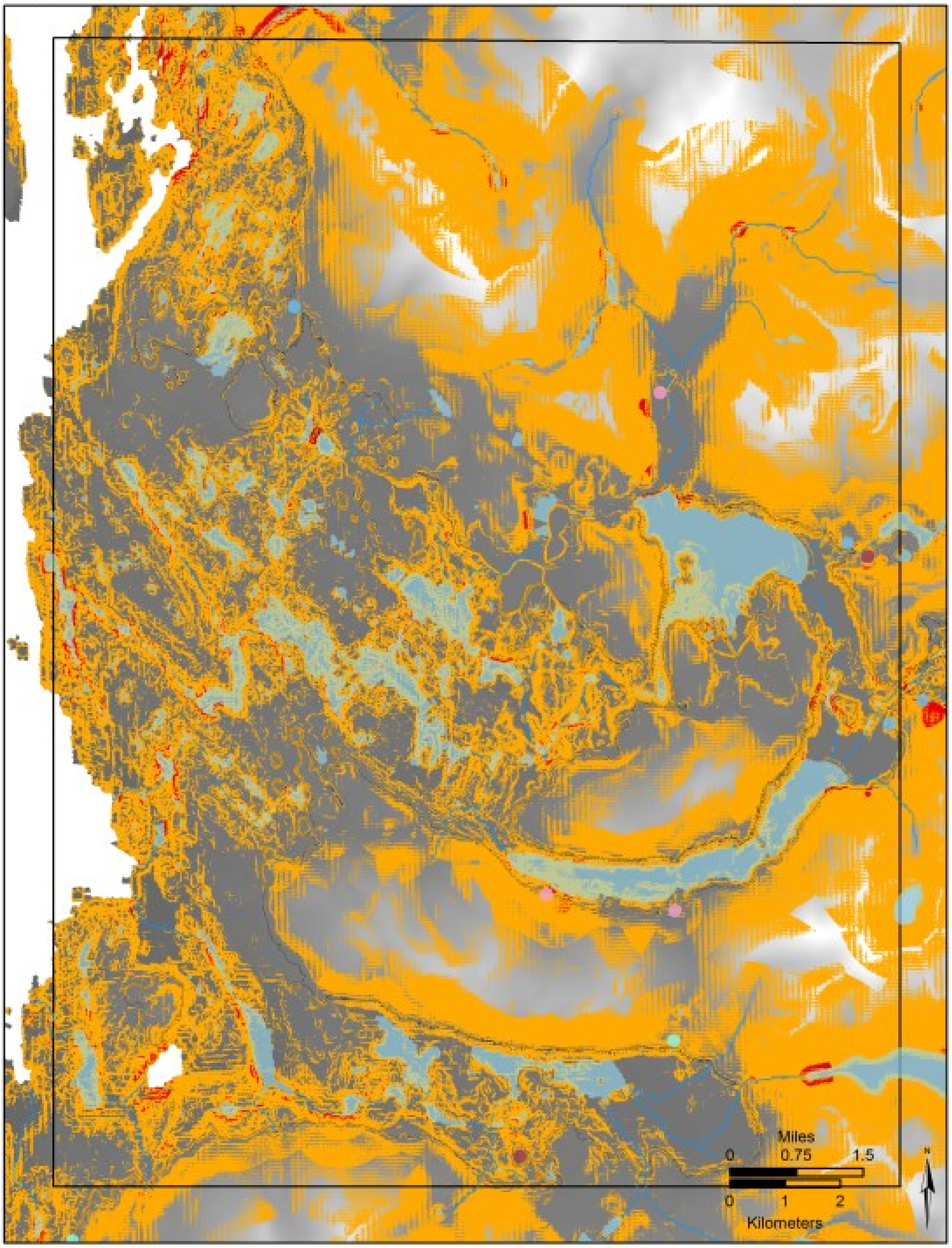
Weight 4a **14,000 cal BP**



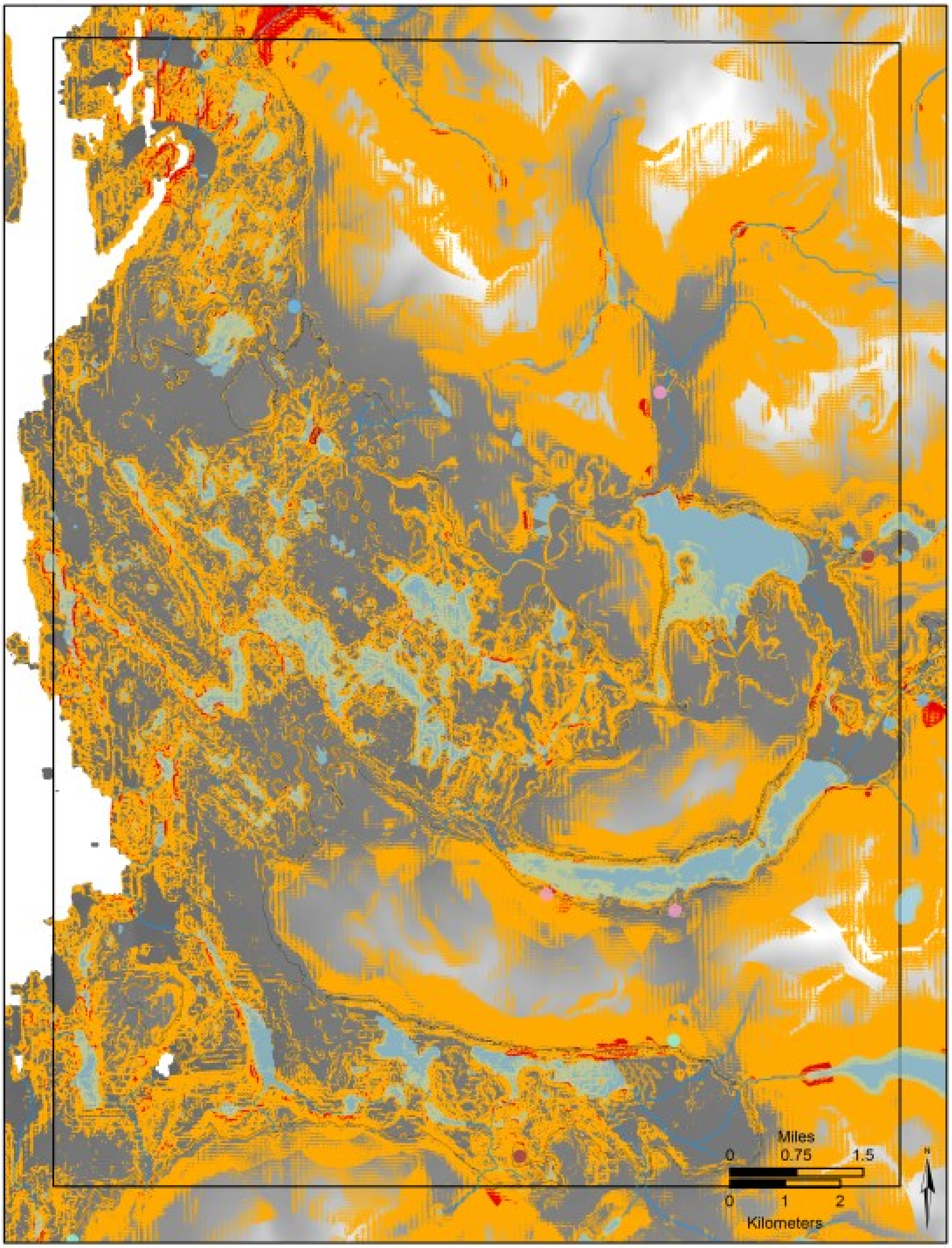
Weight 4a **14,500 cal BP**



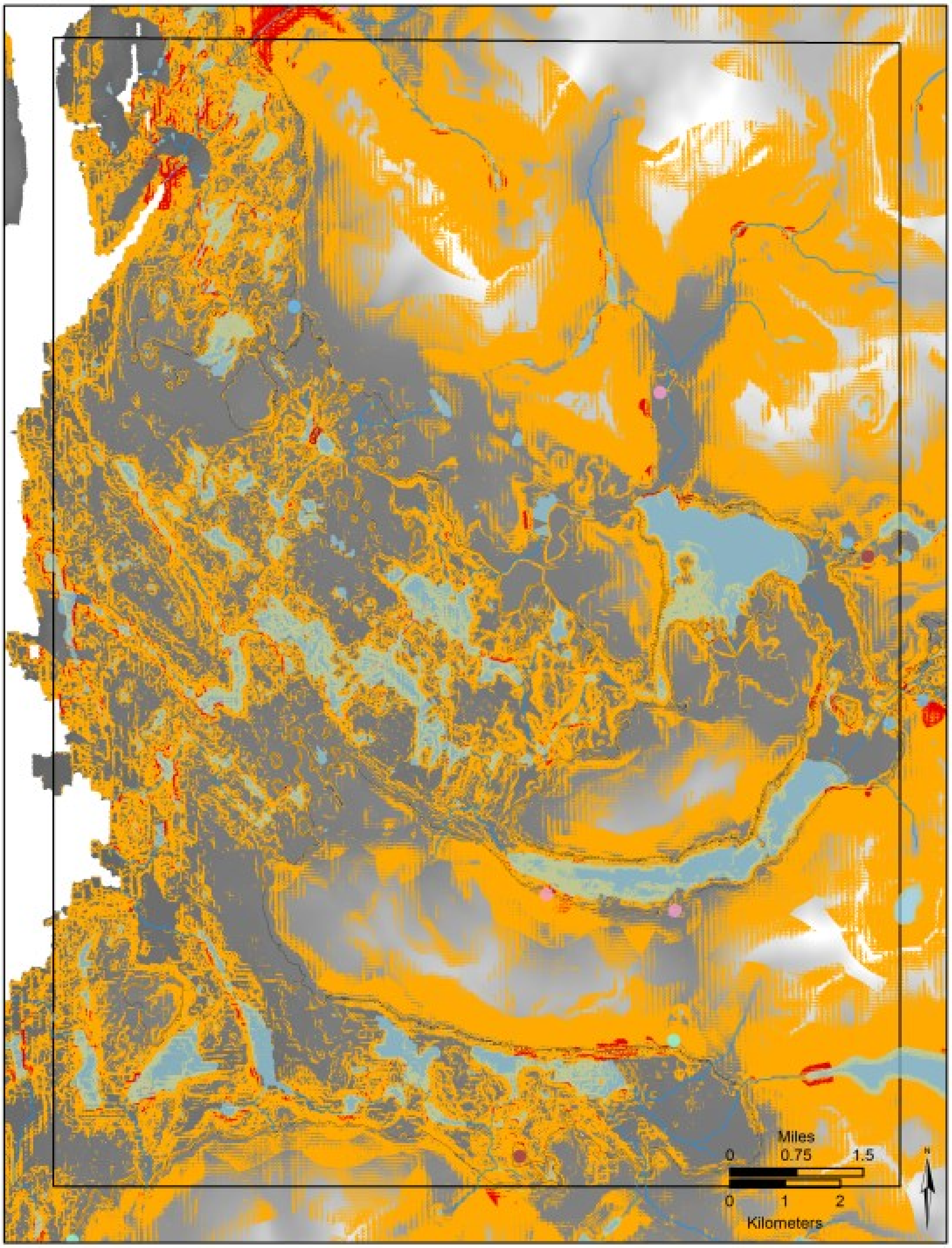
Weight 4a **15,000 cal BP**



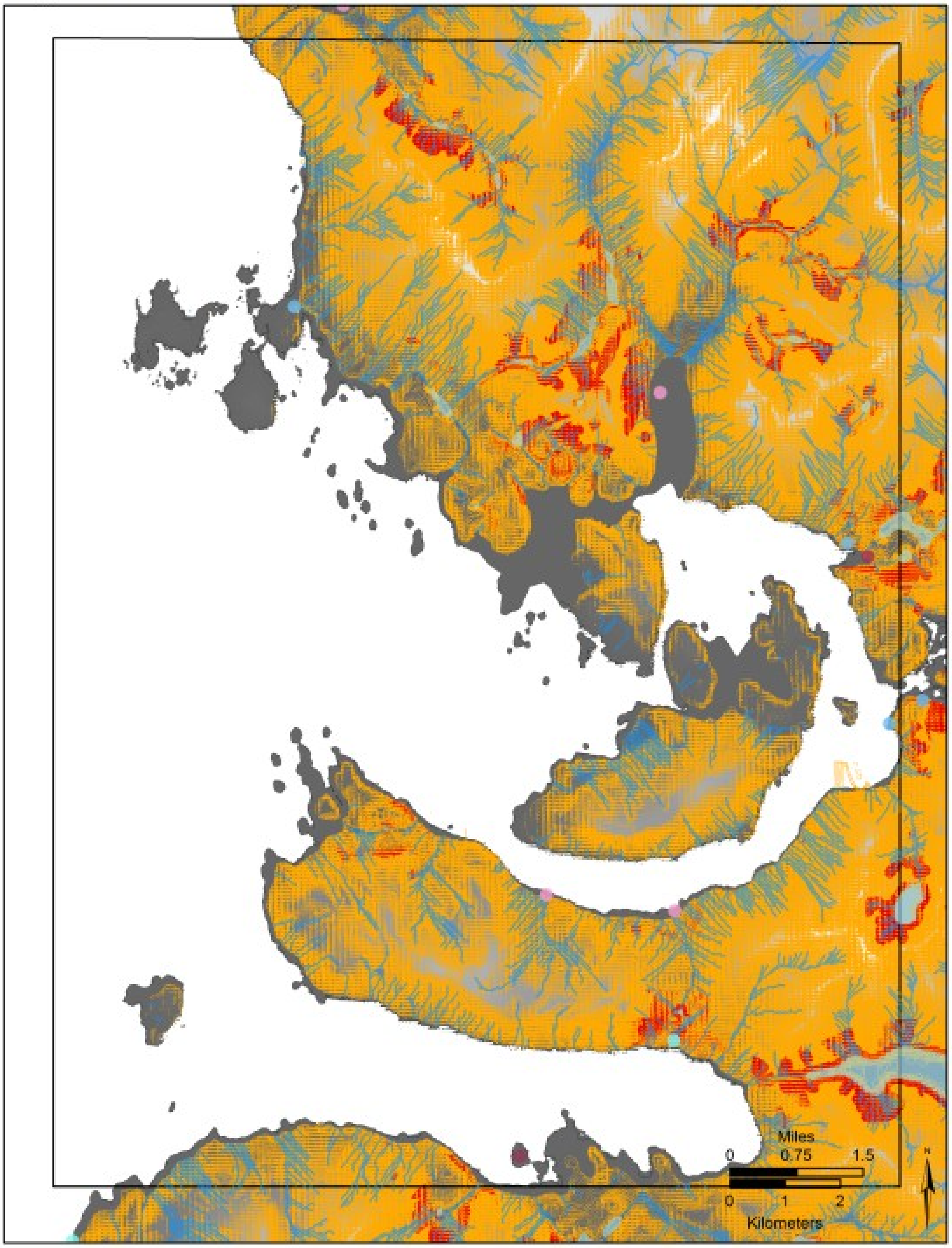
Weight 4a **15,500 cal BP**

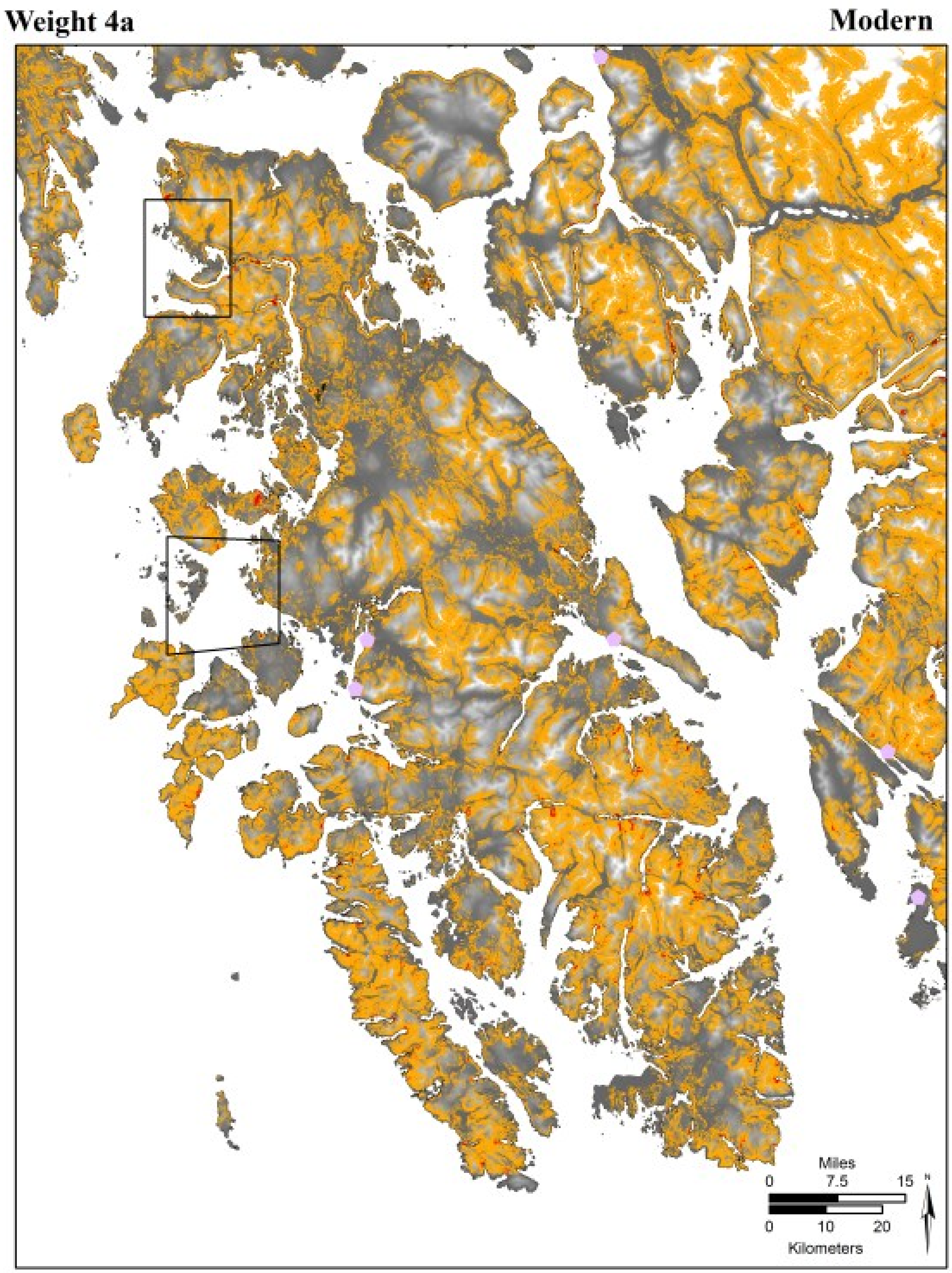


Weight 4a **16,000 cal BP**



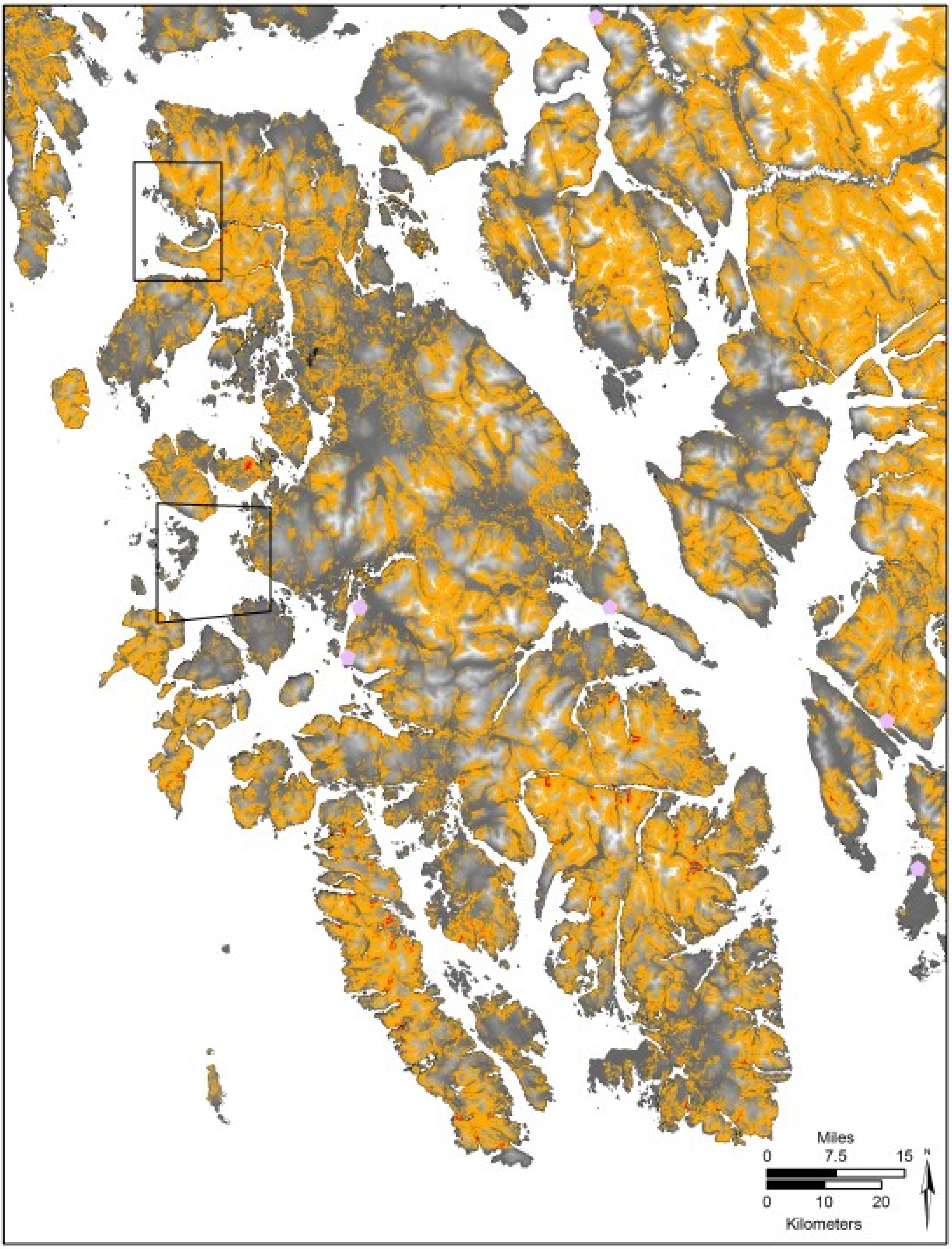
Weight 4a **Modern - Small Area**



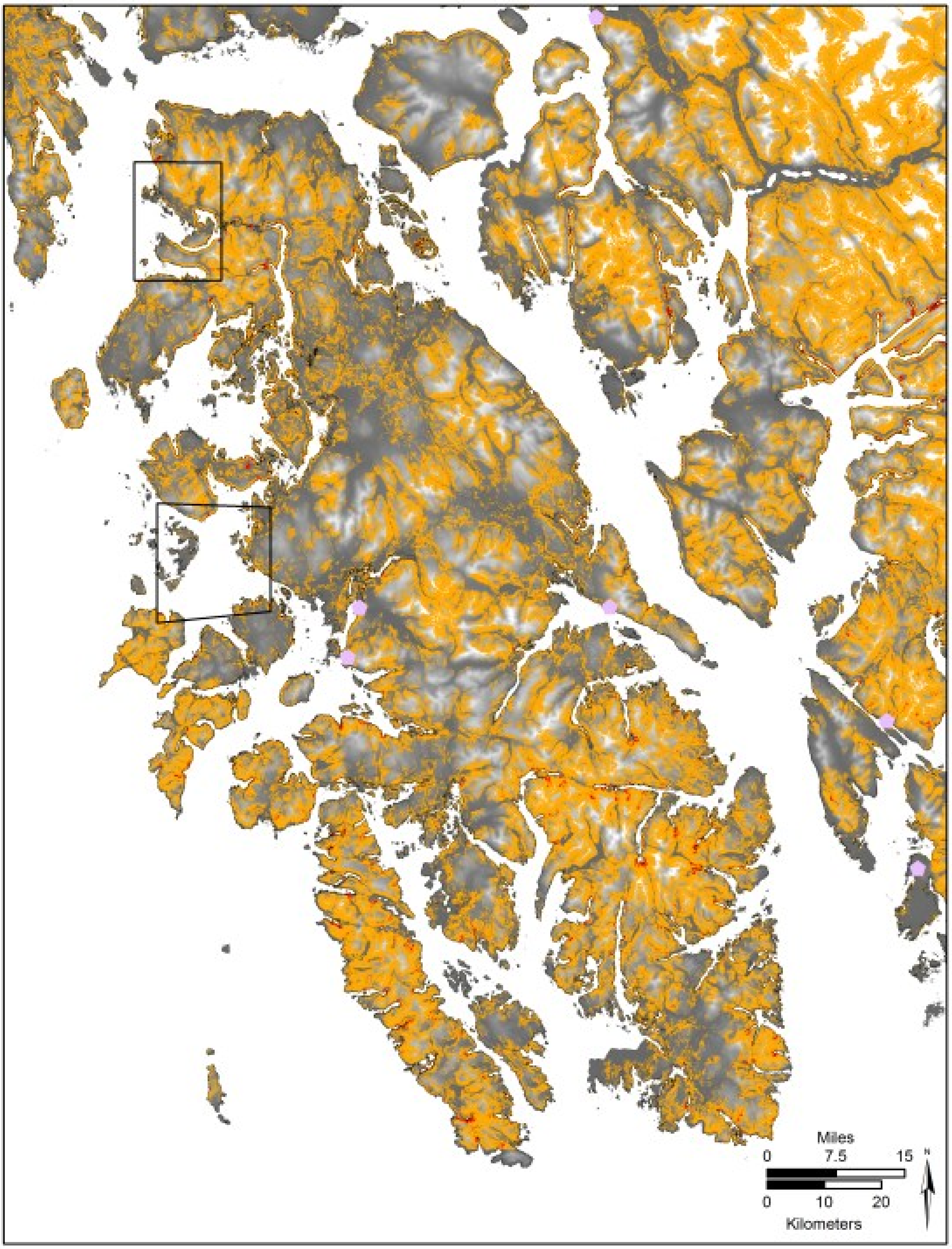


Weight 4a
Modern
Miles
0
7.5
15
0
10
20
Kilometers
N

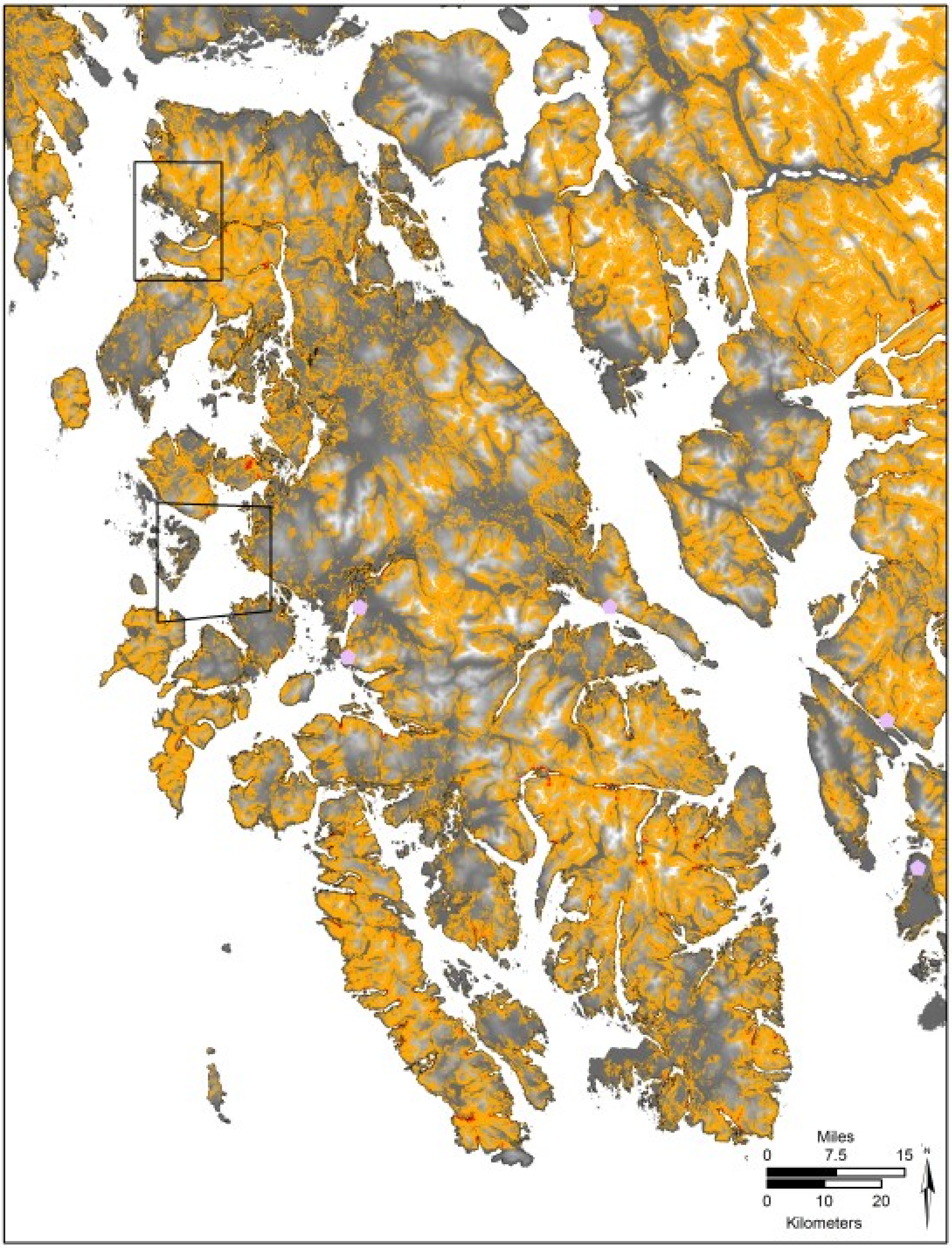
Weight 4a **10,500 cal BP**



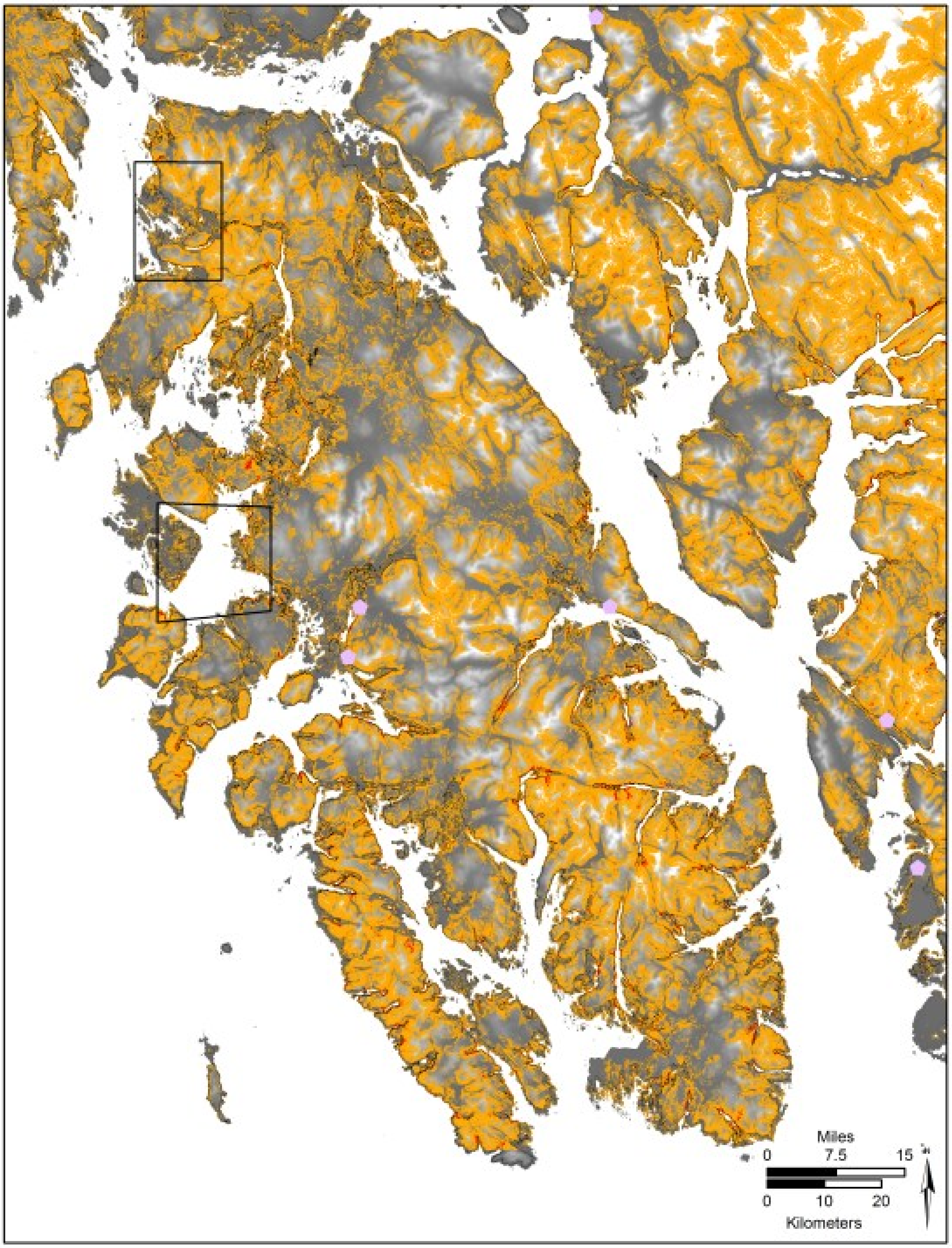
Weight 4a **11,000 cal BP**



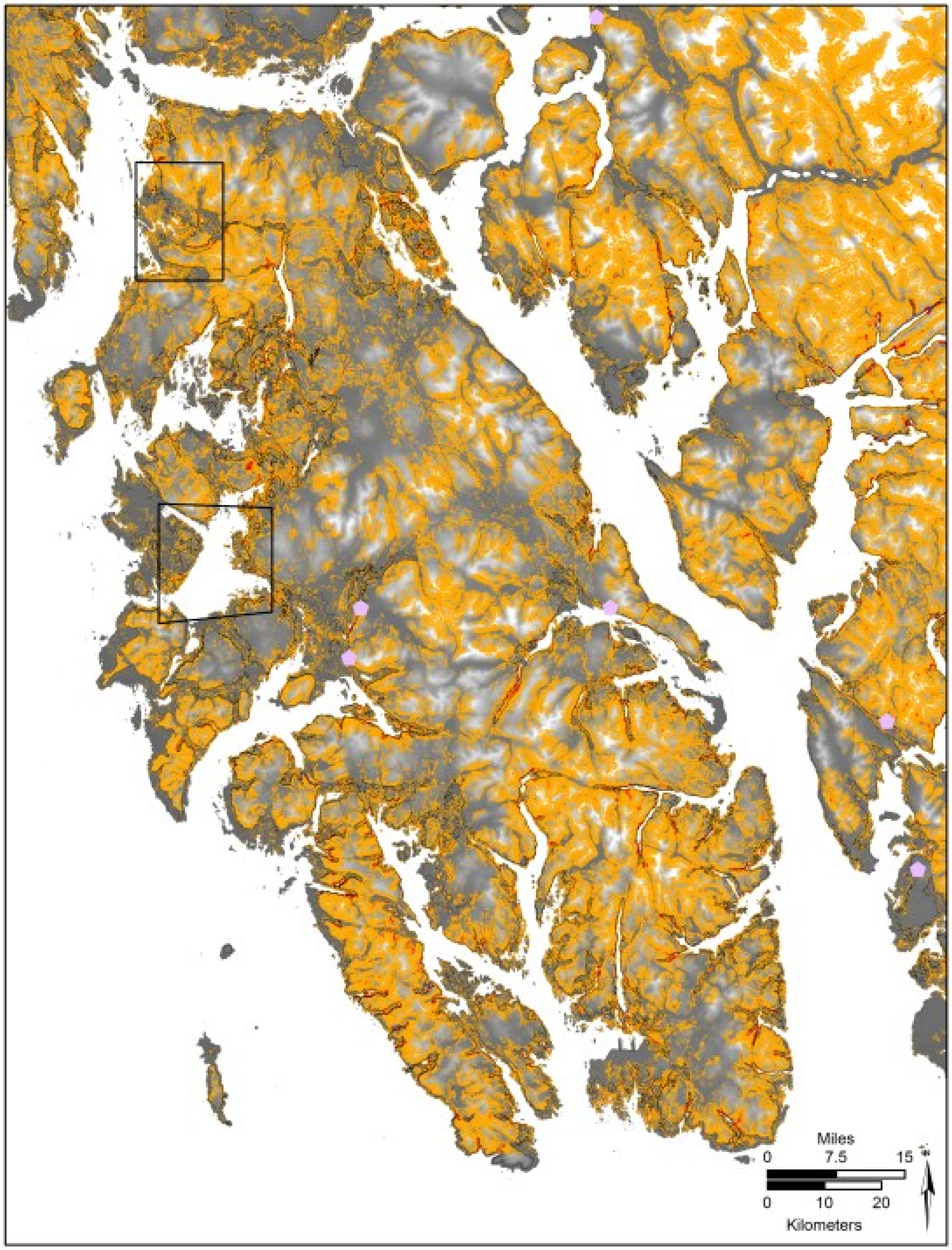
Weight 4a **11,500 cal BP**

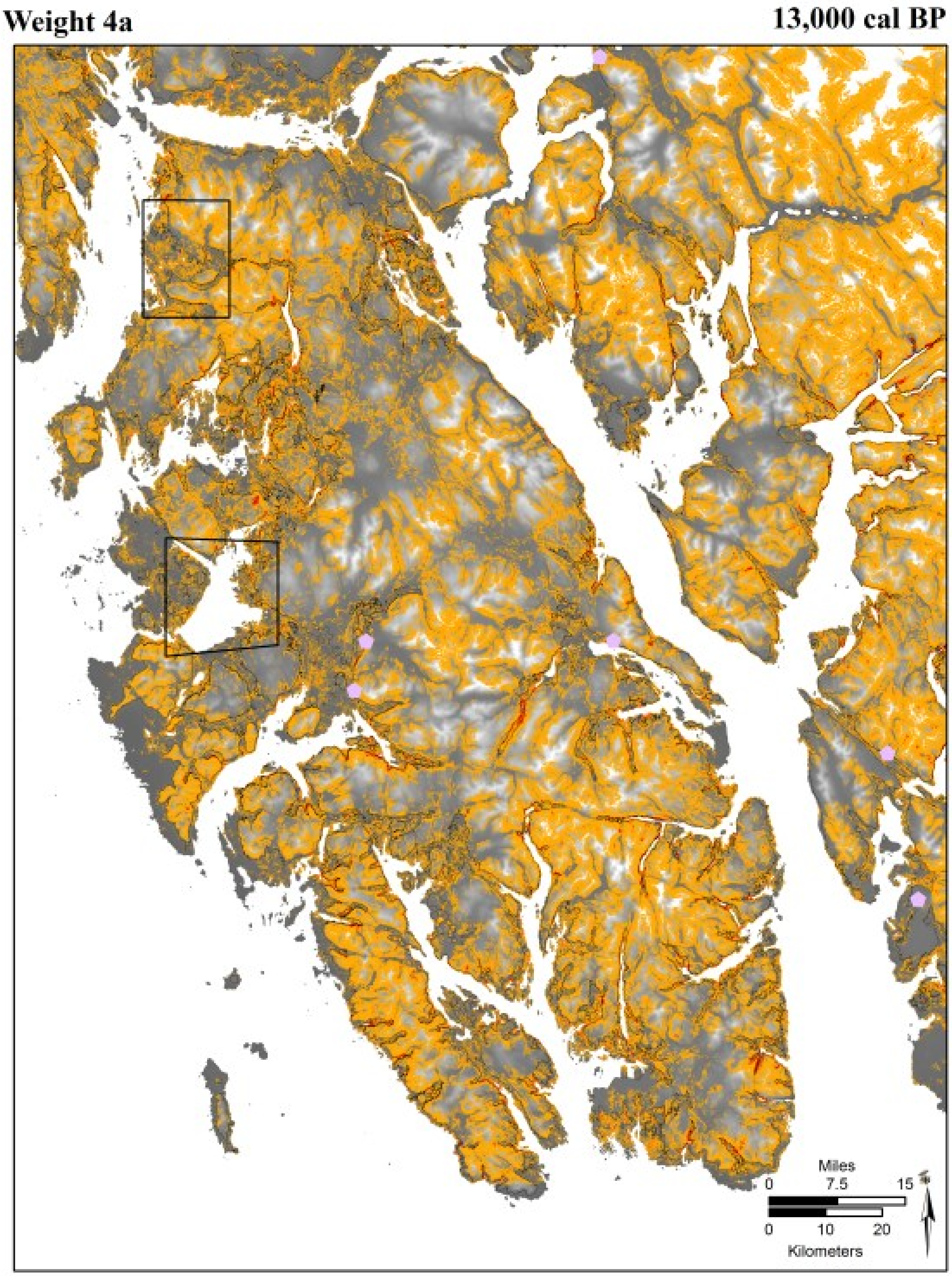


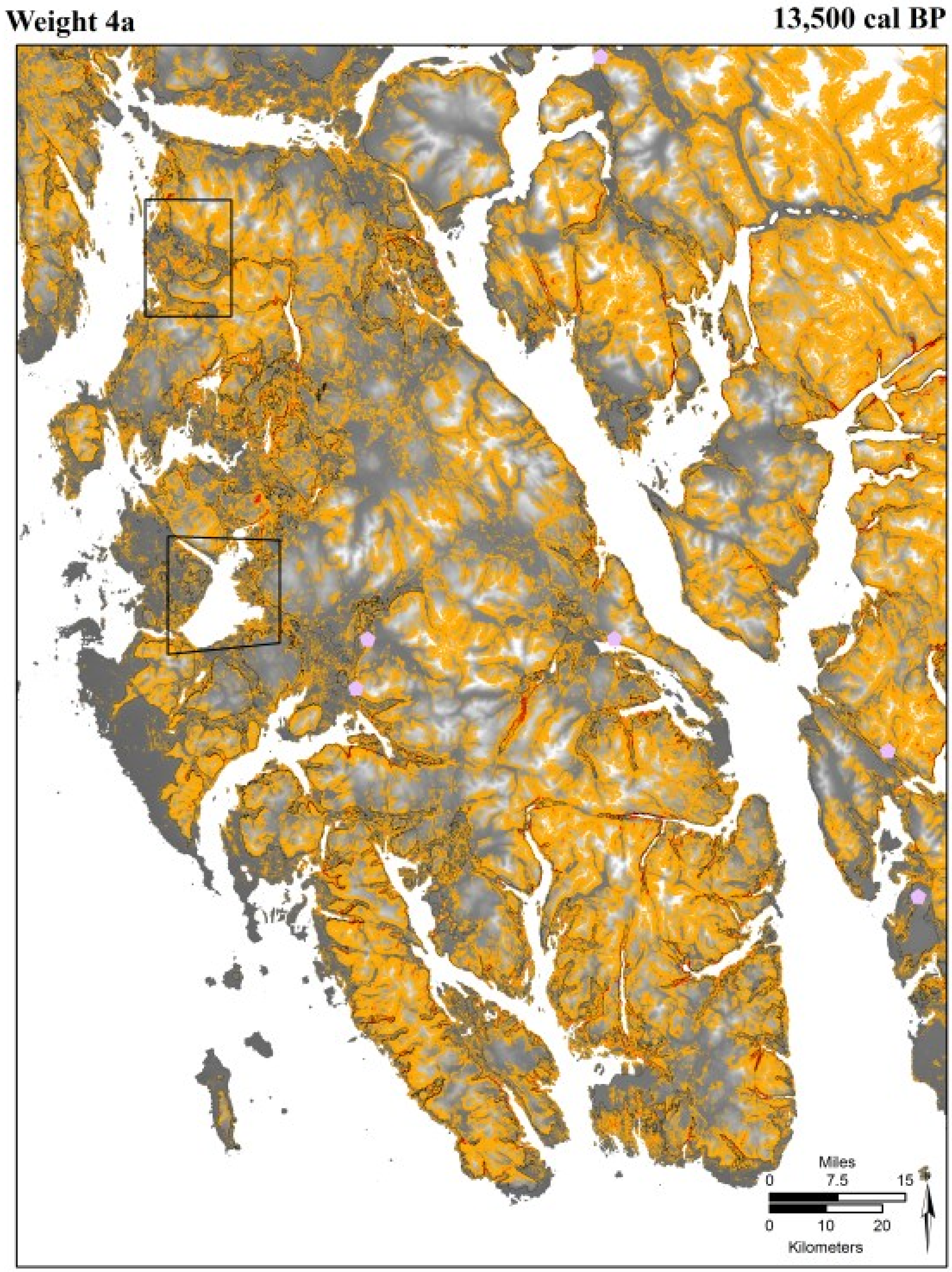
Weight 4a **12,000 cal BP**



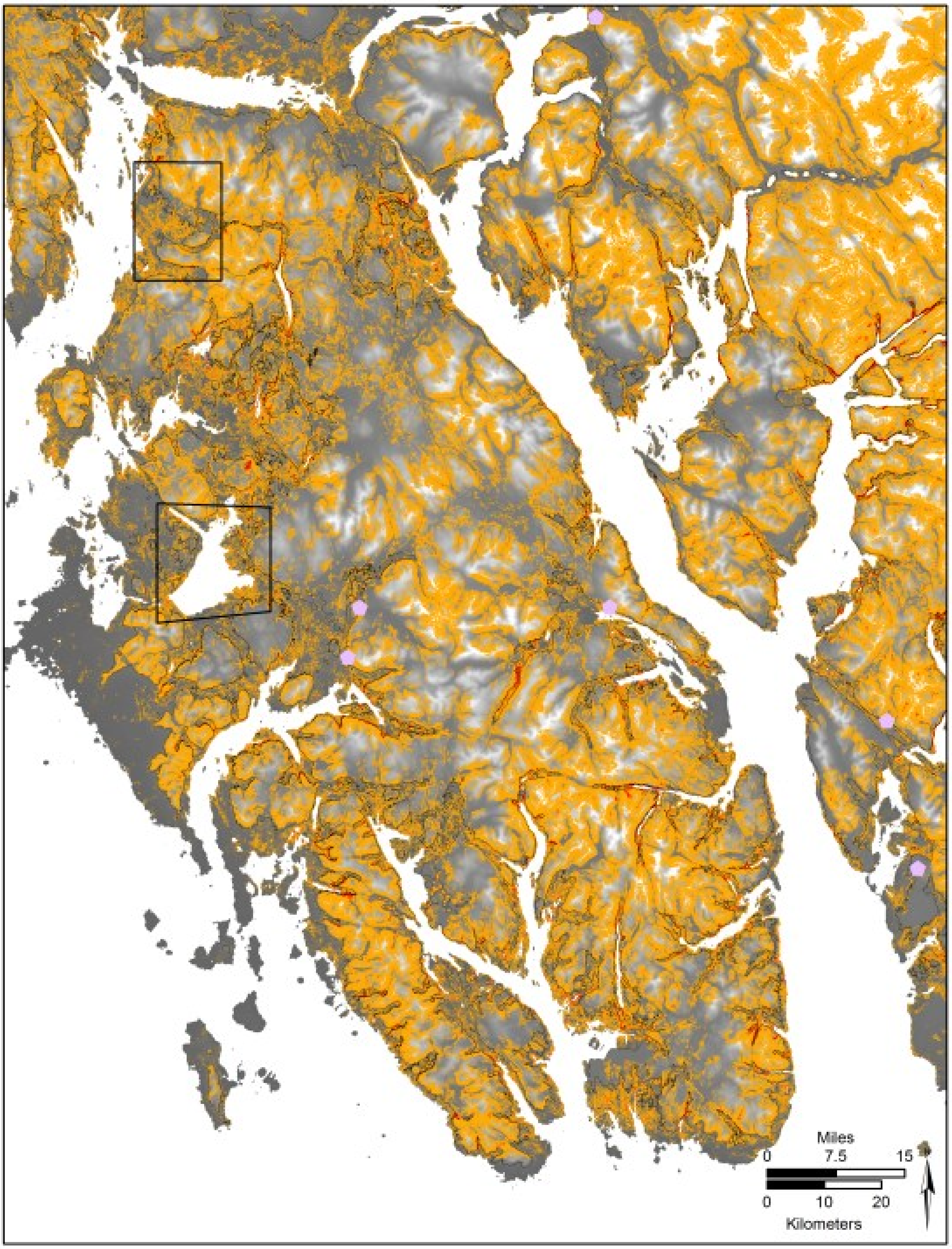
Weight 4a **12,500 cal BP**



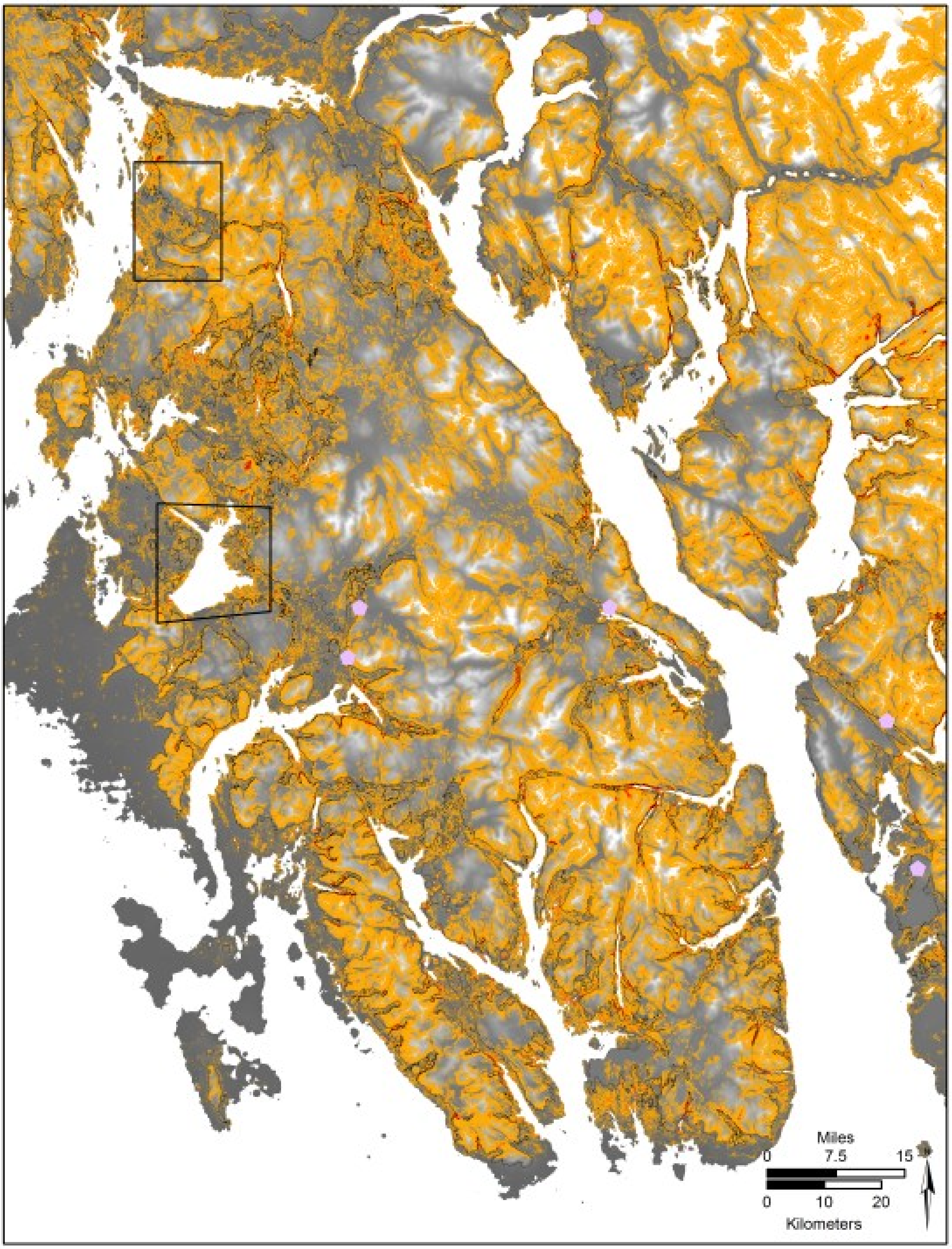

Weight 4a
13,000 cal BP
Miles
0
7.5
15
0
10
20
Kilometers


Weight 4a
13,500 cal BP
Miles
0
7.5
15
0
10
20
Kilometers

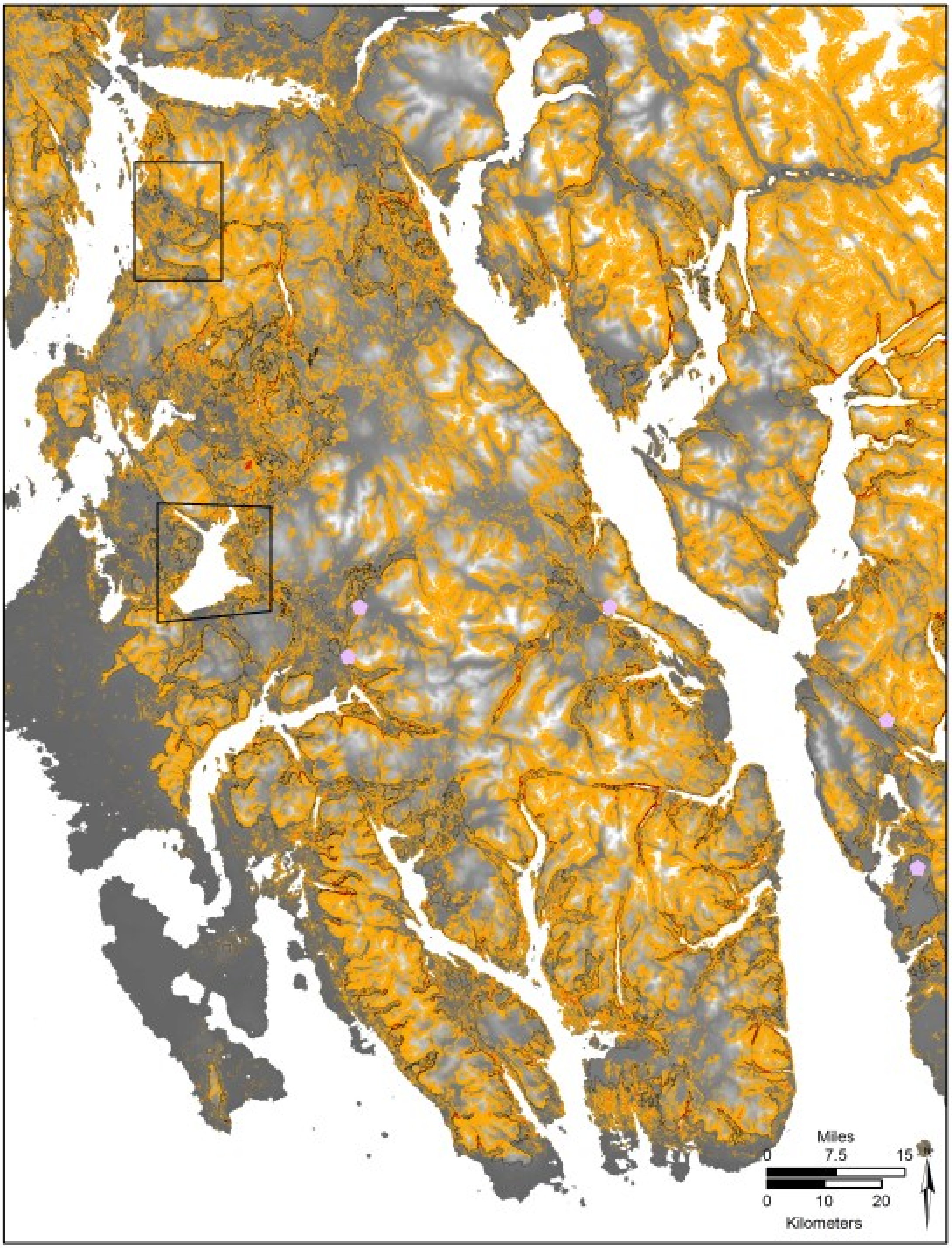
Weight 4a **14,000 cal BP**

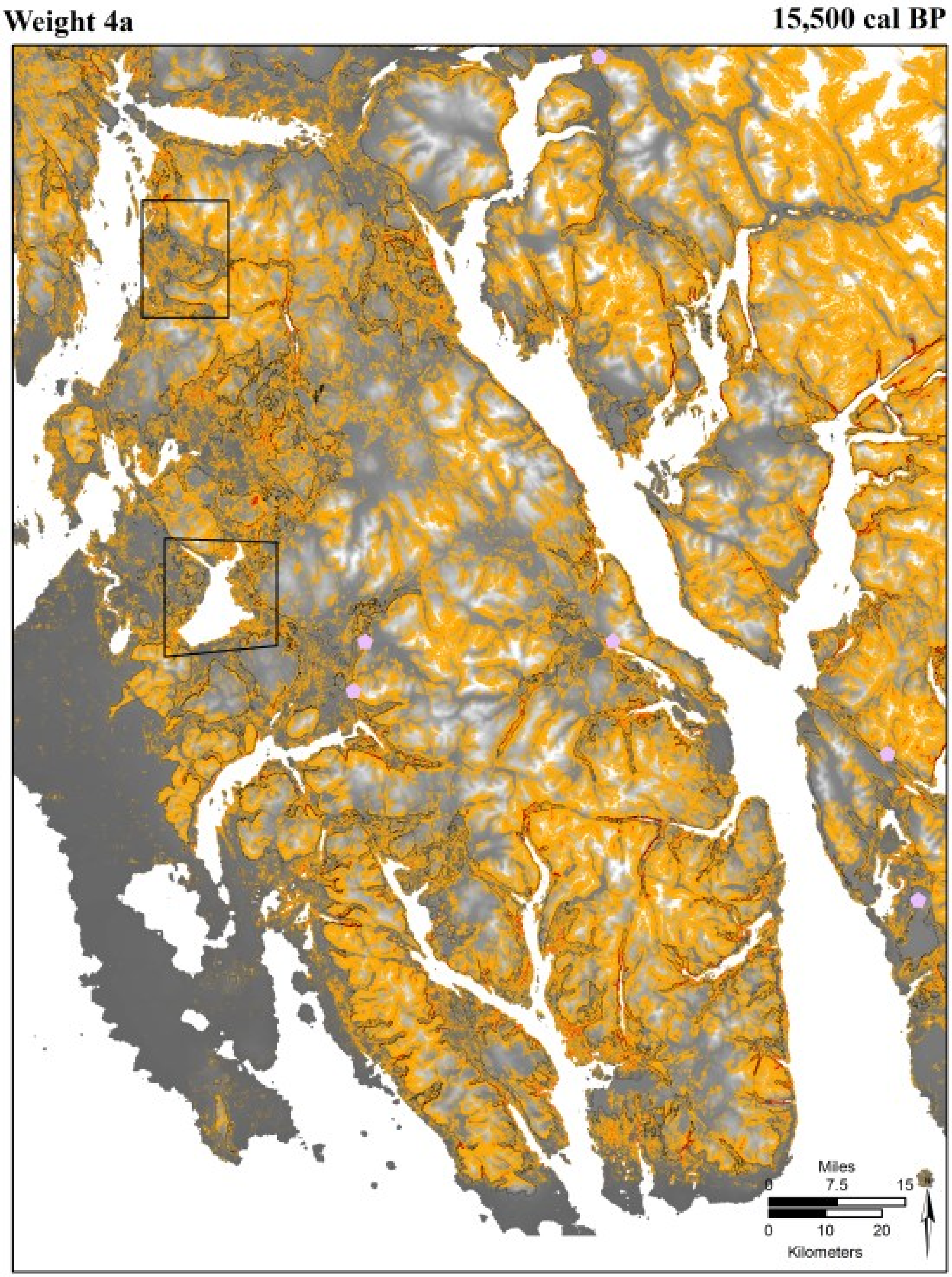


Weight 4a **14,500 cal BP**

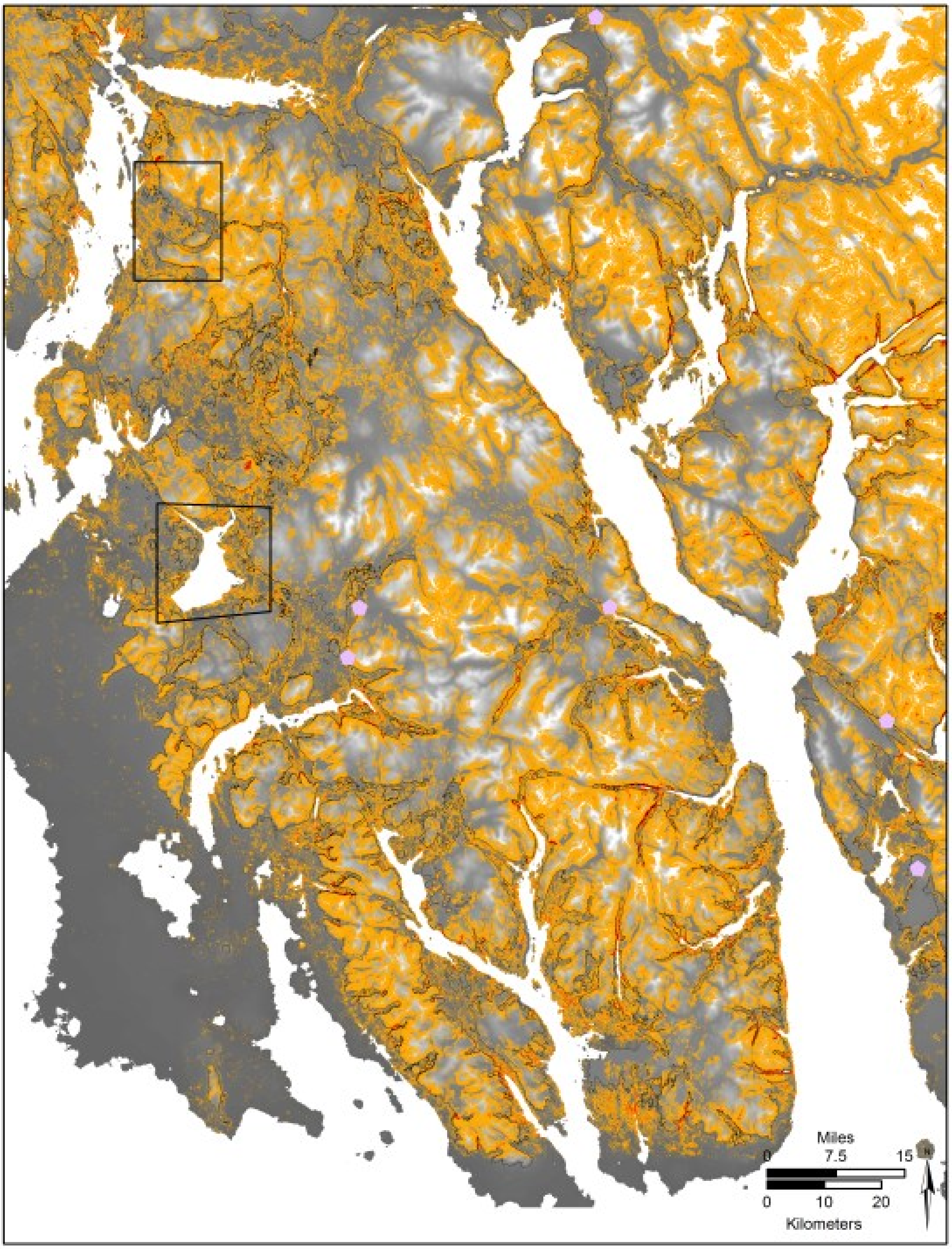


Weight 4a **15,000 cal BP**

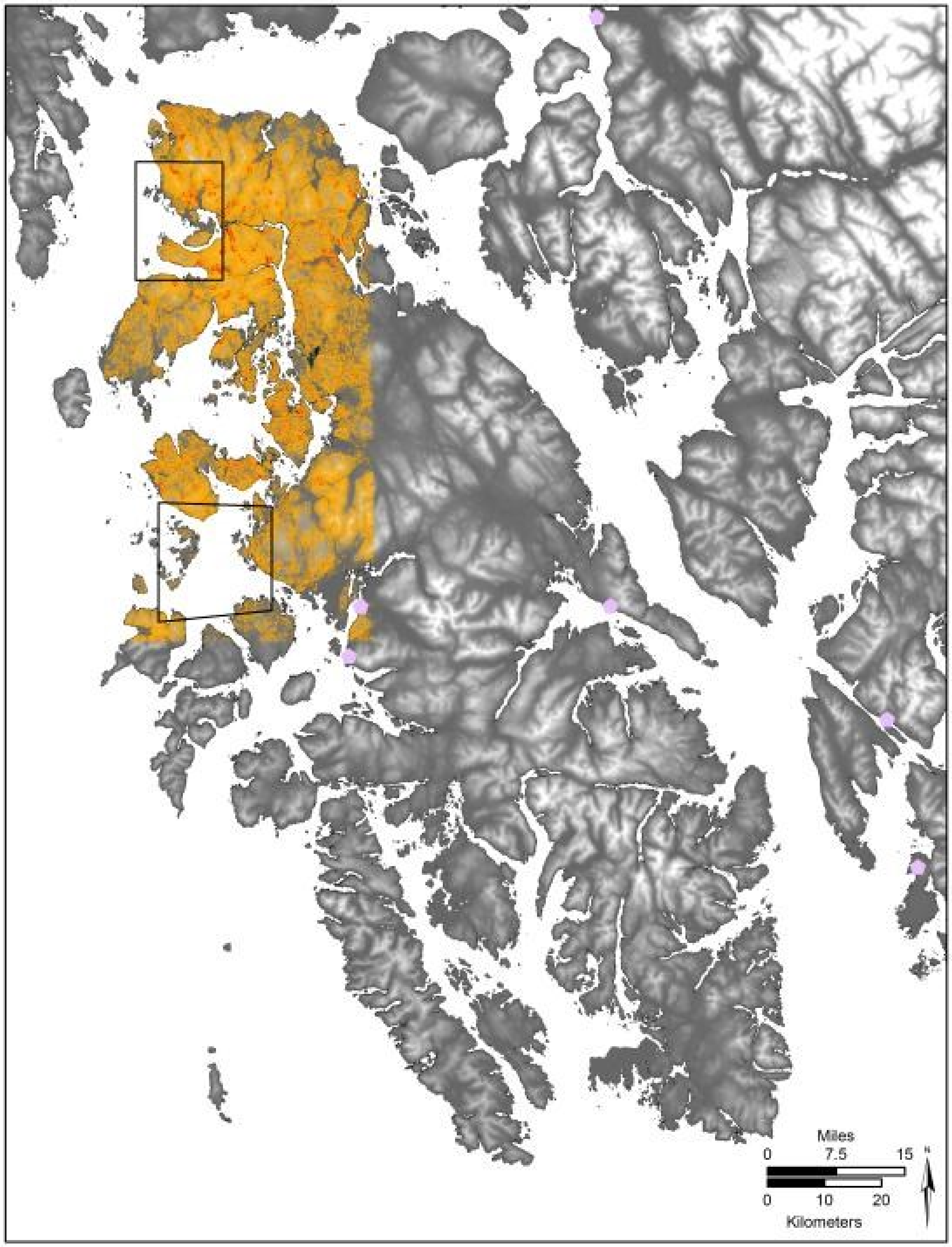



Weight 4a
15,500 cal BP
Miles
0
7.5
15
0
10
20
Kilometers

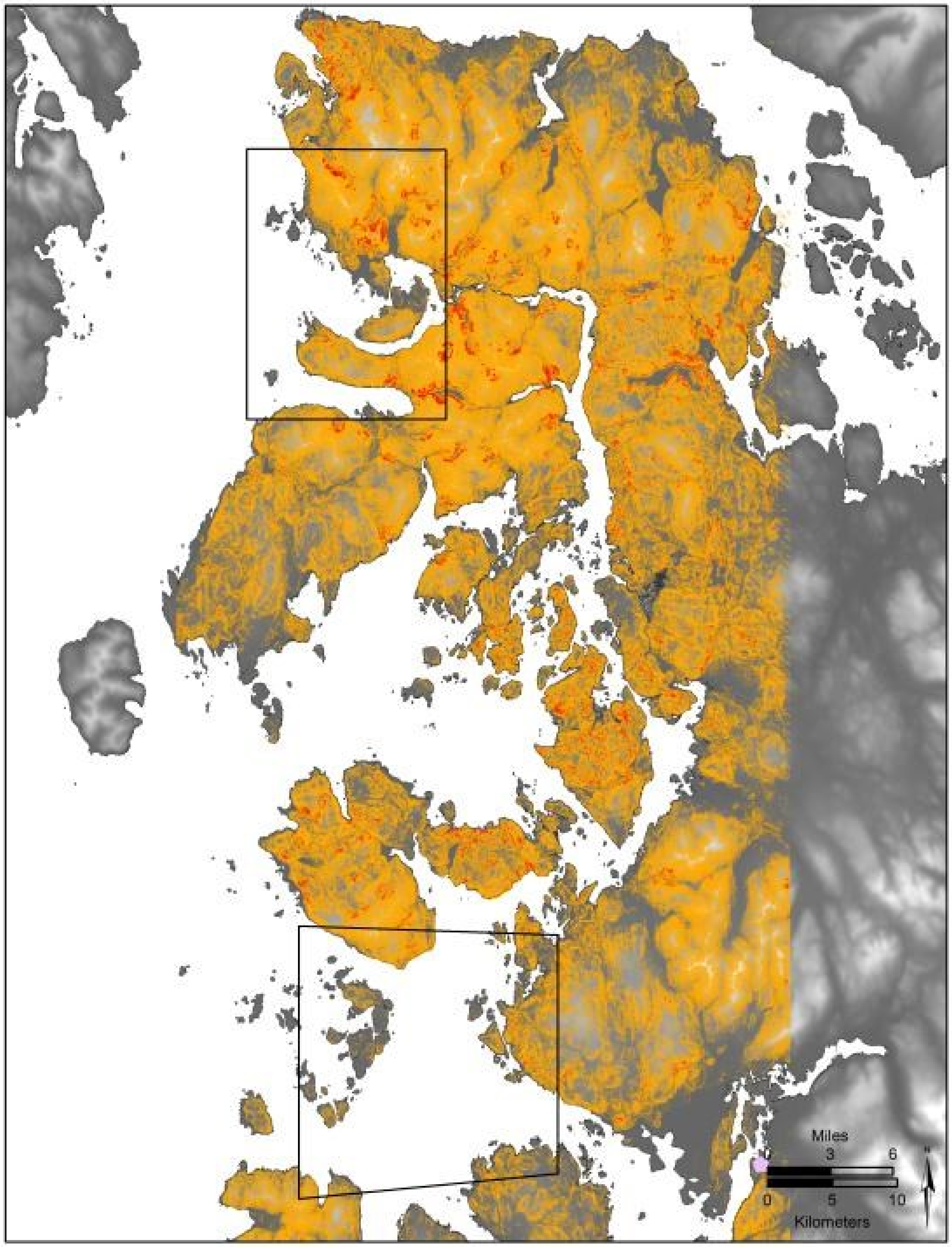
Weight 4a **16,000 cal BP**



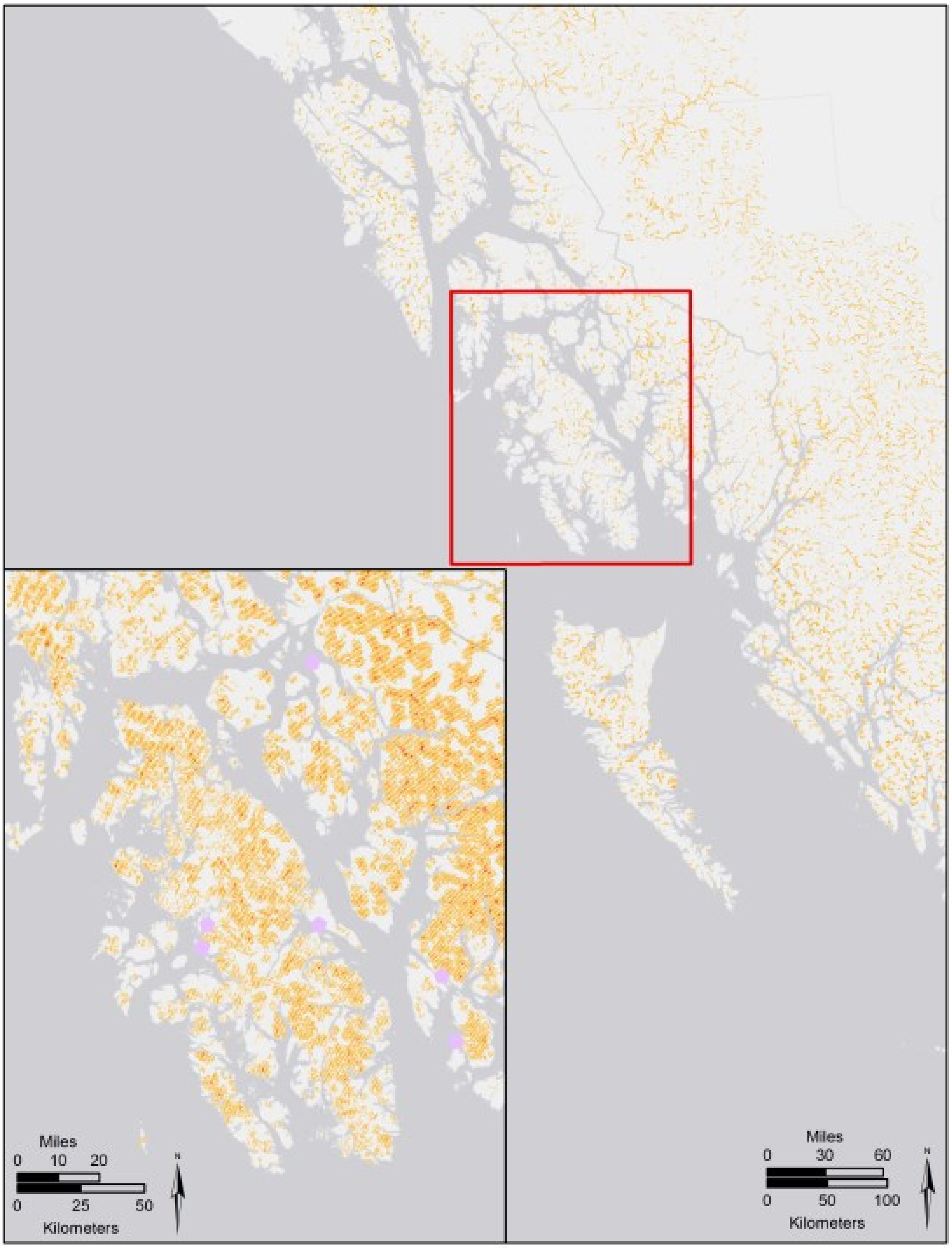
Weight 4a **Modern - Small Area**



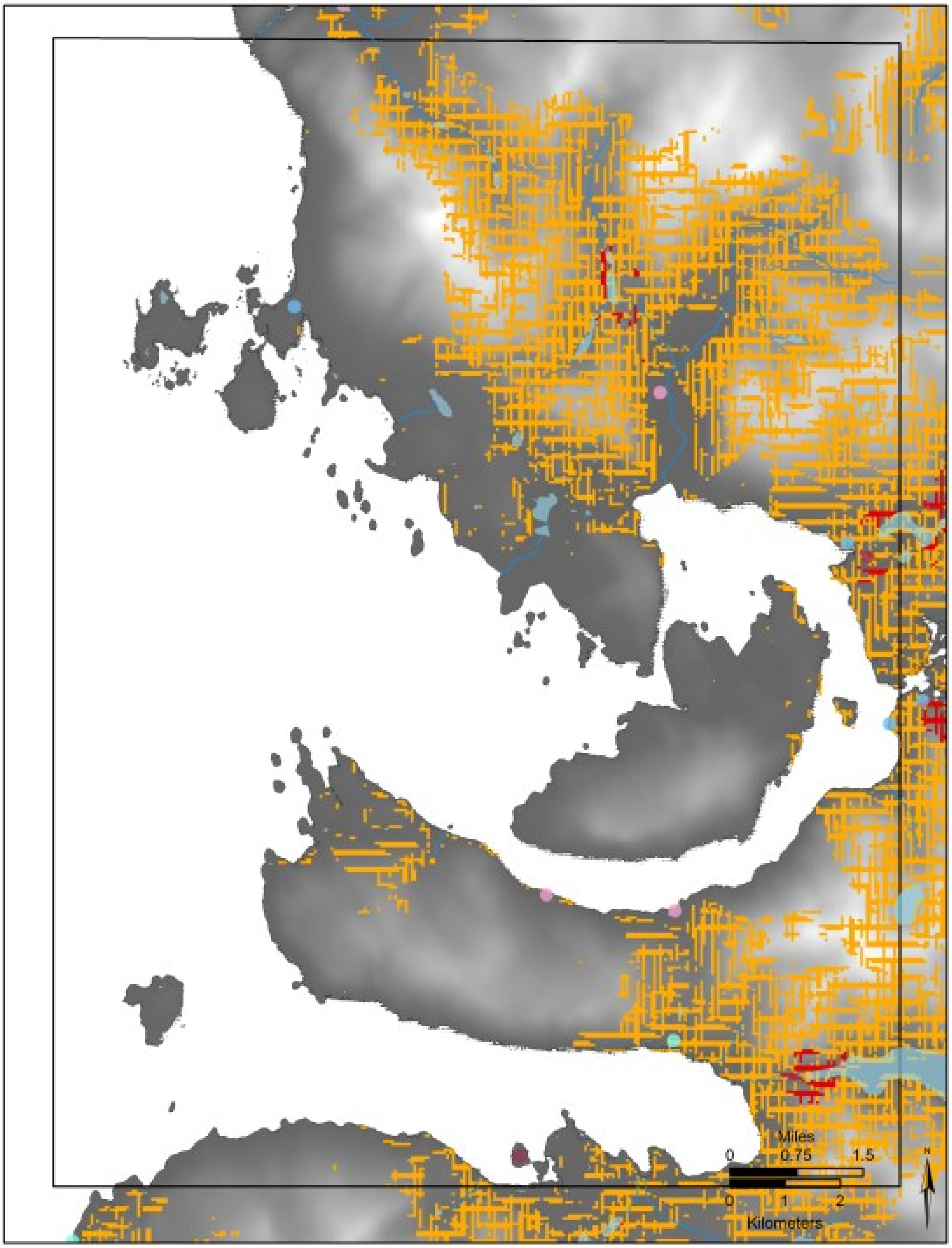
Weight 4a **Modern - Small Area**



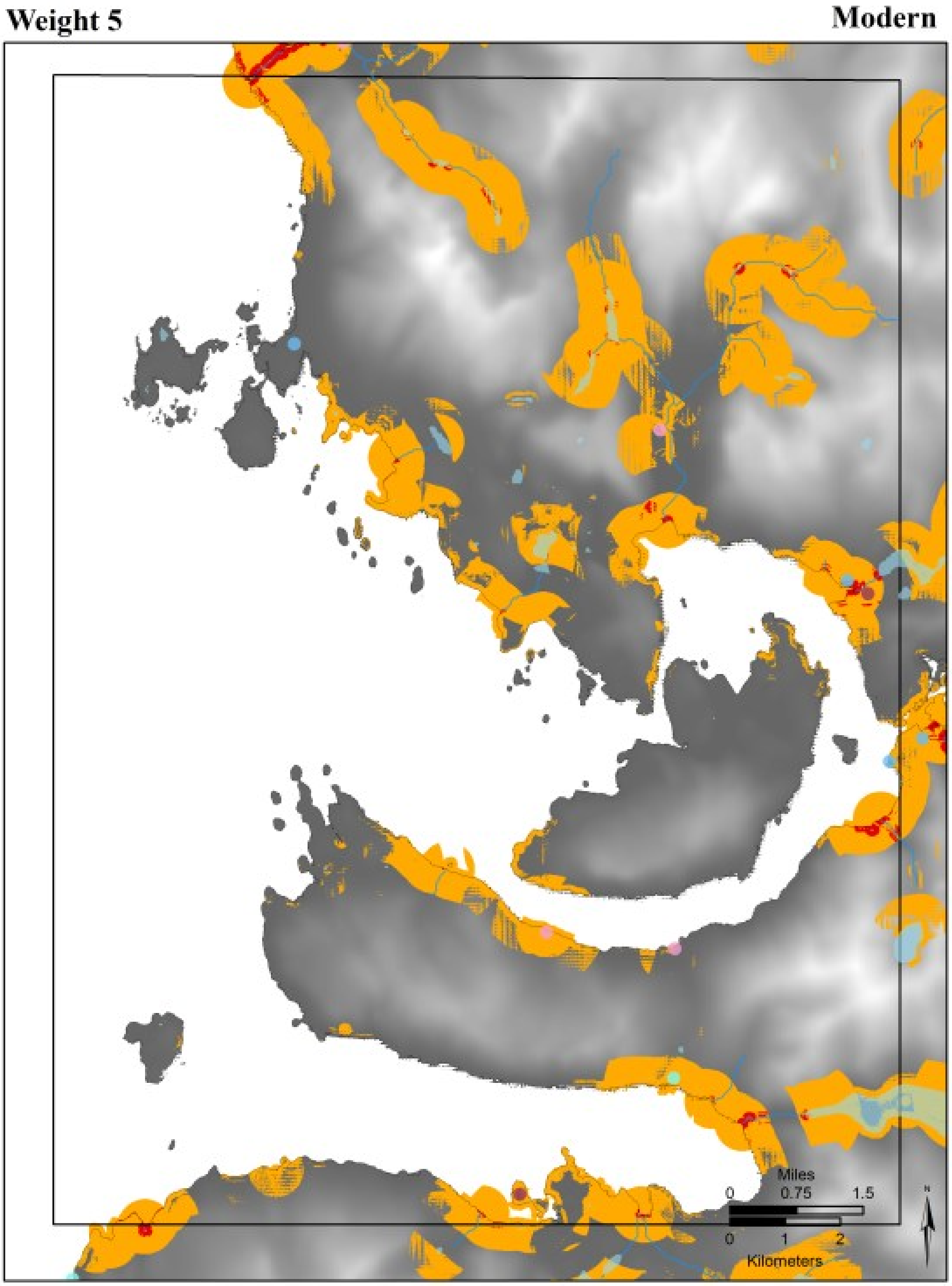
Weight 4a **NWC - modern**



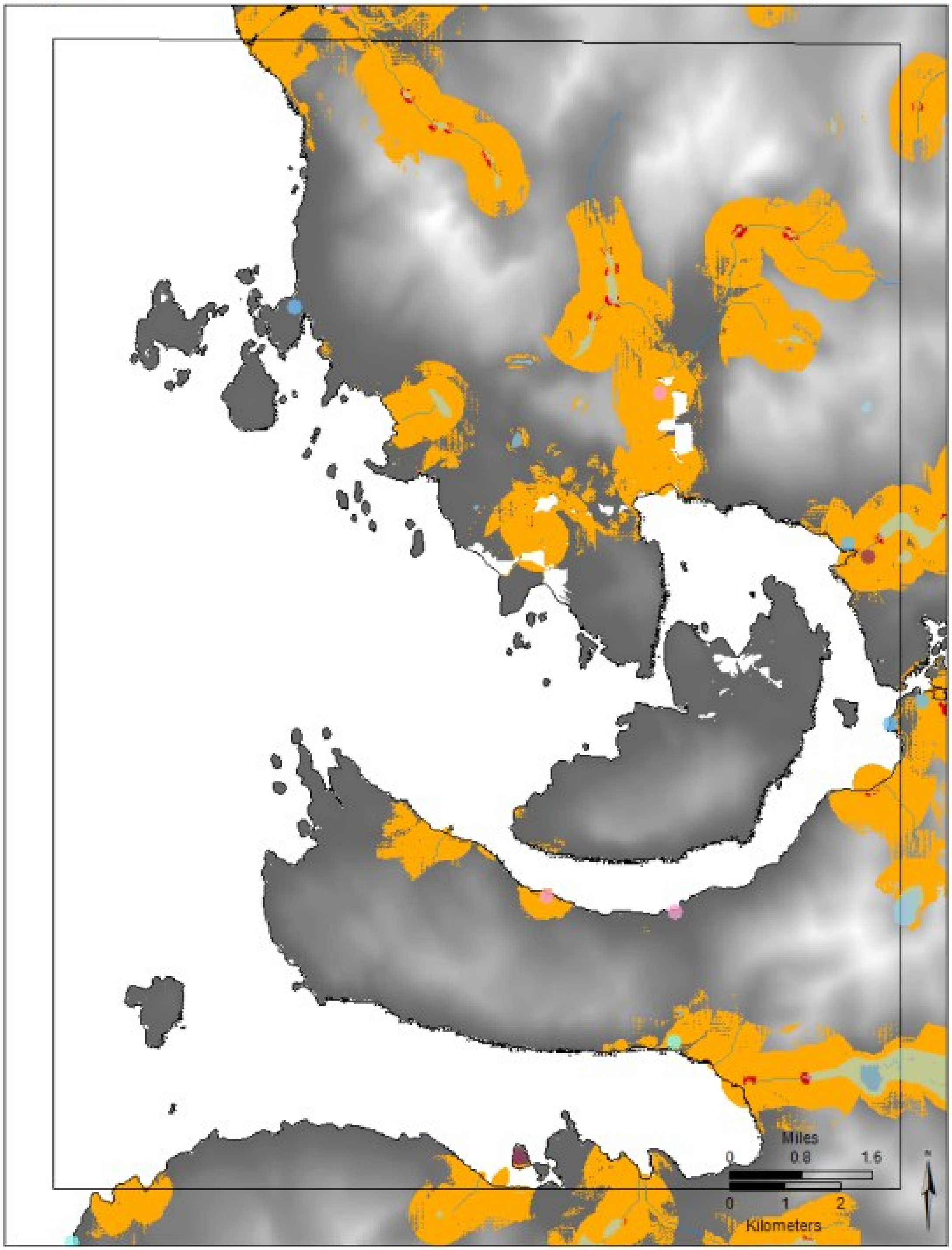
Weight 4a **NWC - modern**



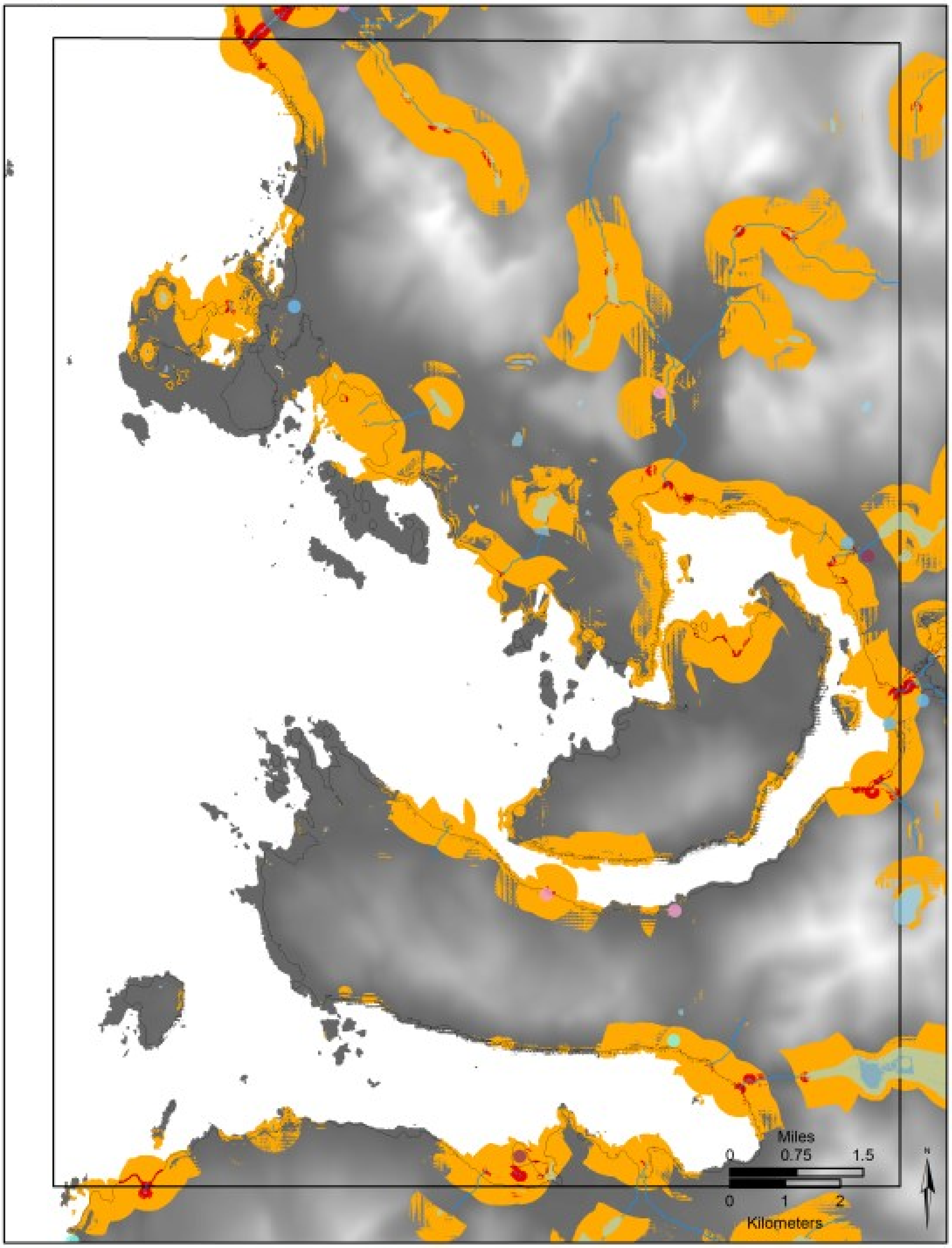
C.10 Weighted Overlay 5



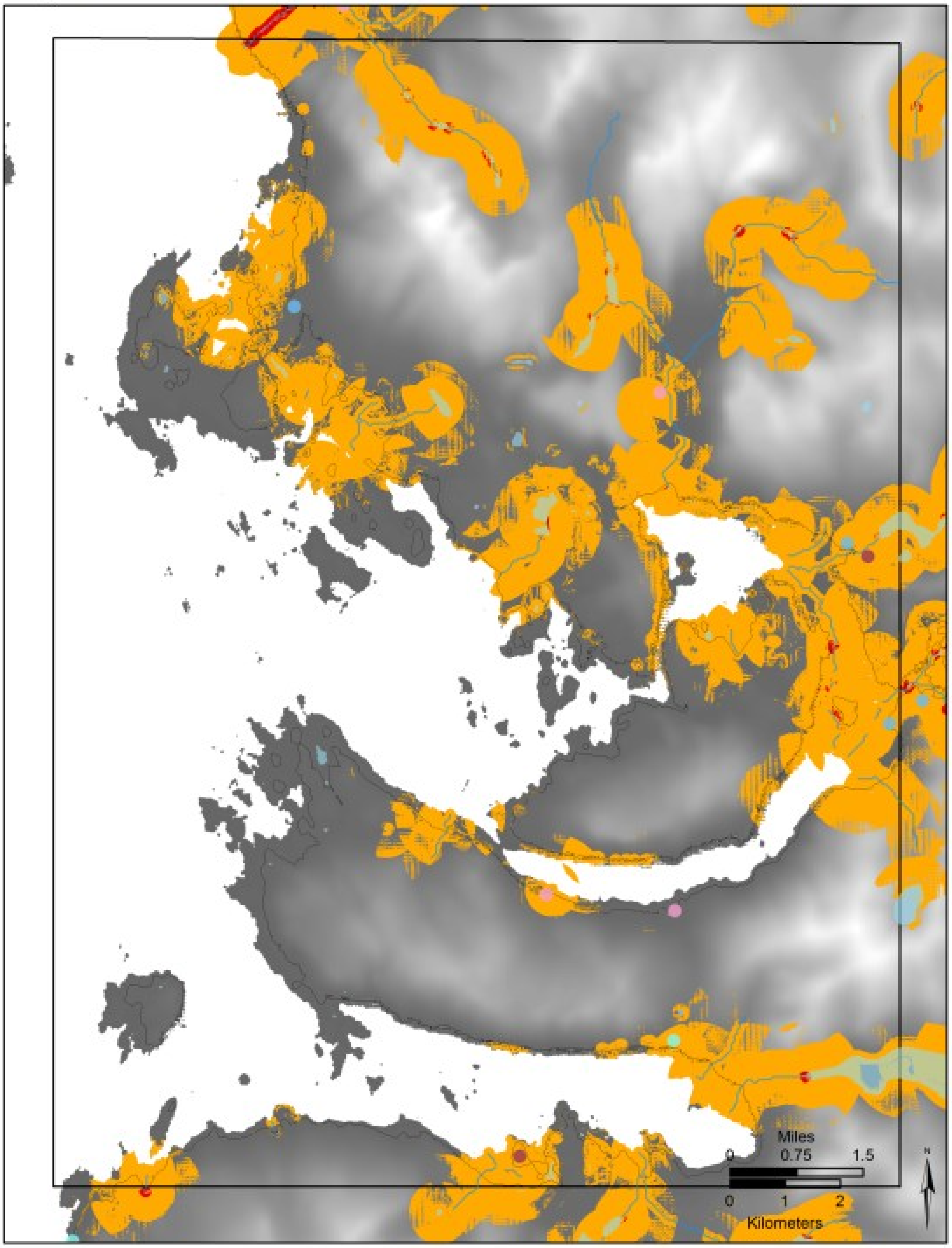
Weight 5 **10,500 cal BP**



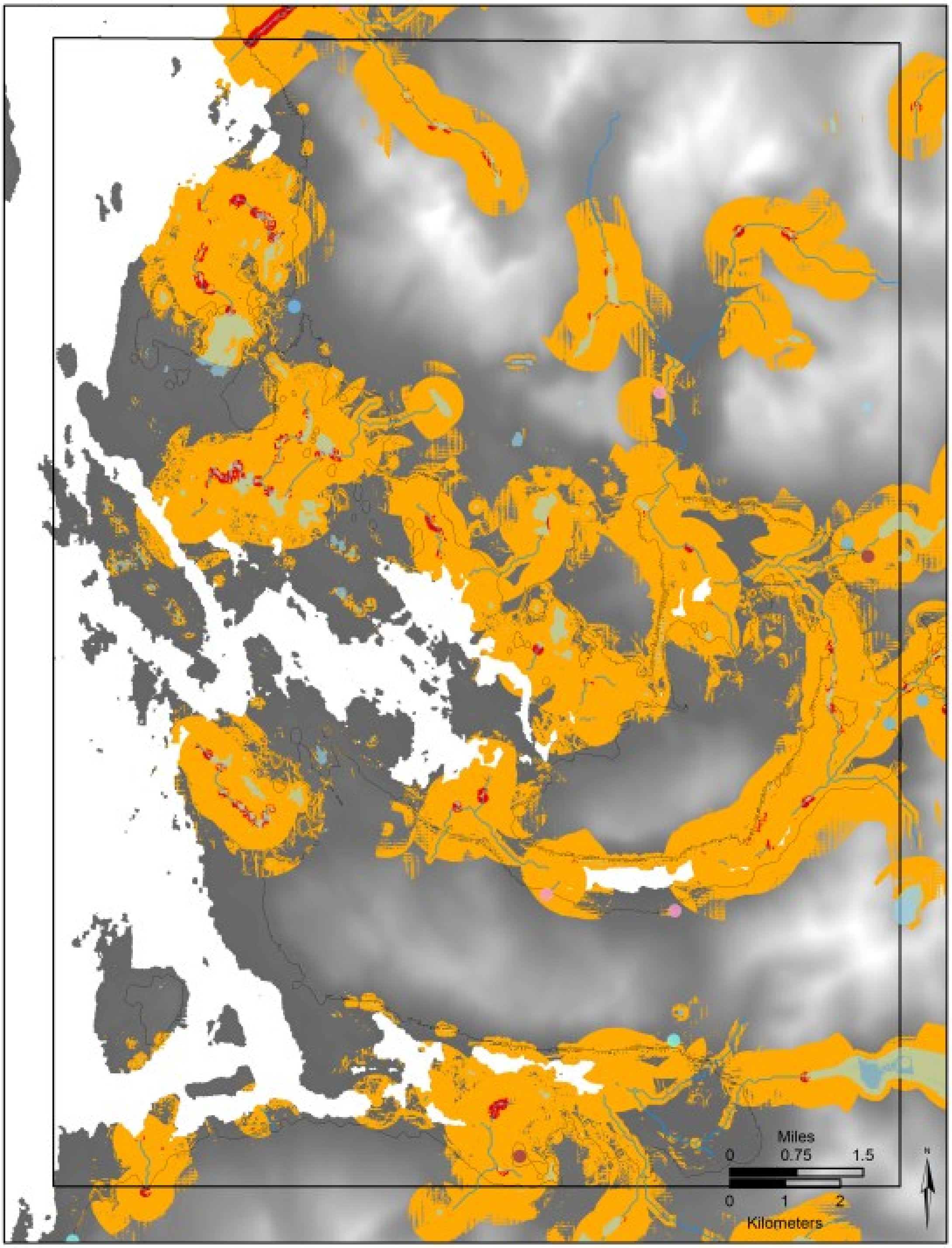
Weight 5 **11,000 cal BP**



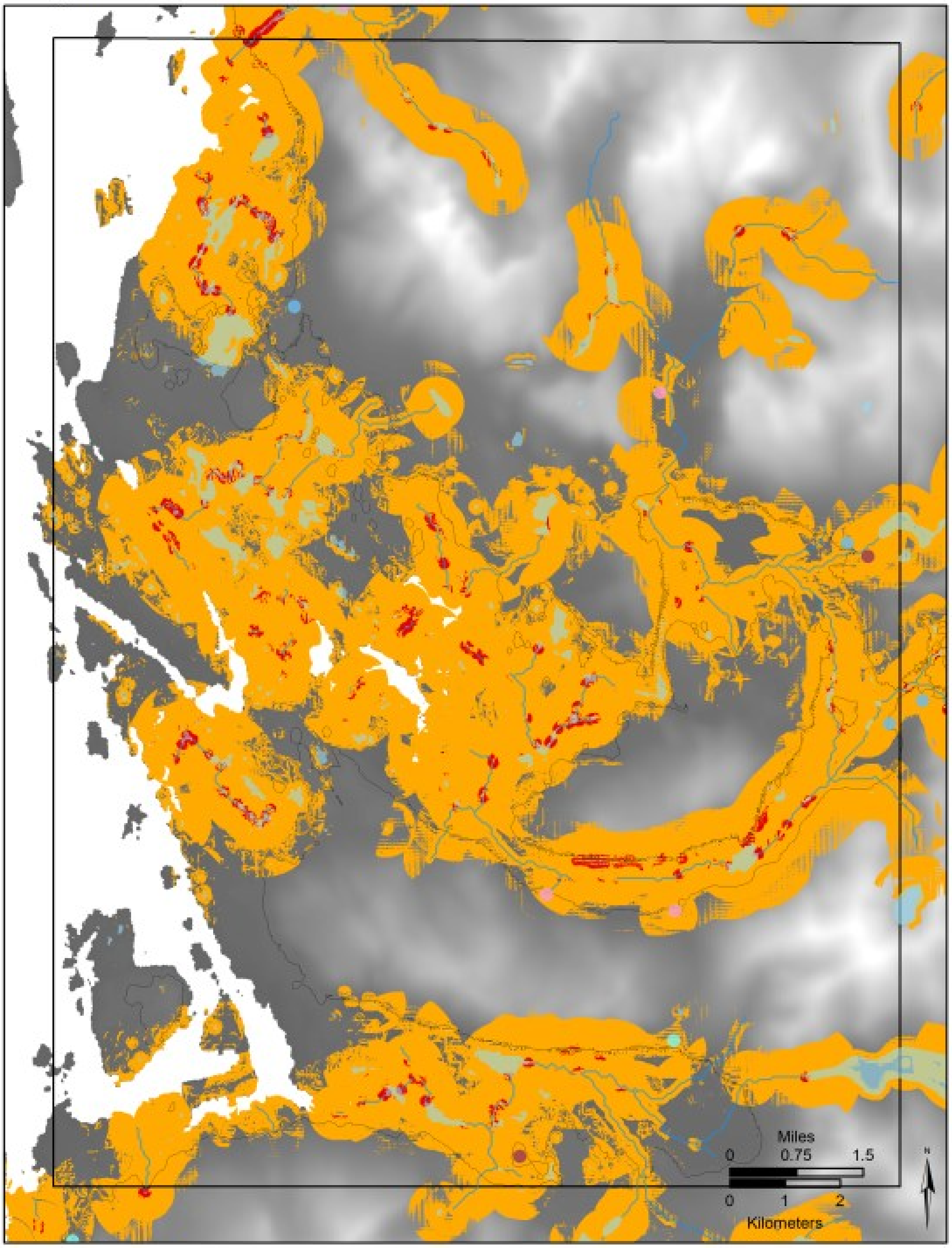
Weight 5 **11,500 cal BP**



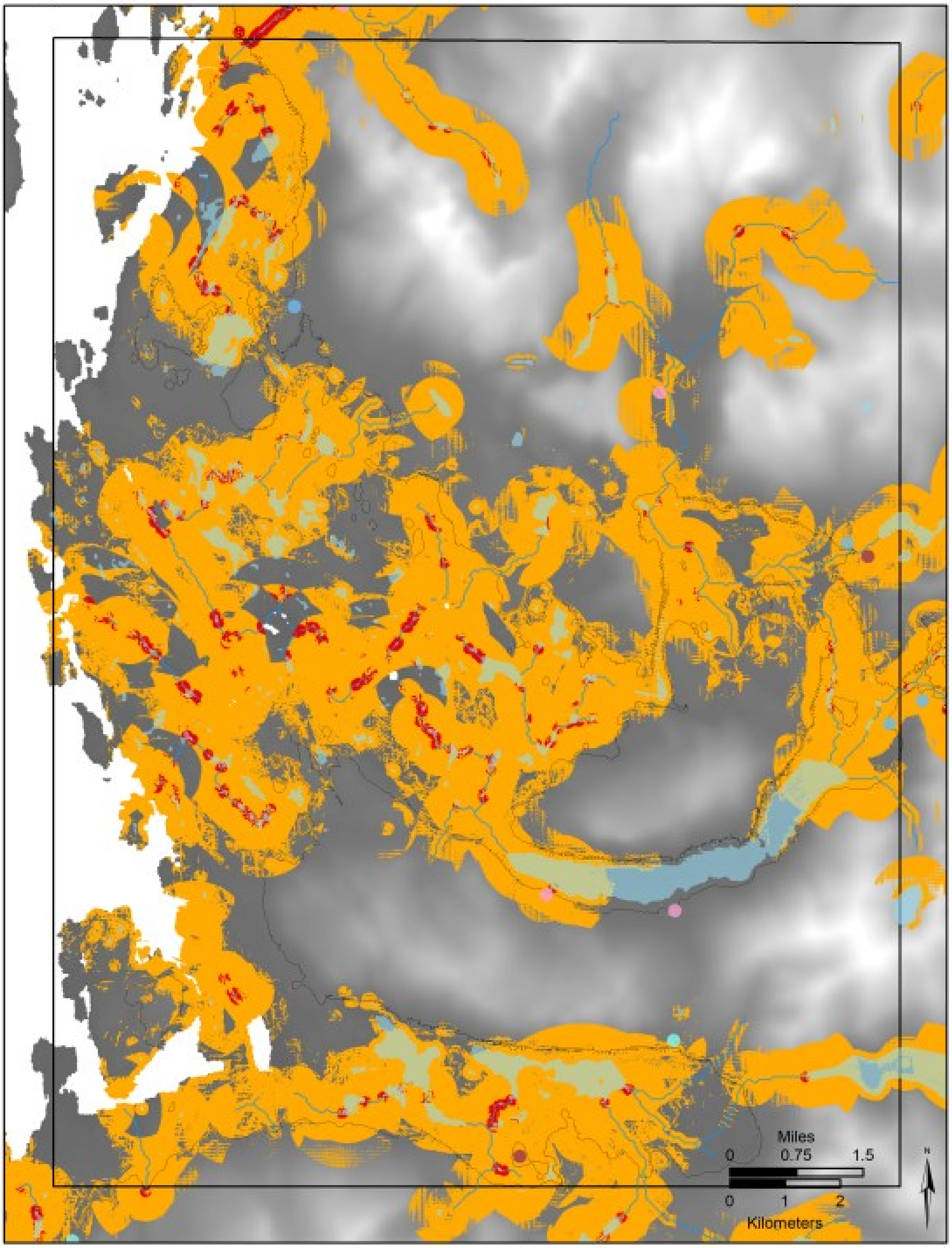
Weight 5 **12,000 cal BP**



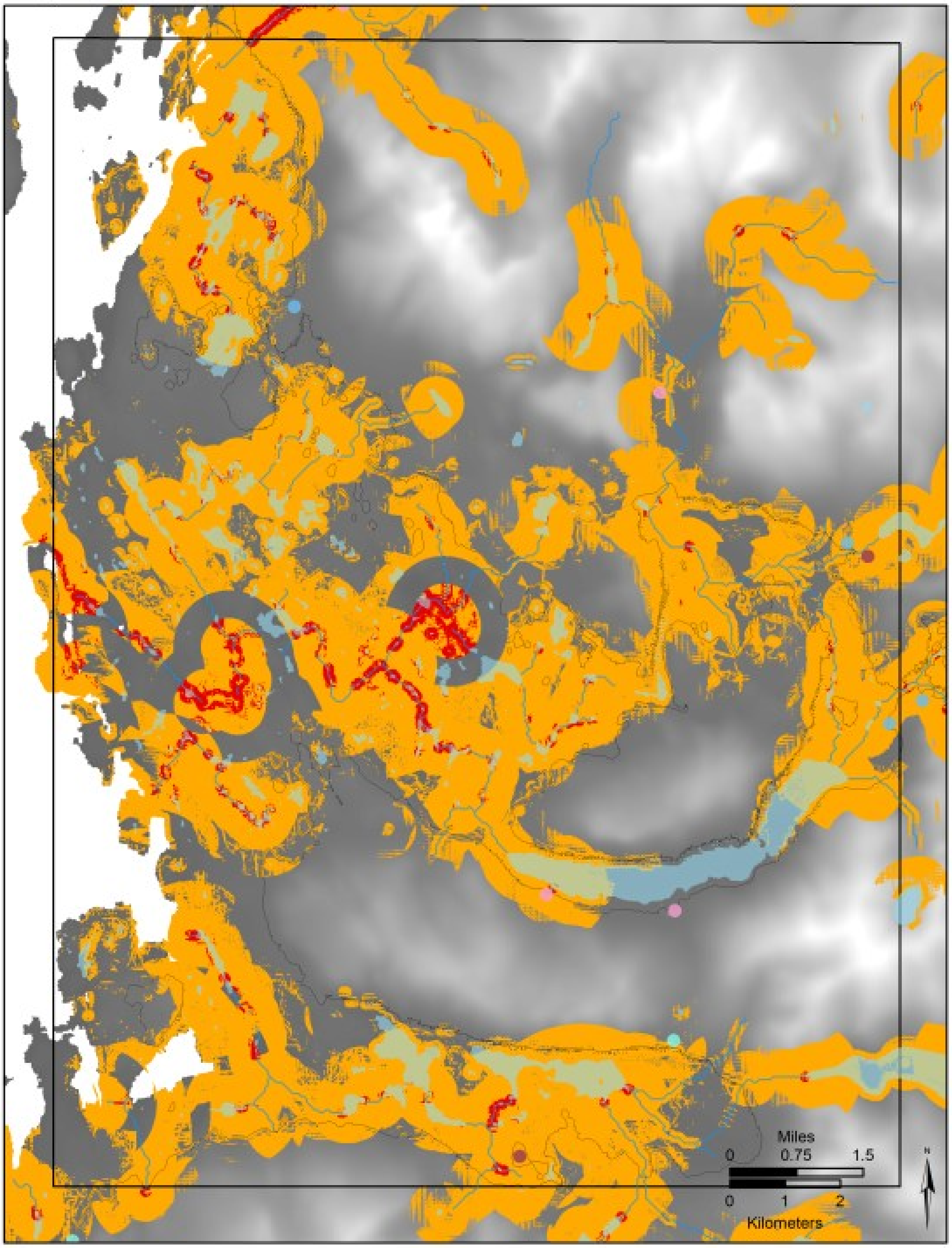
Weight 5 **12,500 cal BP**



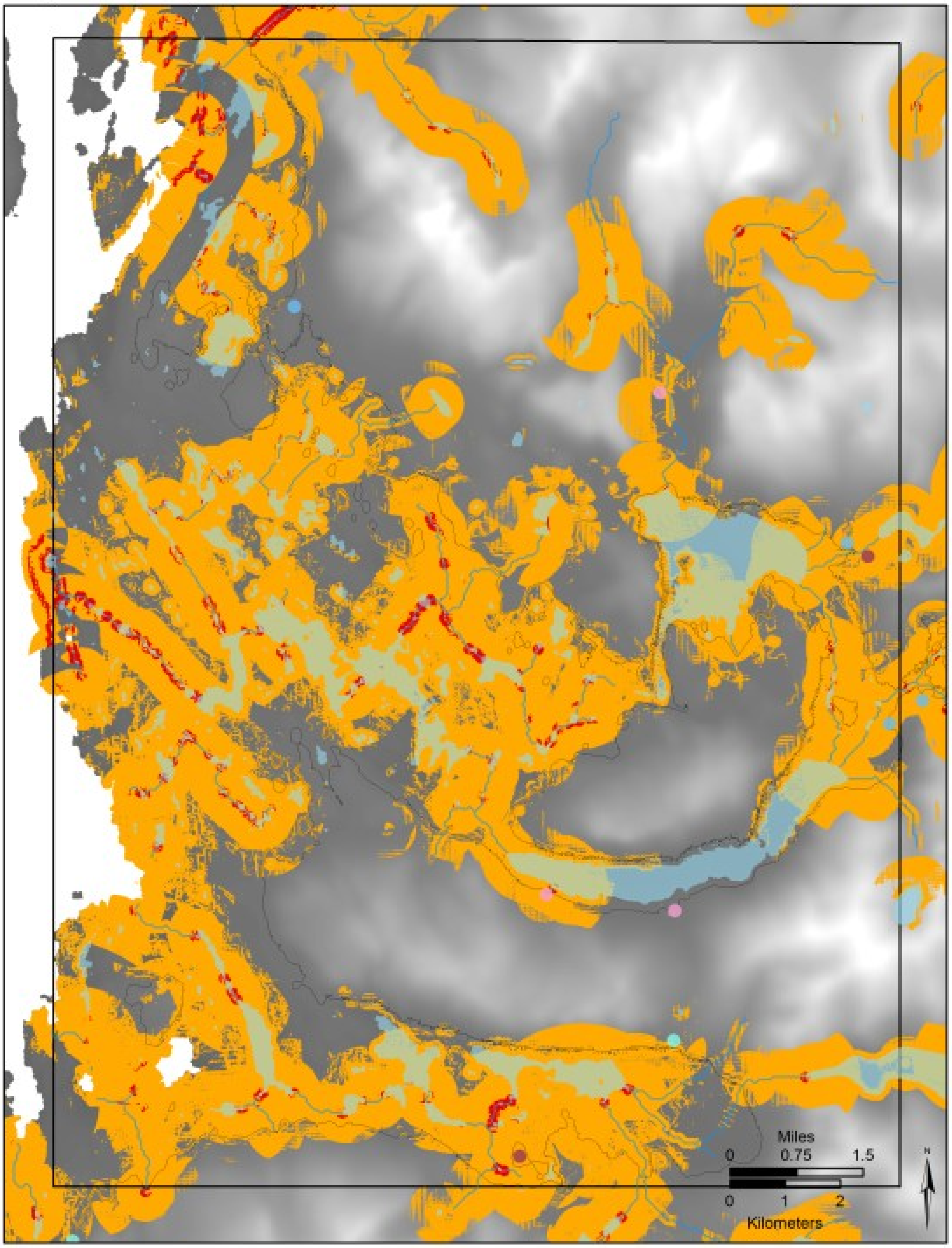
Weight 5 **13,000 cal BP**



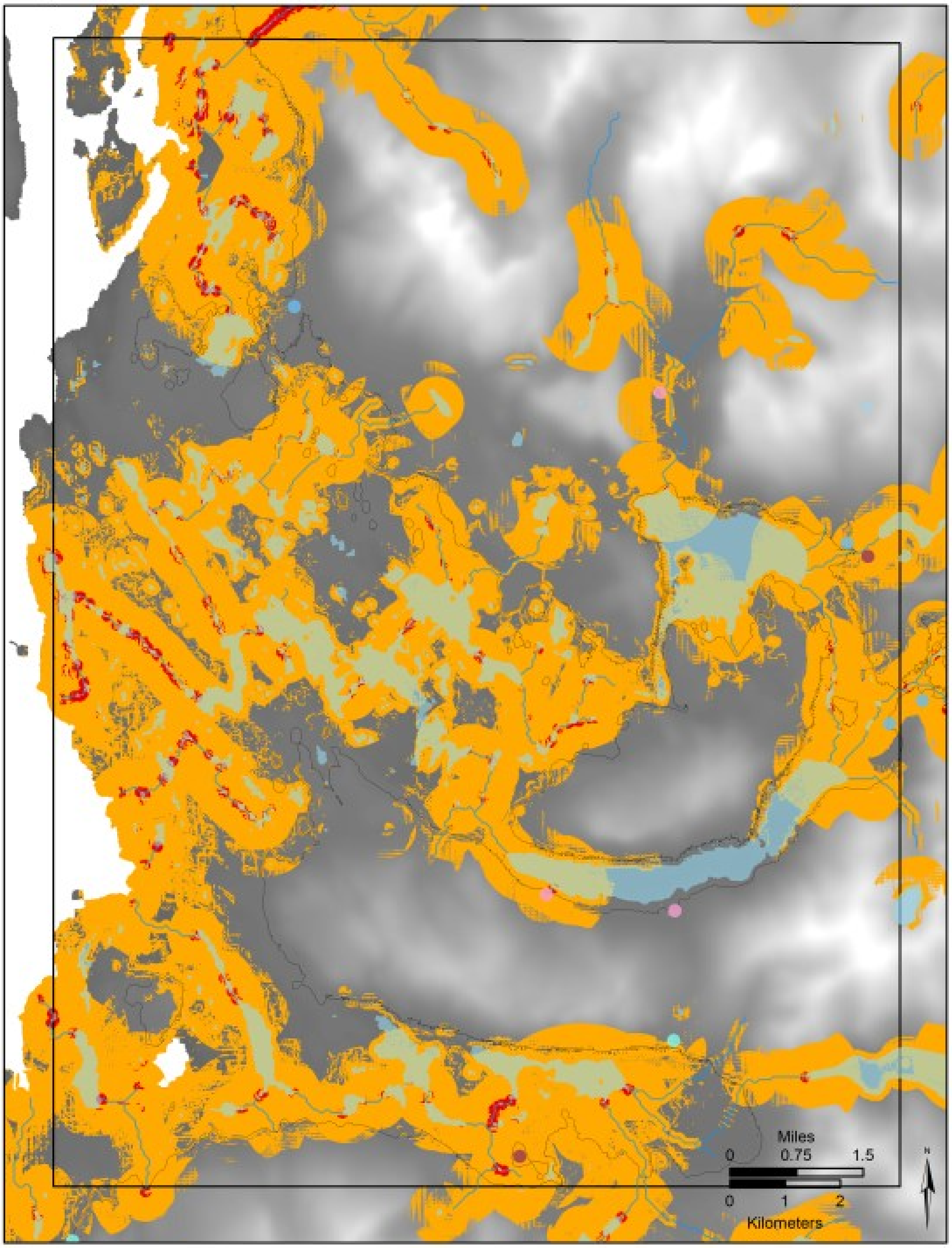
Weight 5 **13,500 cal BP**



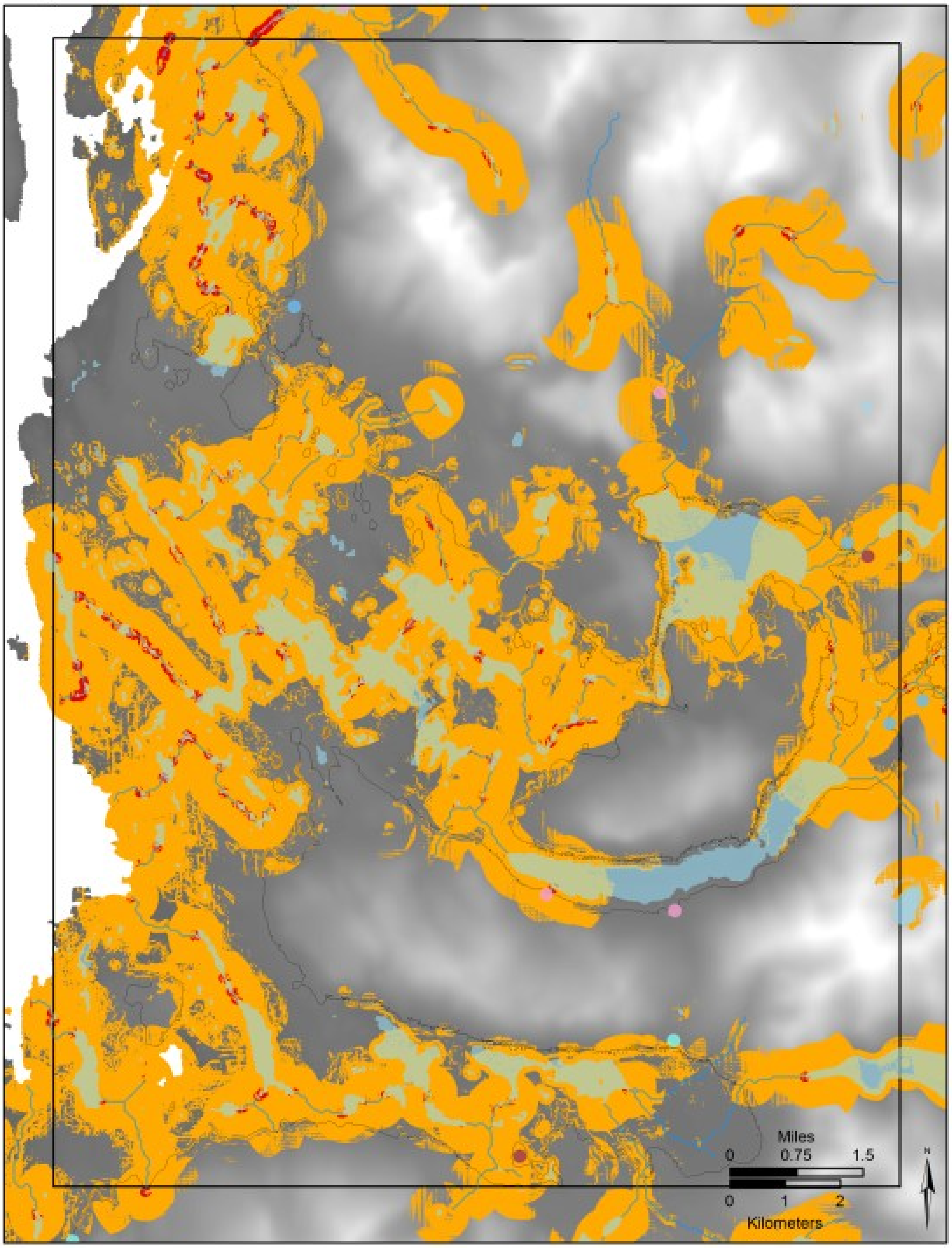
Weight 5 **14,000 cal BP**



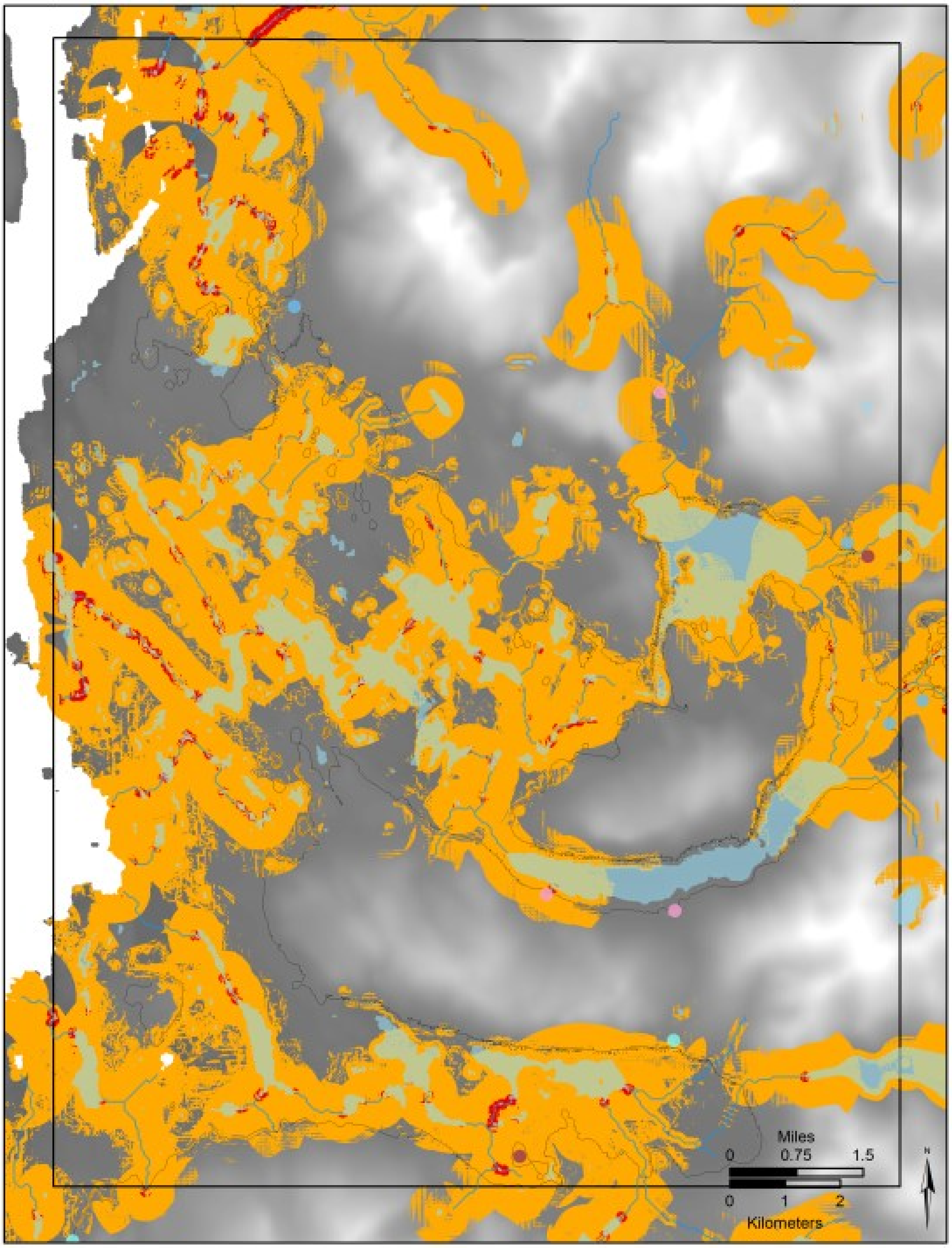
Weight 5 **14,500 cal BP**



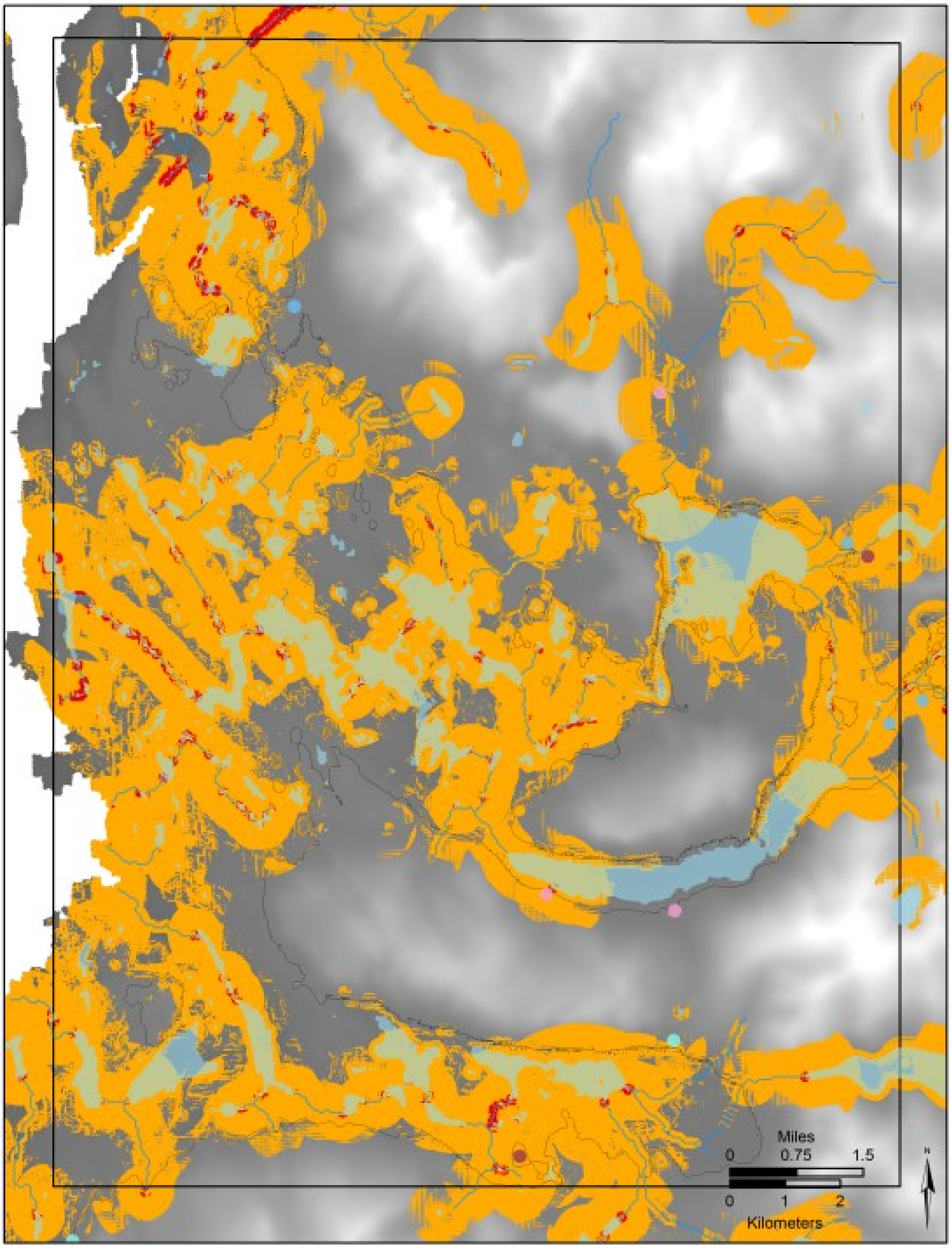
Weight 5 **15,000 cal BP**



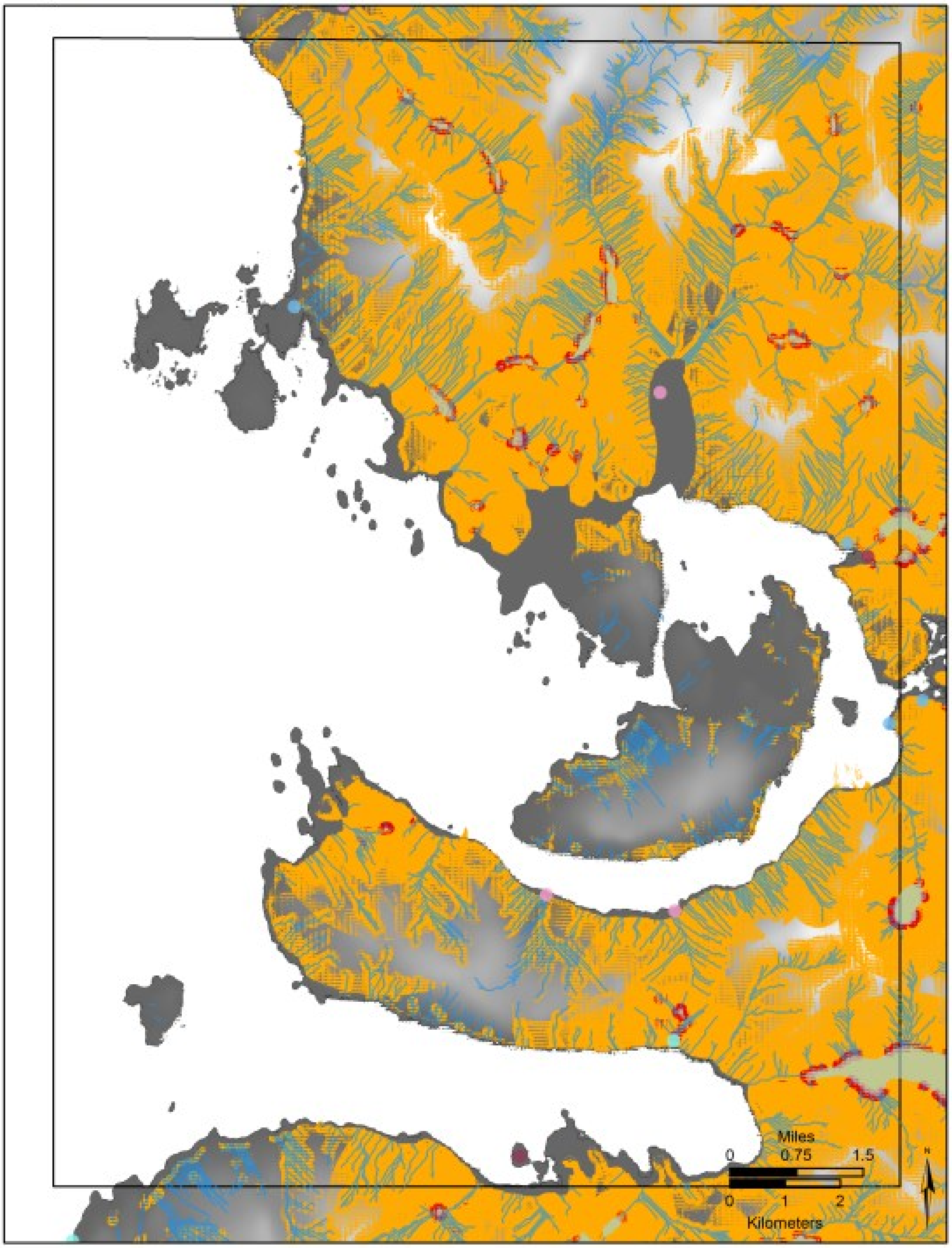
Weight 5 **15,500 cal BP**



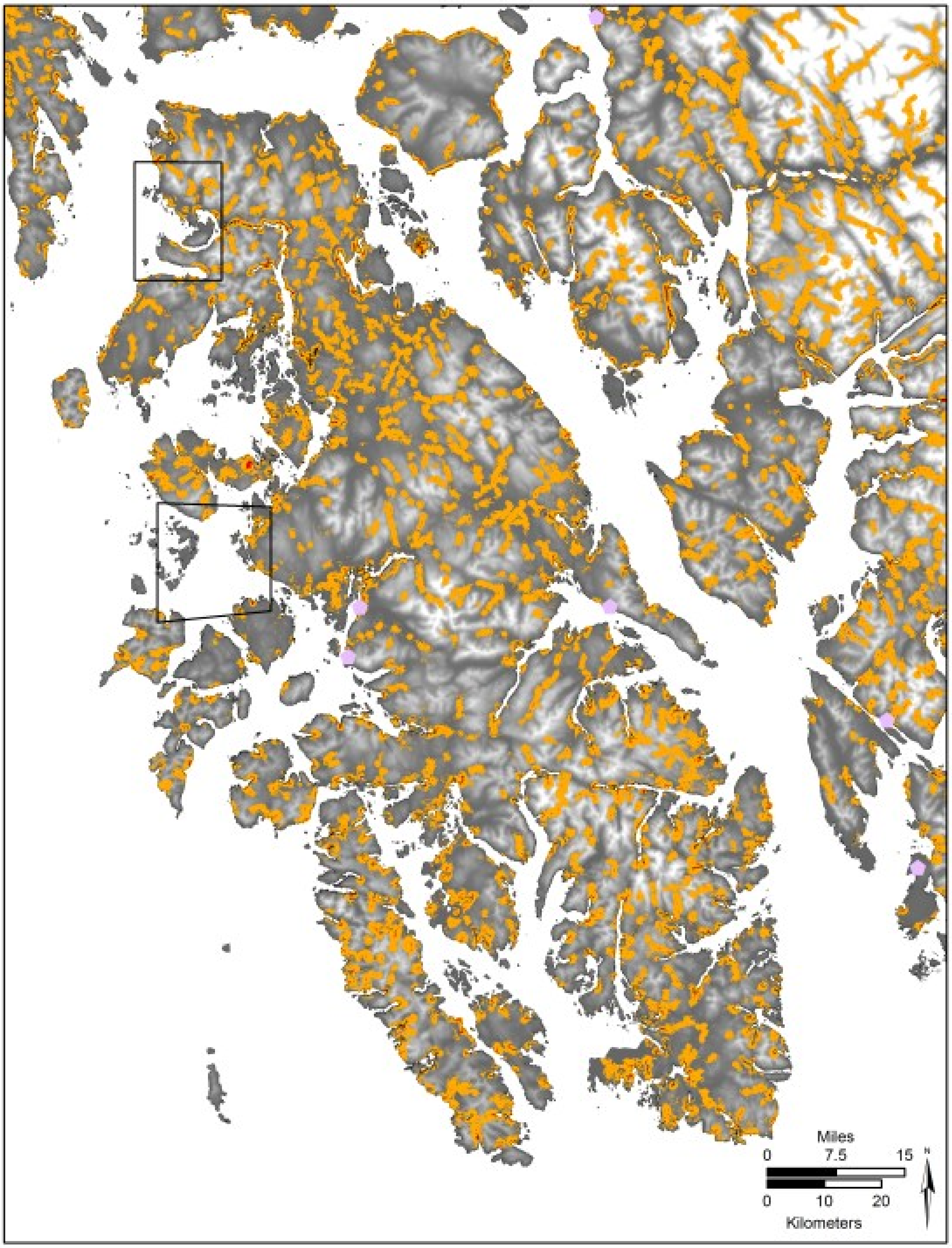
Weight 5 **16,000 cal BP**



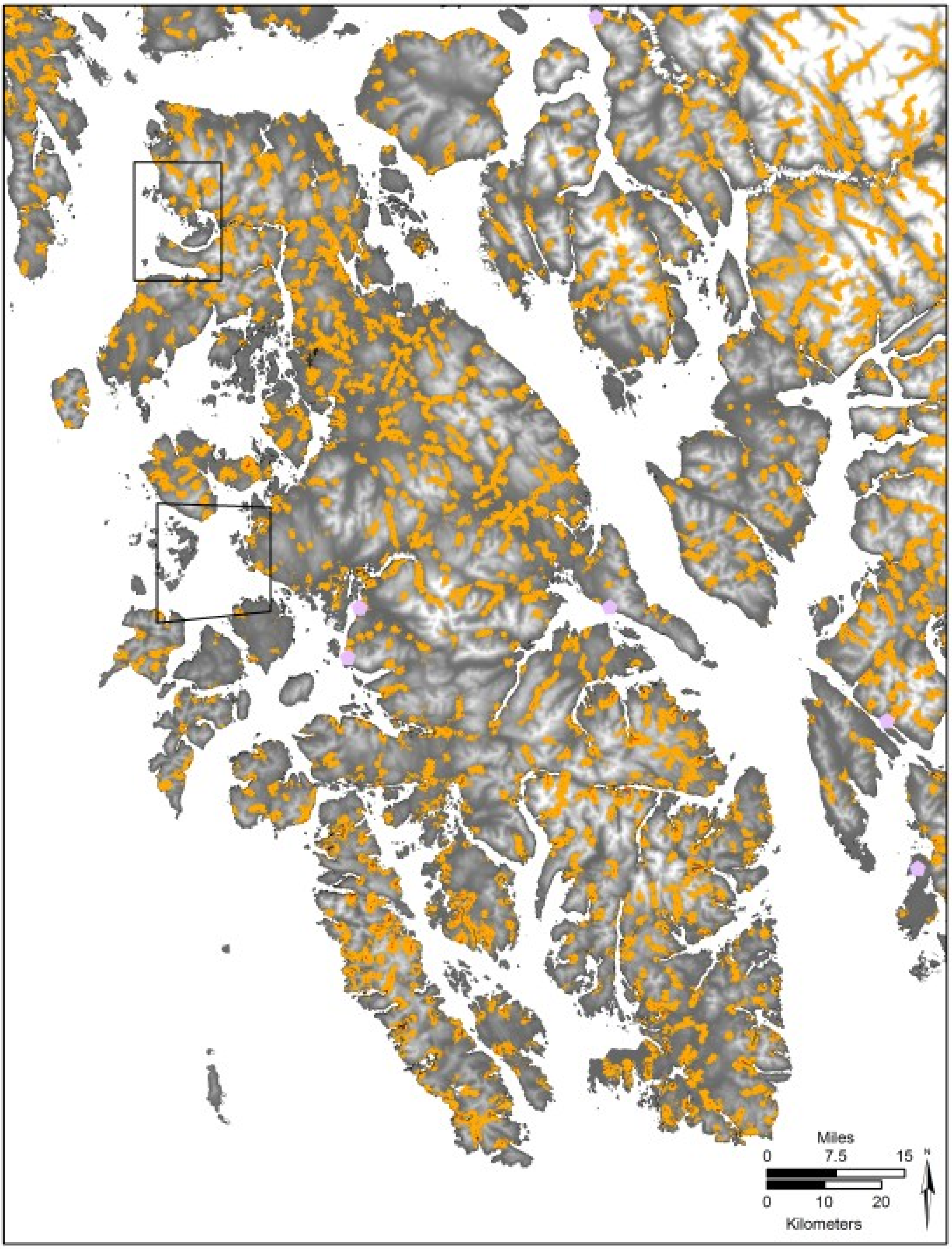
Weight 5 **Modern - Small Area**



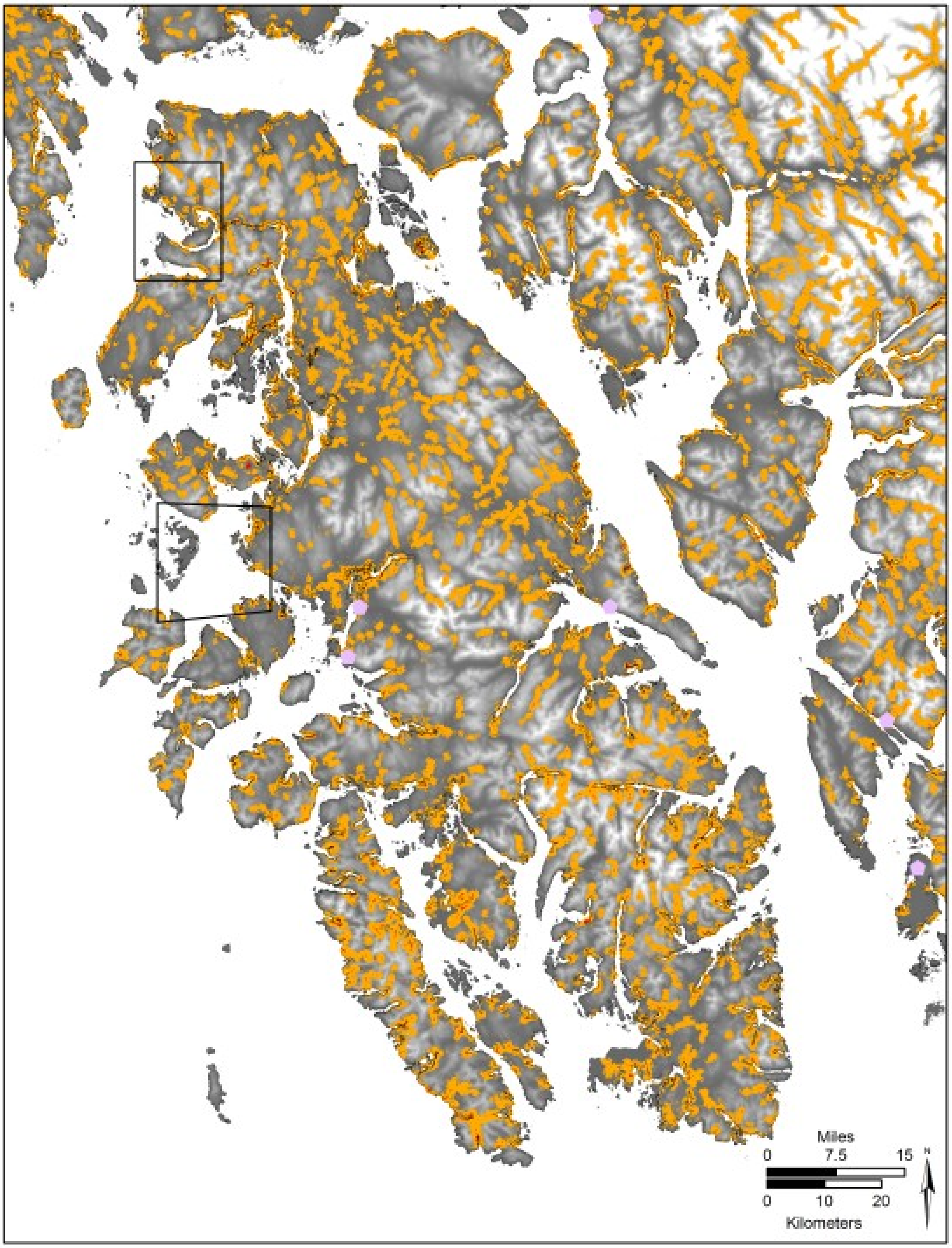
Weight 5 **Modern**



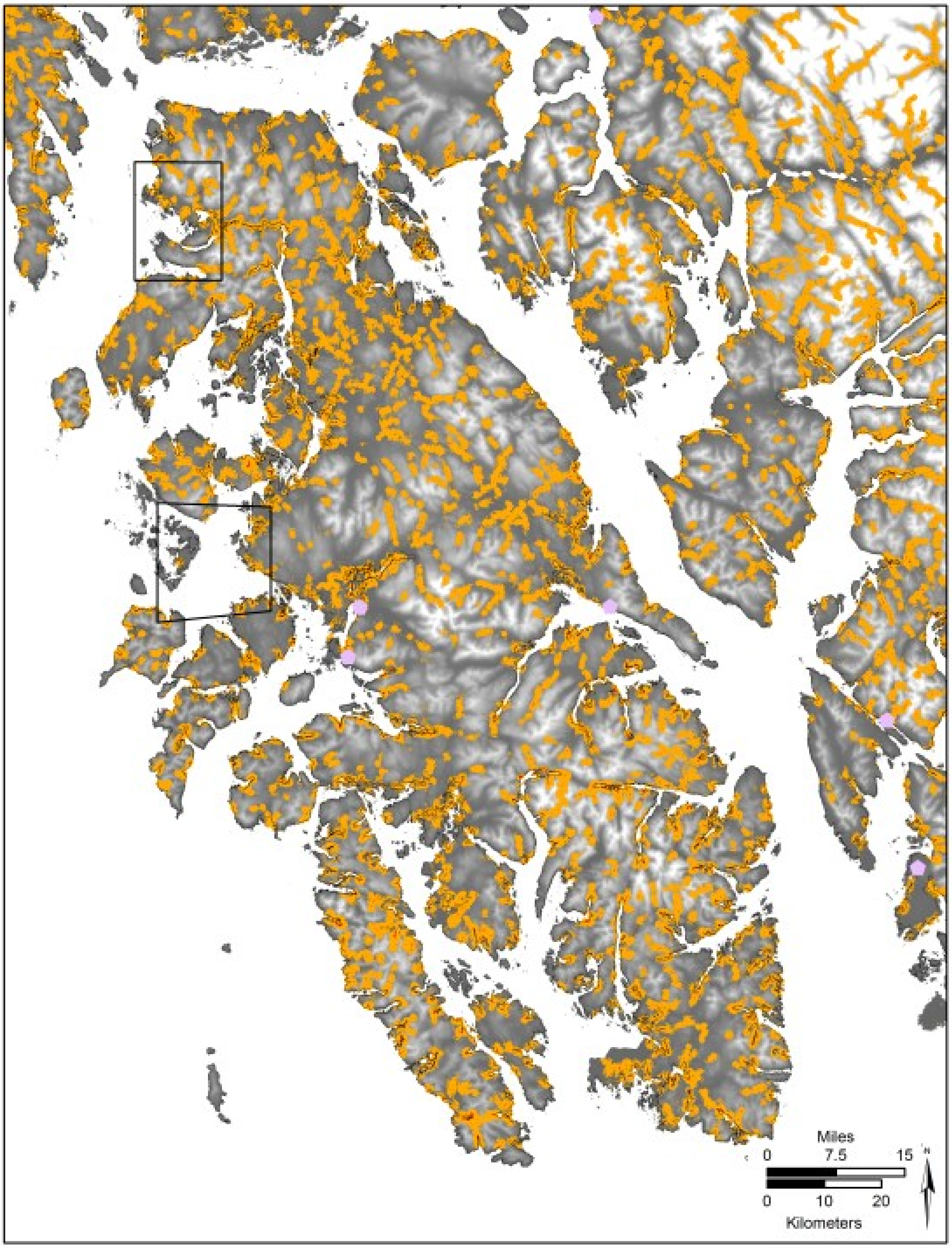
Weight 5 **10,500 cal BP**



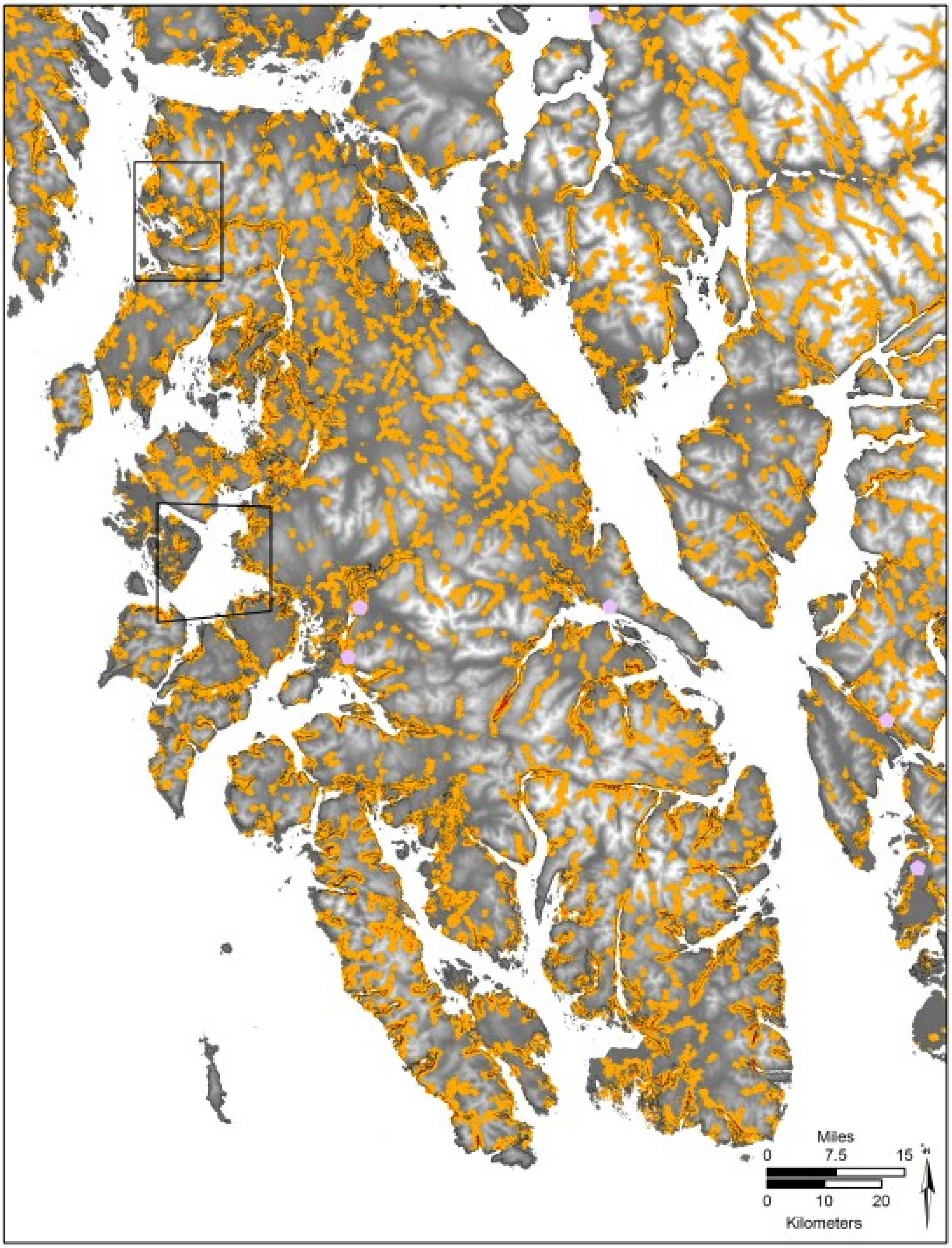
Weight 5 **11,000 cal BP**



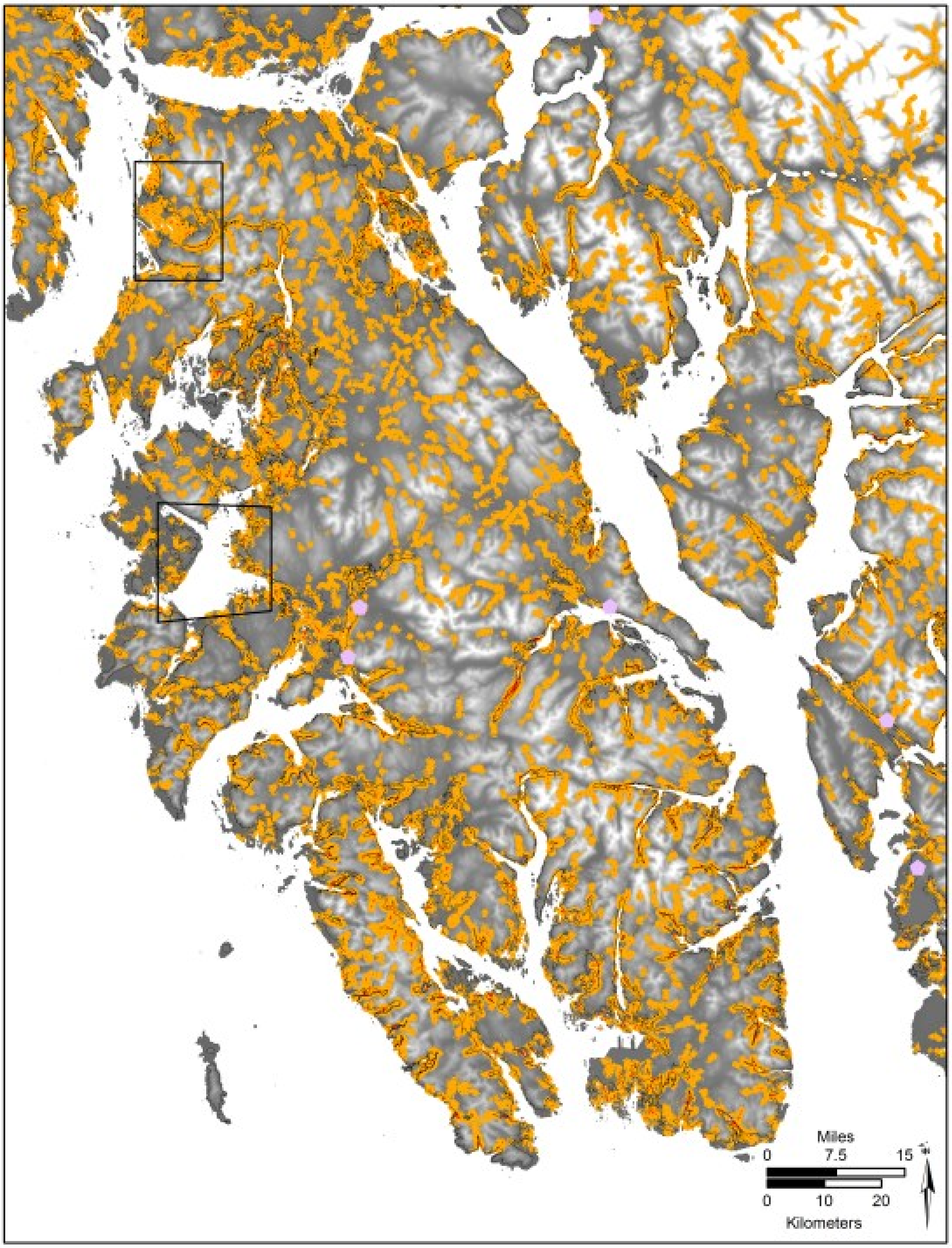
Weight 5 **11,500 cal BP**



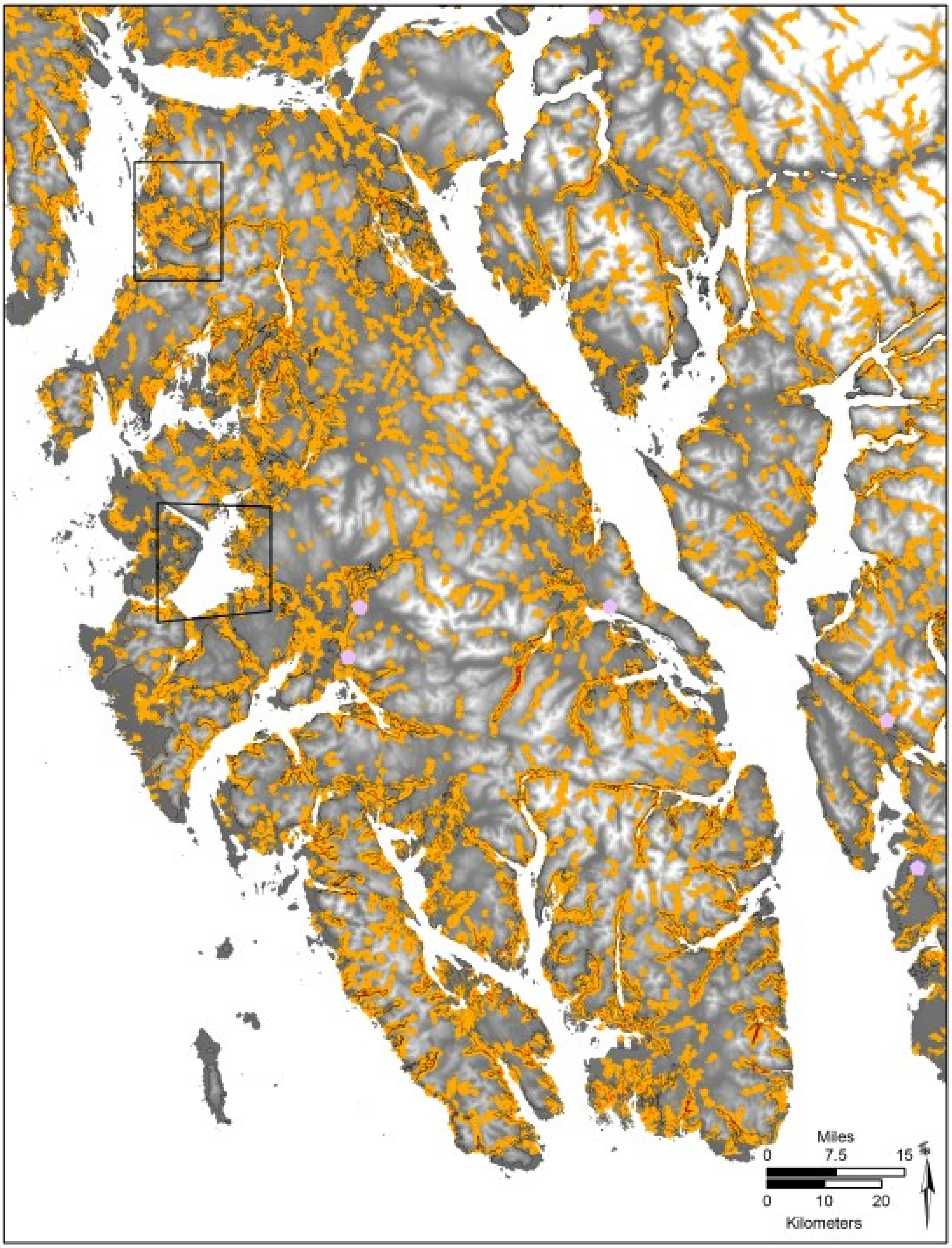
Weight 5 **12,000 cal BP**



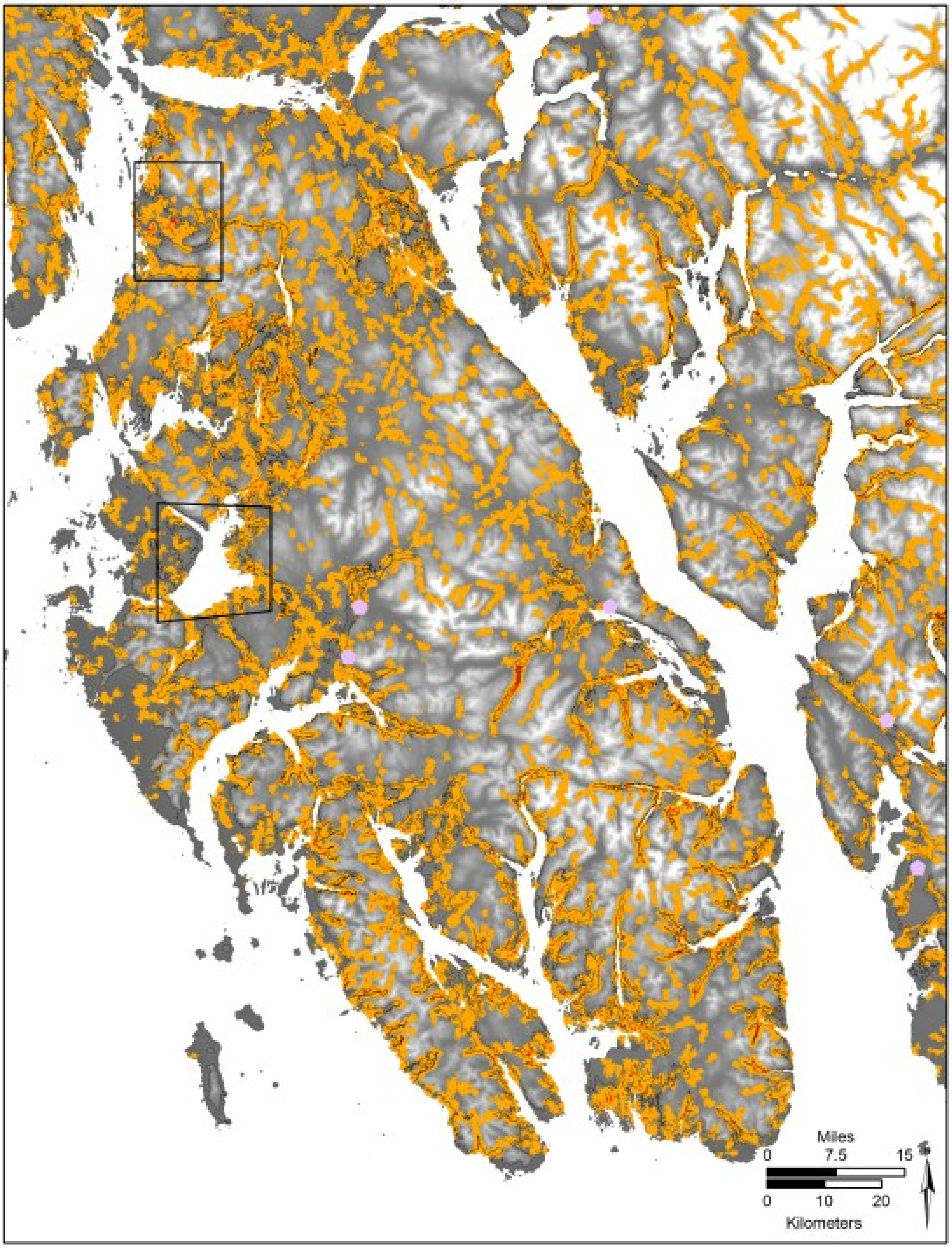
Weight 5 **12,500 cal BP**



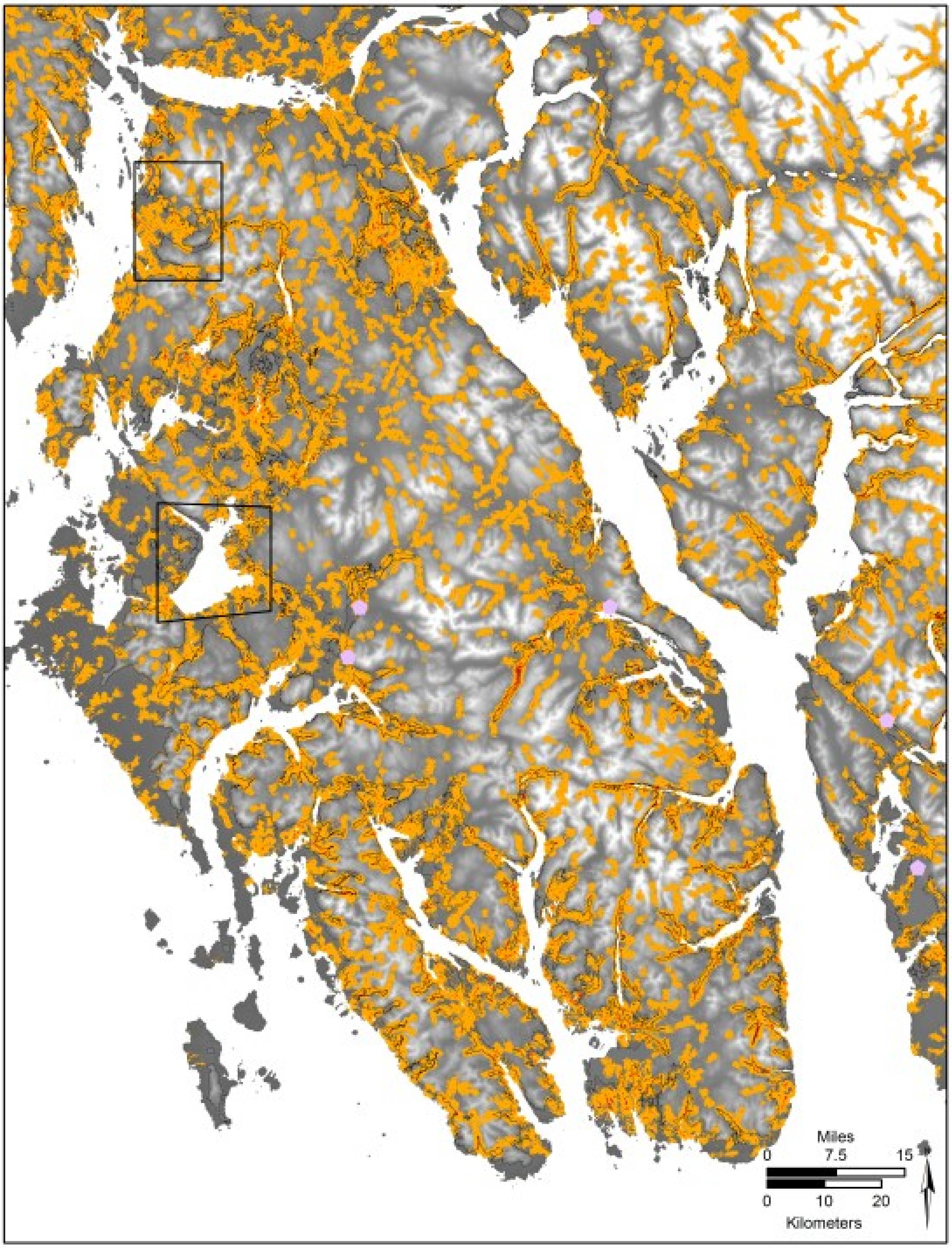
Weight 5 **13,000 cal BP**



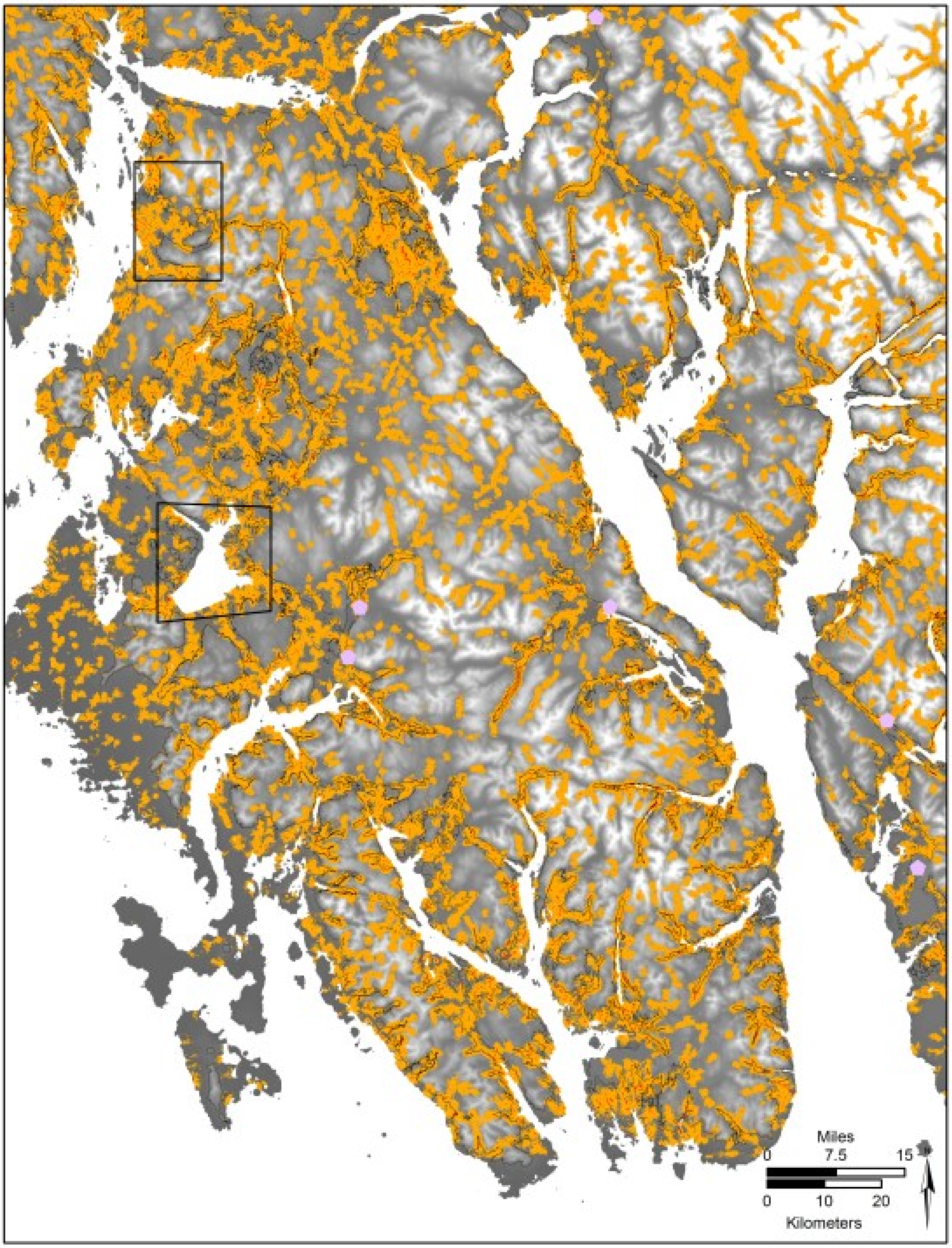
Weight 5 **13,500 cal BP**



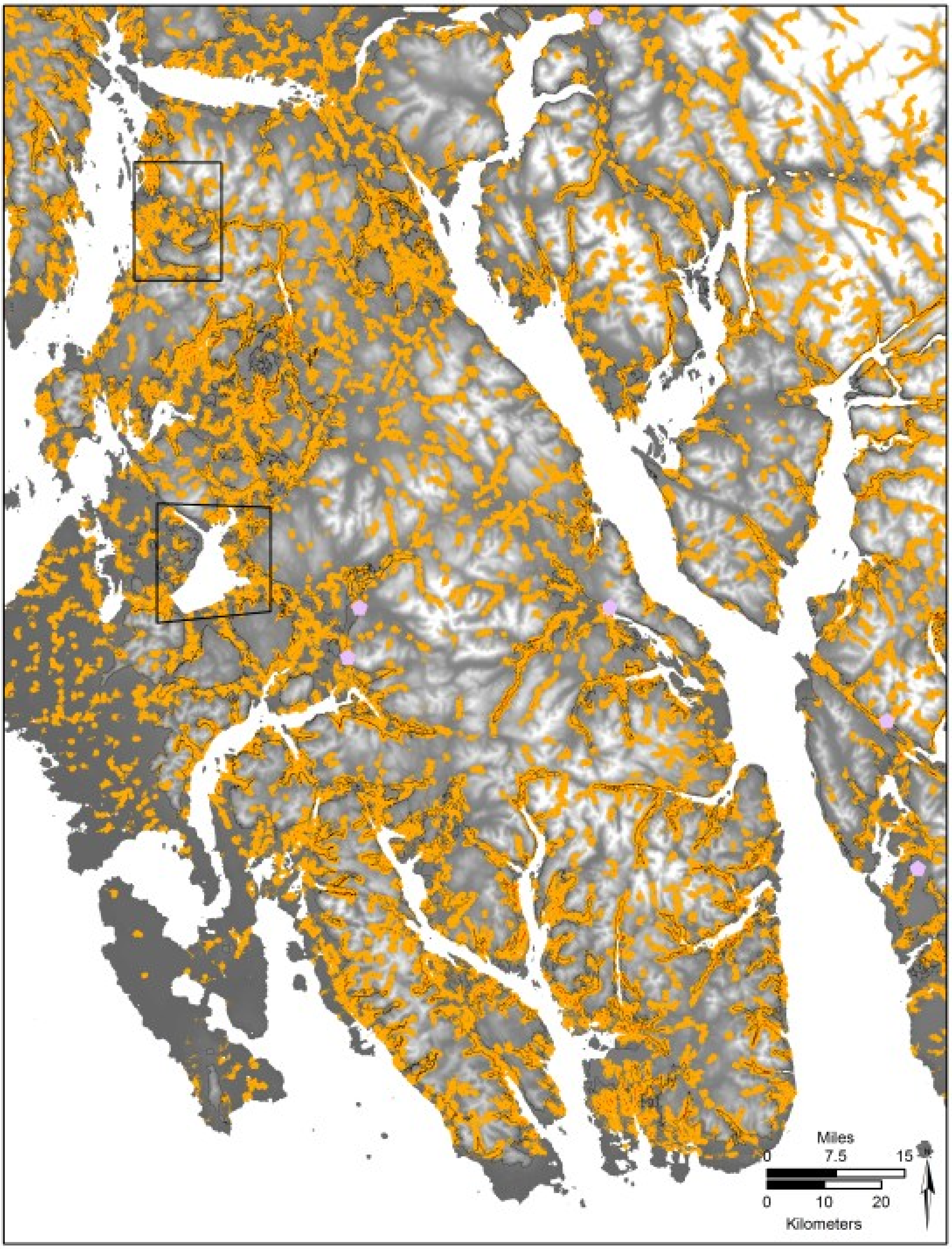
Weight 5 **14,000 cal BP**



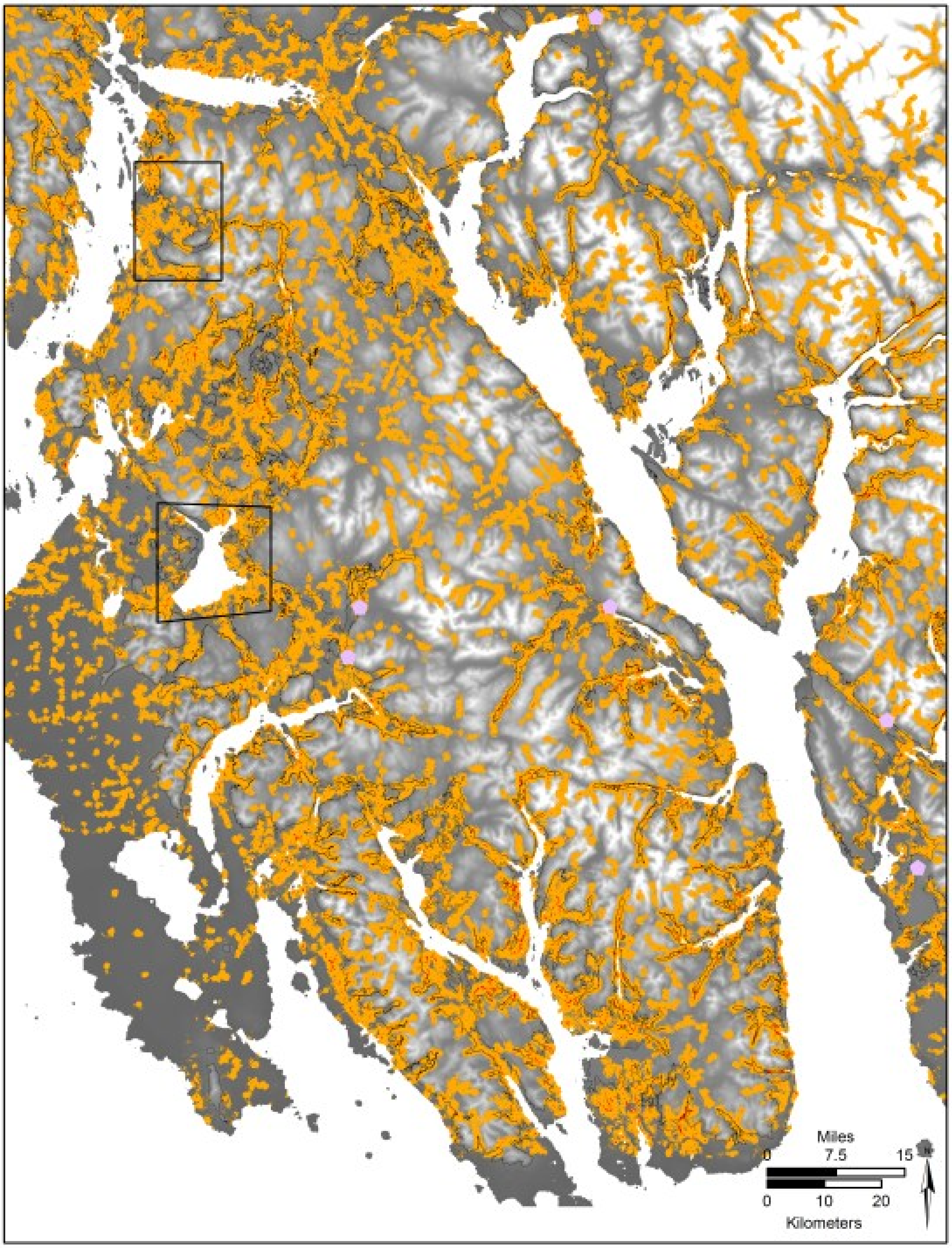
Weight 5 **14,500 cal BP**



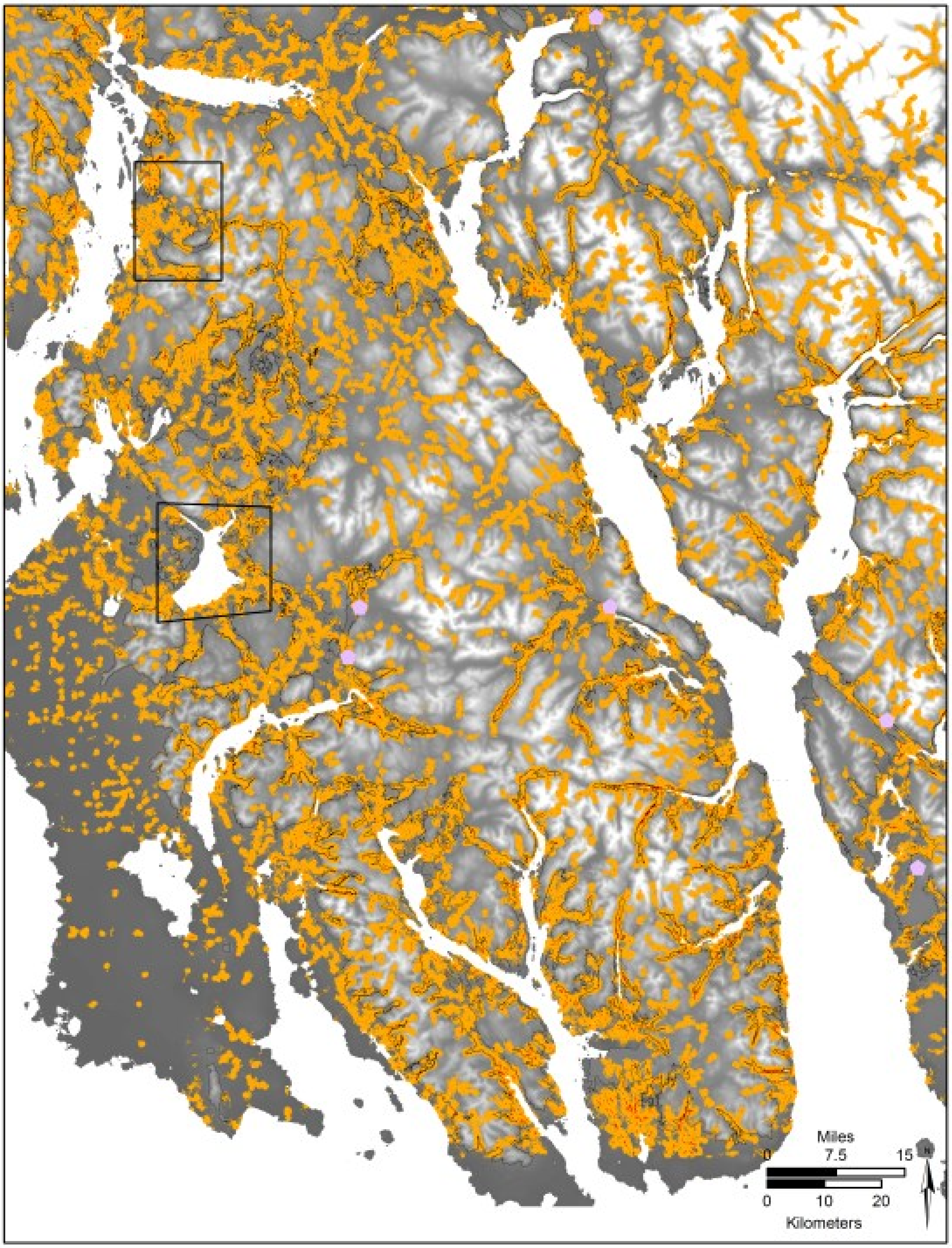
Weight 5 **15,000 cal BP**



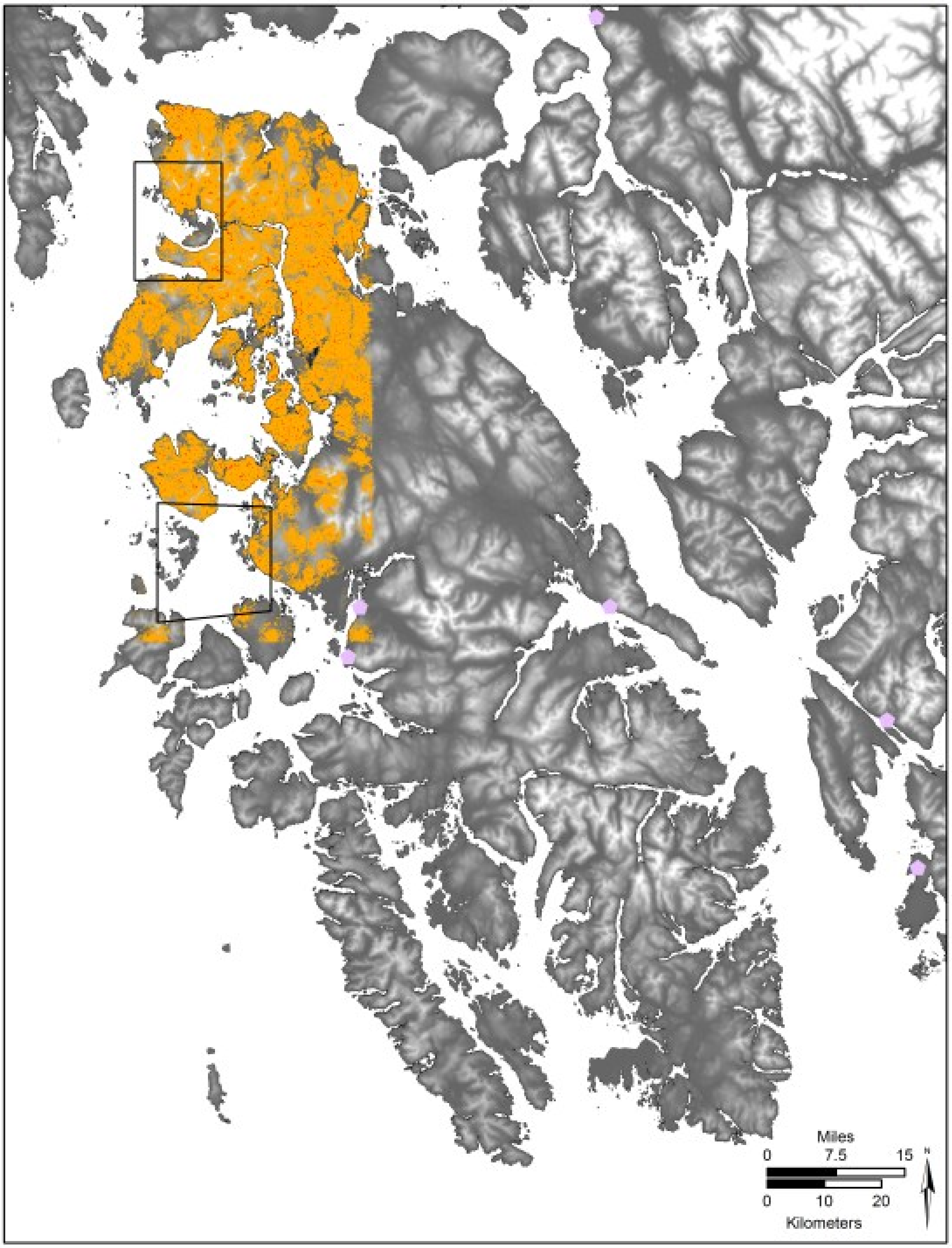
Weight 5 **15,500 cal BP**



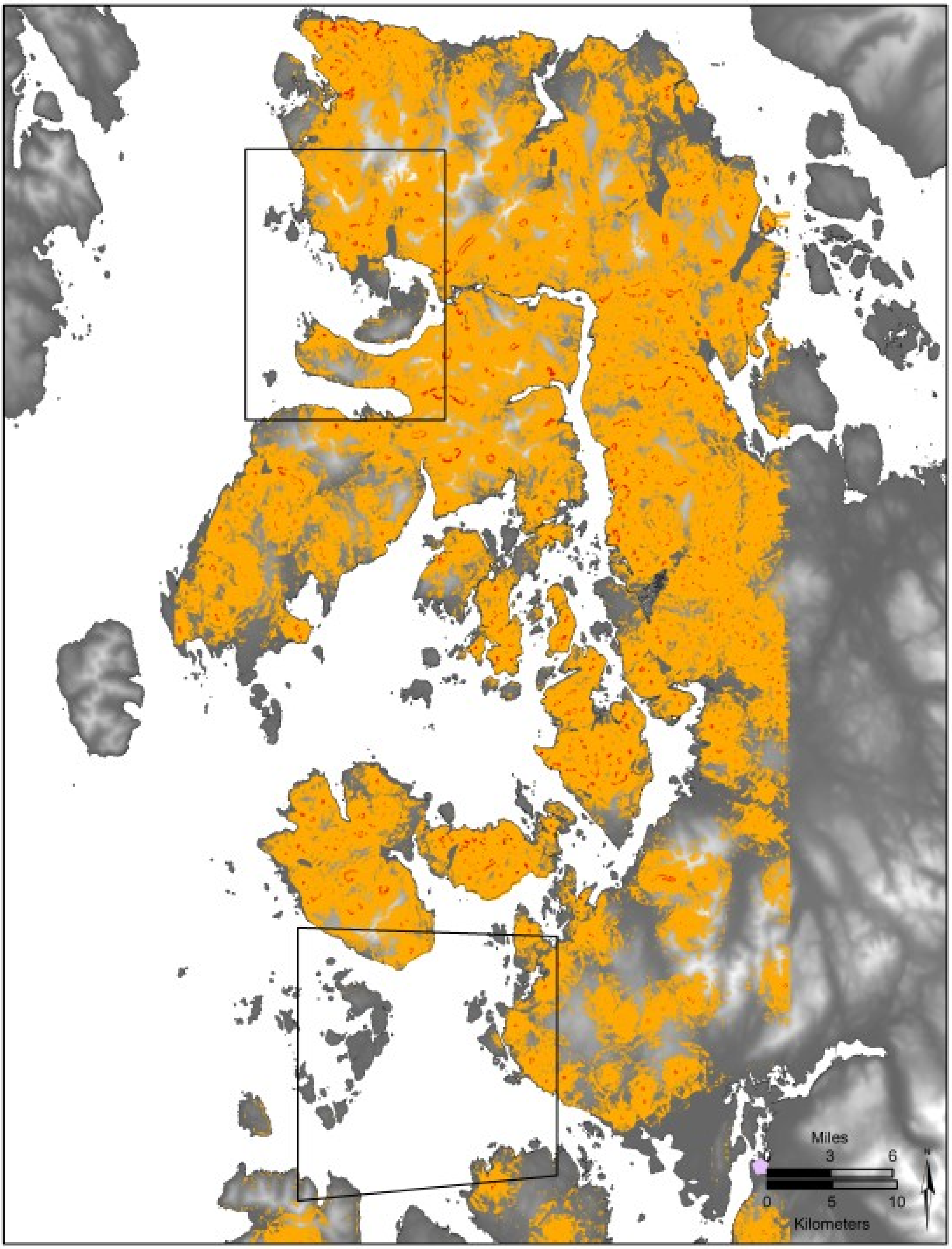
Weight 5 **16,000 cal BP**



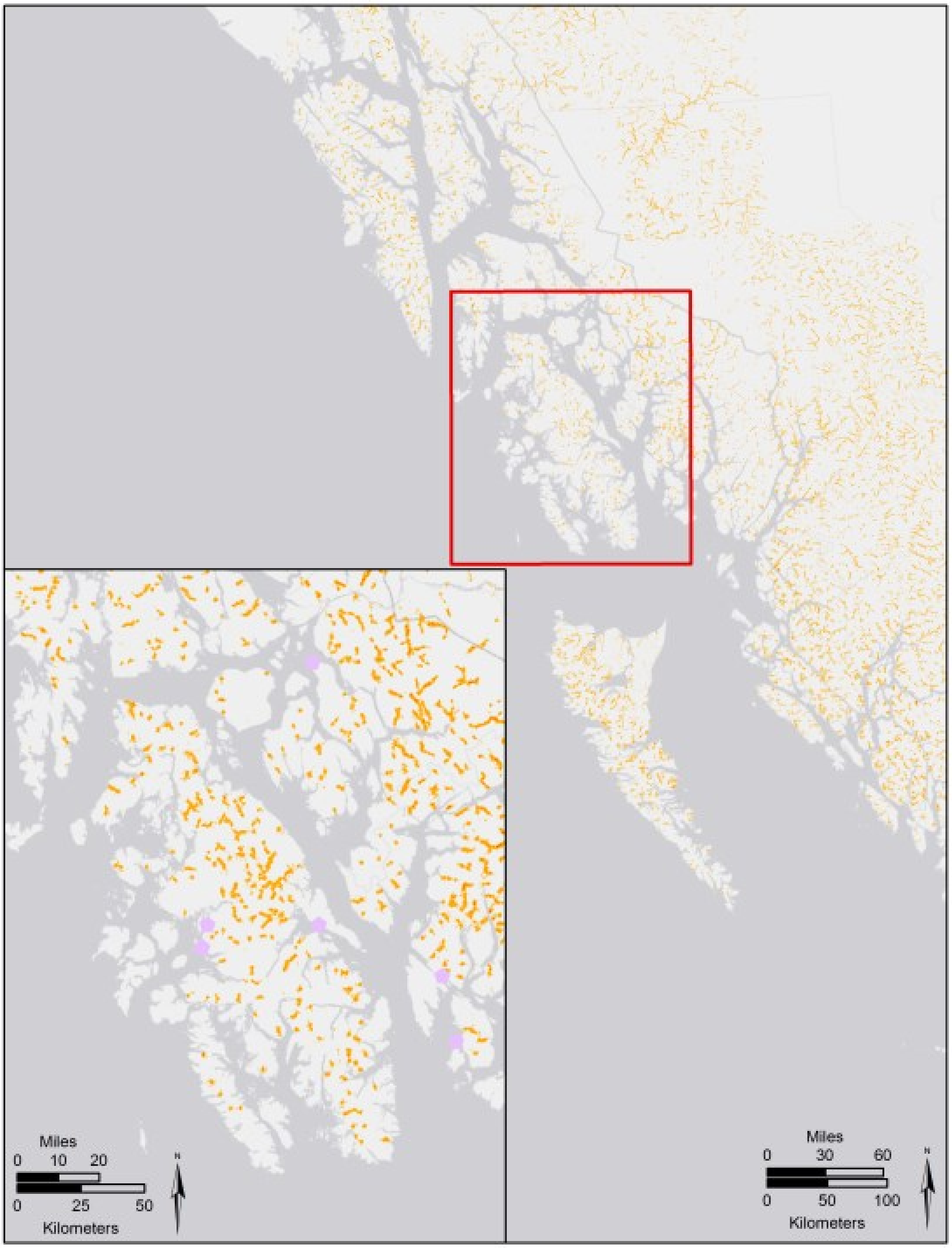
Weight 5 **Modern - Small Area**



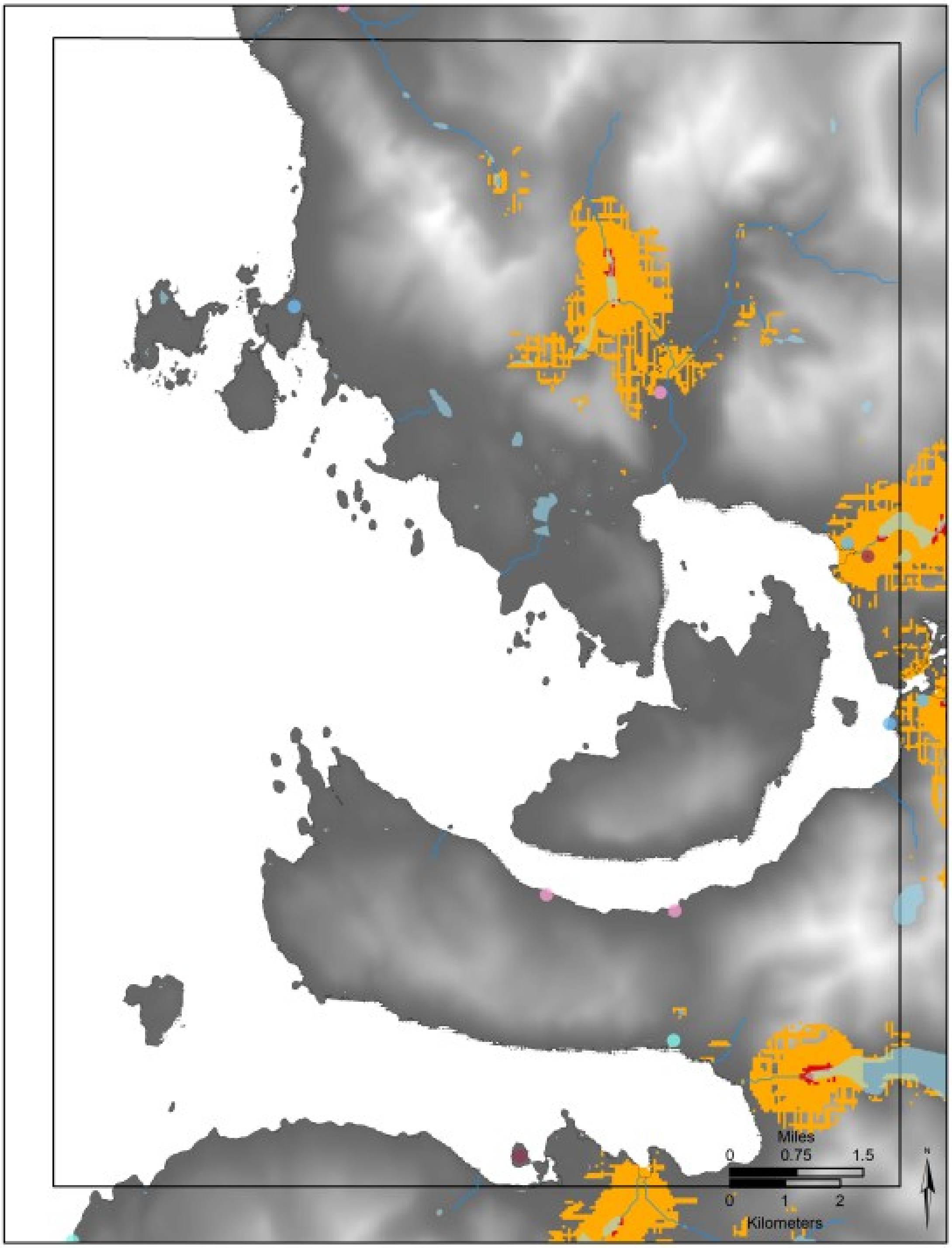
Weight 5 **Modern - Small Area**



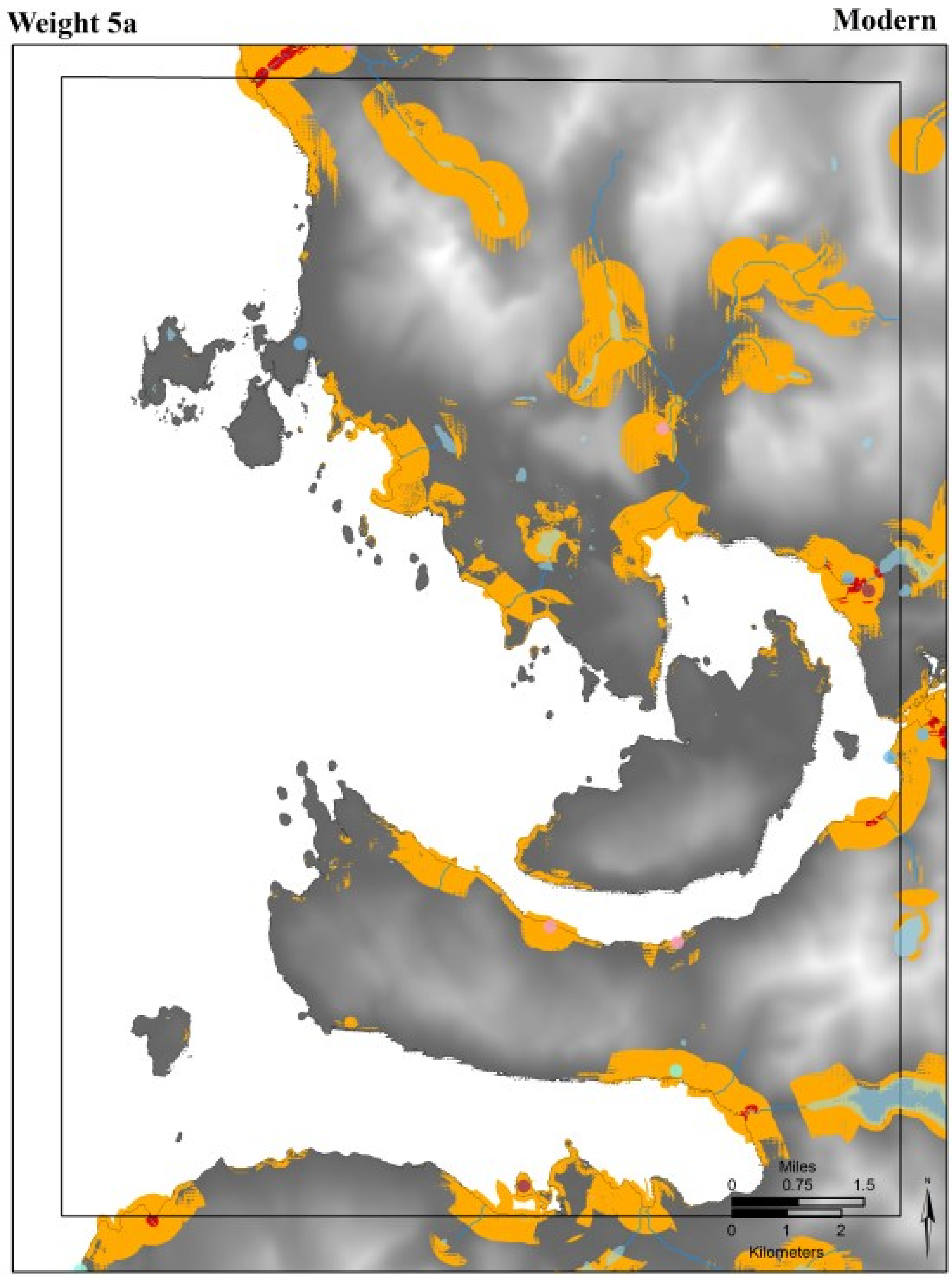
Weight 5 **NWC - modern**



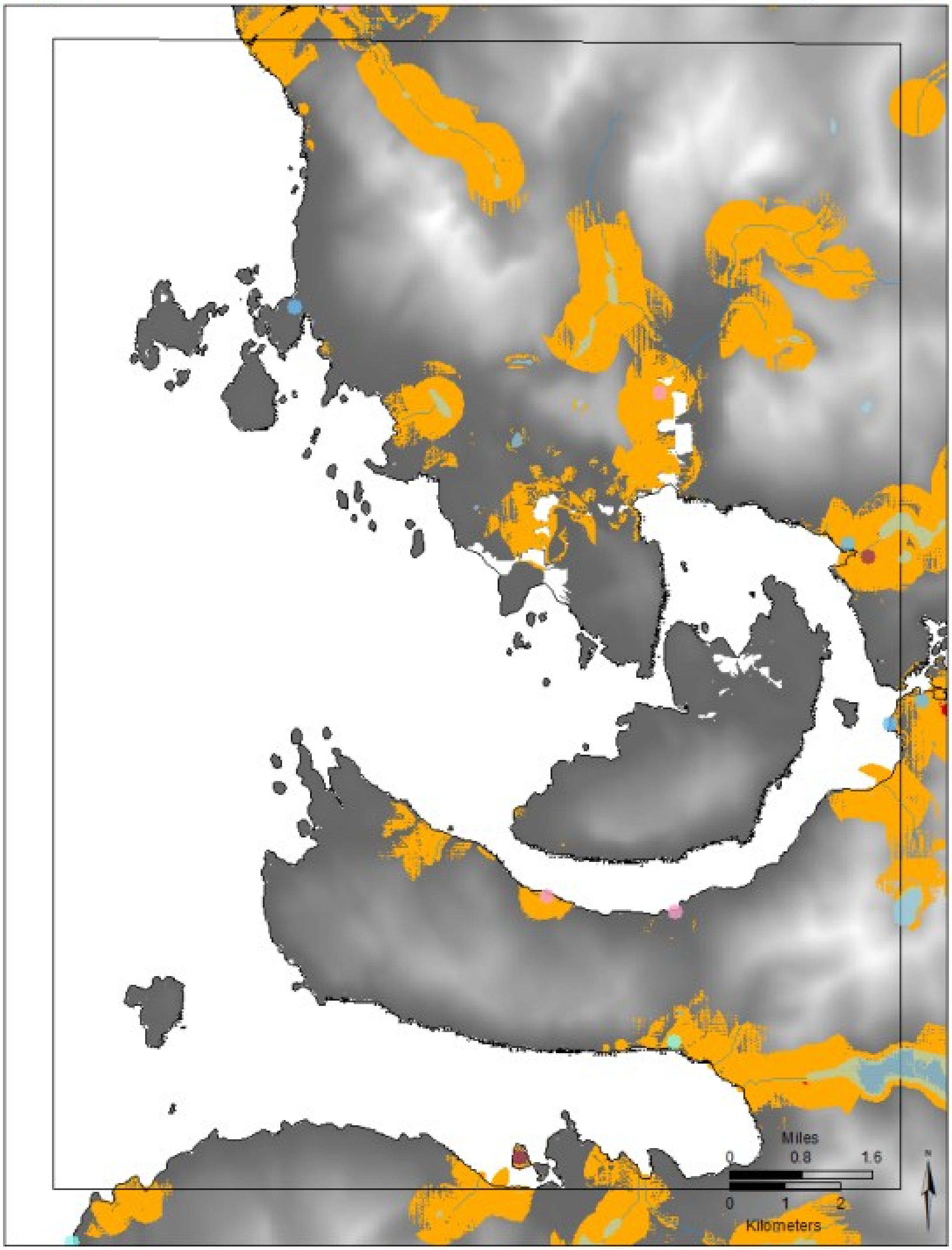
Weight 5 **NWC - modern**



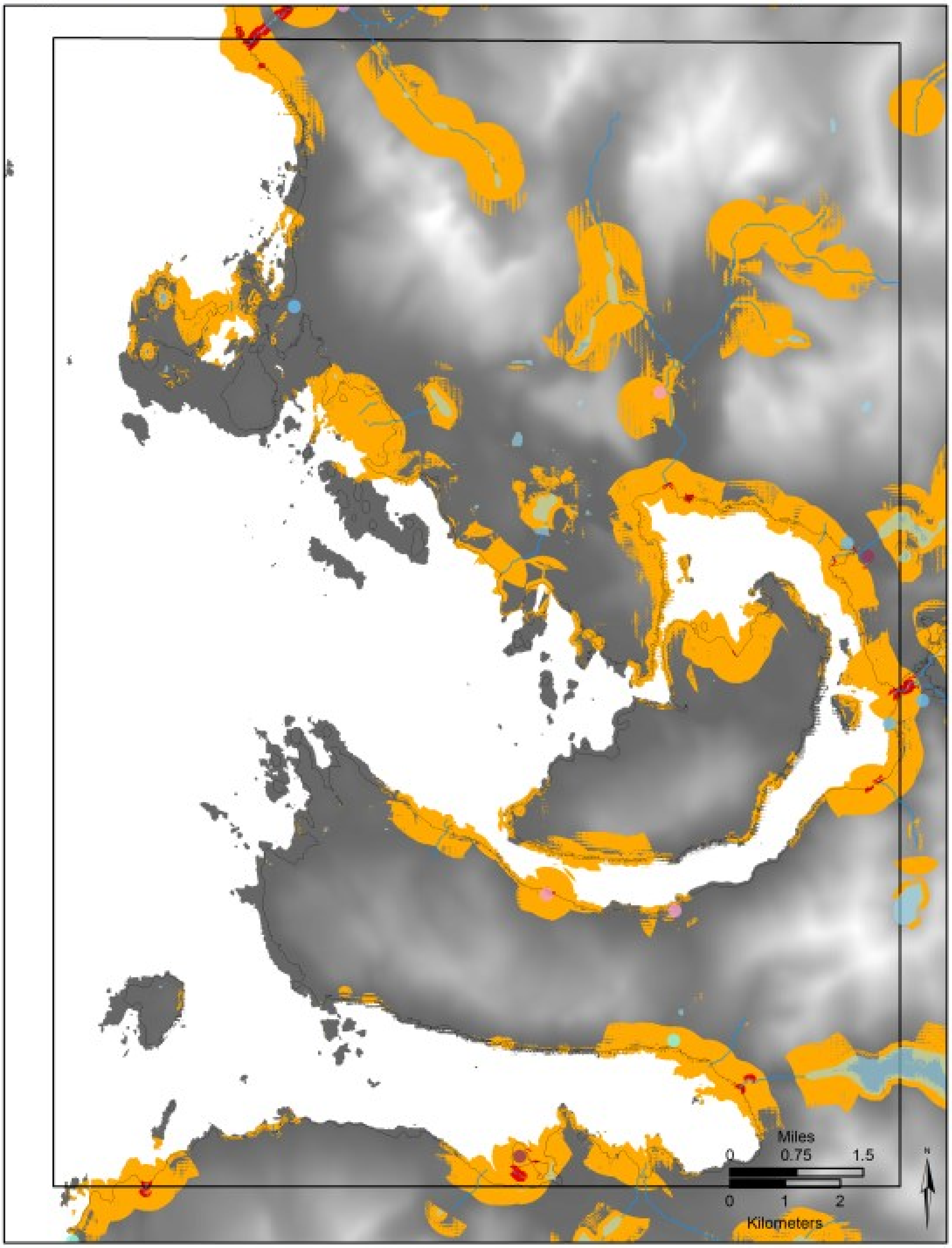
C.11 Weighted Overlay 5a



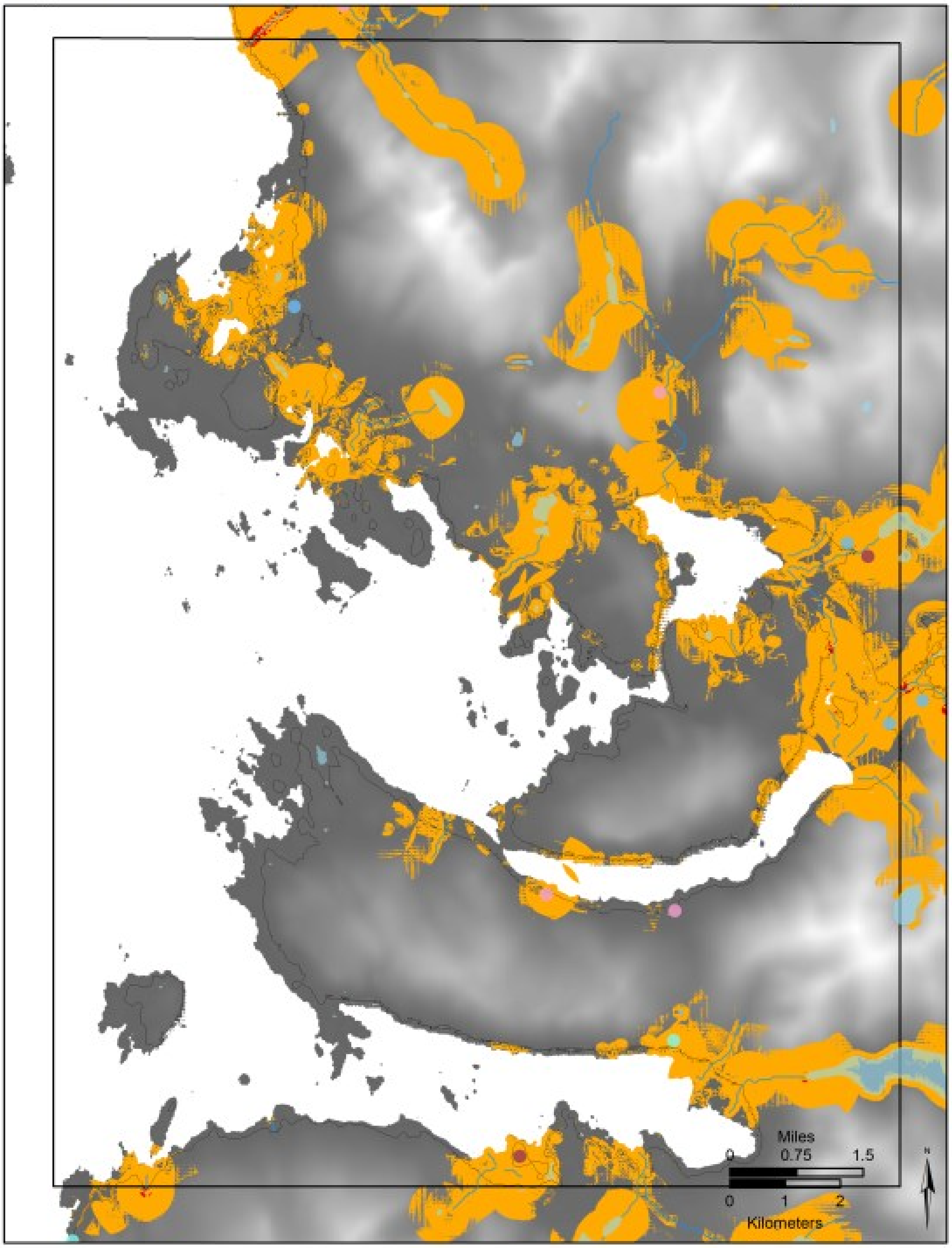
Weight 5a **10,500 cal BP**



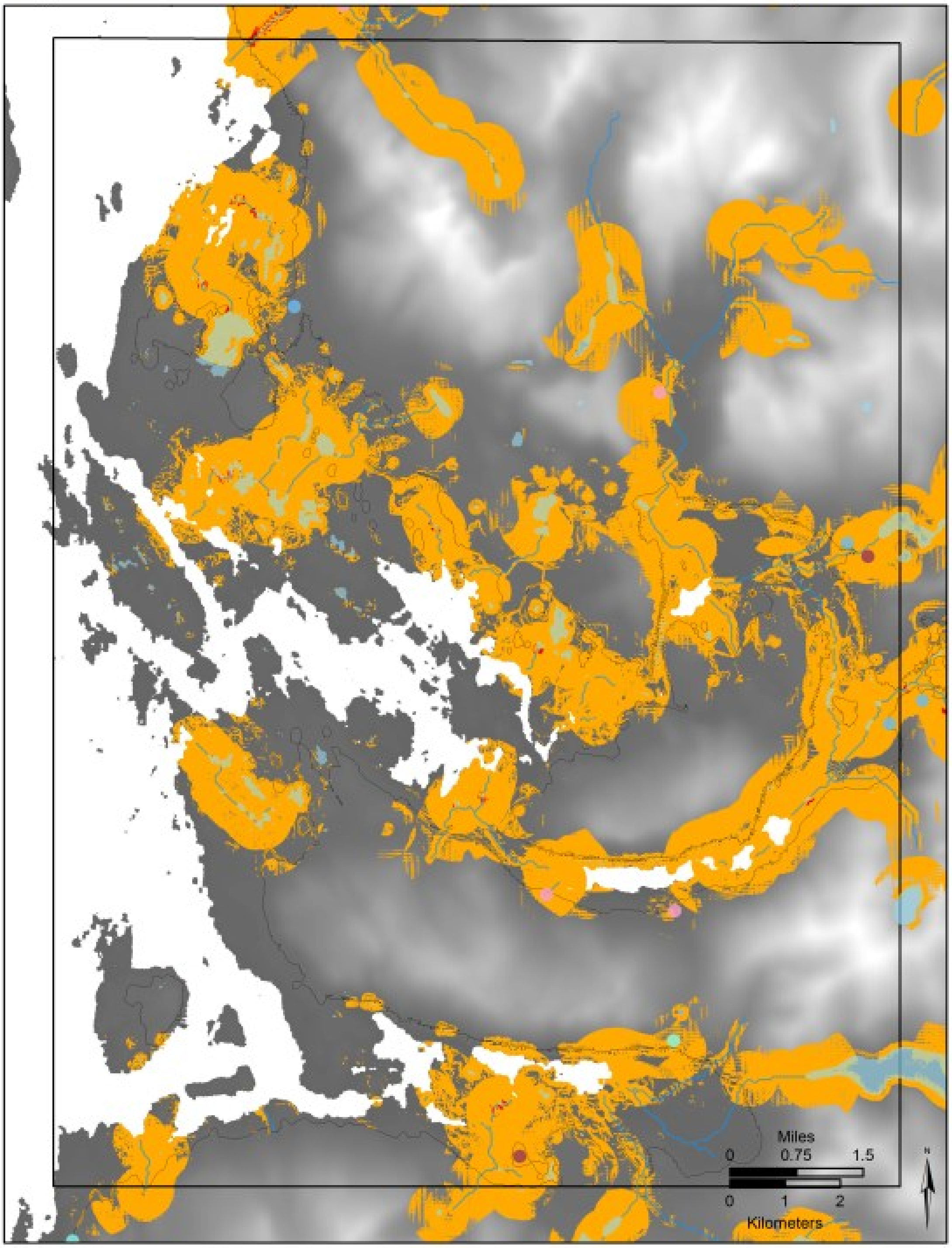
Weight 5a **11,000 cal BP**



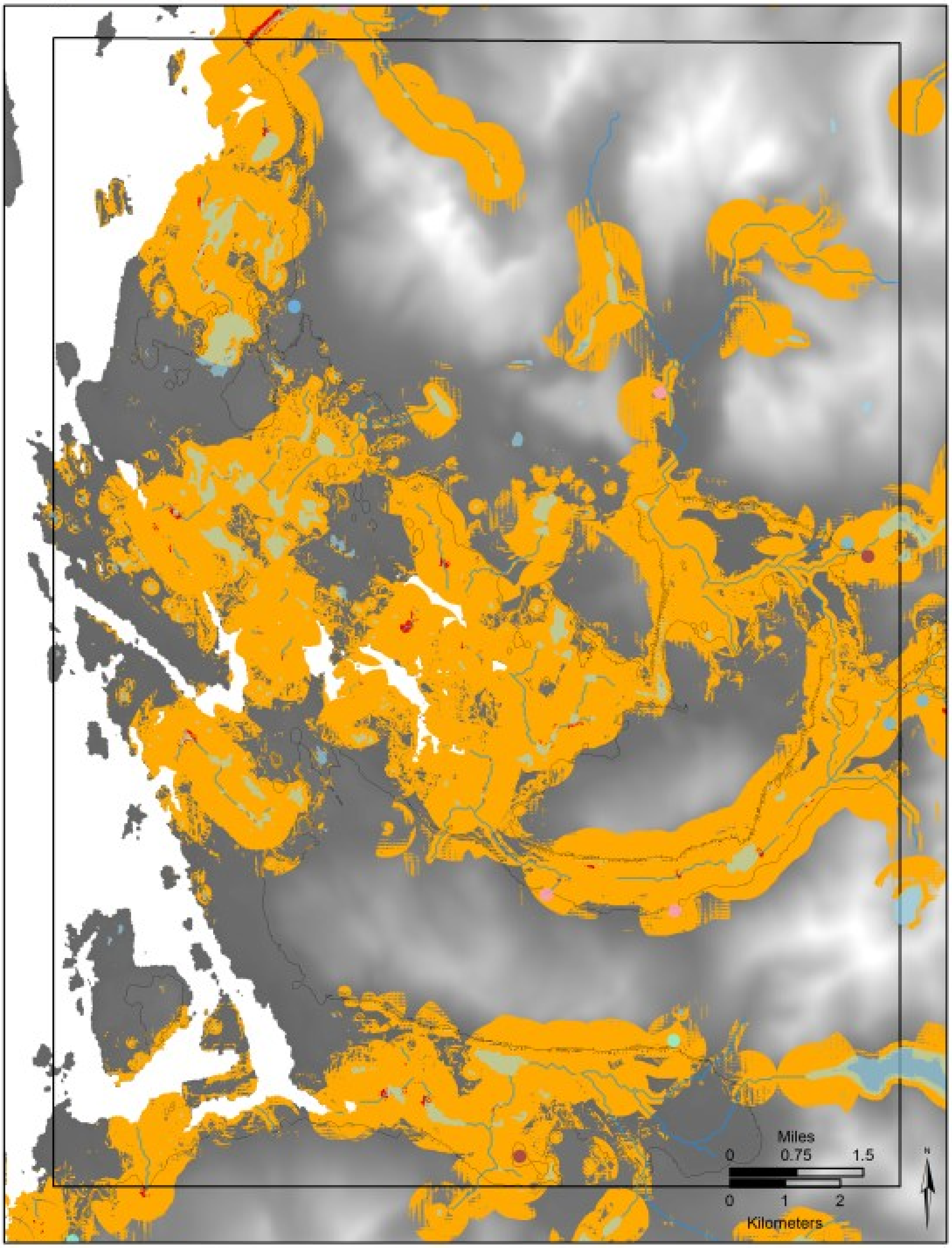
Weight 5a **11,500 cal BP**



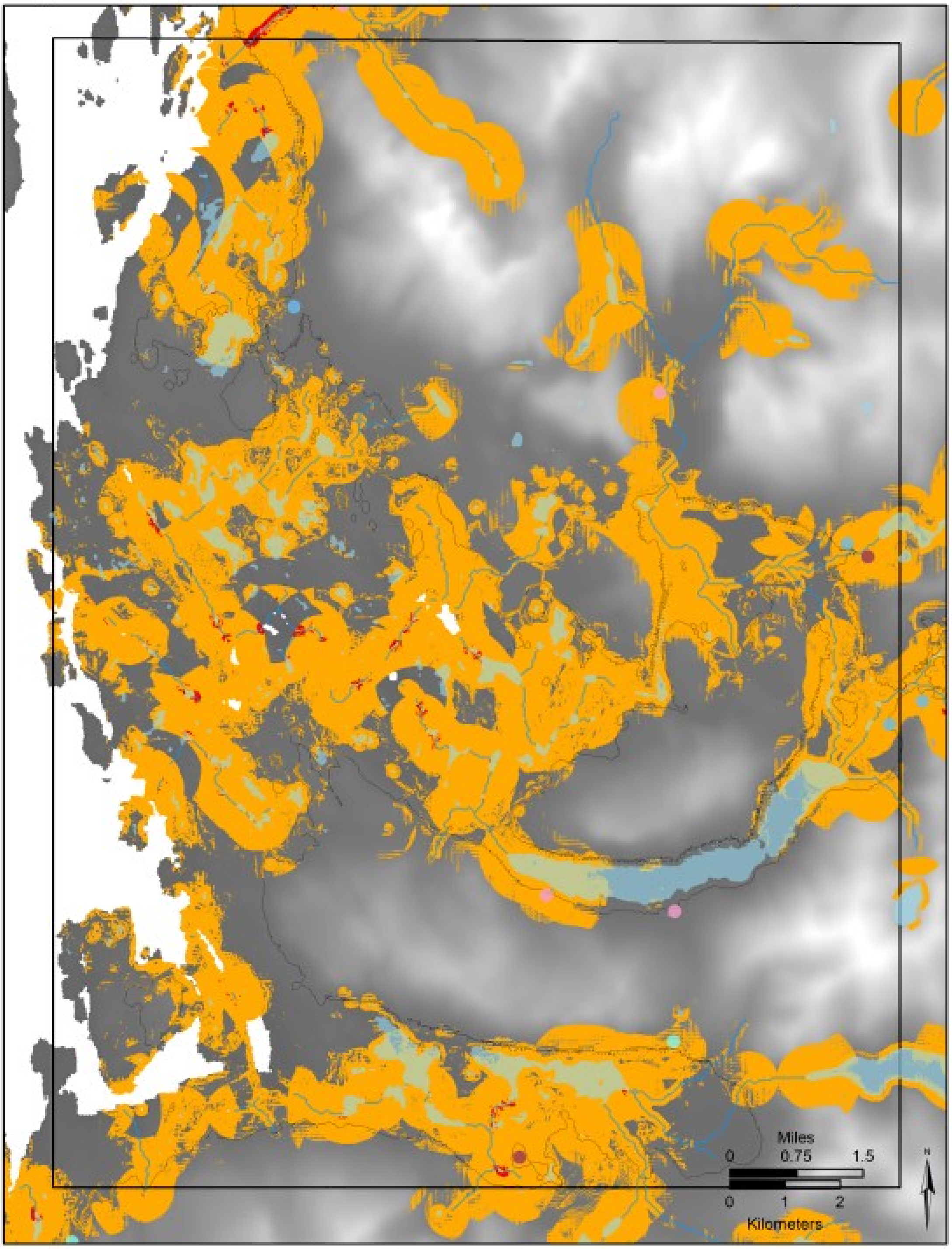
Weight 5a **12,000 cal BP**



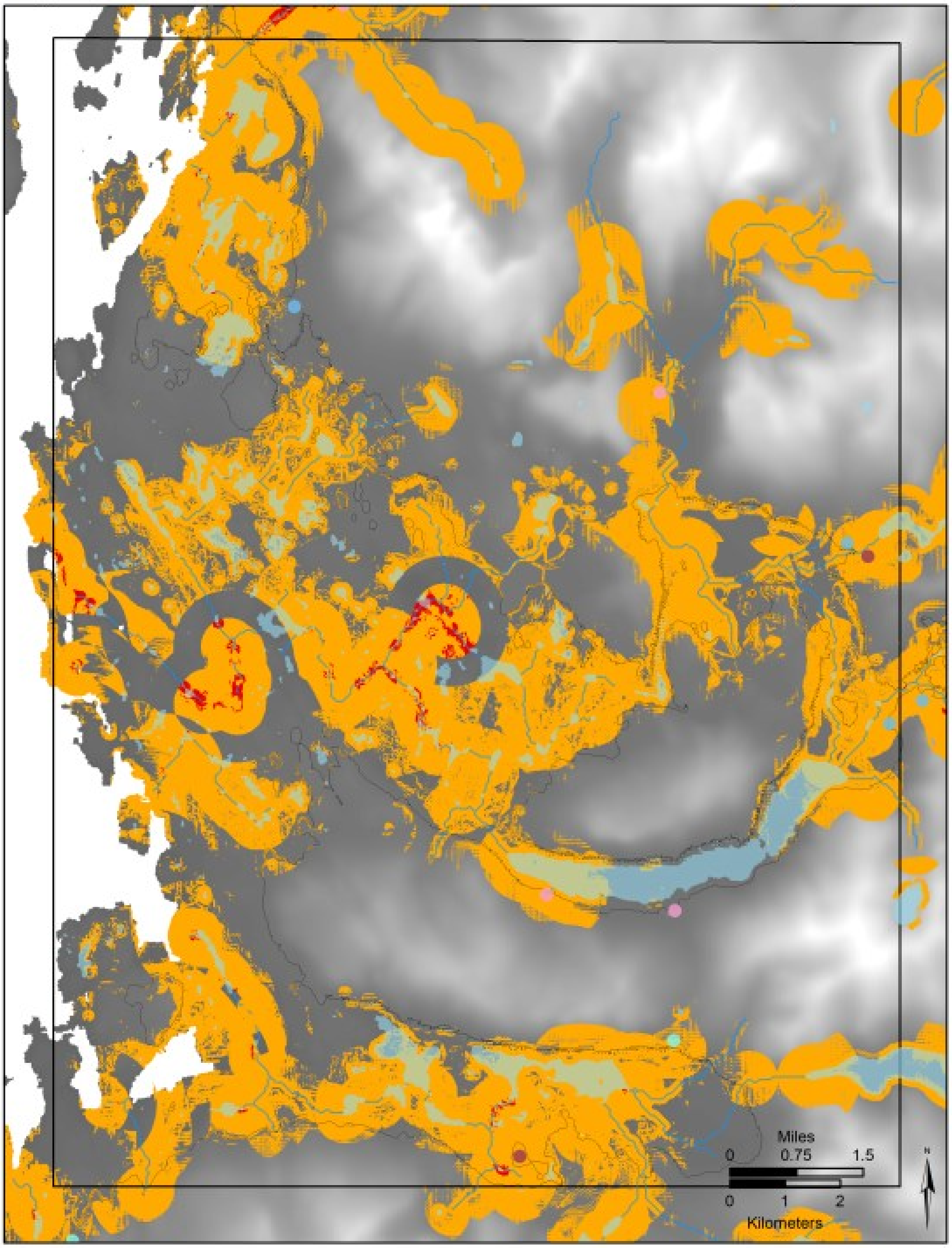
Weight 5a **12,500 cal BP**



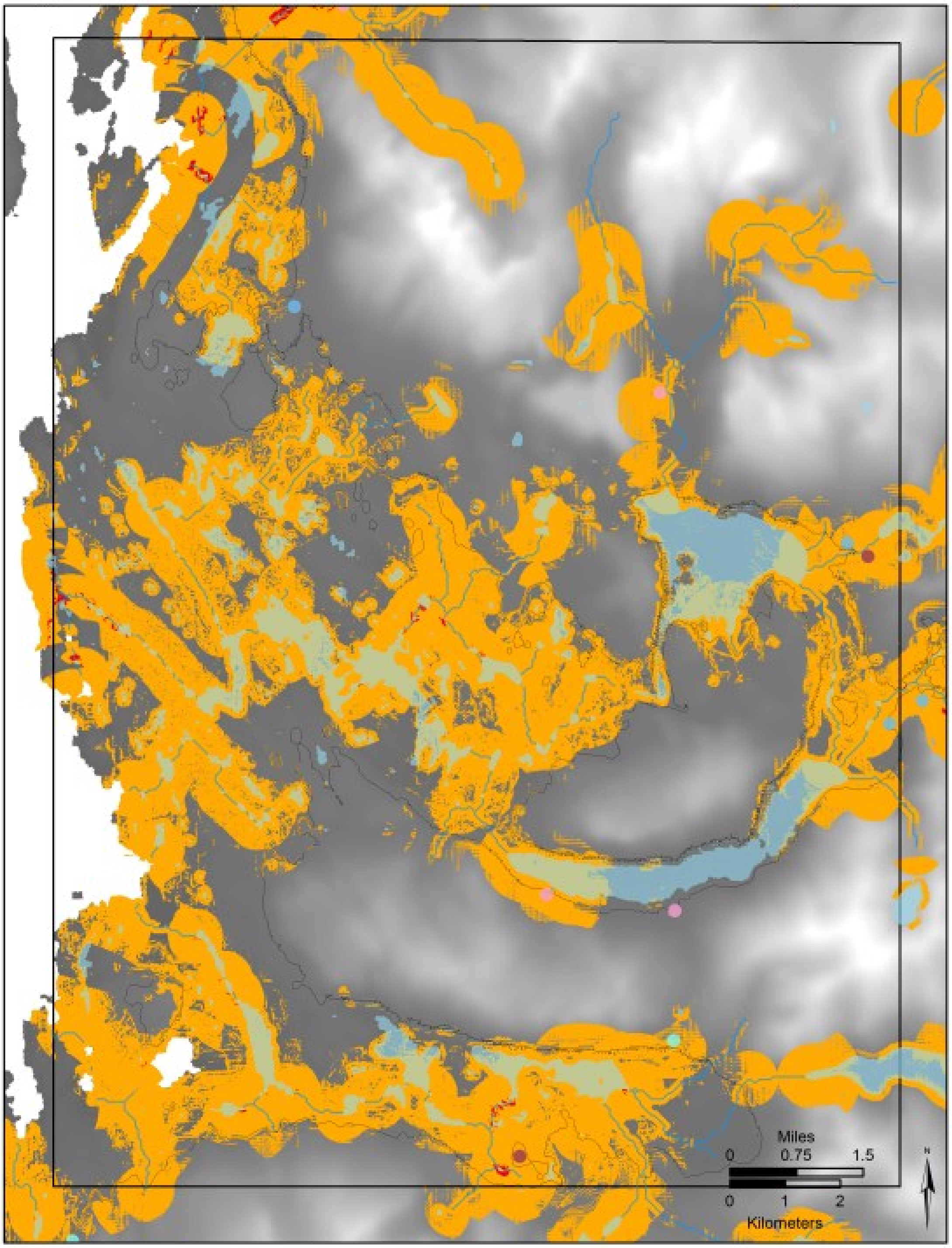
Weight 5a **13,000 cal BP**



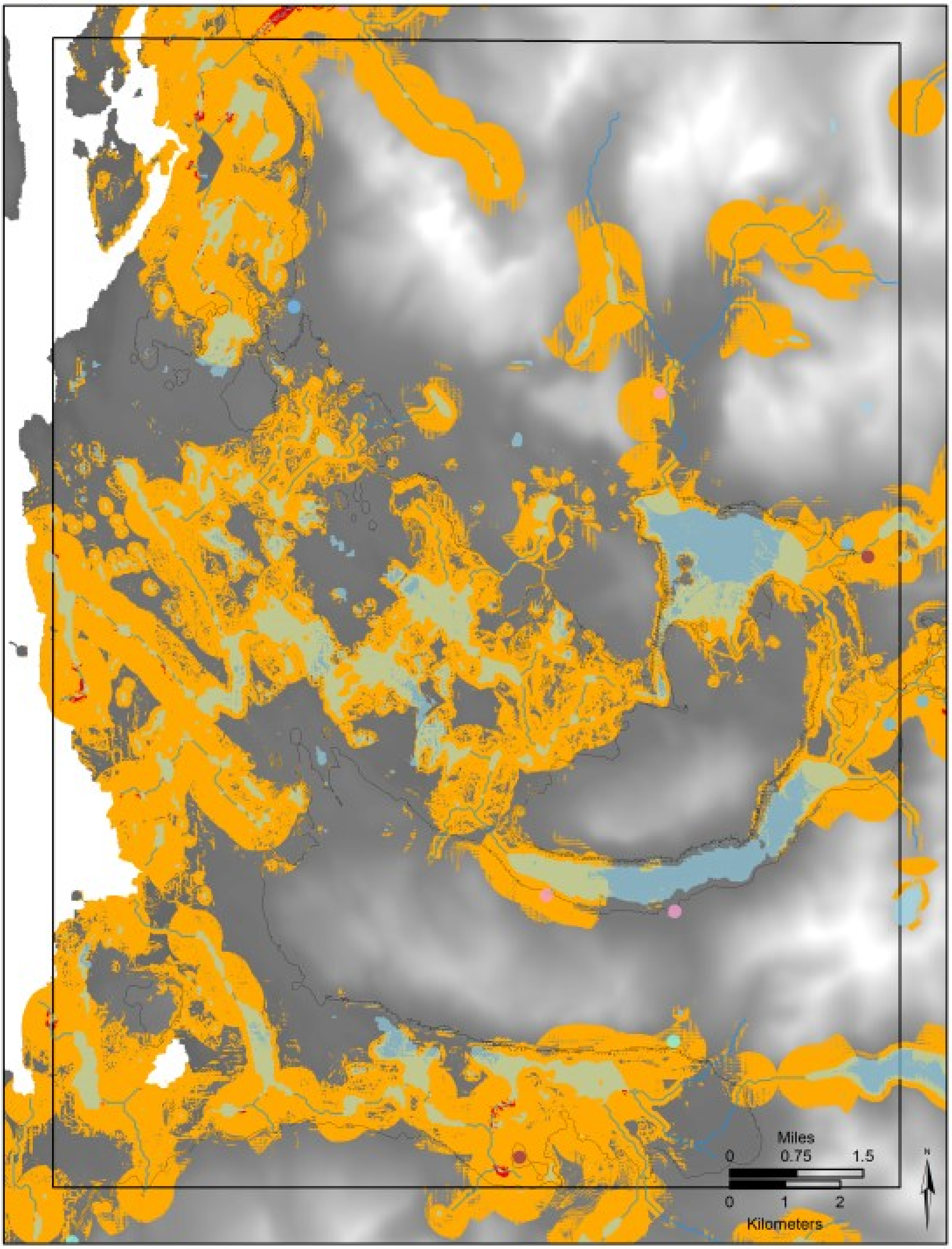
Weight 5a **13,500 cal BP**



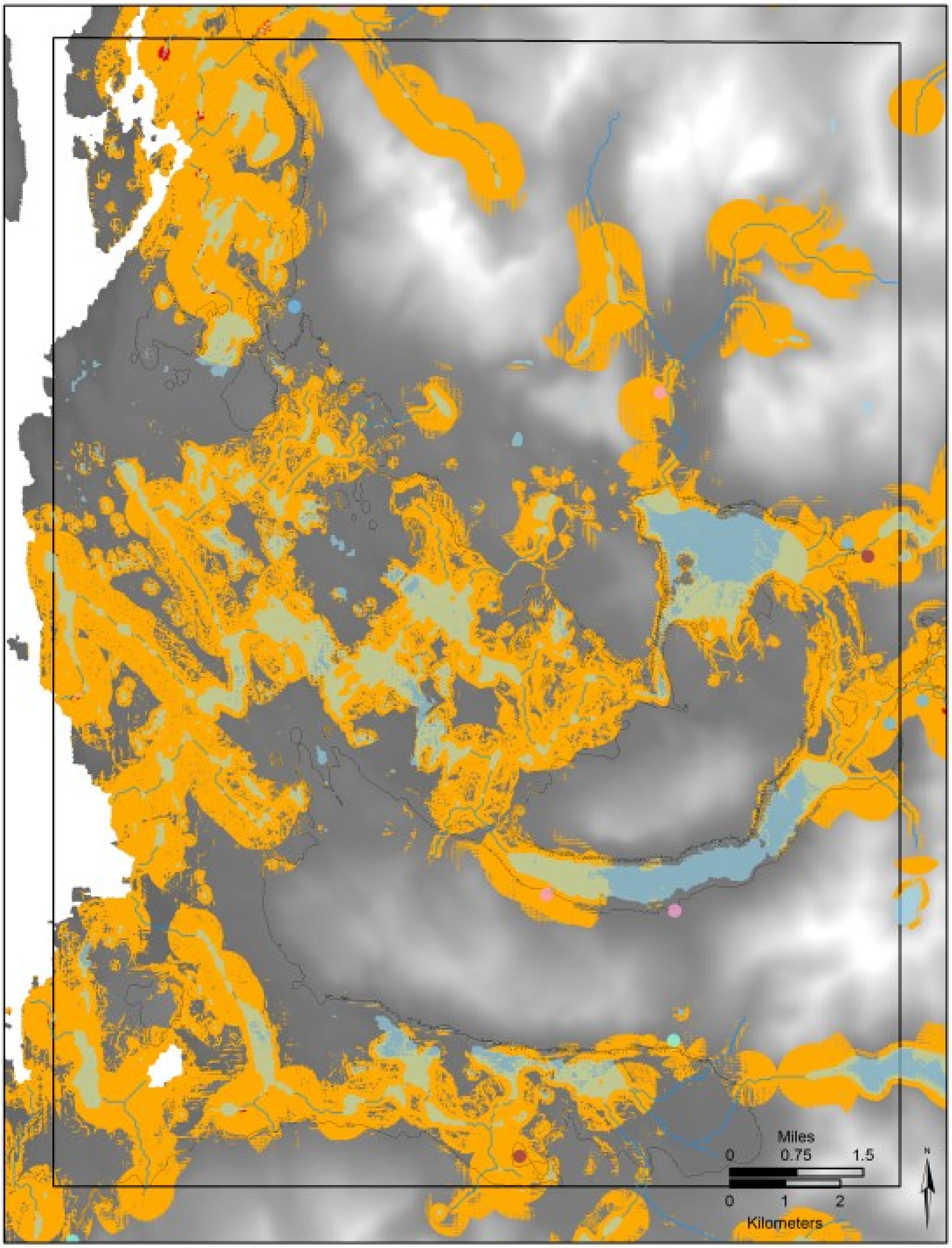
Weight 5a **14,000 cal BP**



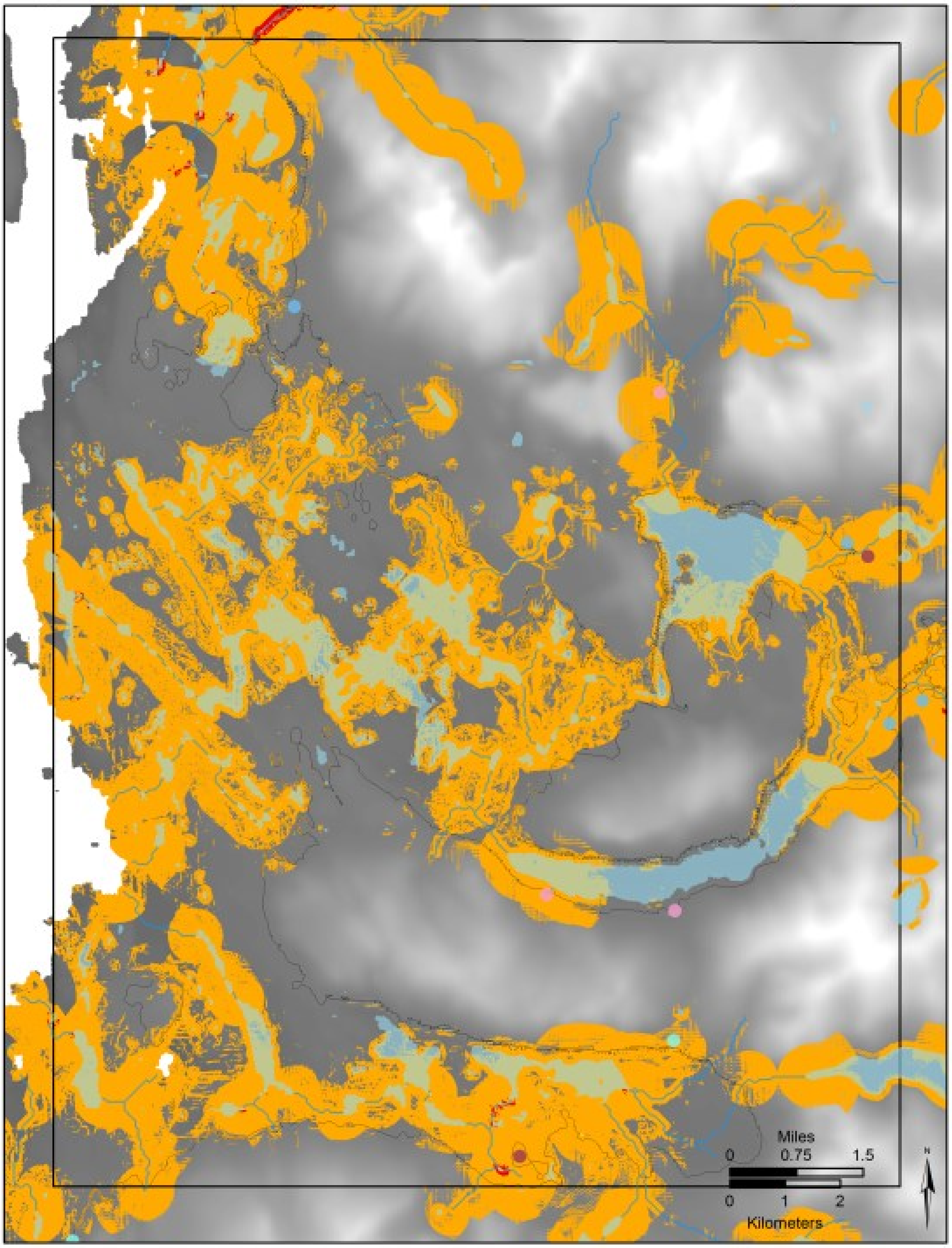
Weight 5a **14,500 cal BP**



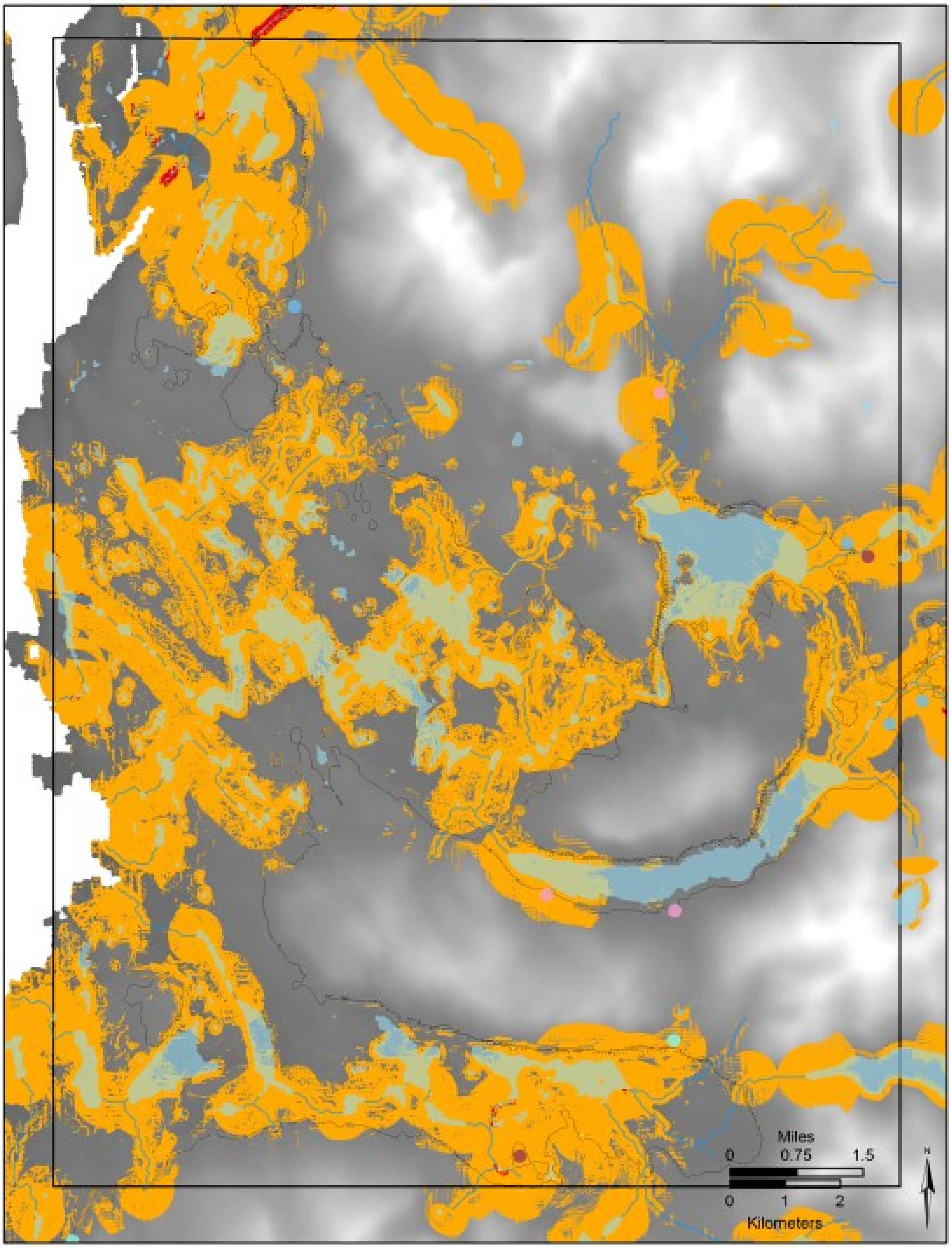
Weight 5a **15,000 cal BP**



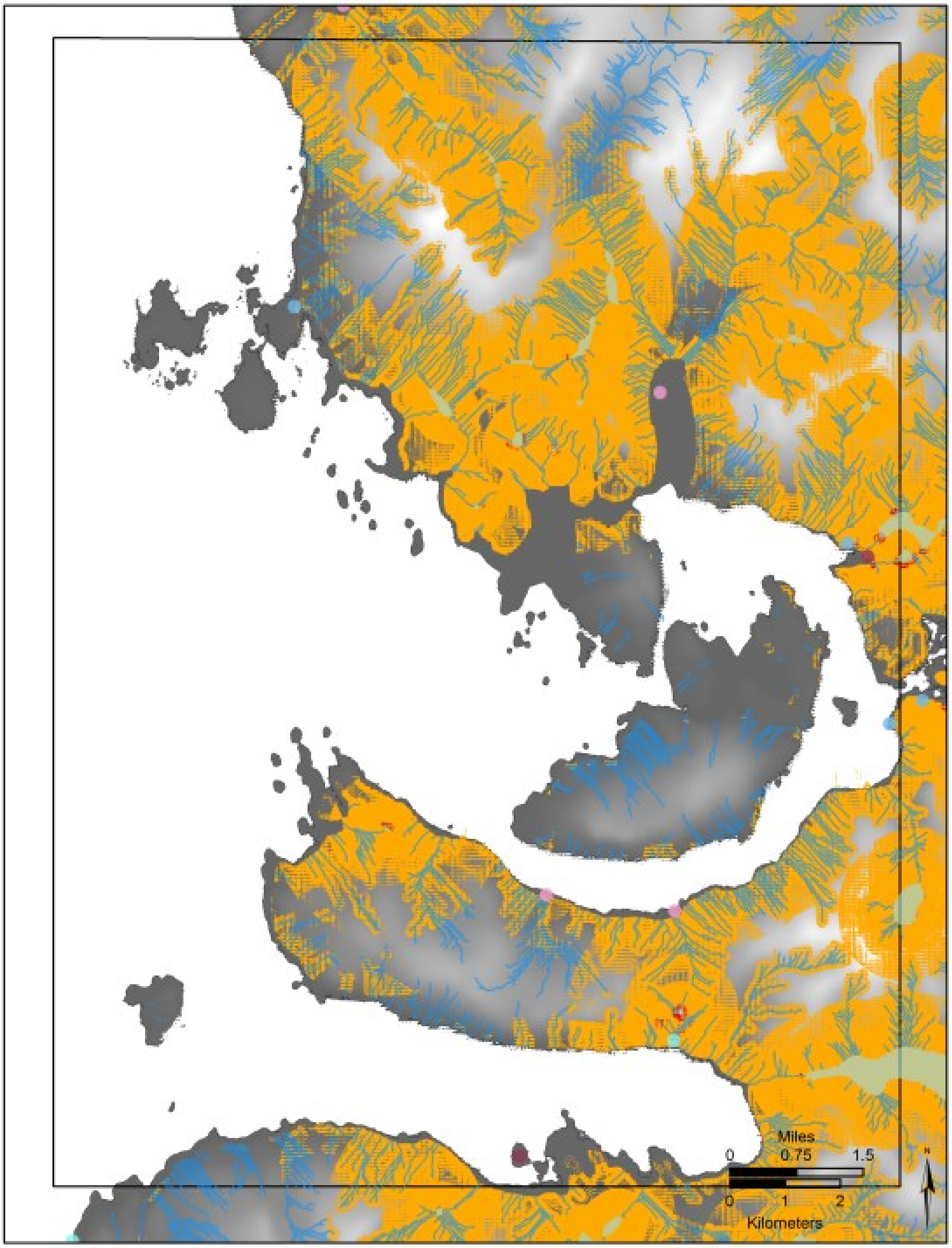
Weight 5a **15,500 cal BP**



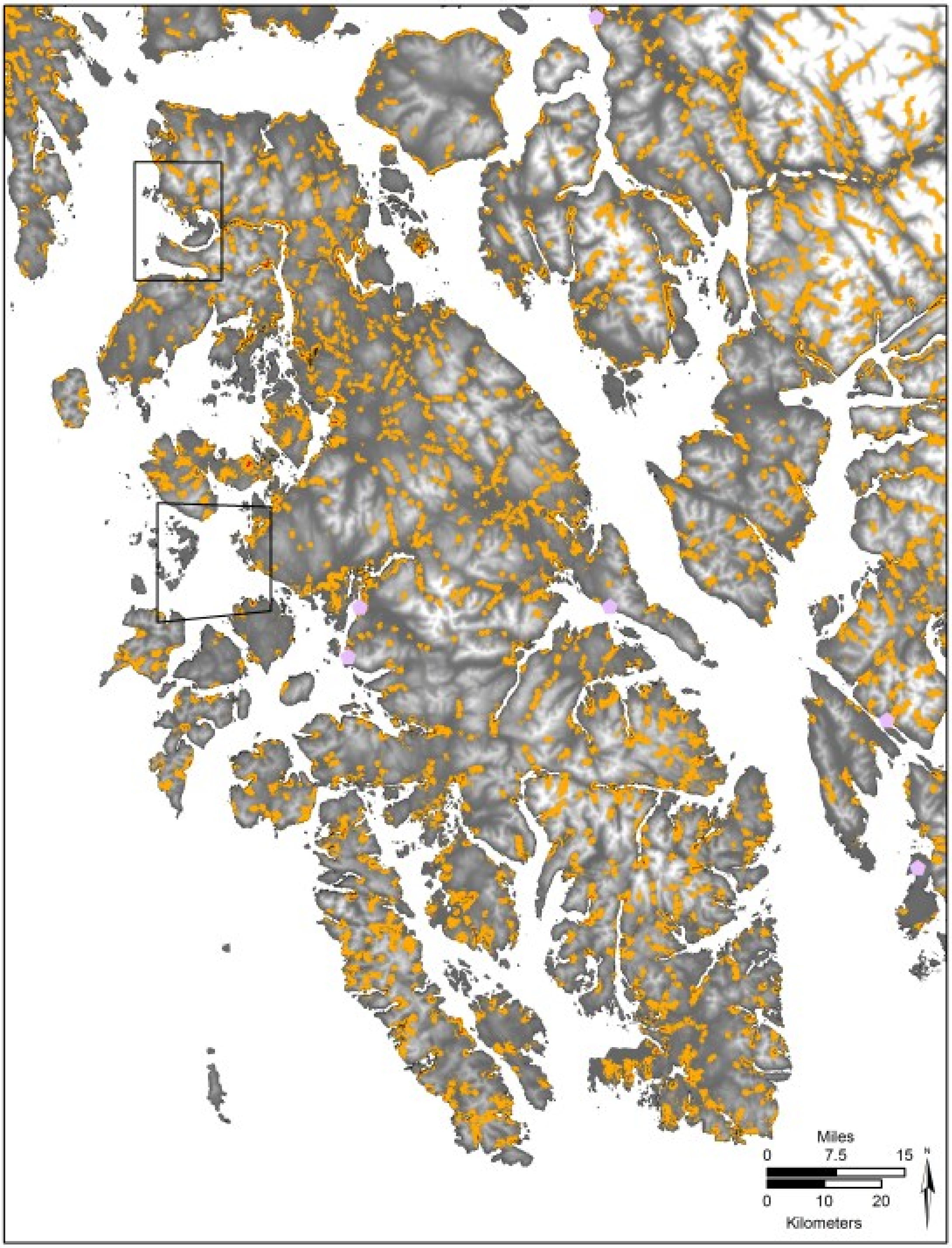
Weight 5a **16,000 cal BP**



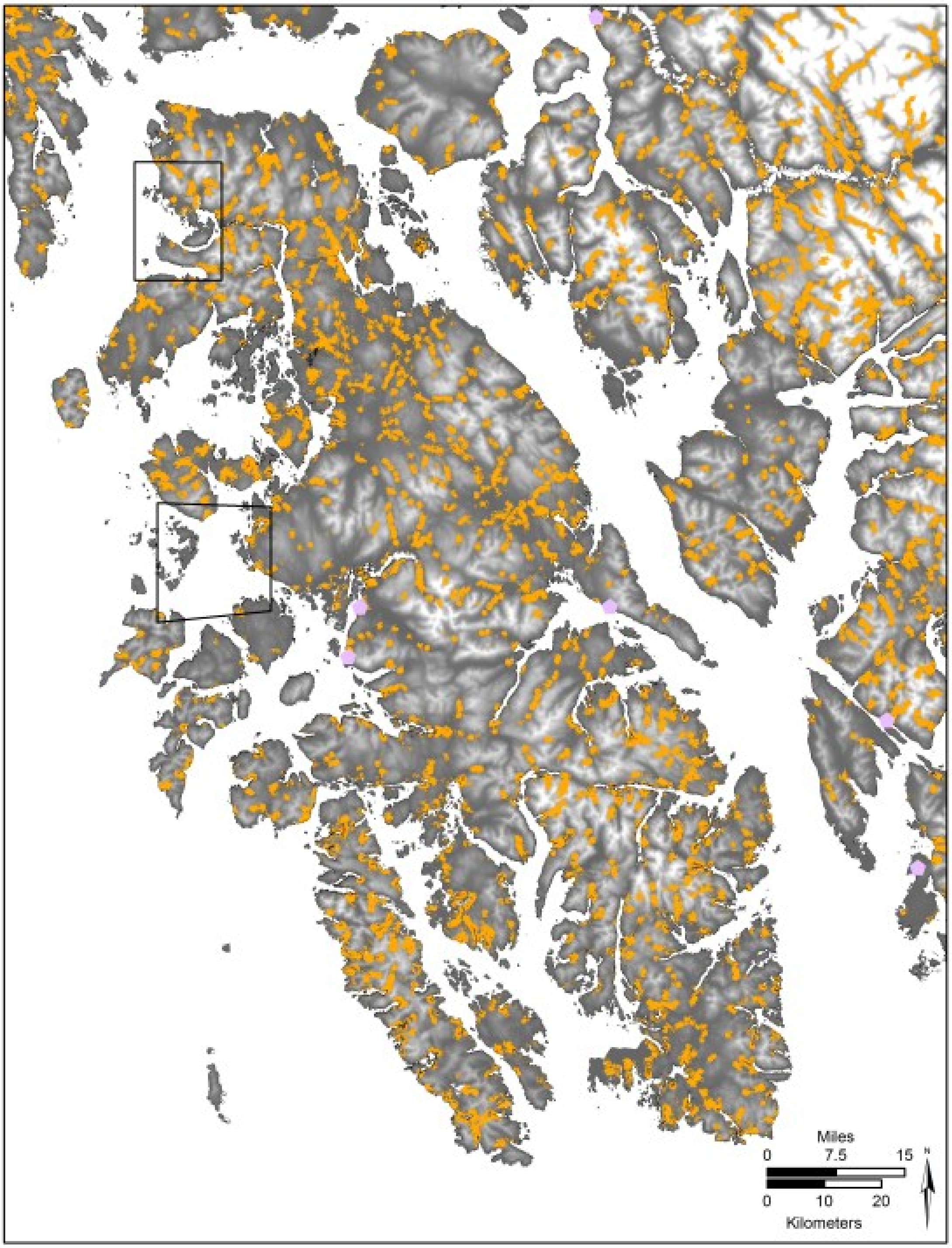
Weight 5a **Modern - Small Area**



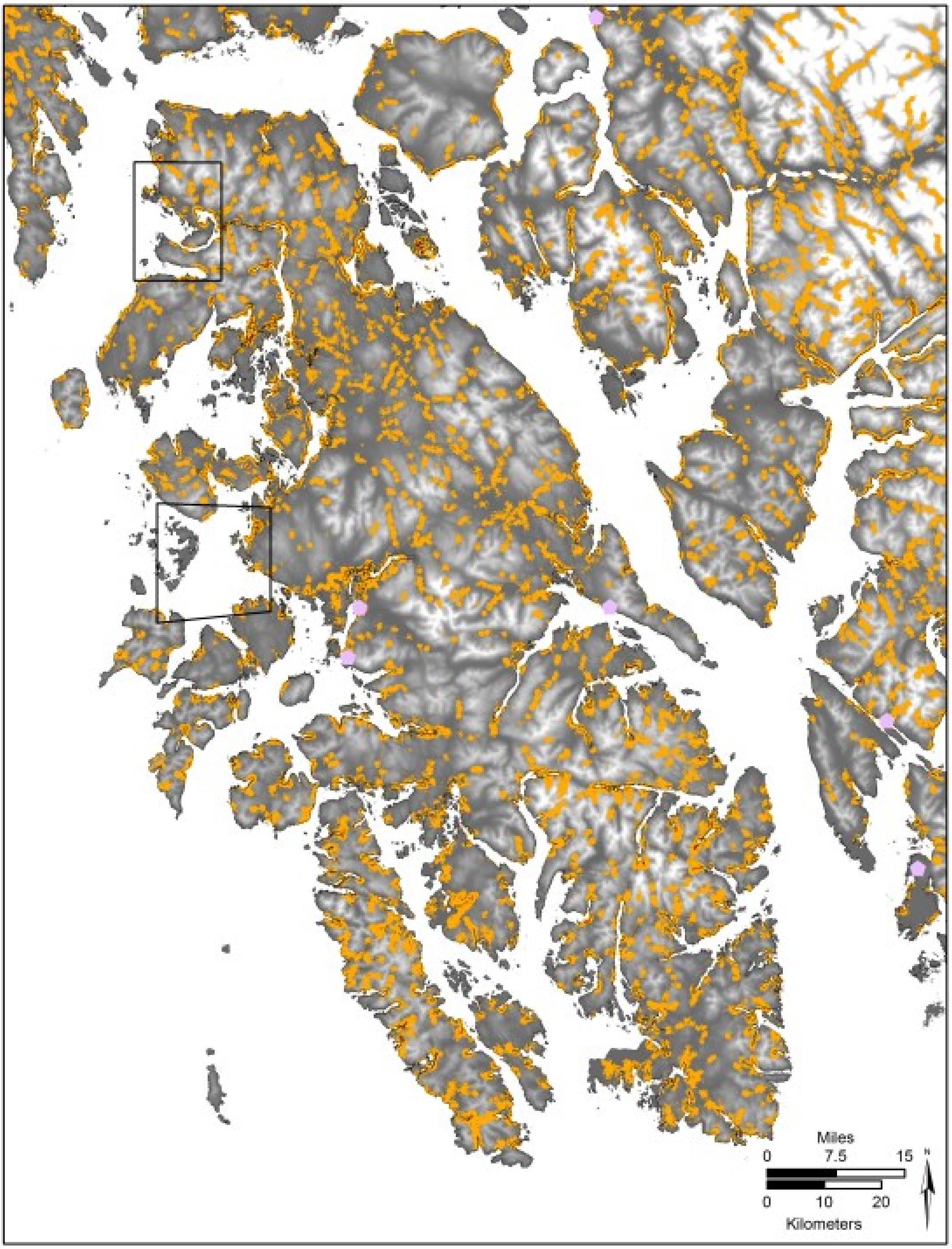
Weight 5a **Modern**



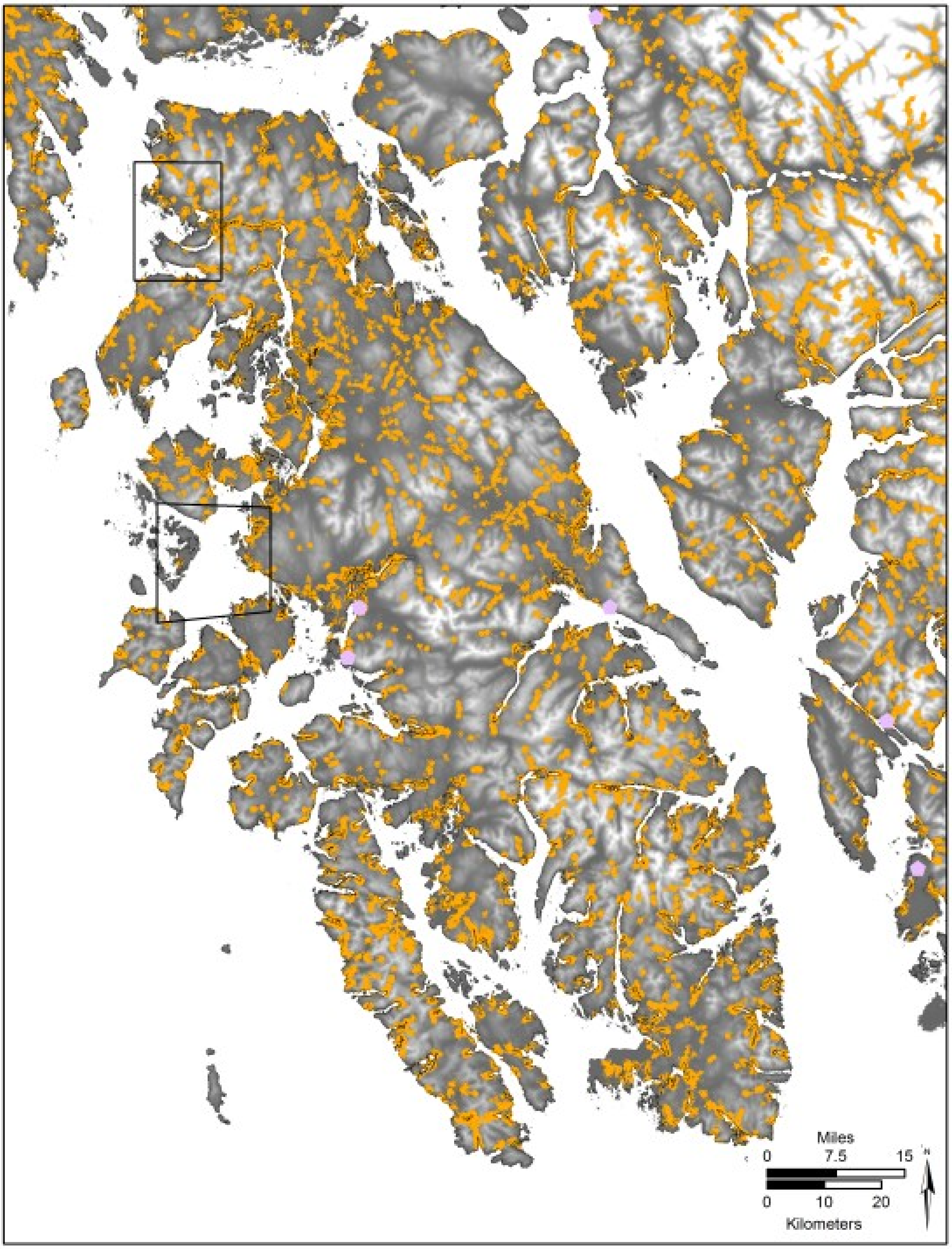
Weight 5a **10,500 cal BP**



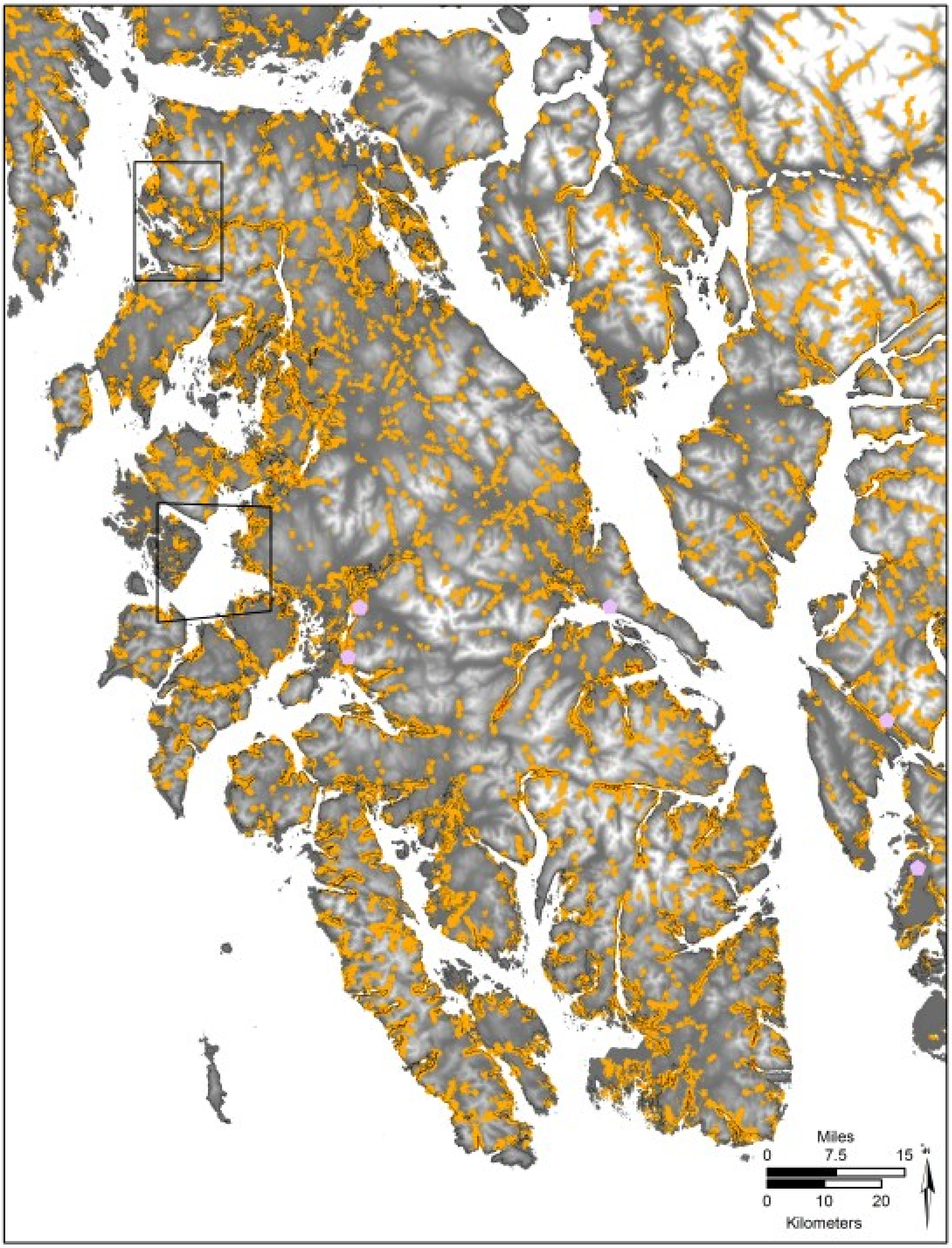
Weight 5a **11,000 cal BP**



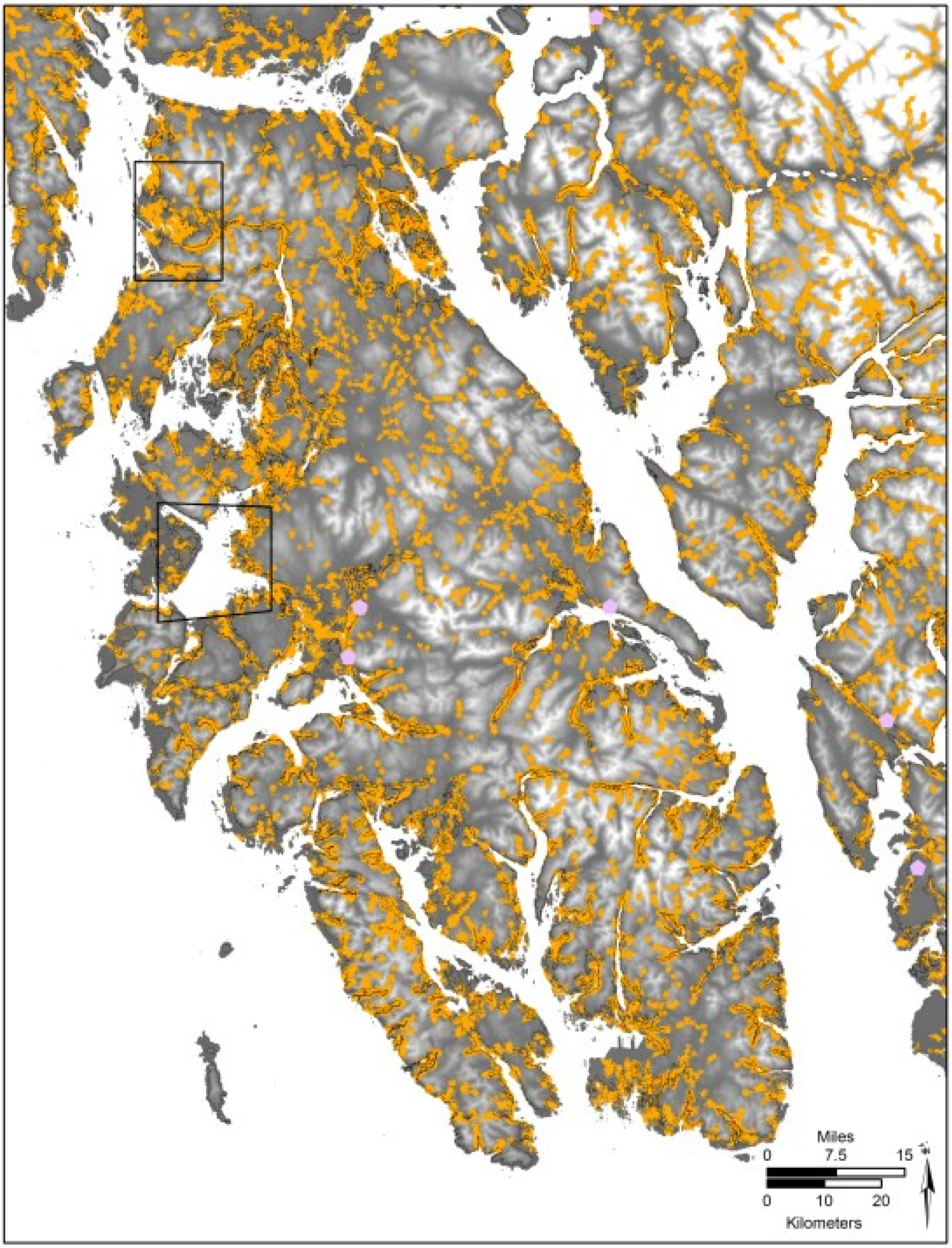
Weight 5a **11,500 cal BP**



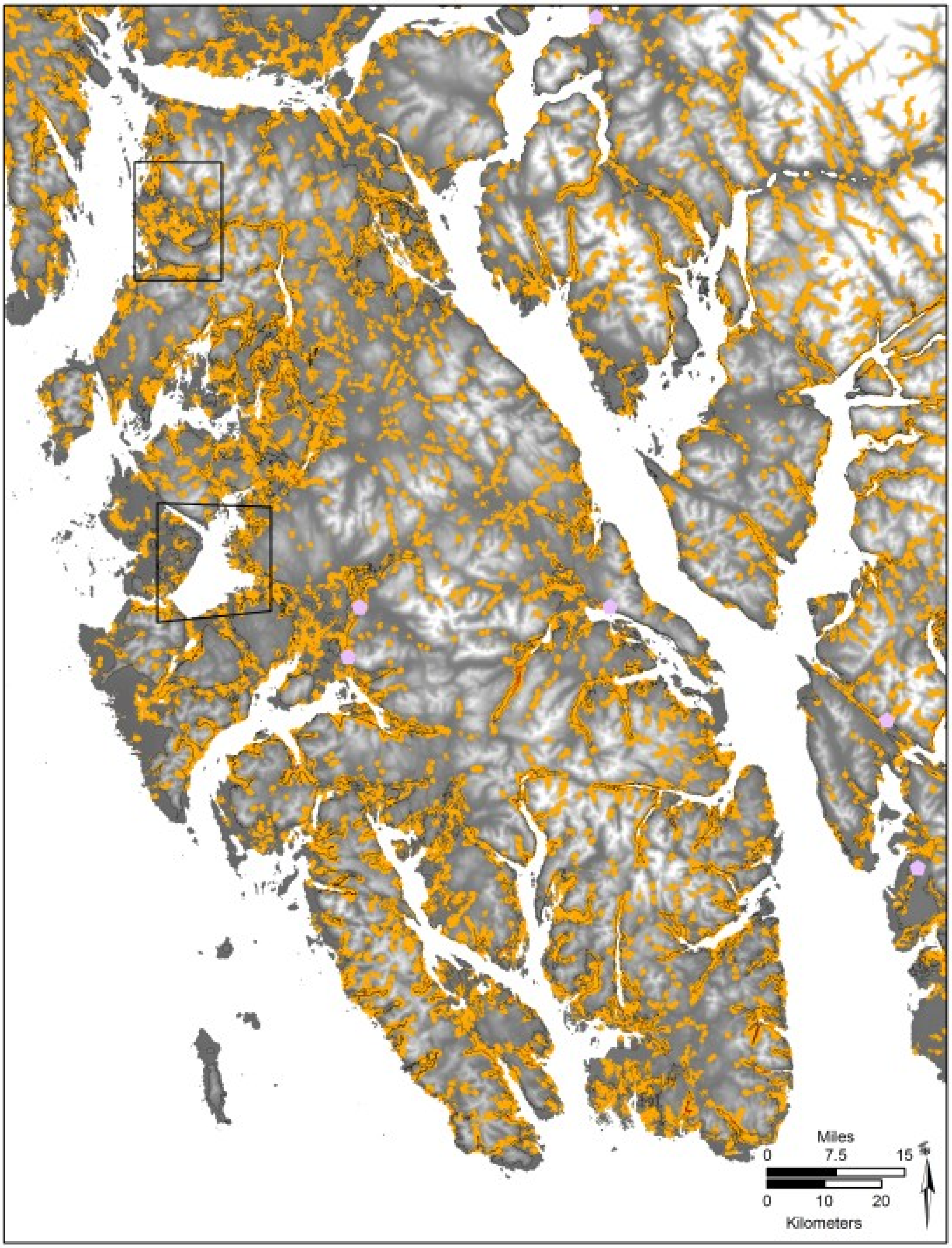
Weight 5a **12,000 cal BP**



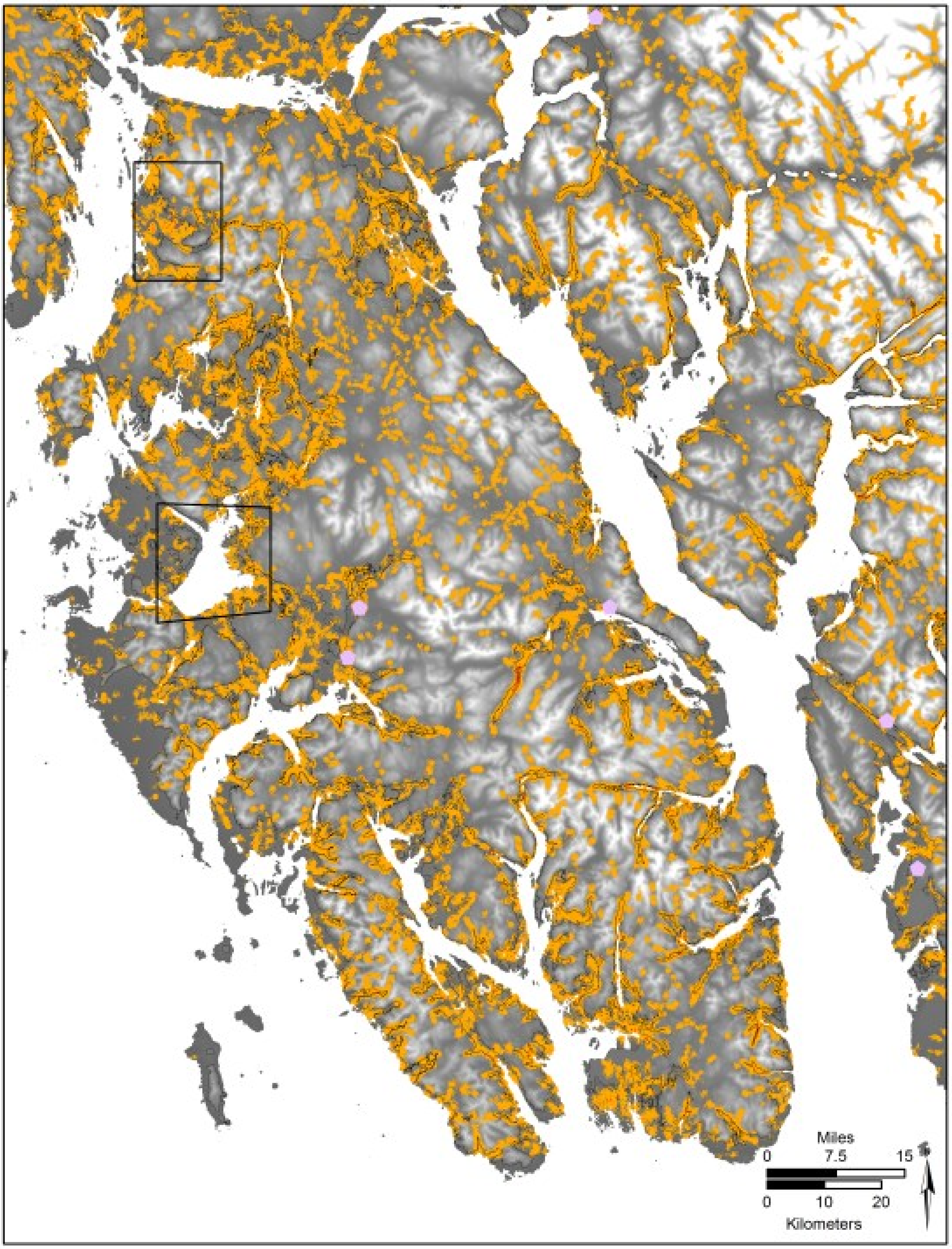
Weight 5a **12,500 cal BP**



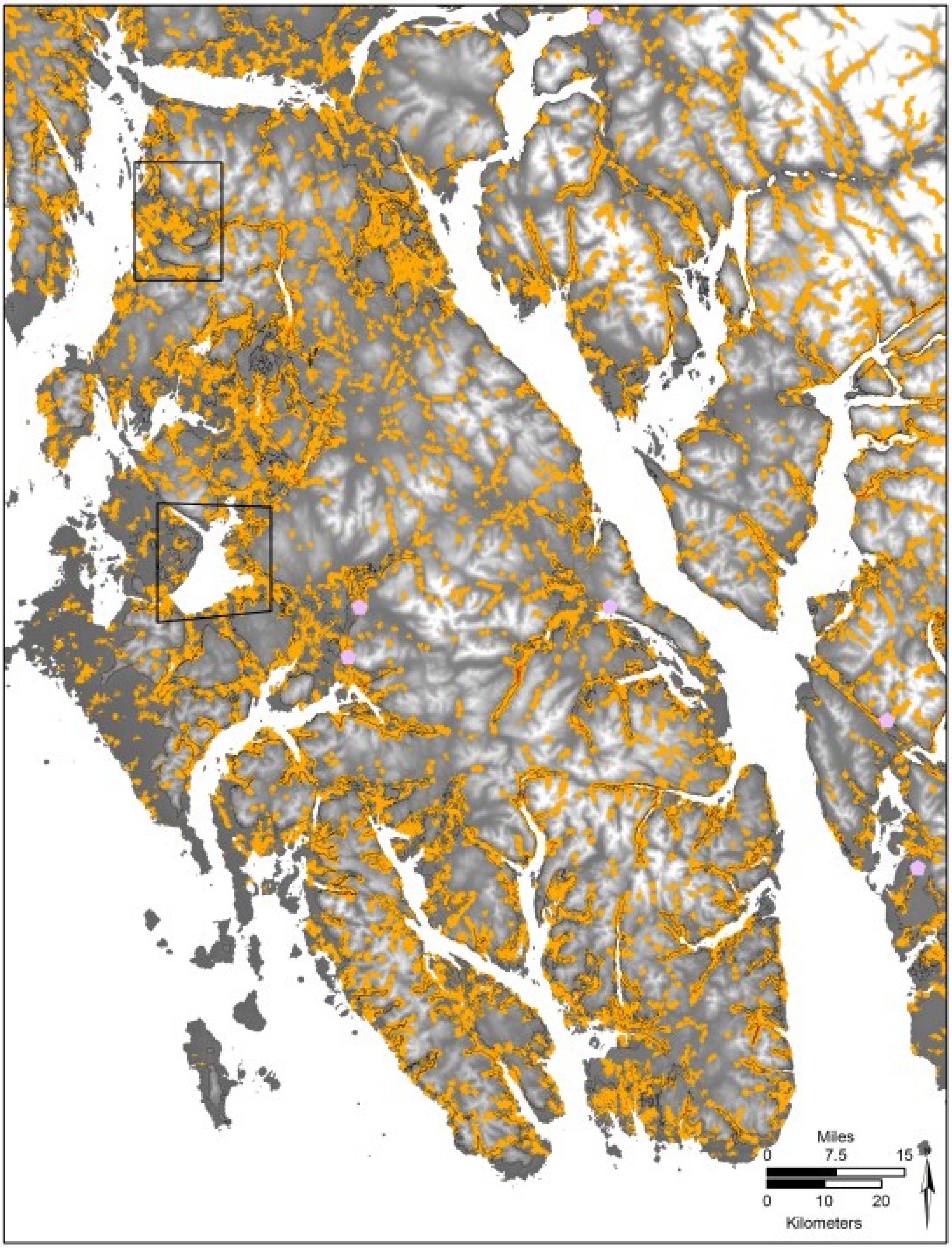
Weight 5a **13,000 cal BP**



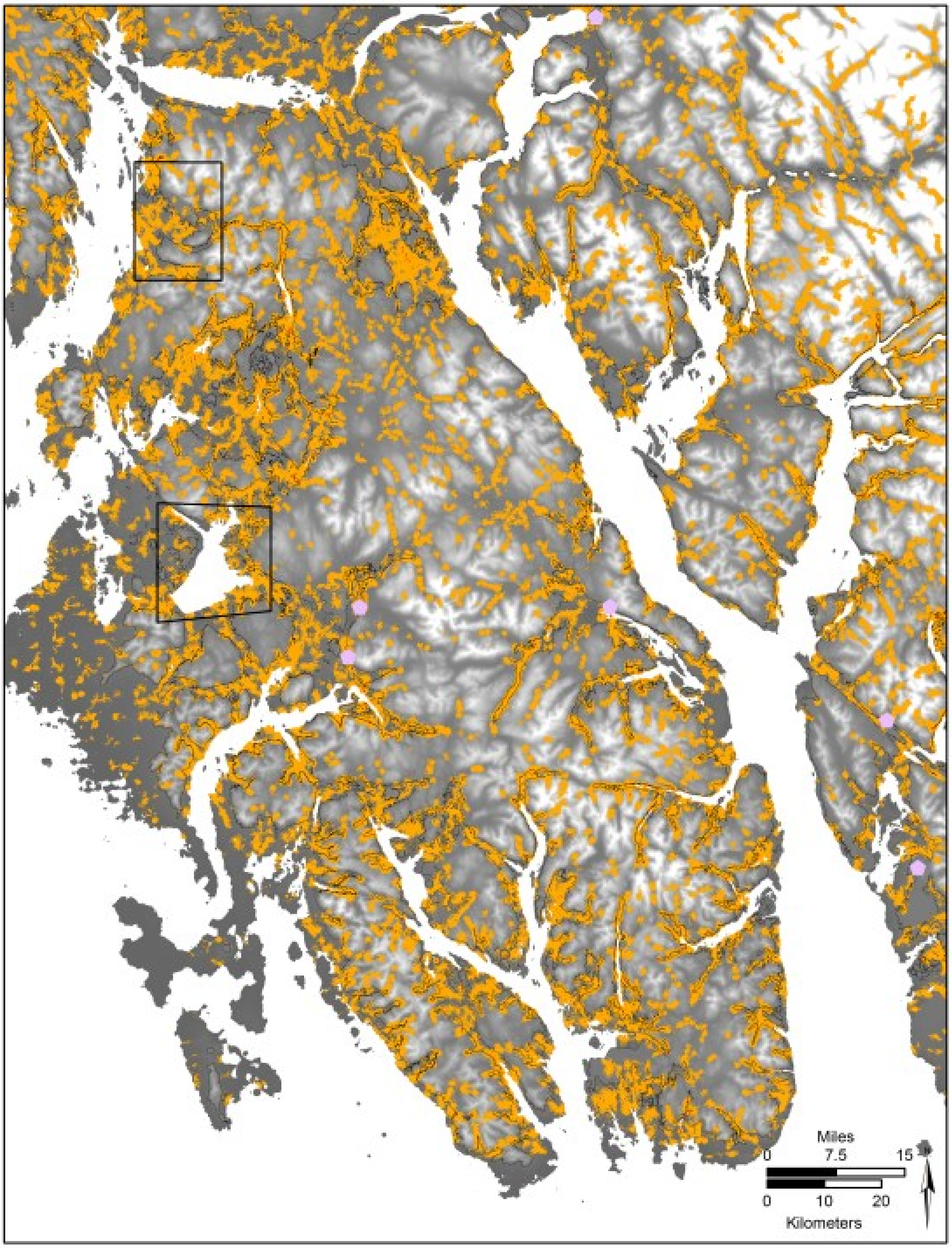
Weight 5a **13,500 cal BP**



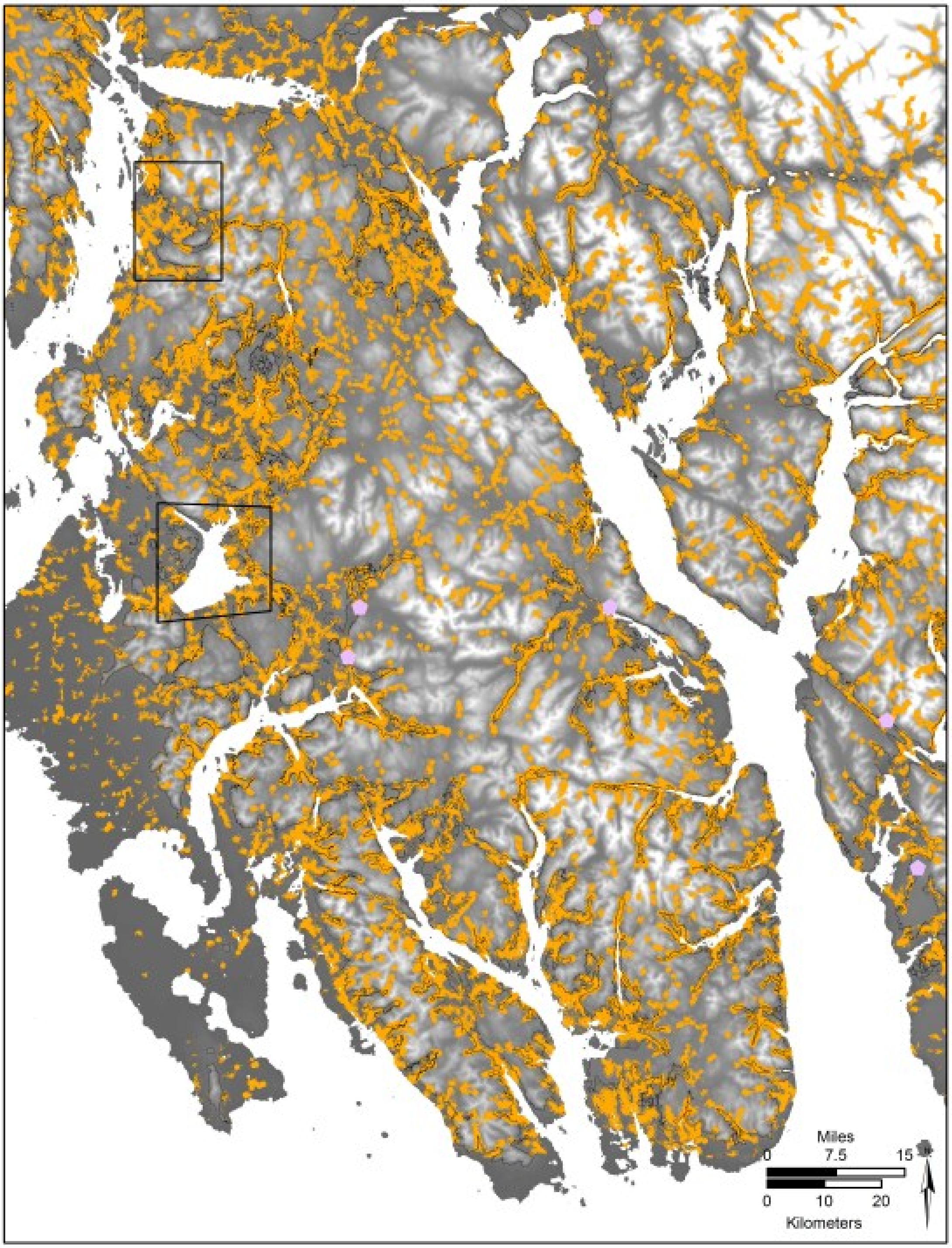
Weight 5a **14,000 cal BP**



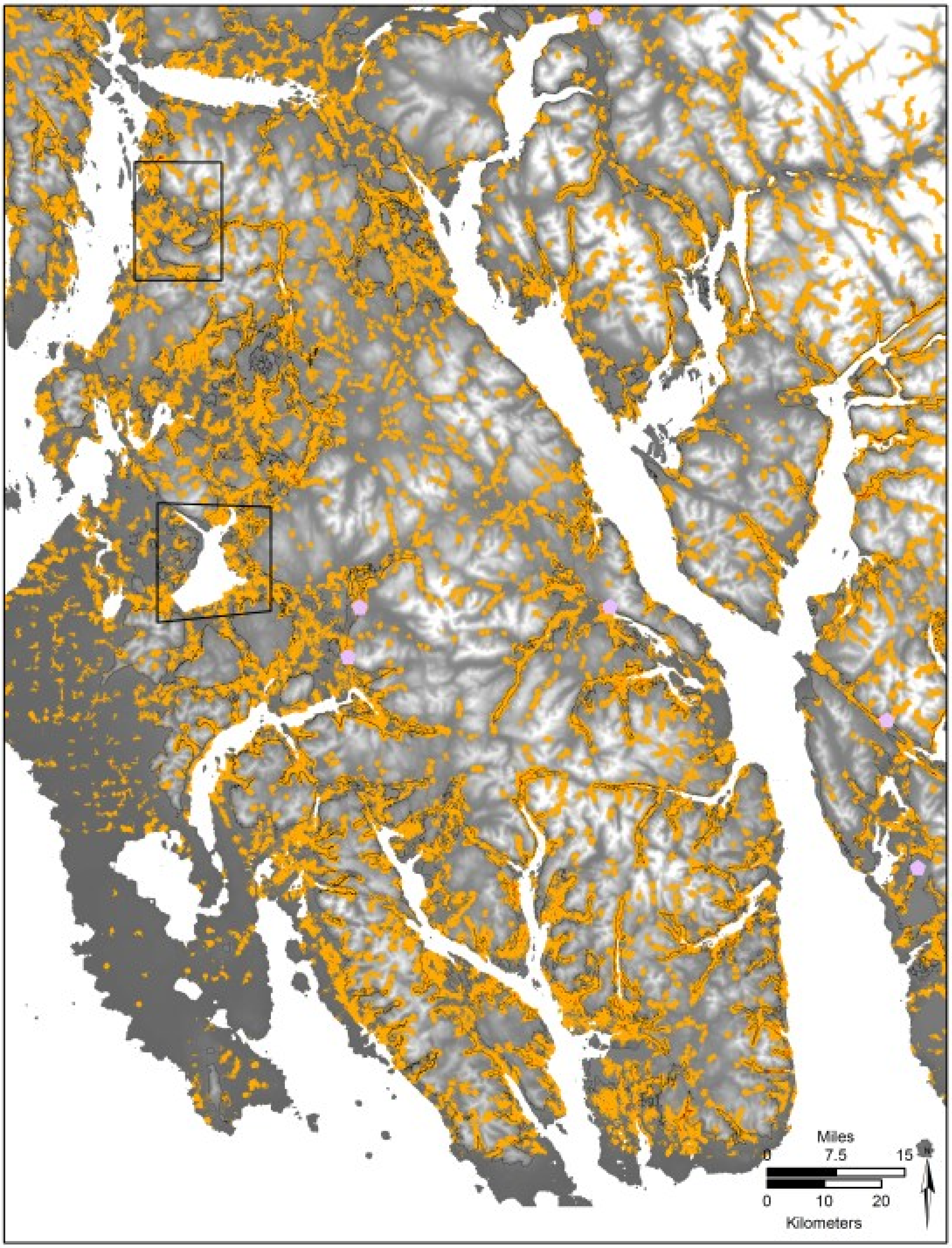
Weight 5a **14,500 cal BP**



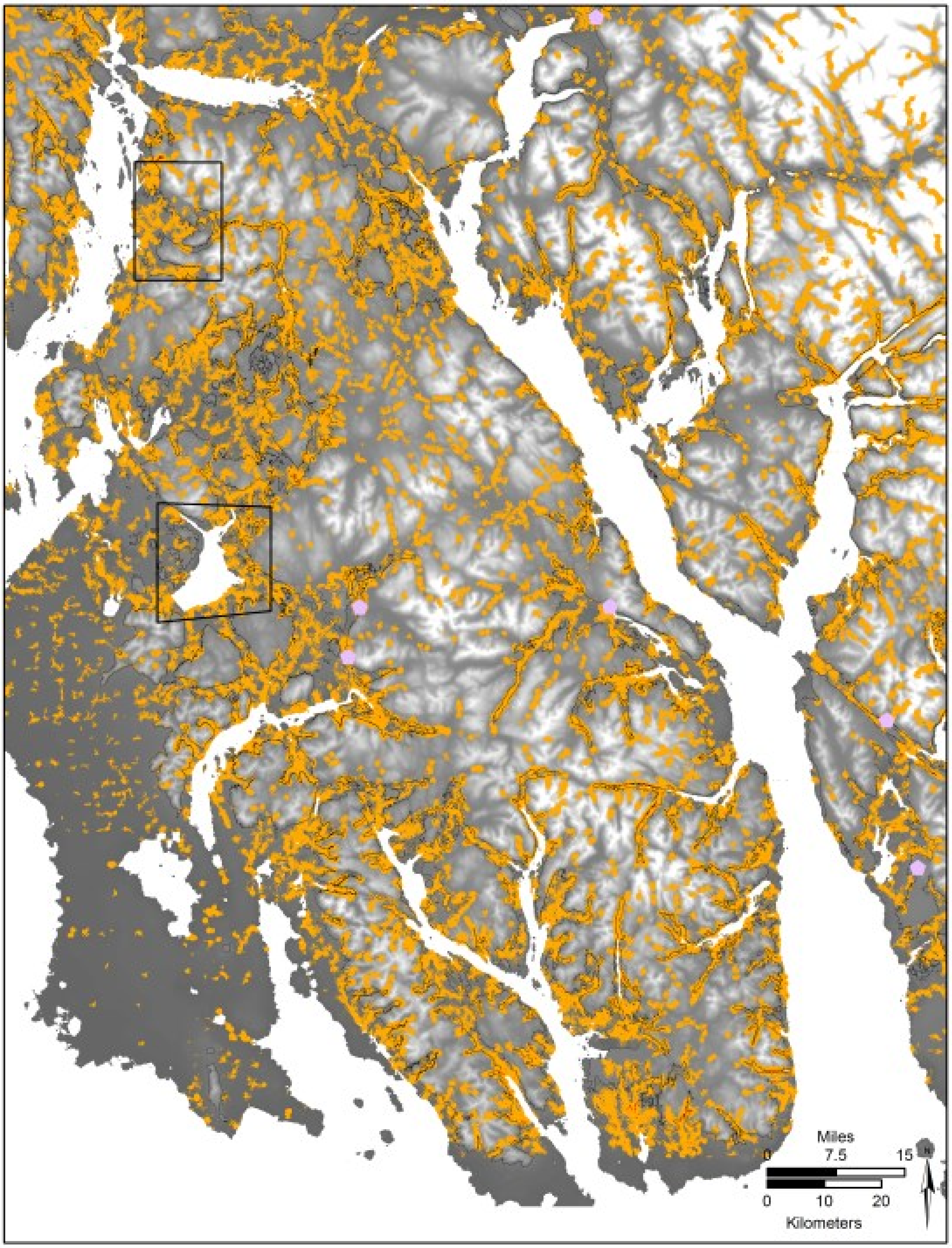
Weight 5a **15,000 cal BP**



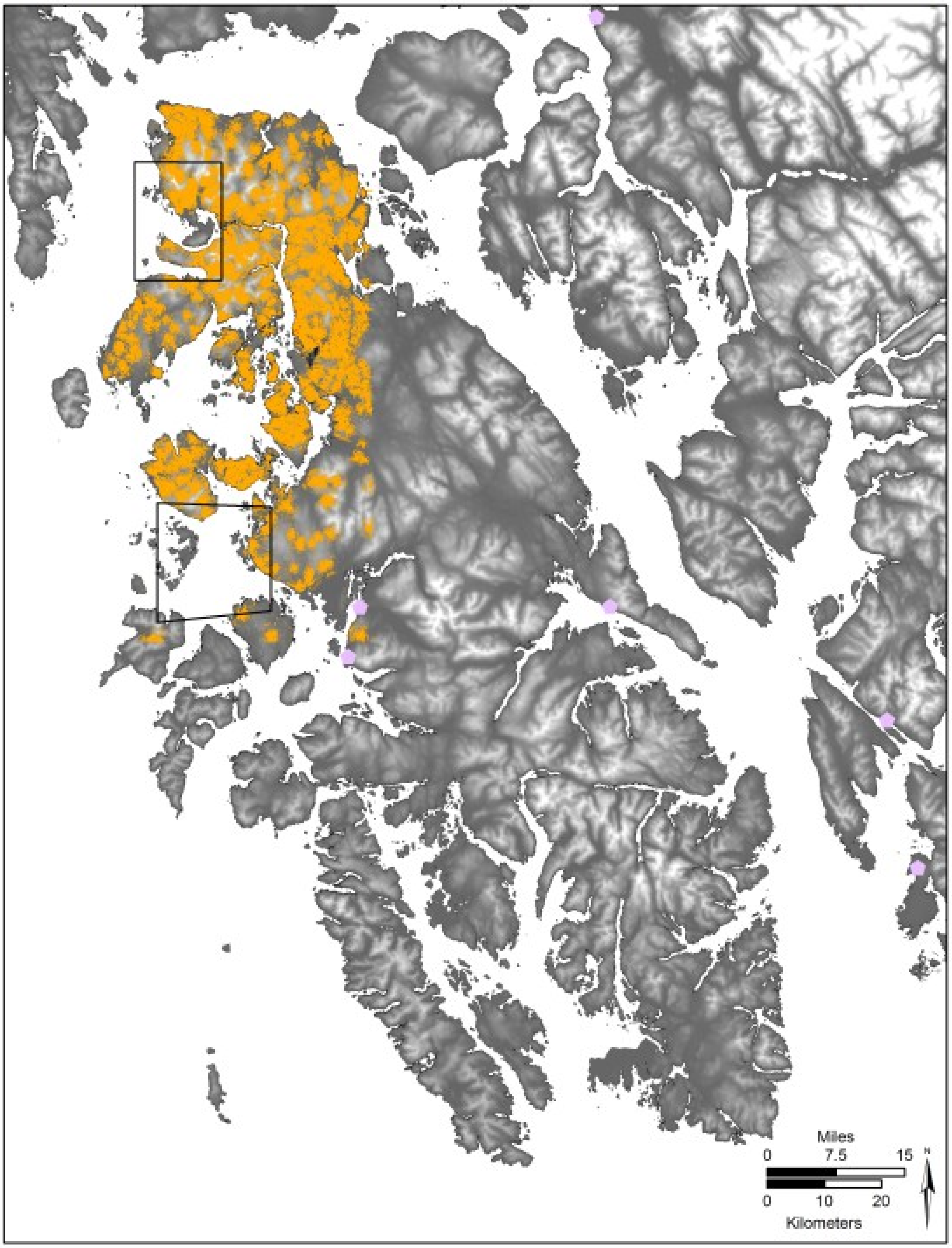
Weight 5a **15,500 cal BP**



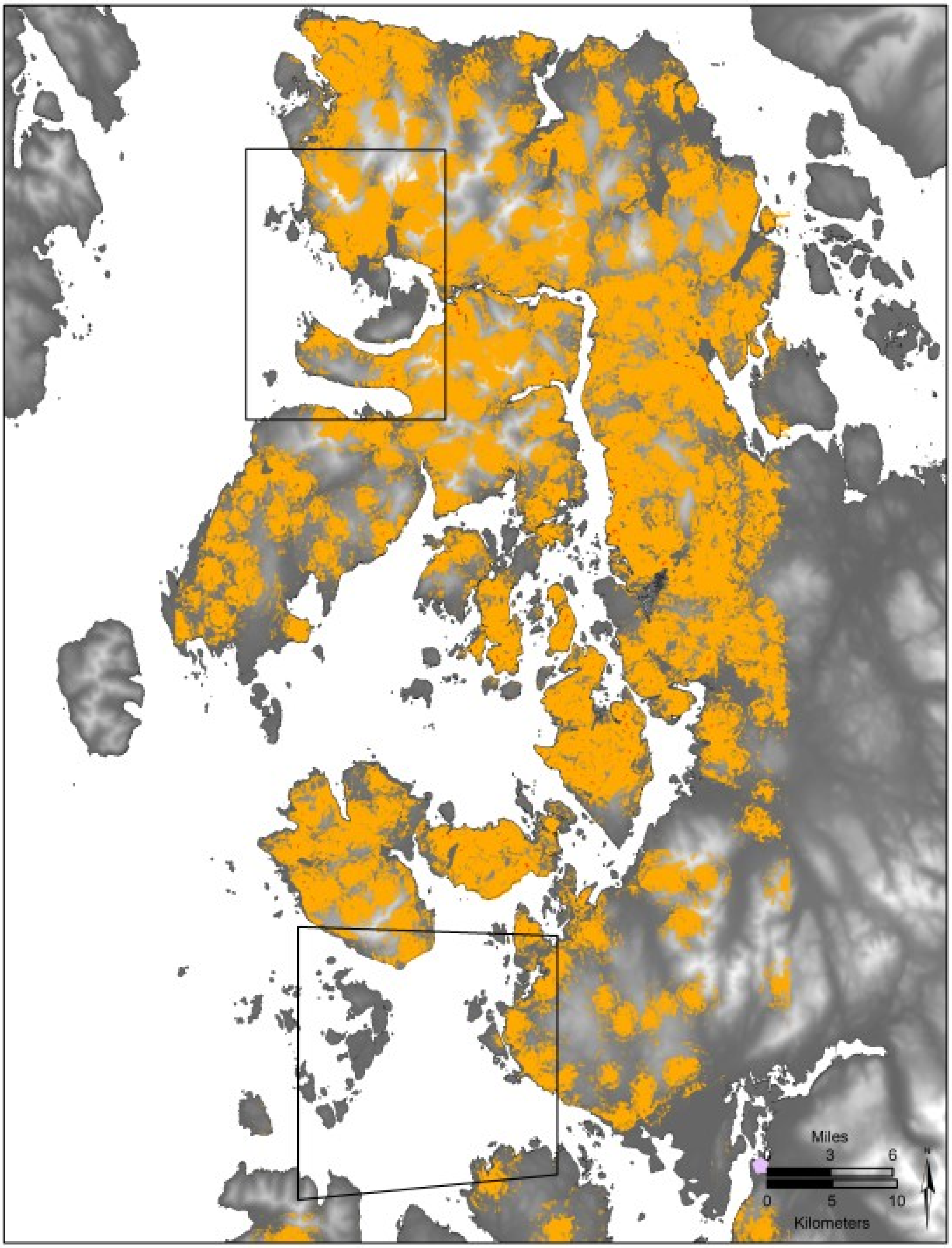
Weight 5a **16,000 cal BP**



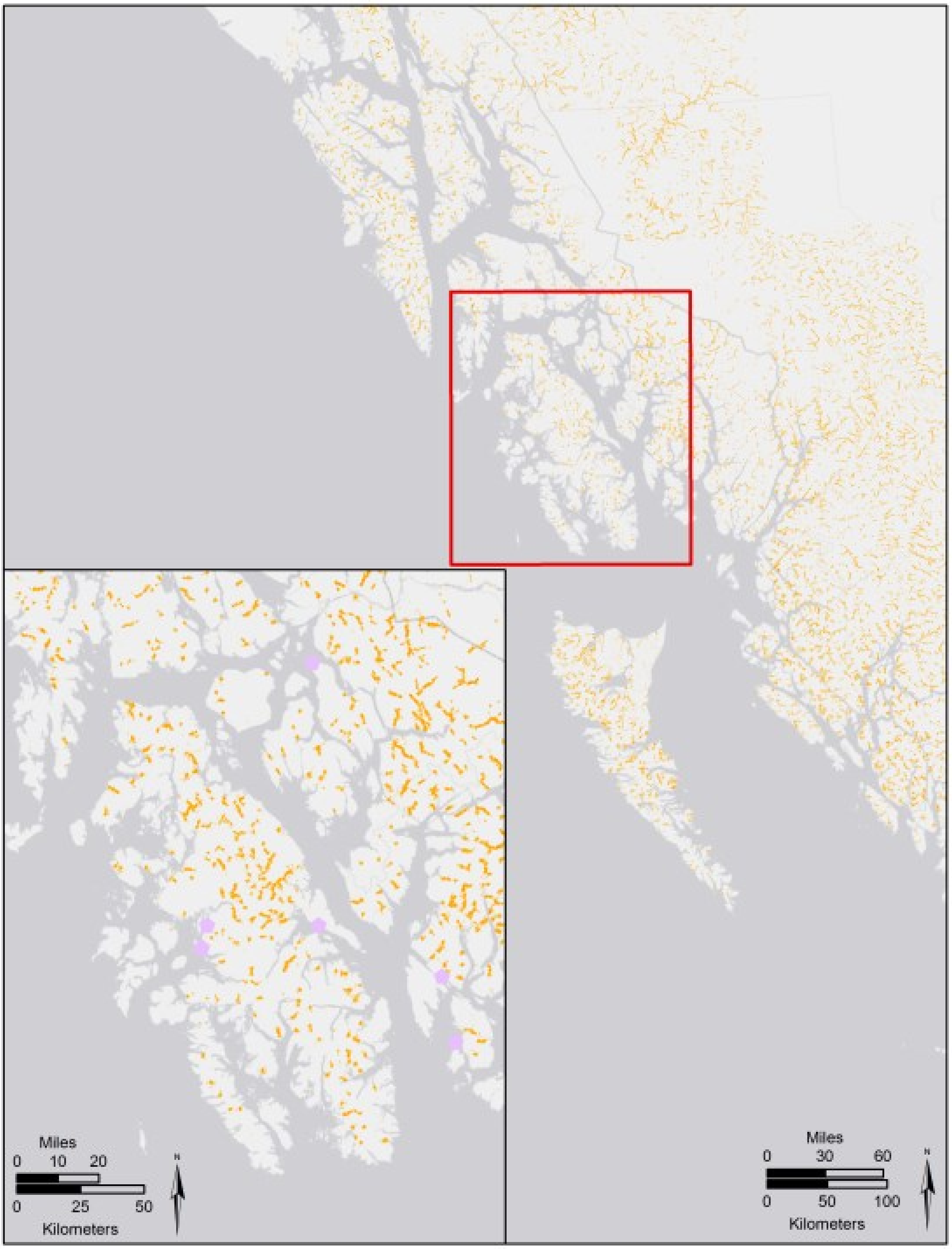
Weight 5a **Modern - Small Area**



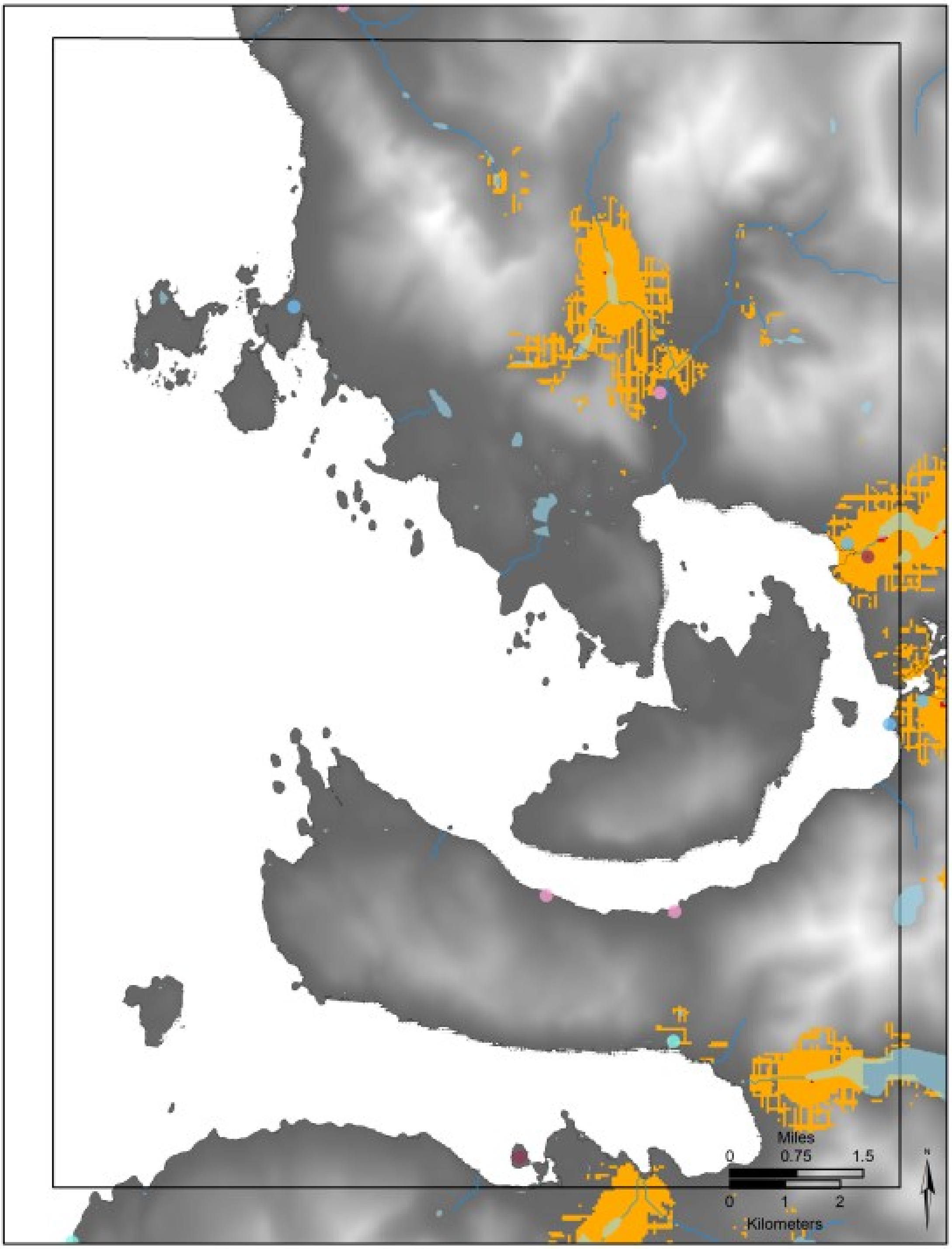
Weight 5a **Modern - Small Area**



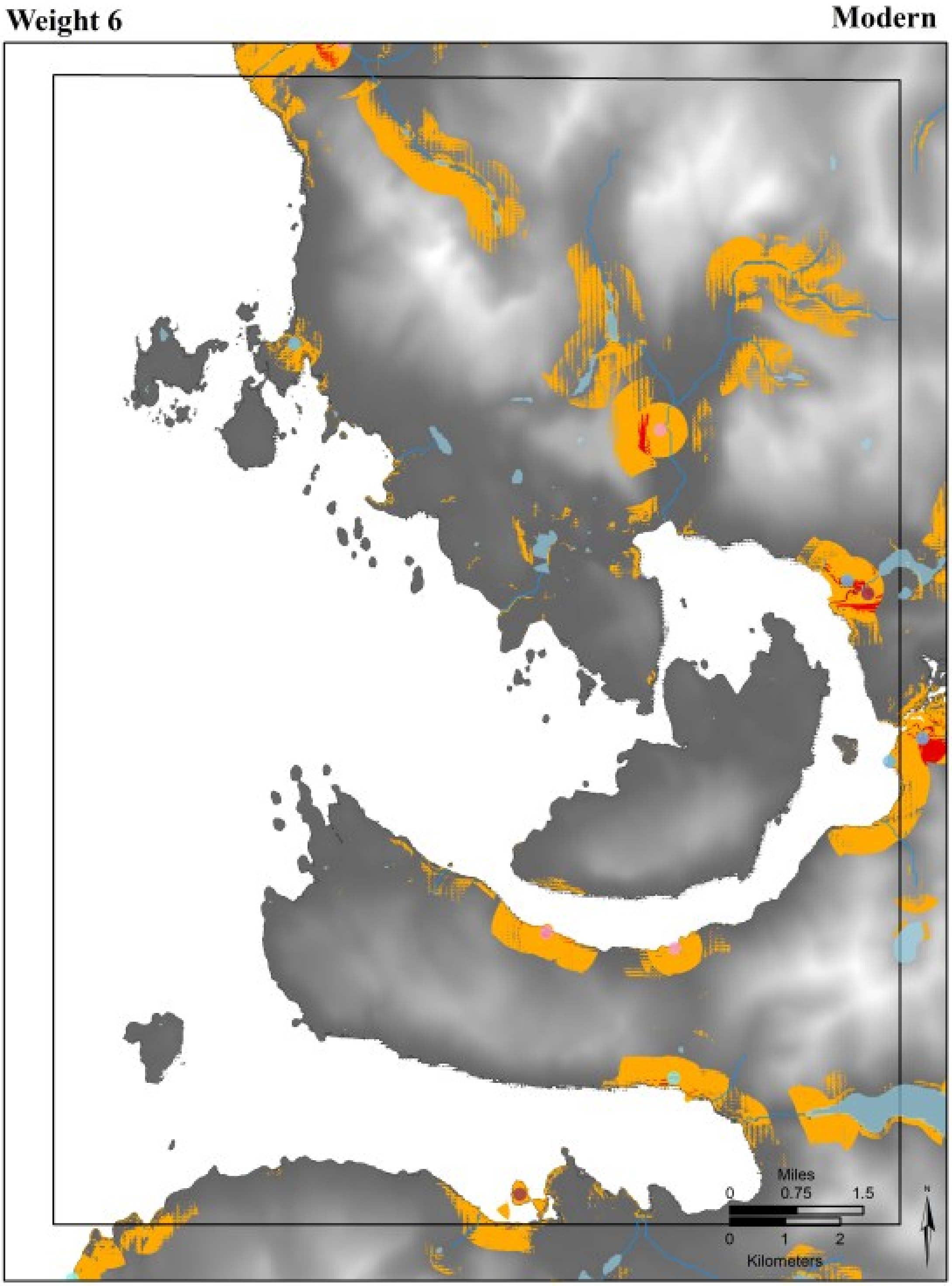
Weight 5a **NWC - modern**



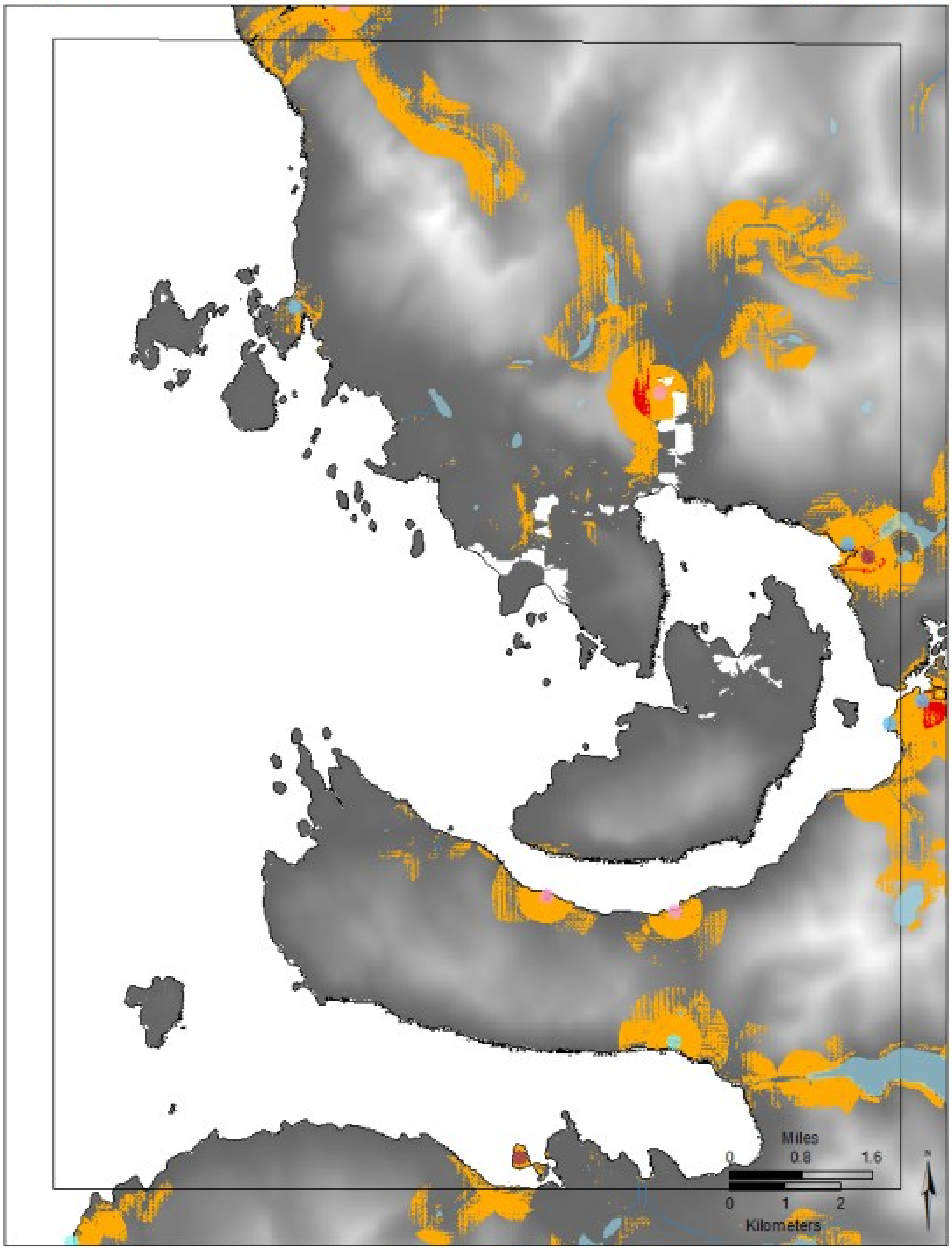
Weight 5a **NWC - modern**



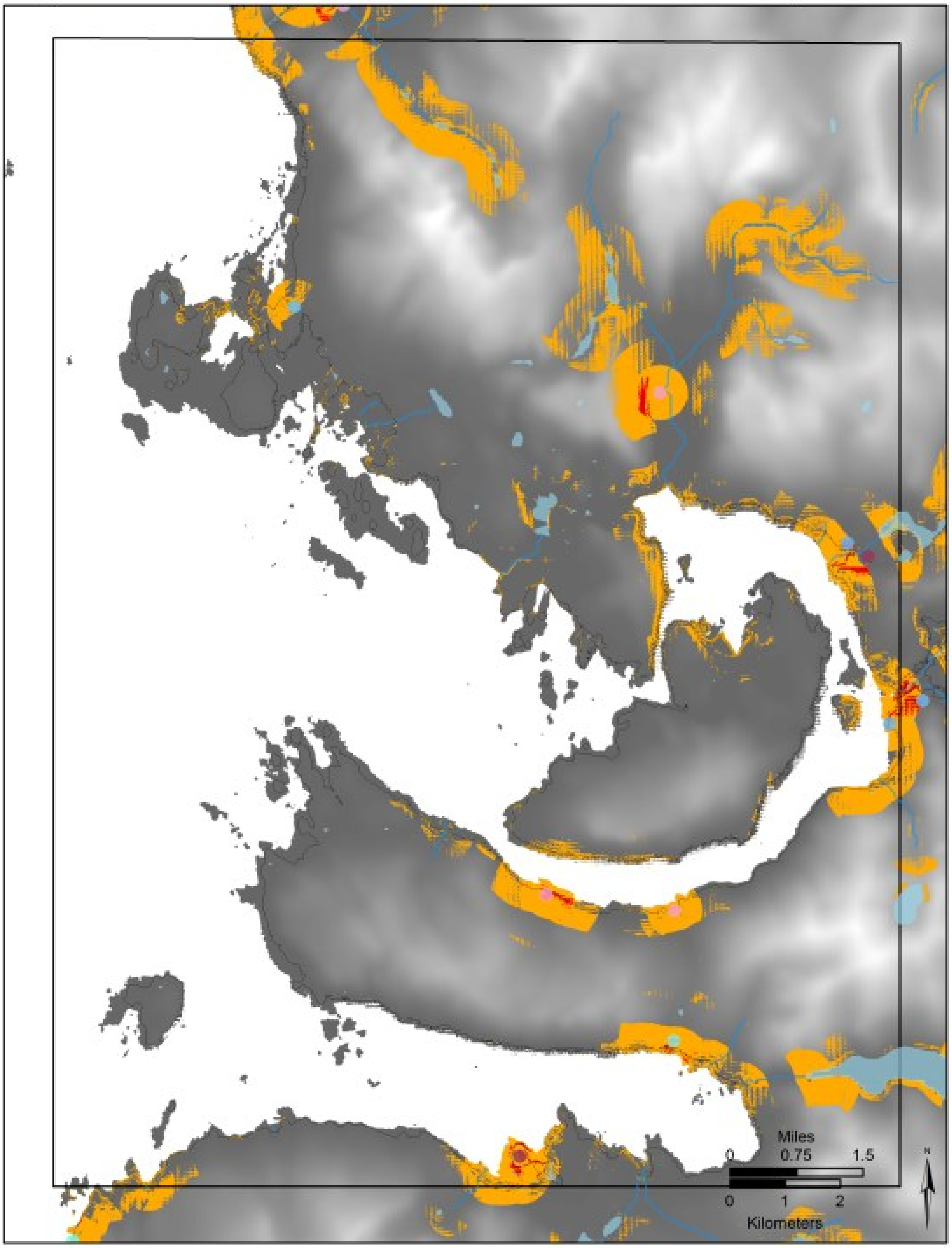
C.12 Weighted Overlay 6



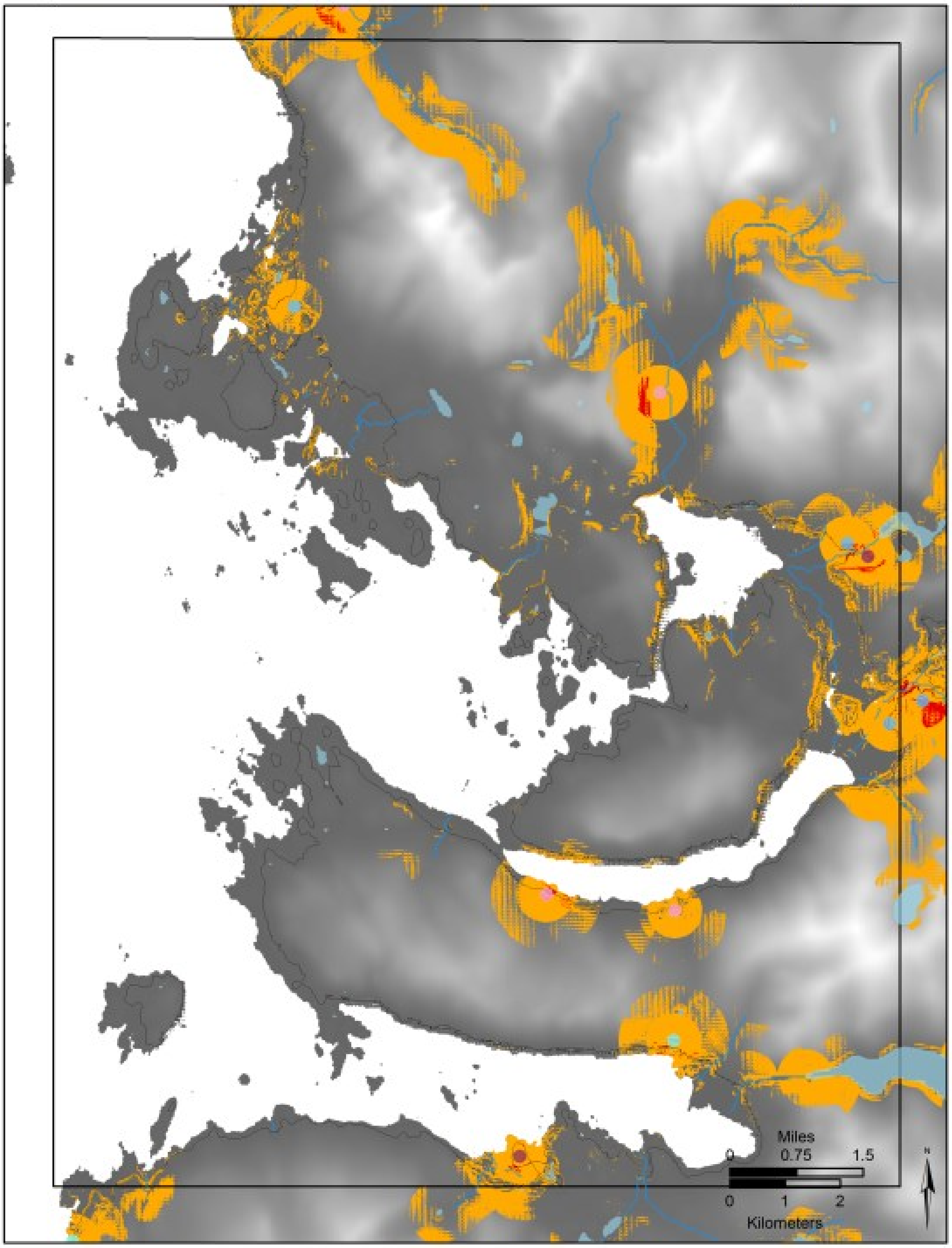
Weight 6 **10,500 cal BP**



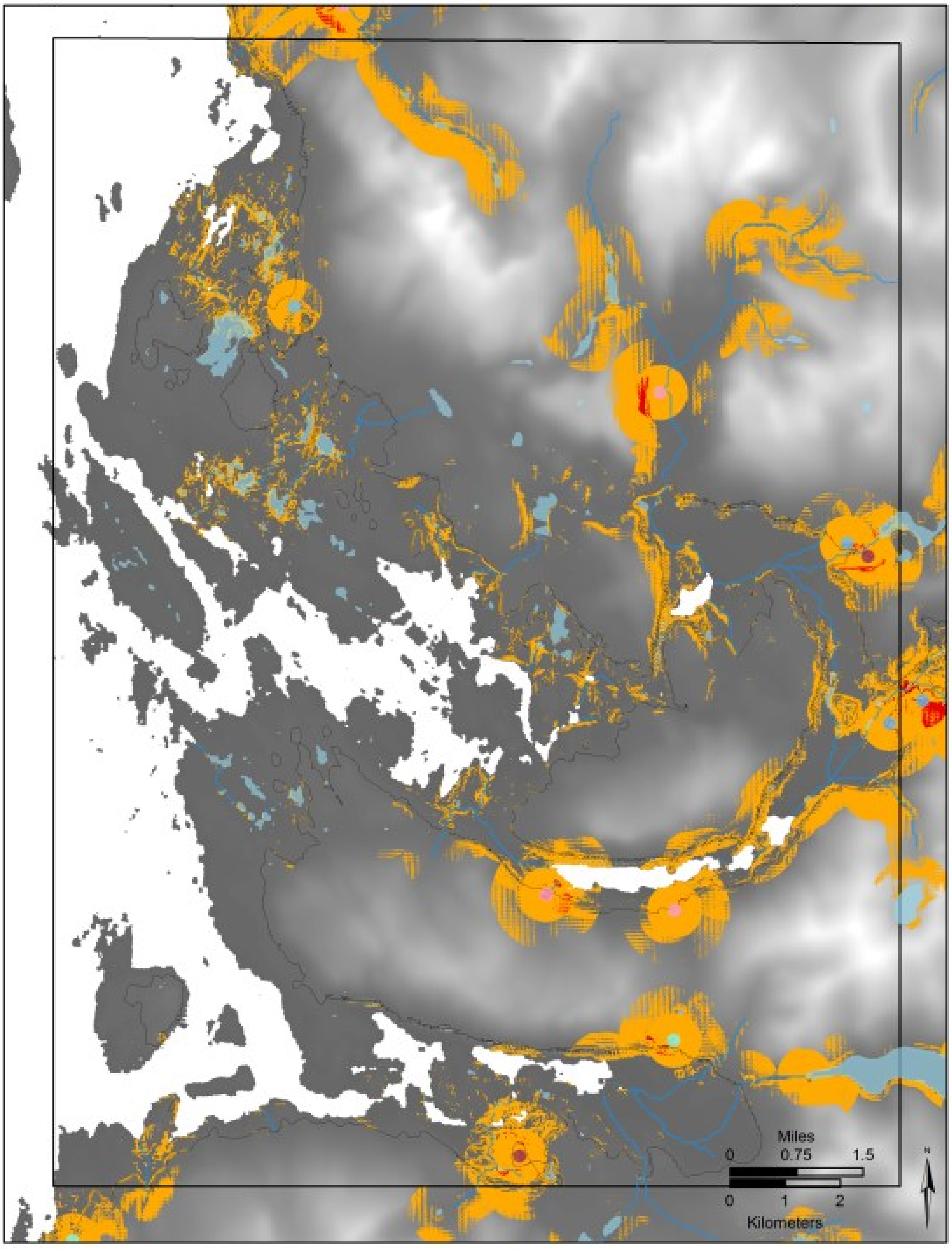
Weight 6 **11,000 cal BP**



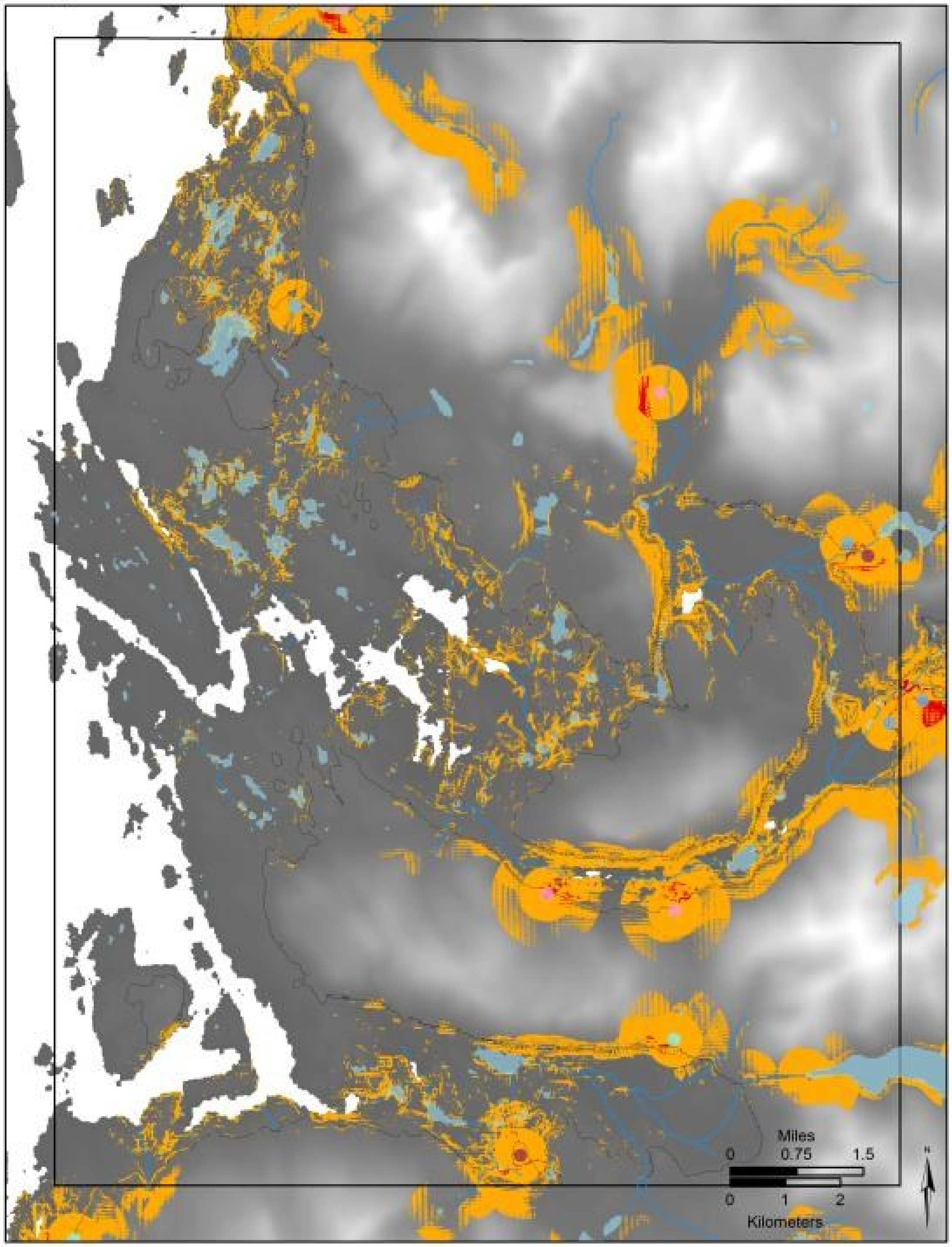
Weight 6 **11,500 cal BP**



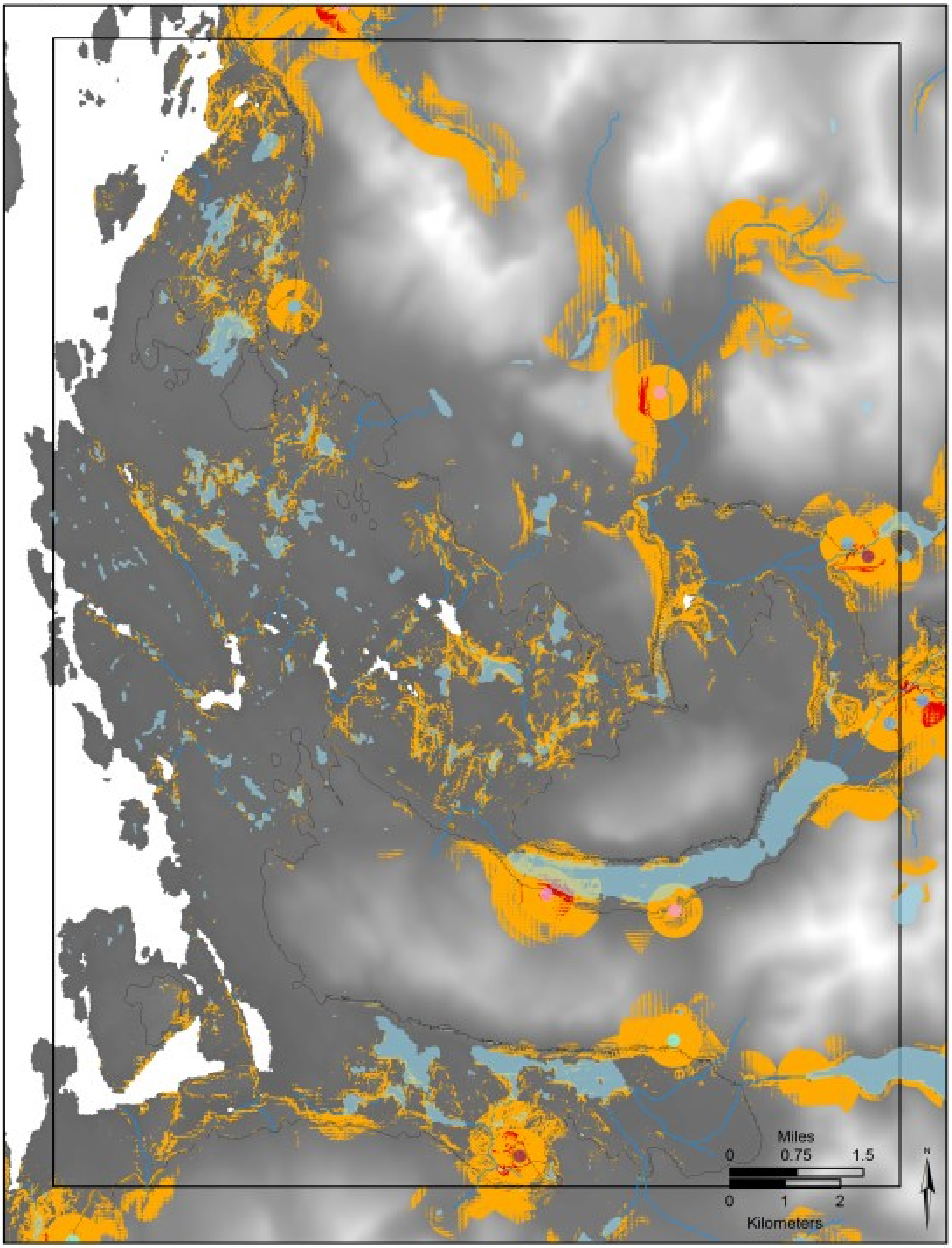
Weight 6 **12,000 cal BP**



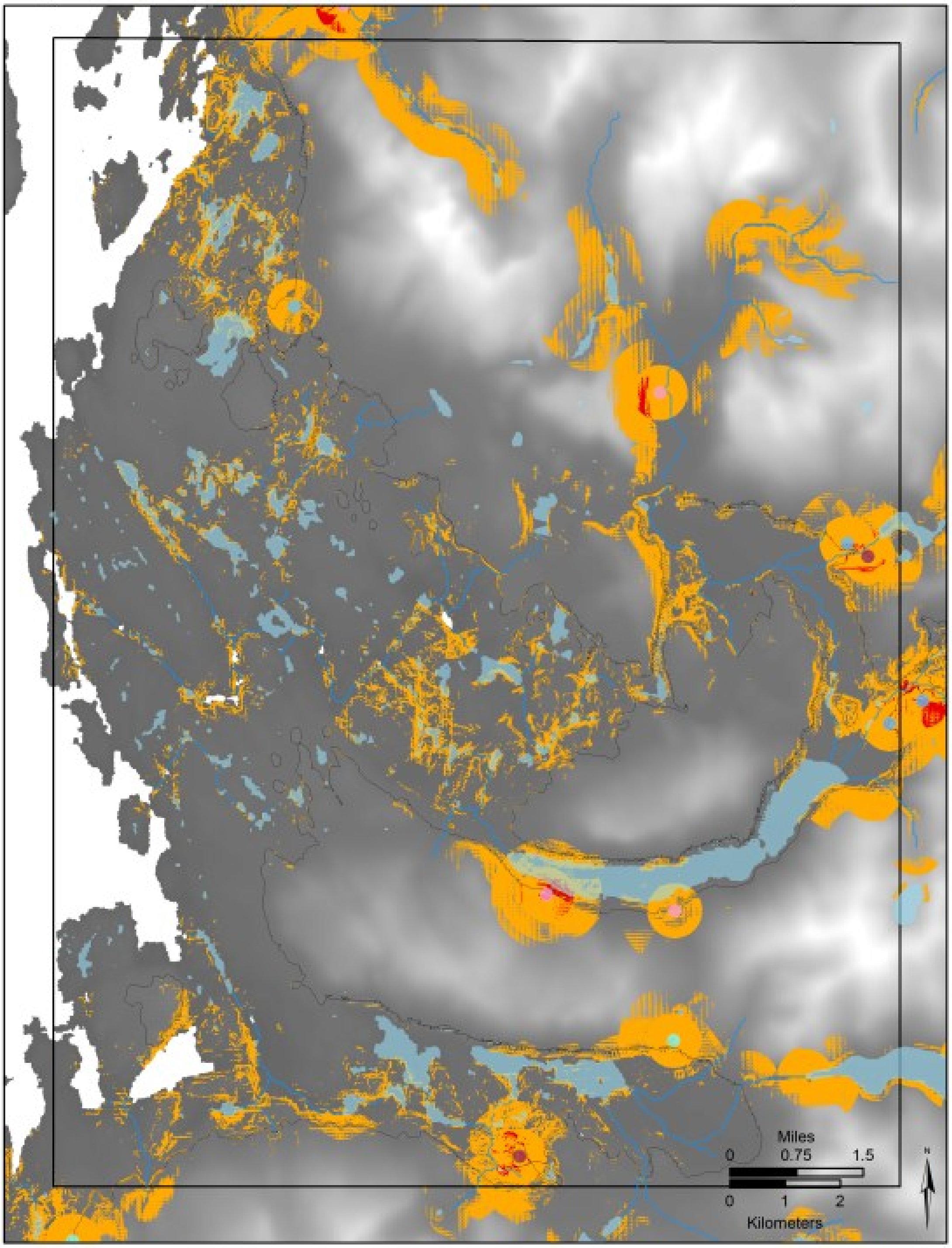
Weight 6 **12,500 cal BP**



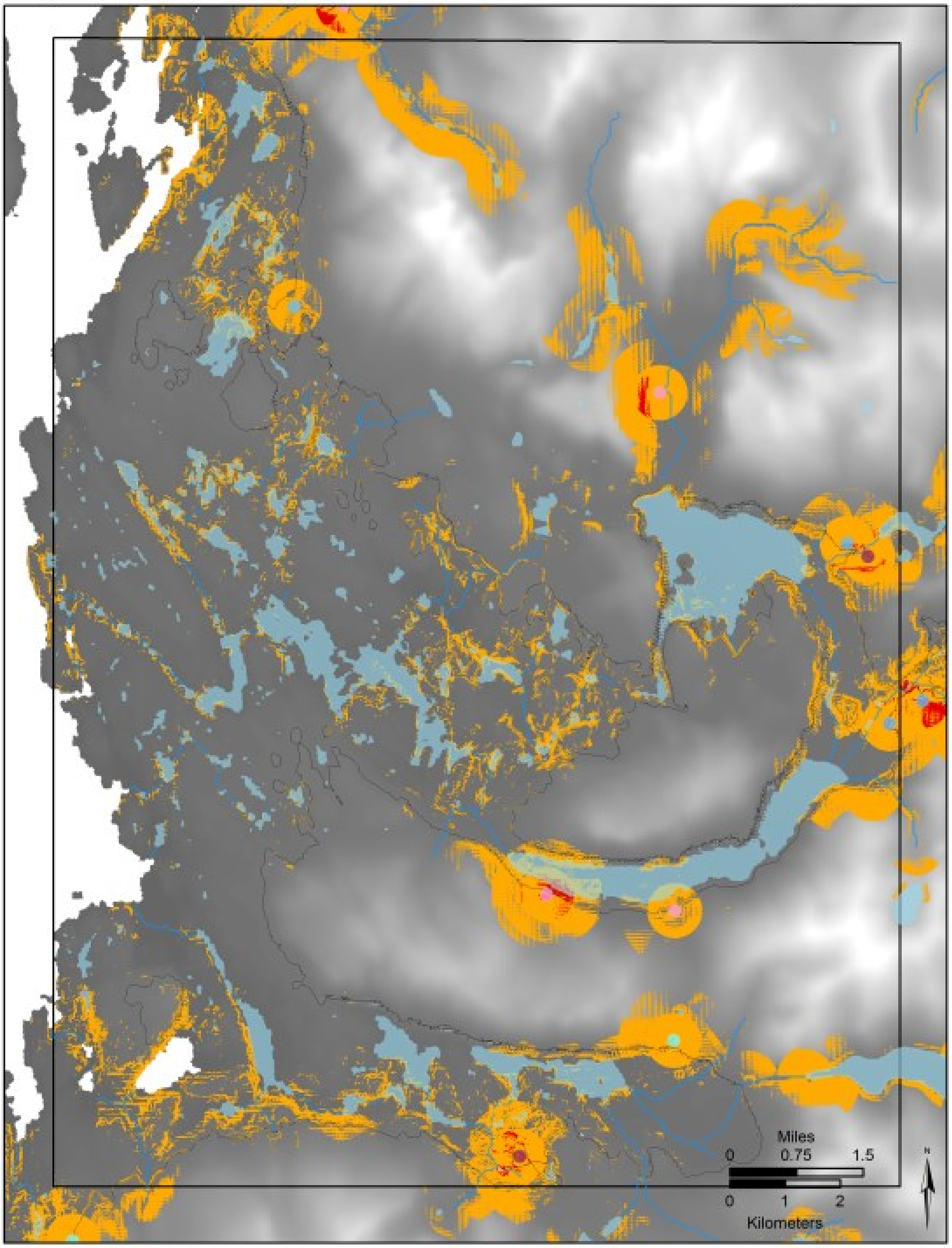
Weight 6 **13,000 cal BP**



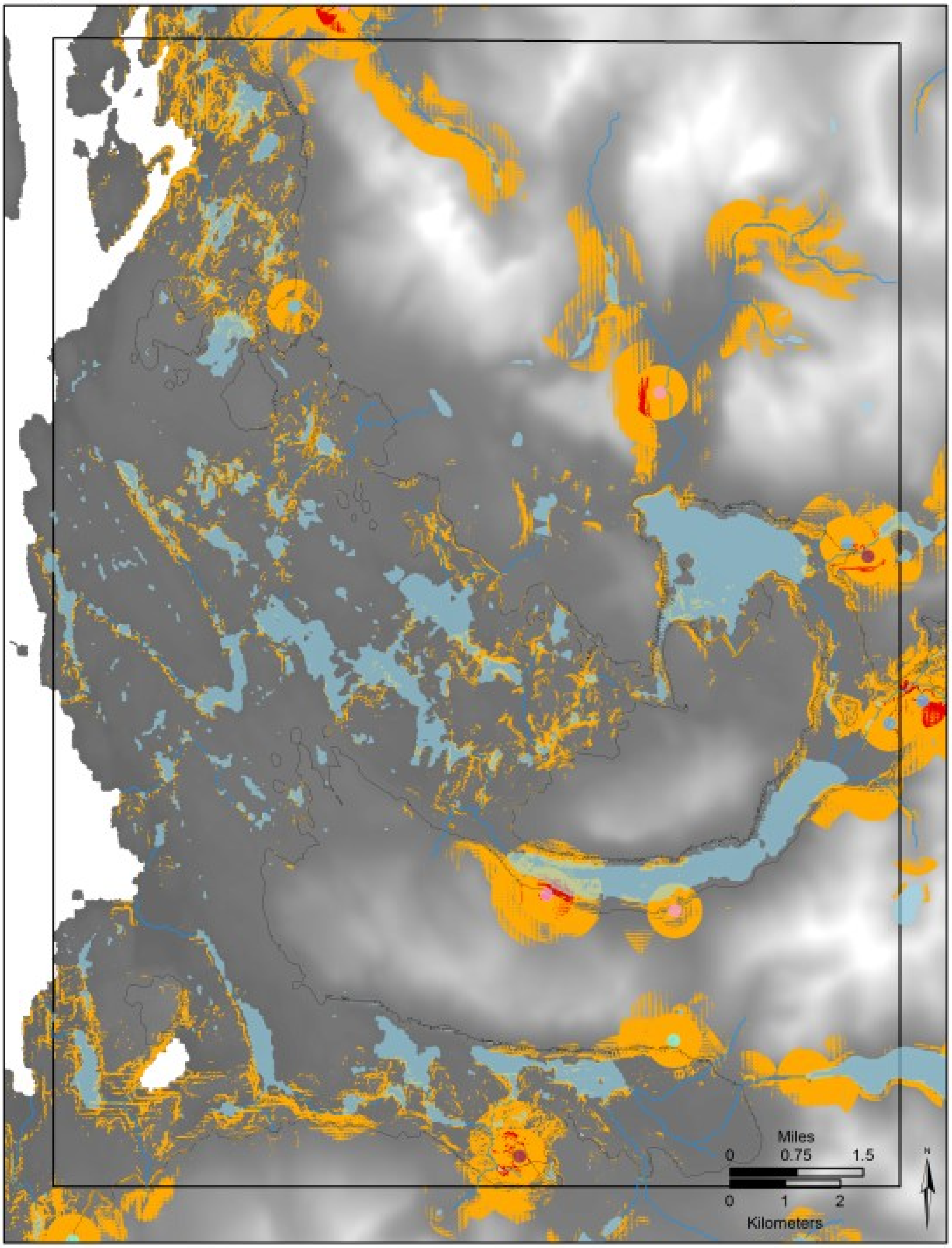
Weight 6 **13,500 cal BP**



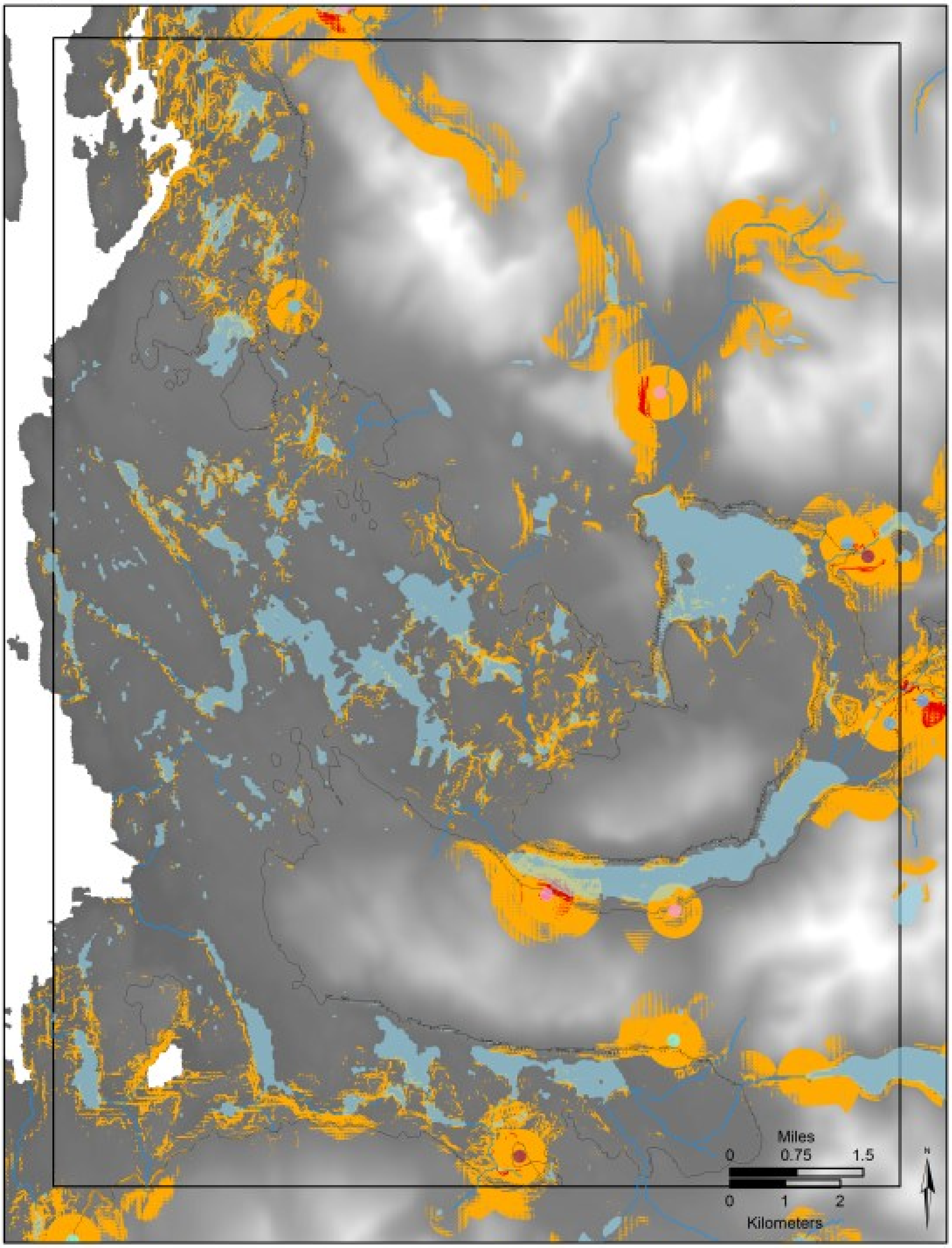
Weight 6 **14,000 cal BP**



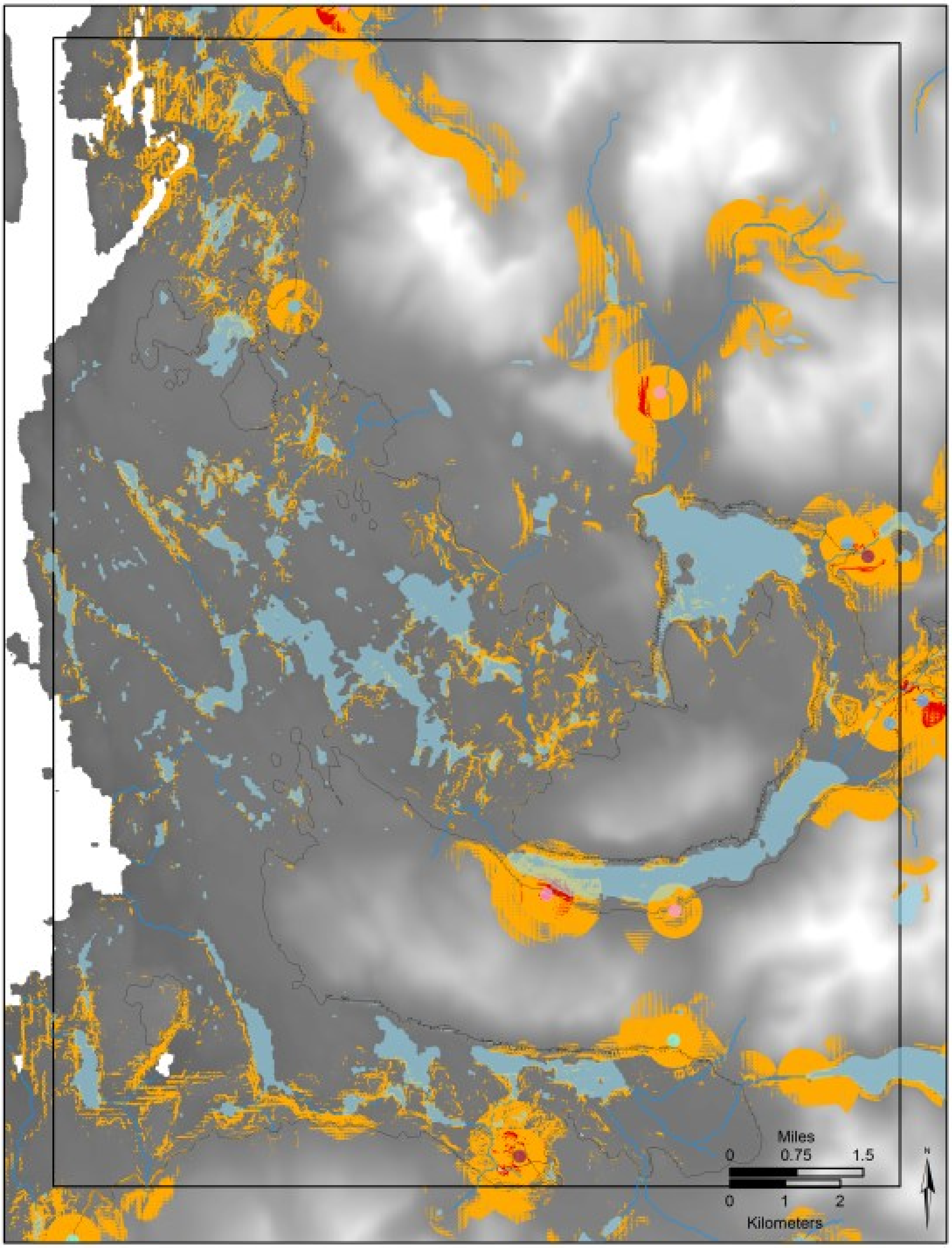
Weight 6 **14,500 cal BP**



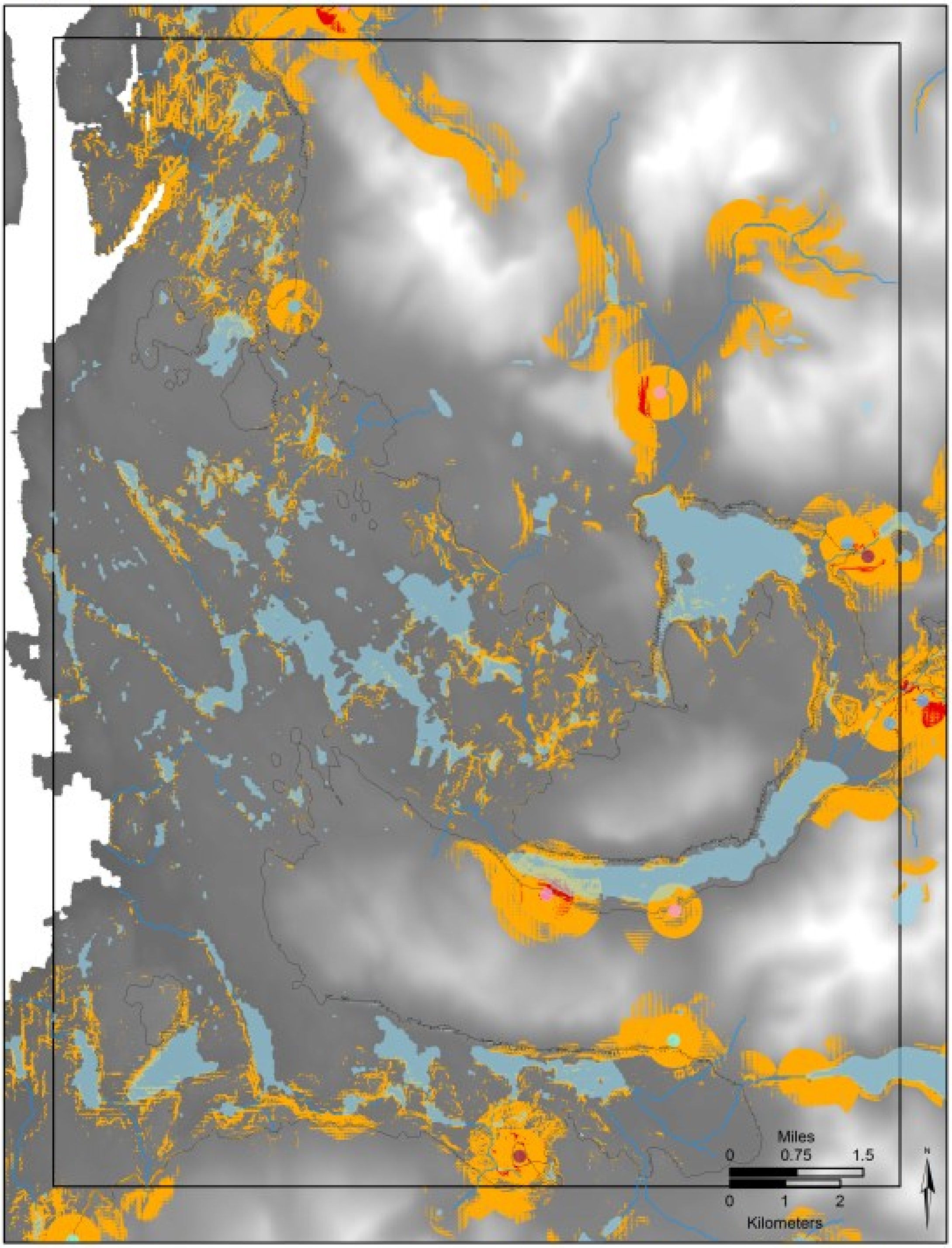
Weight 6 **15,000 cal BP**



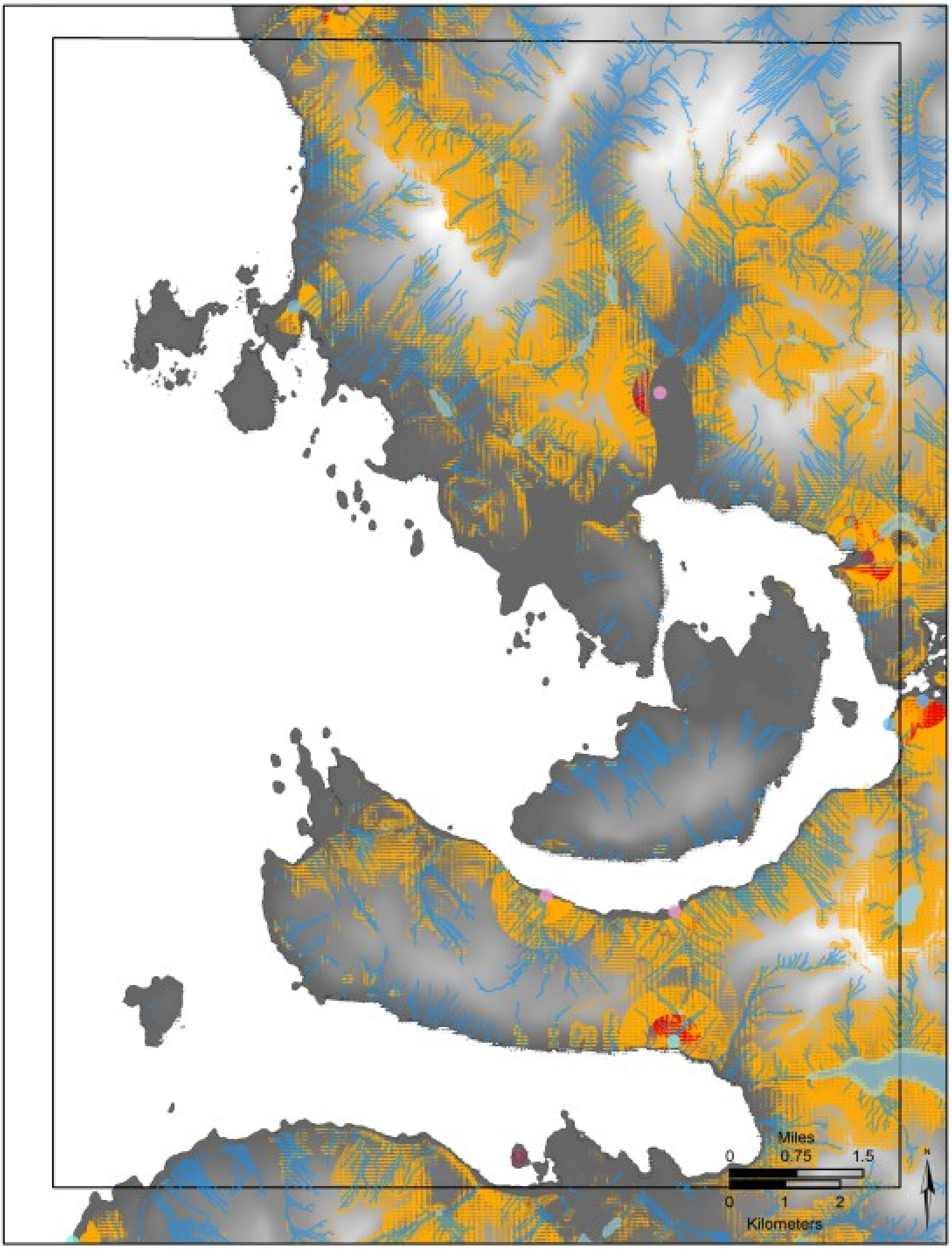
Weight 6 **15,500 cal BP**



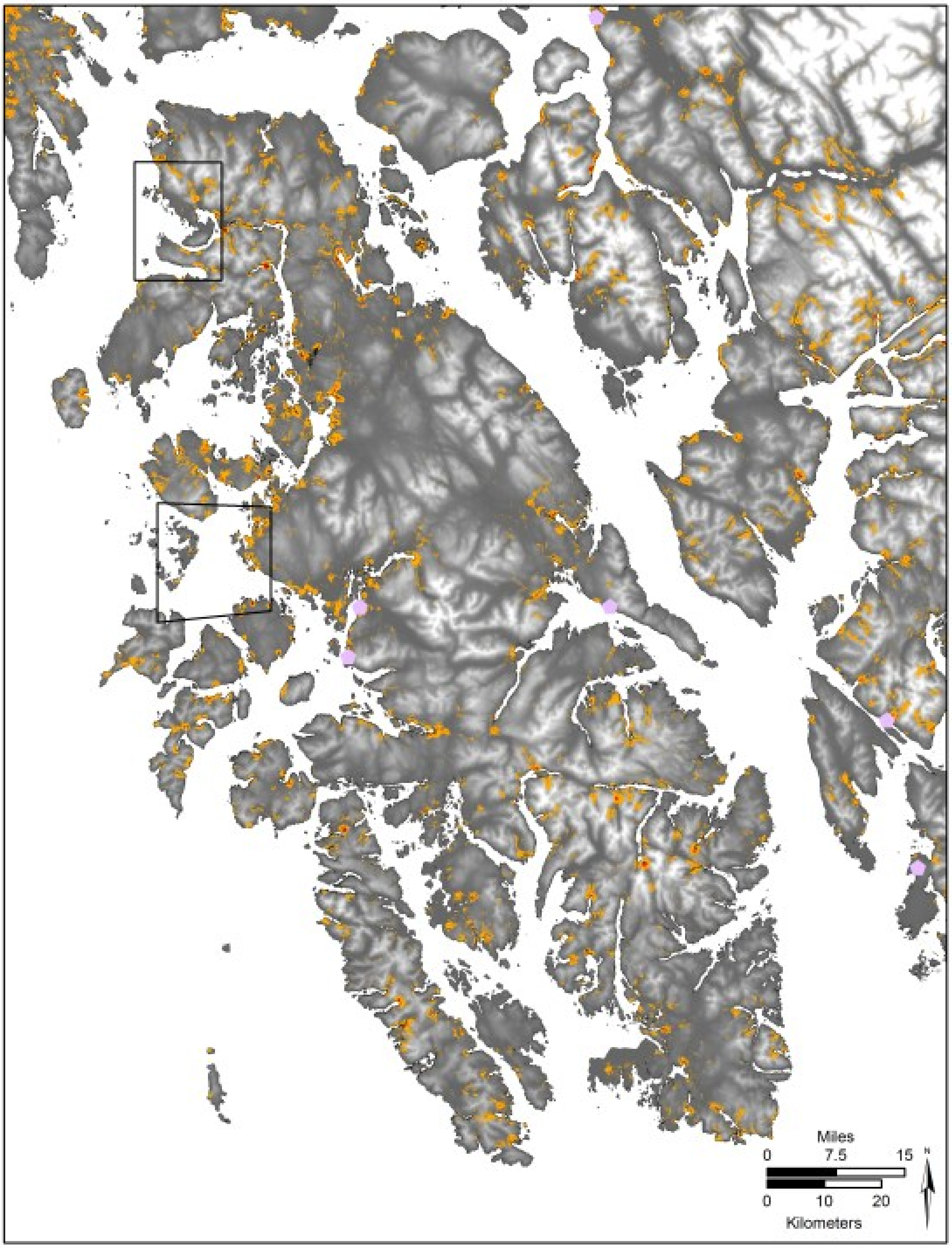
Weight 6 **16,000 cal BP**



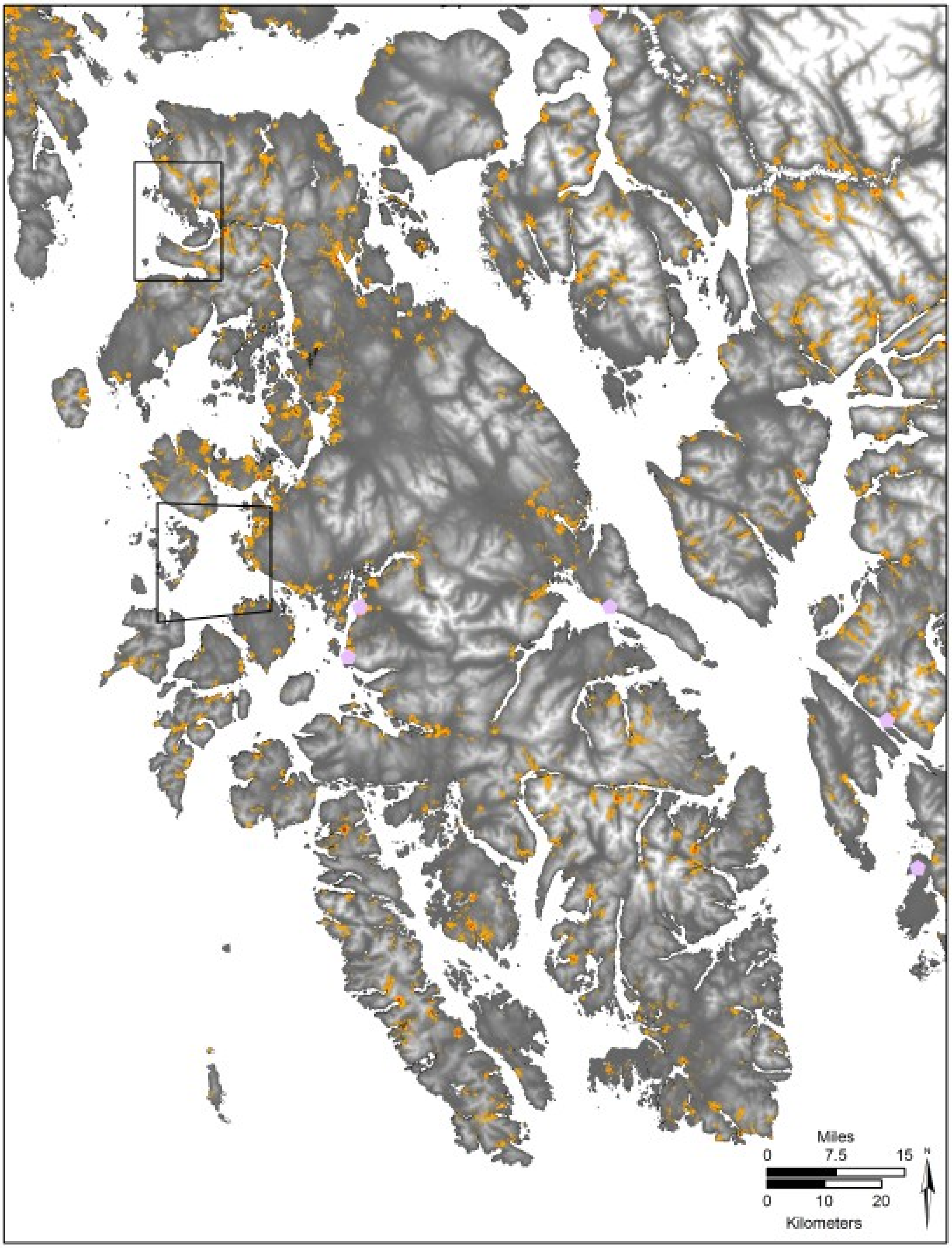
Weight 6 **Modern - Small Area**



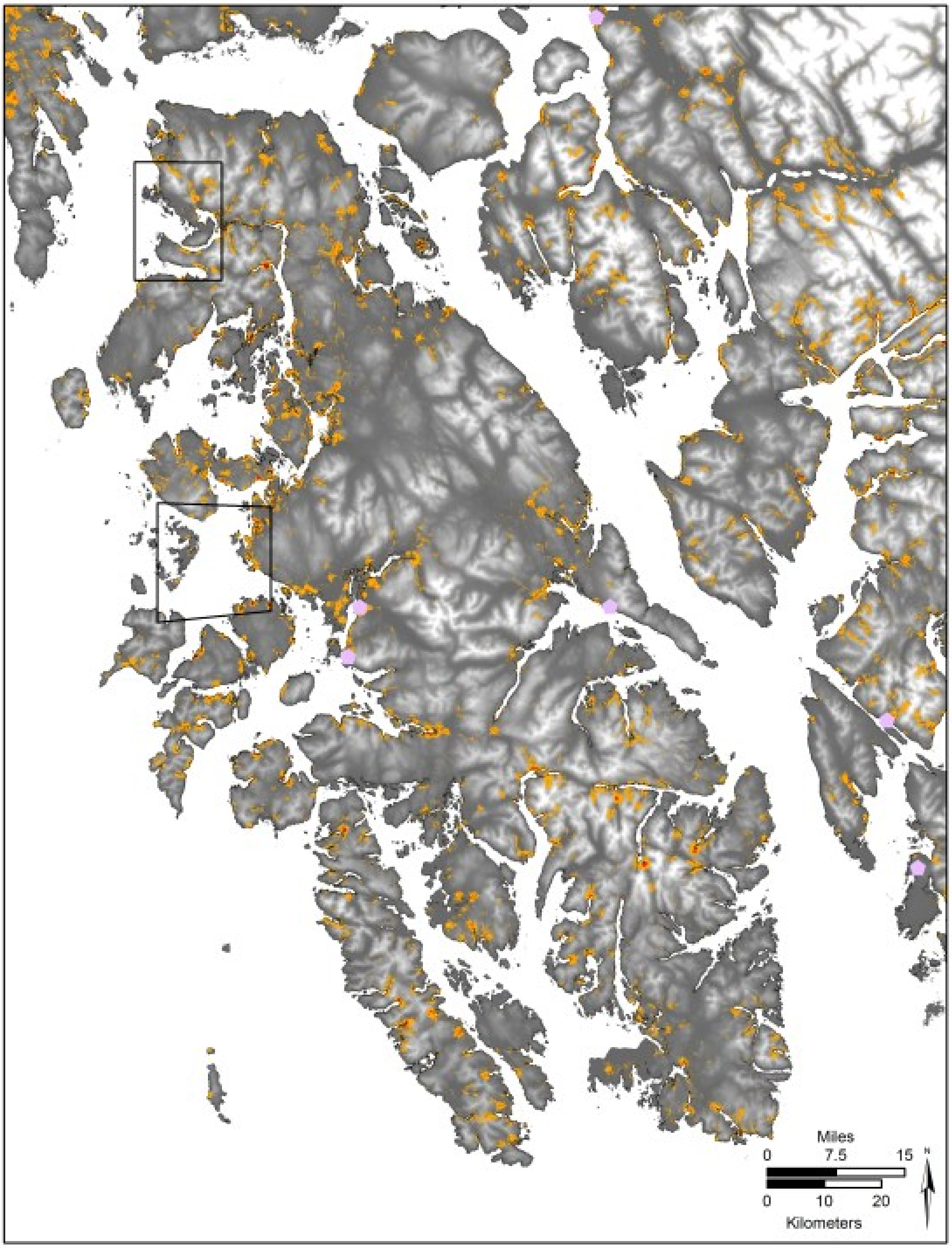
Weight 6 **Modern**



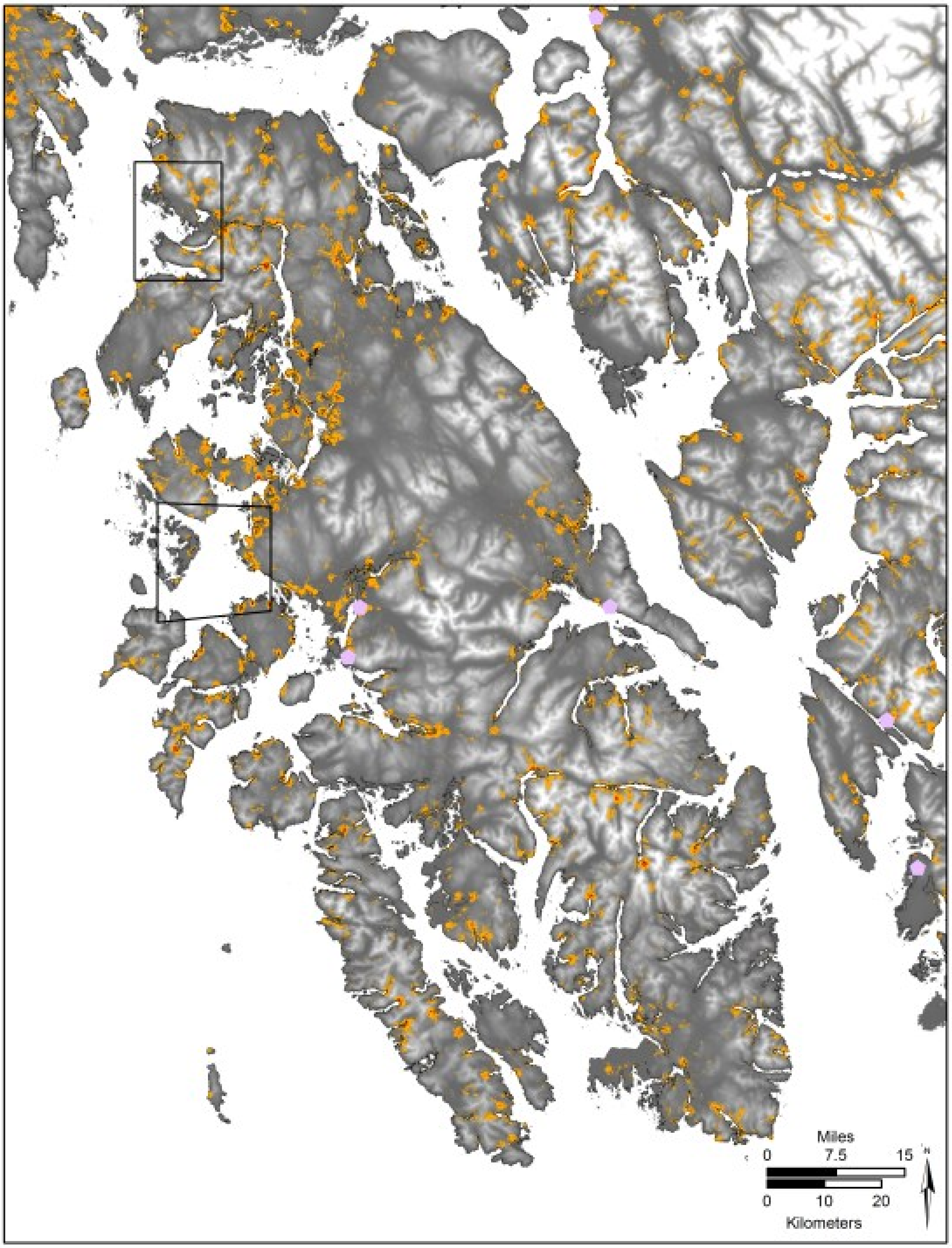
Weight 6 **10,500 cal BP**

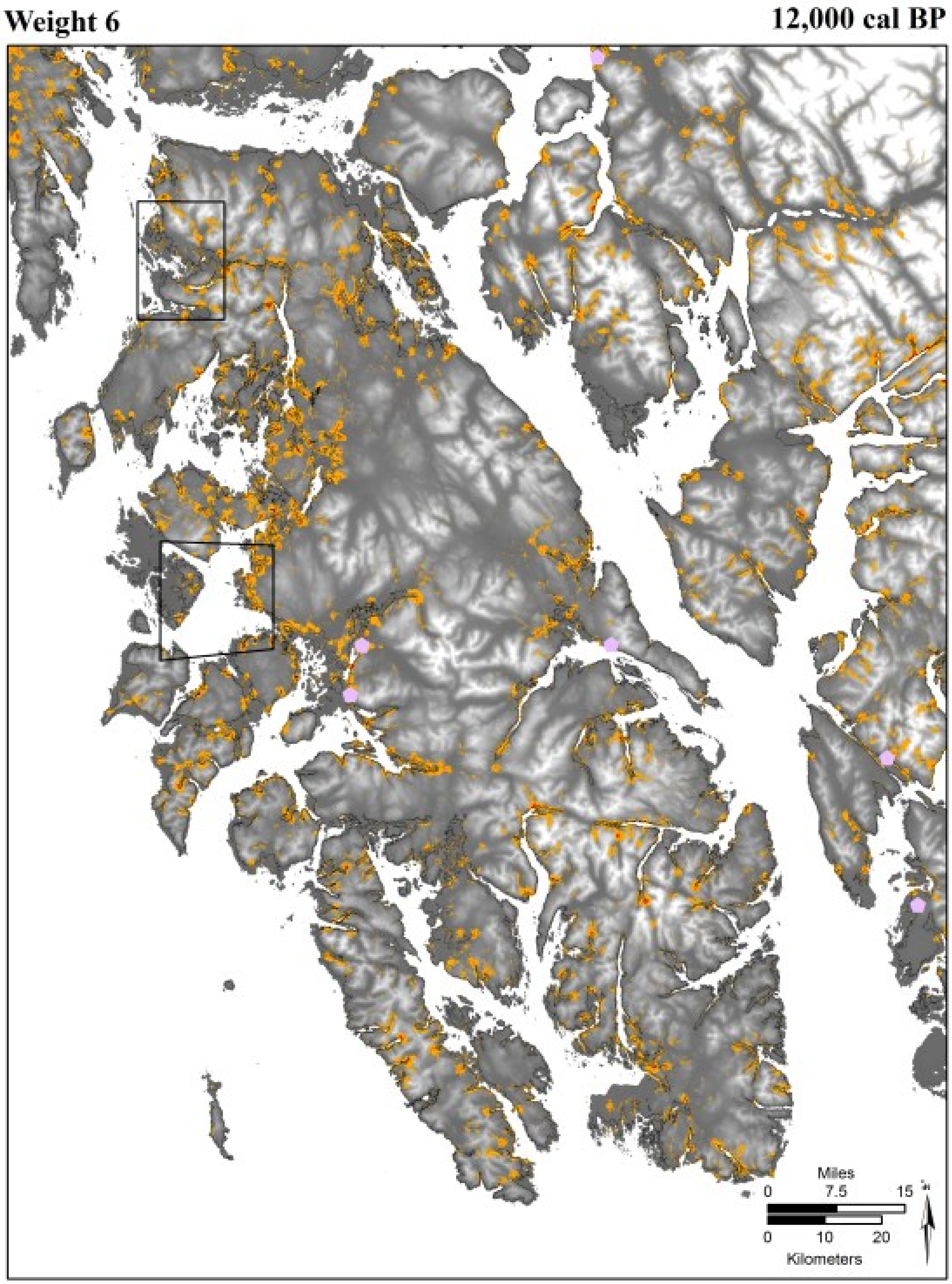


Weight 6 **11,000 cal BP**

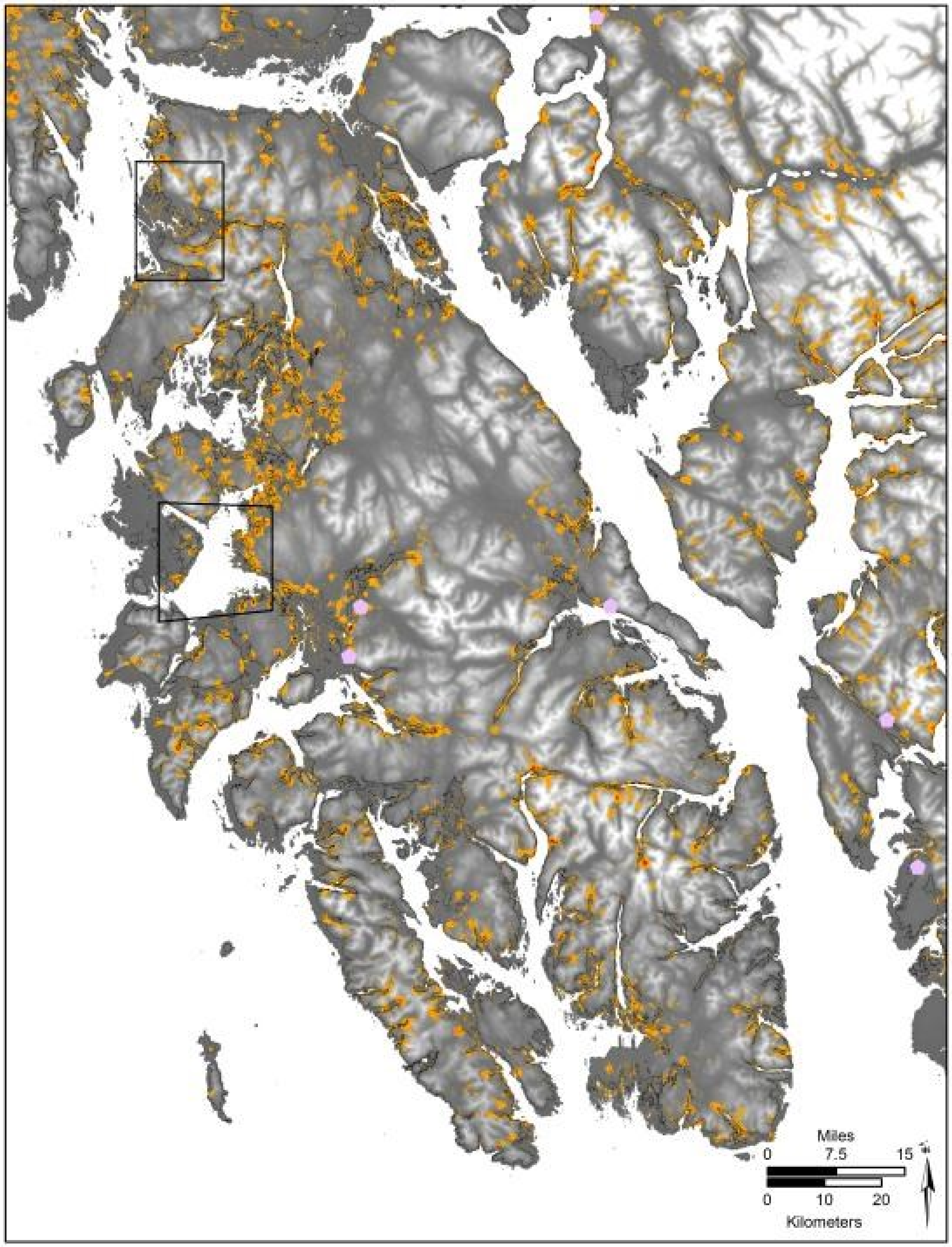


Weight 6 **11,500 cal BP**

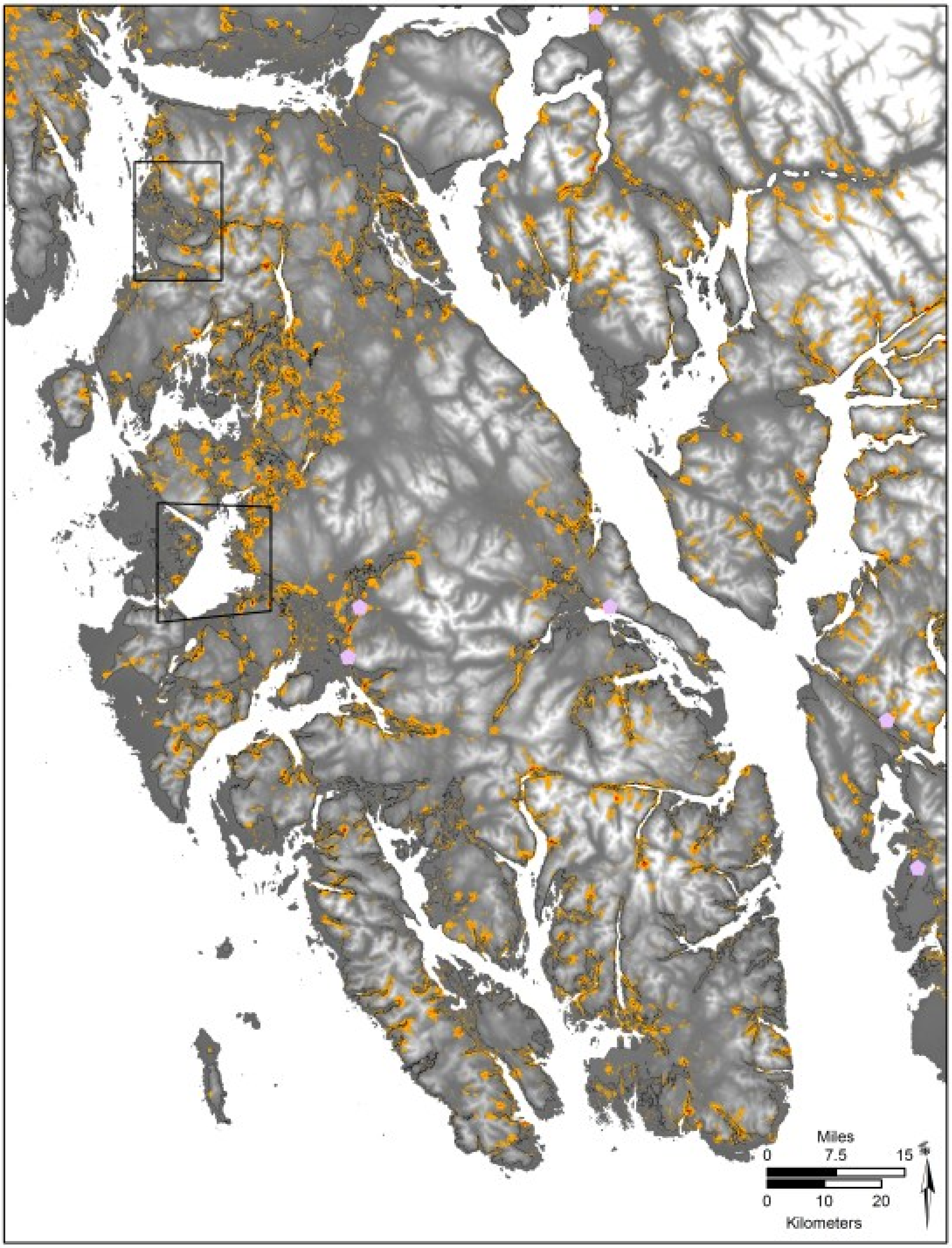



Weight 6
12,000 cal BP
Miles
0
7.5
15
0
10
20
Kilometers

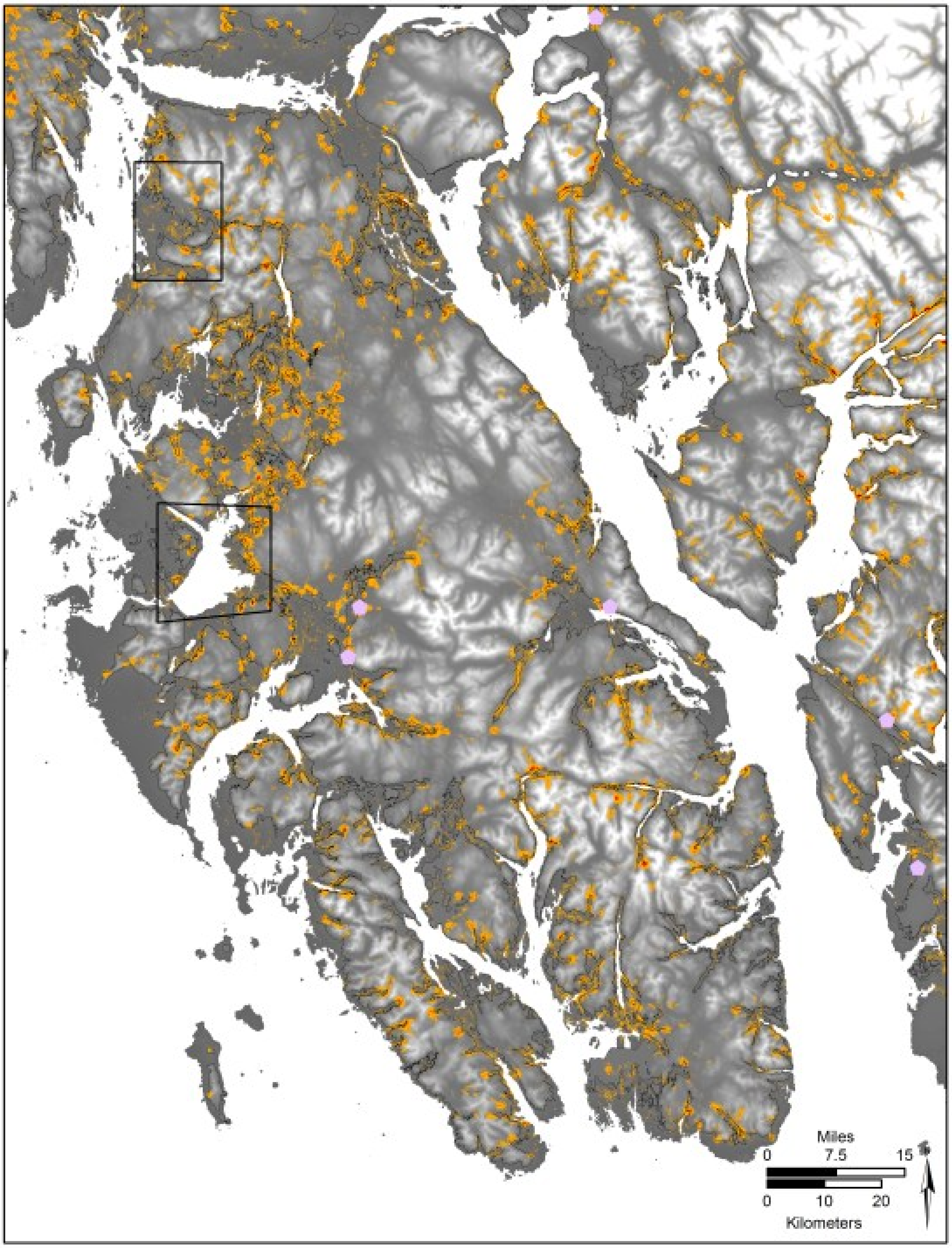
Weight 6 **12,500 cal BP**



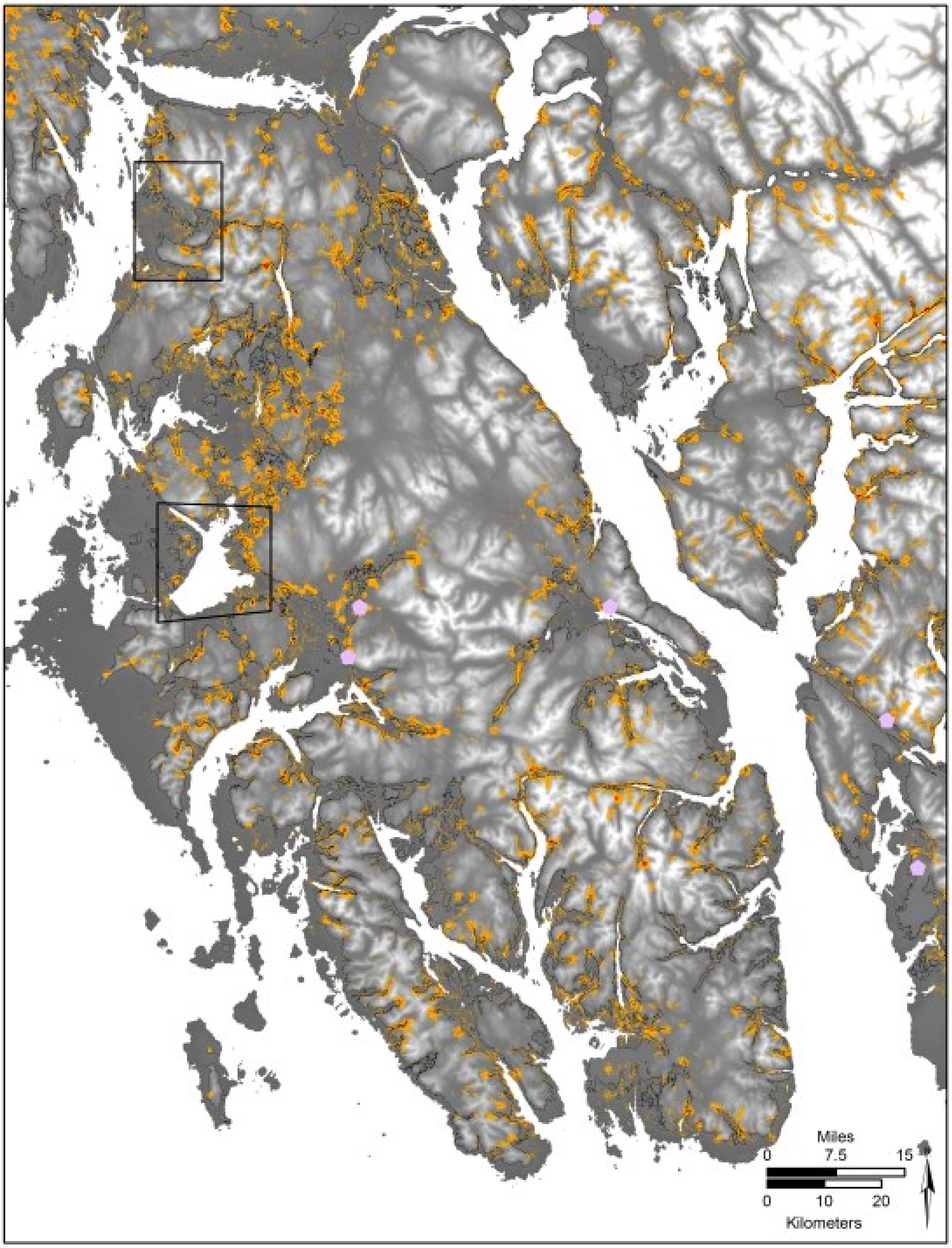
Weight 6 **13,000 cal BP**



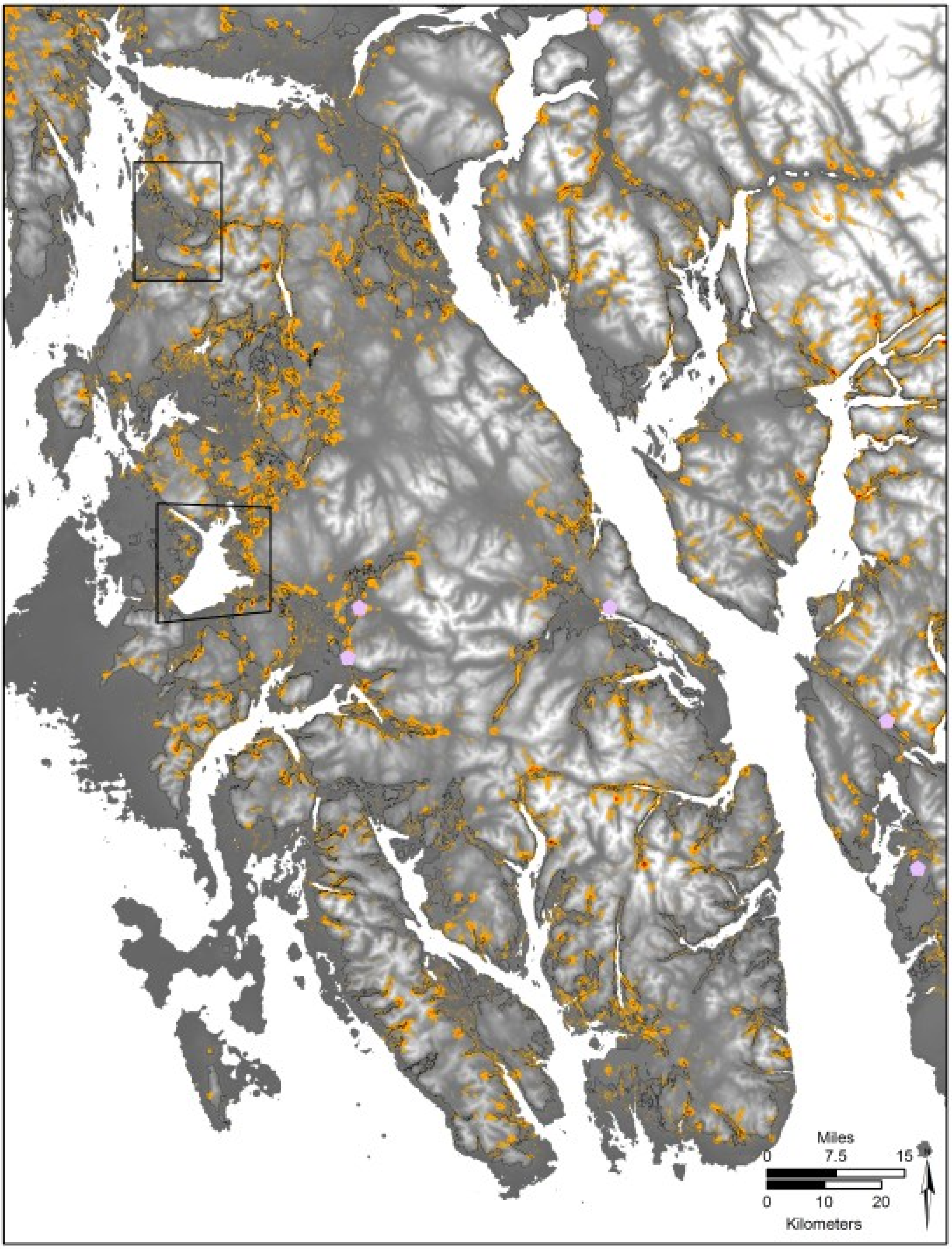
Weight 6 **13,500 cal BP**



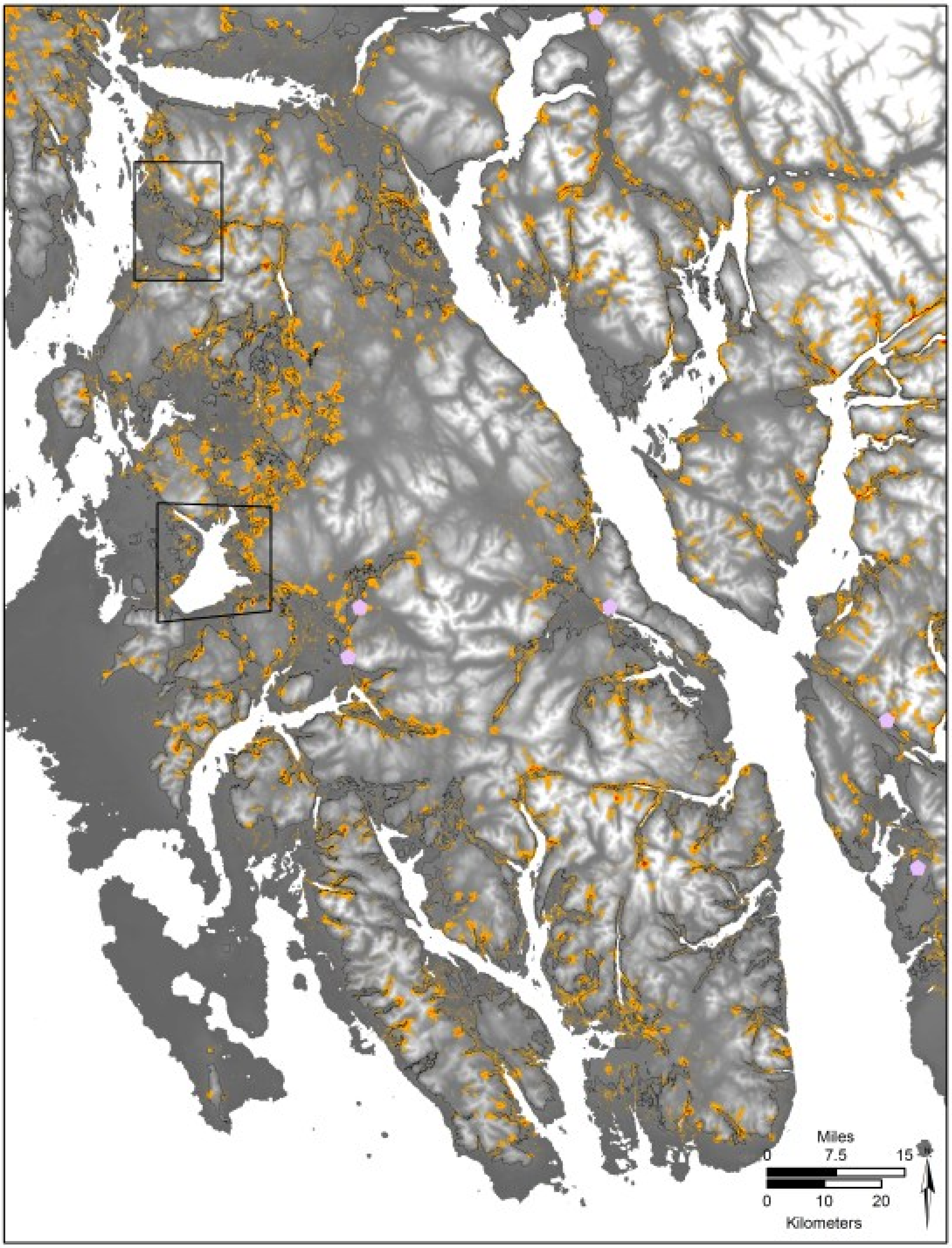
Weight 6 **14,000 cal BP**



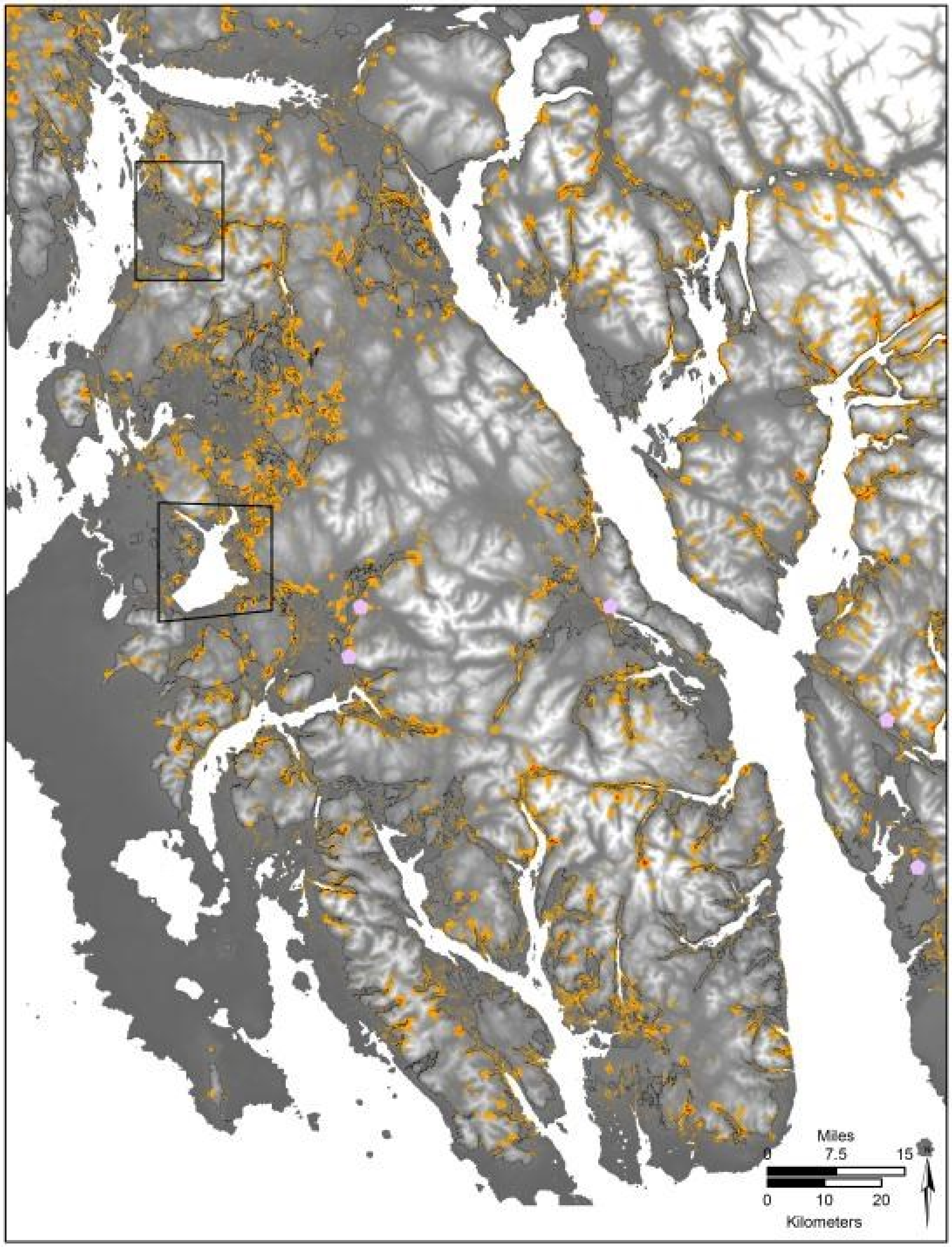
Weight 6 **14,500 cal BP**



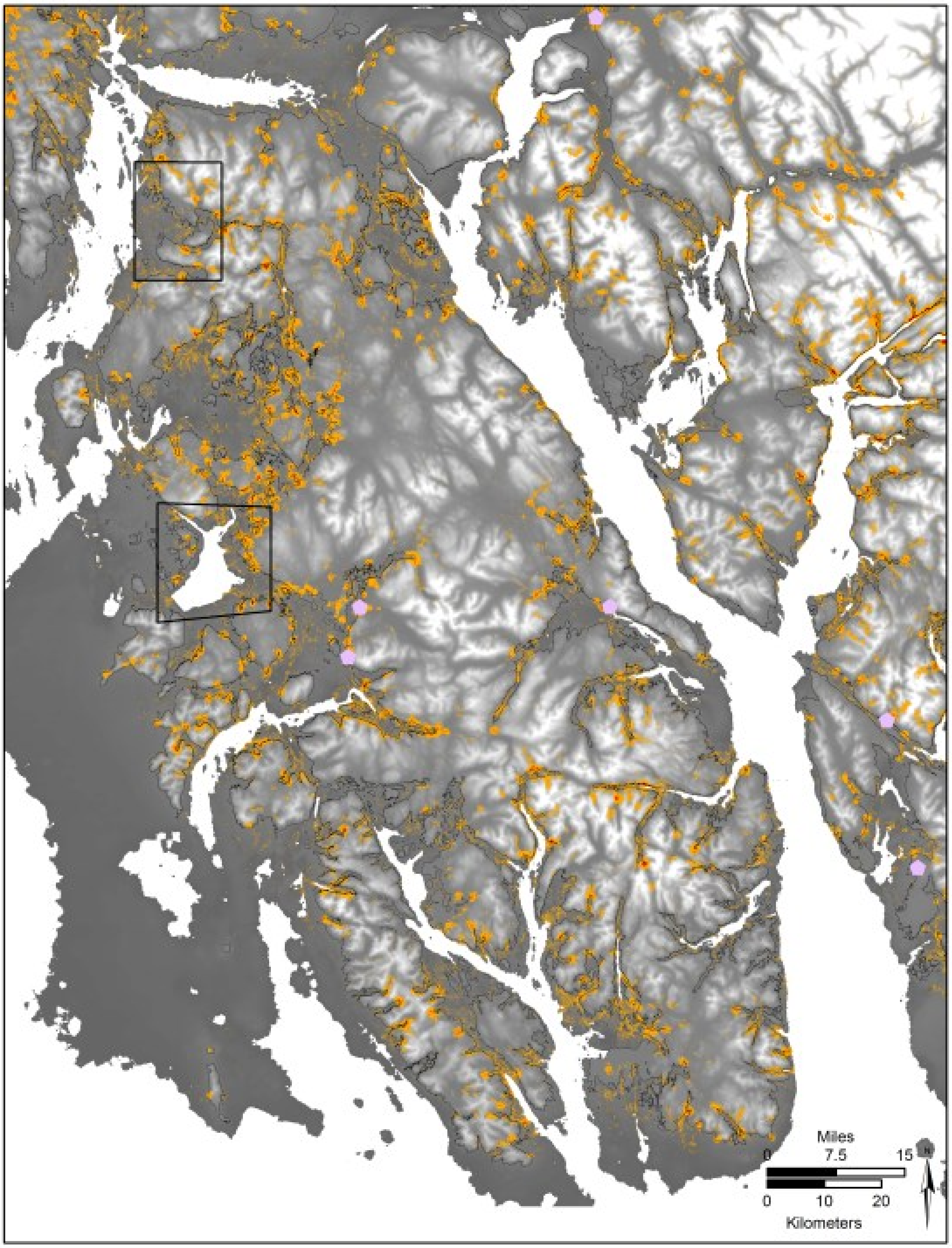
Weight 6 **15,000 cal BP**



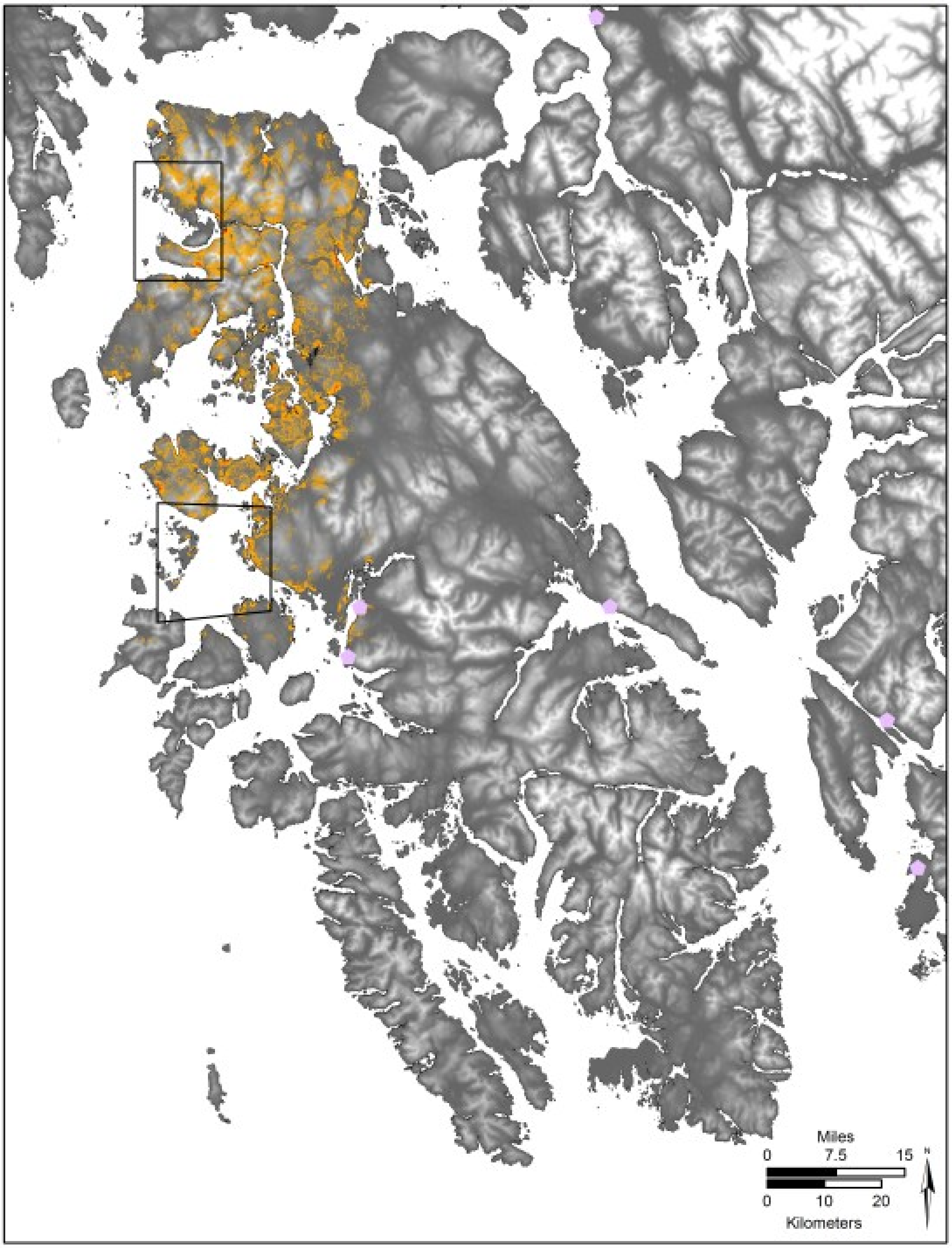
Weight 6 **15,500 cal BP**



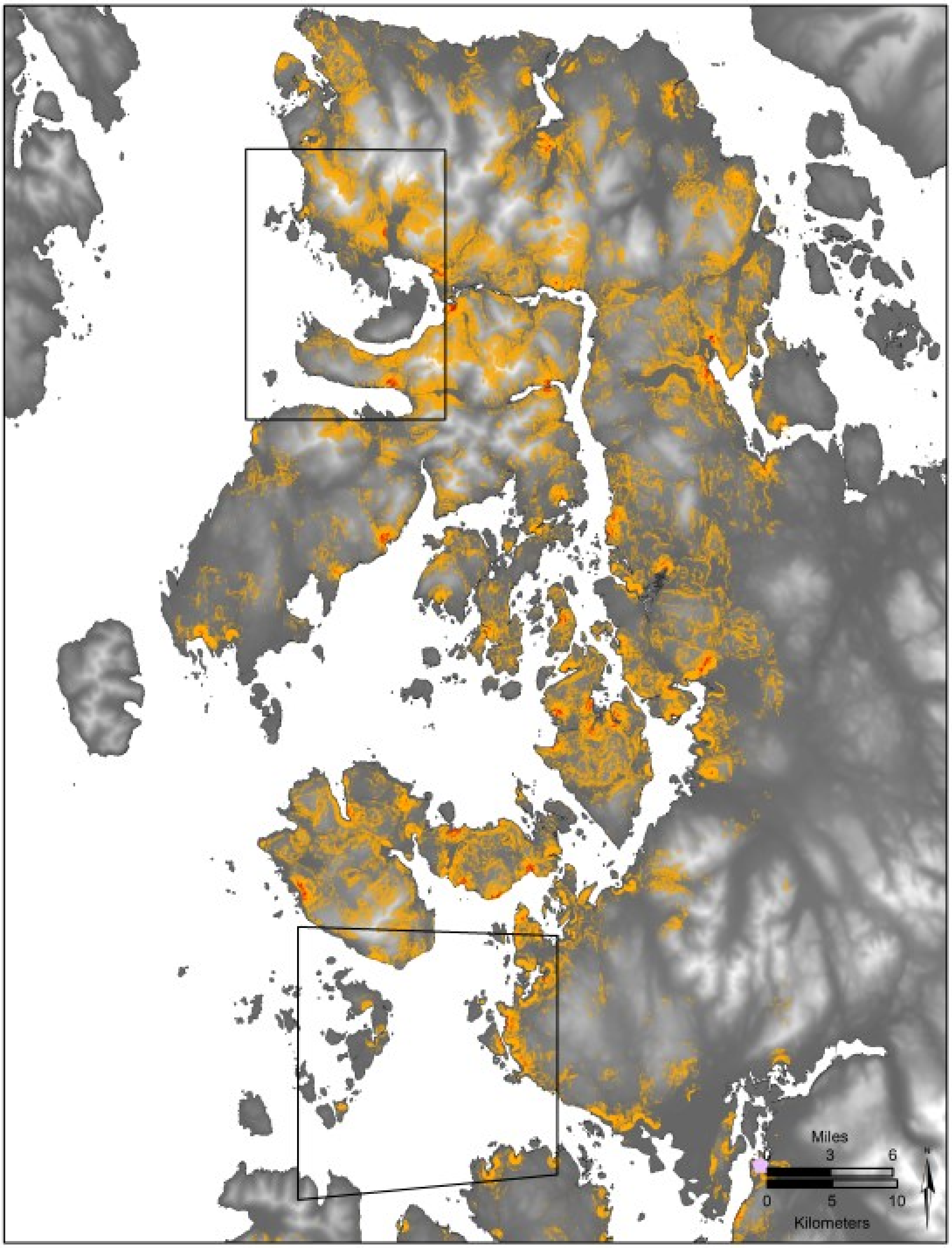
Weight 6 **16,000 cal BP**



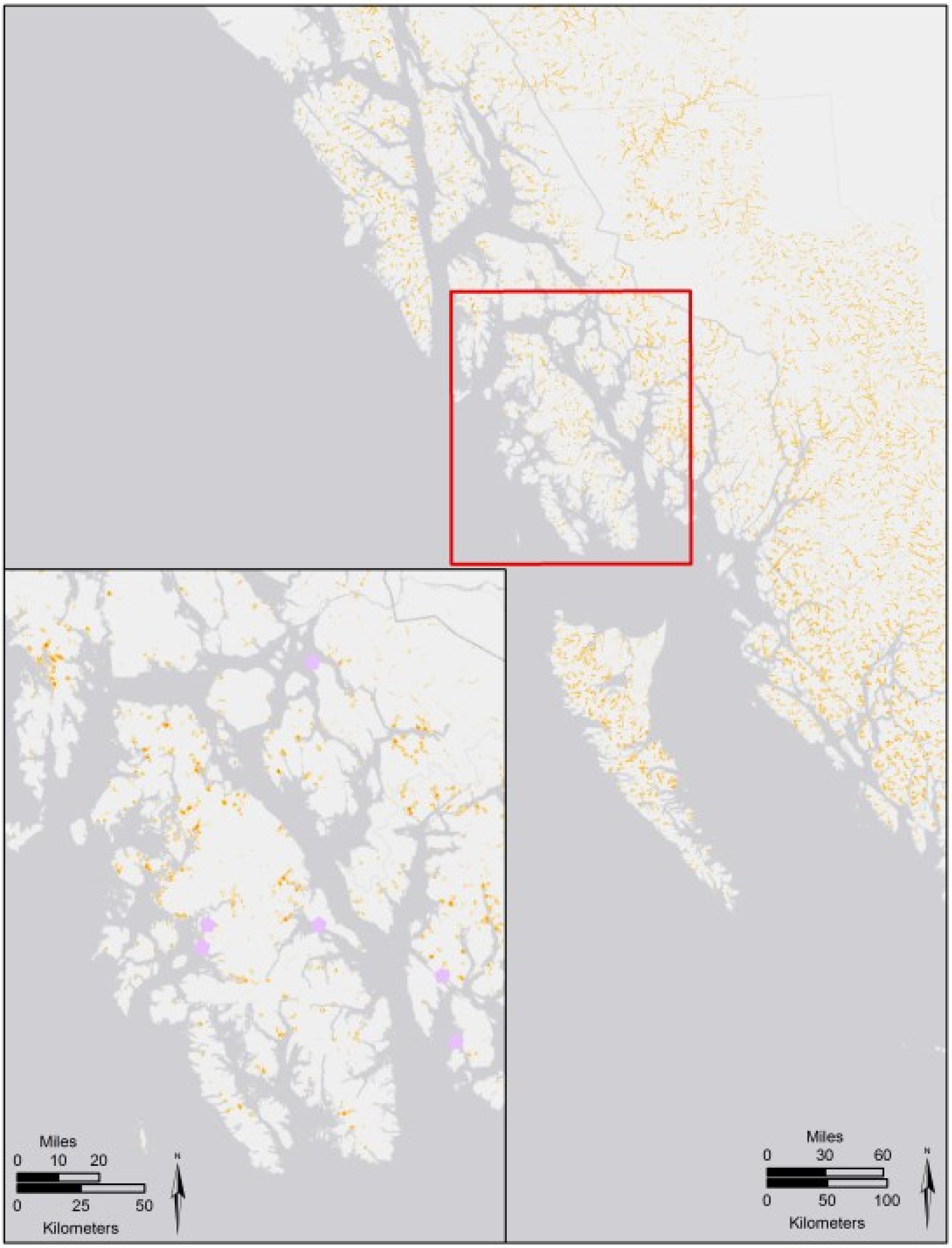
Weight 6 **Modern - Small Area**



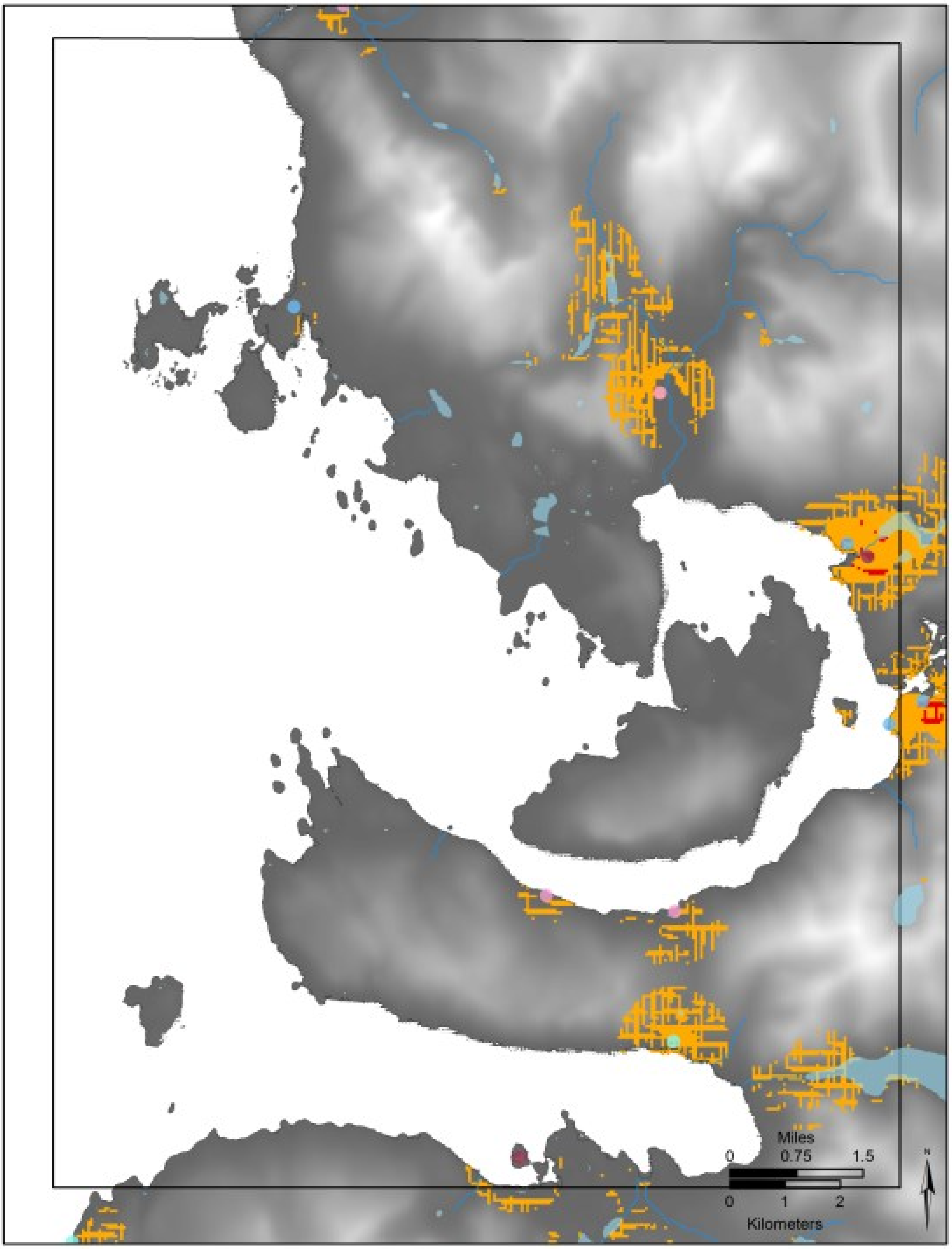
Weight 6 **Modern - Small Area**



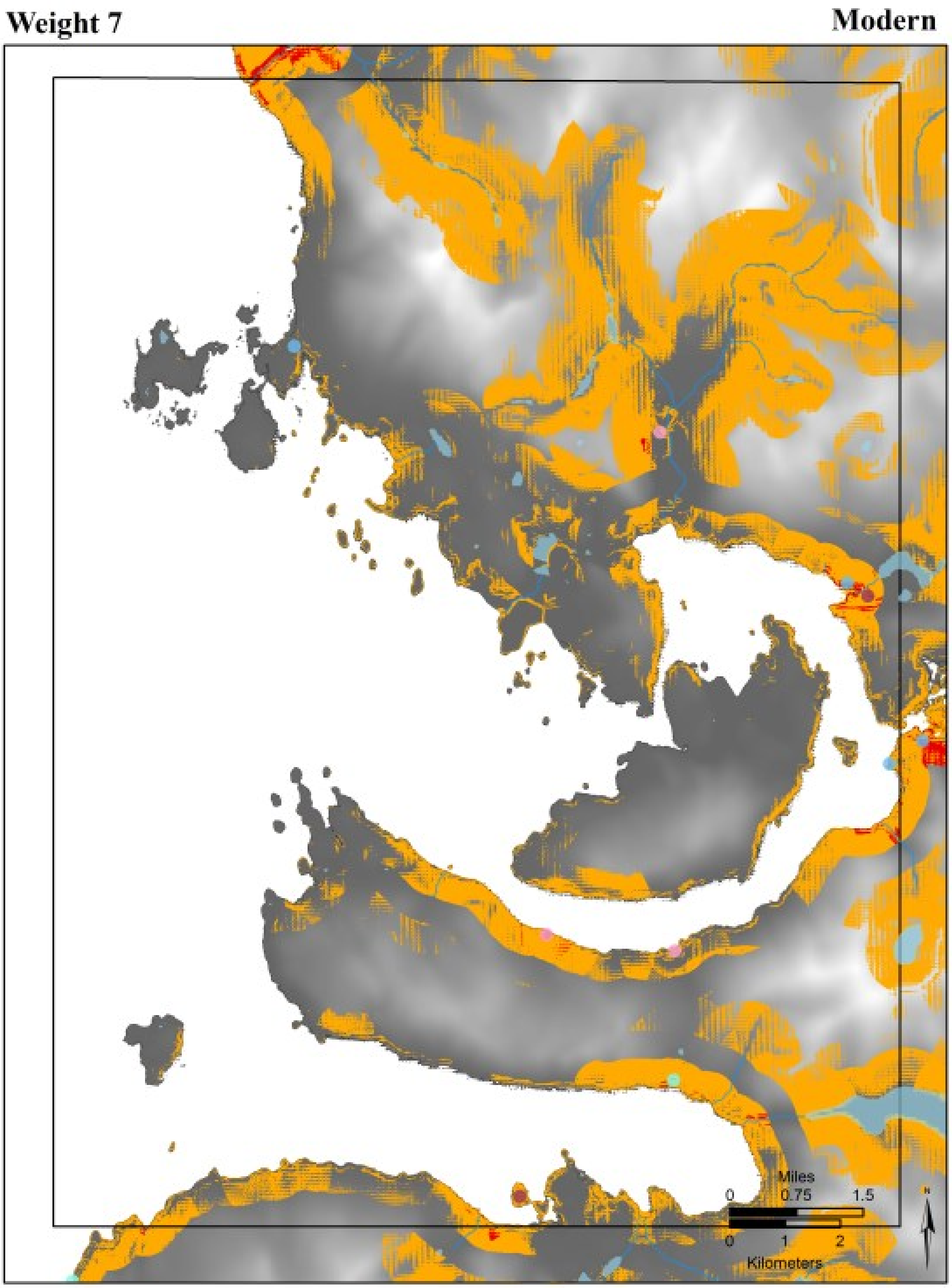
Weight 6 **NWC - modern**



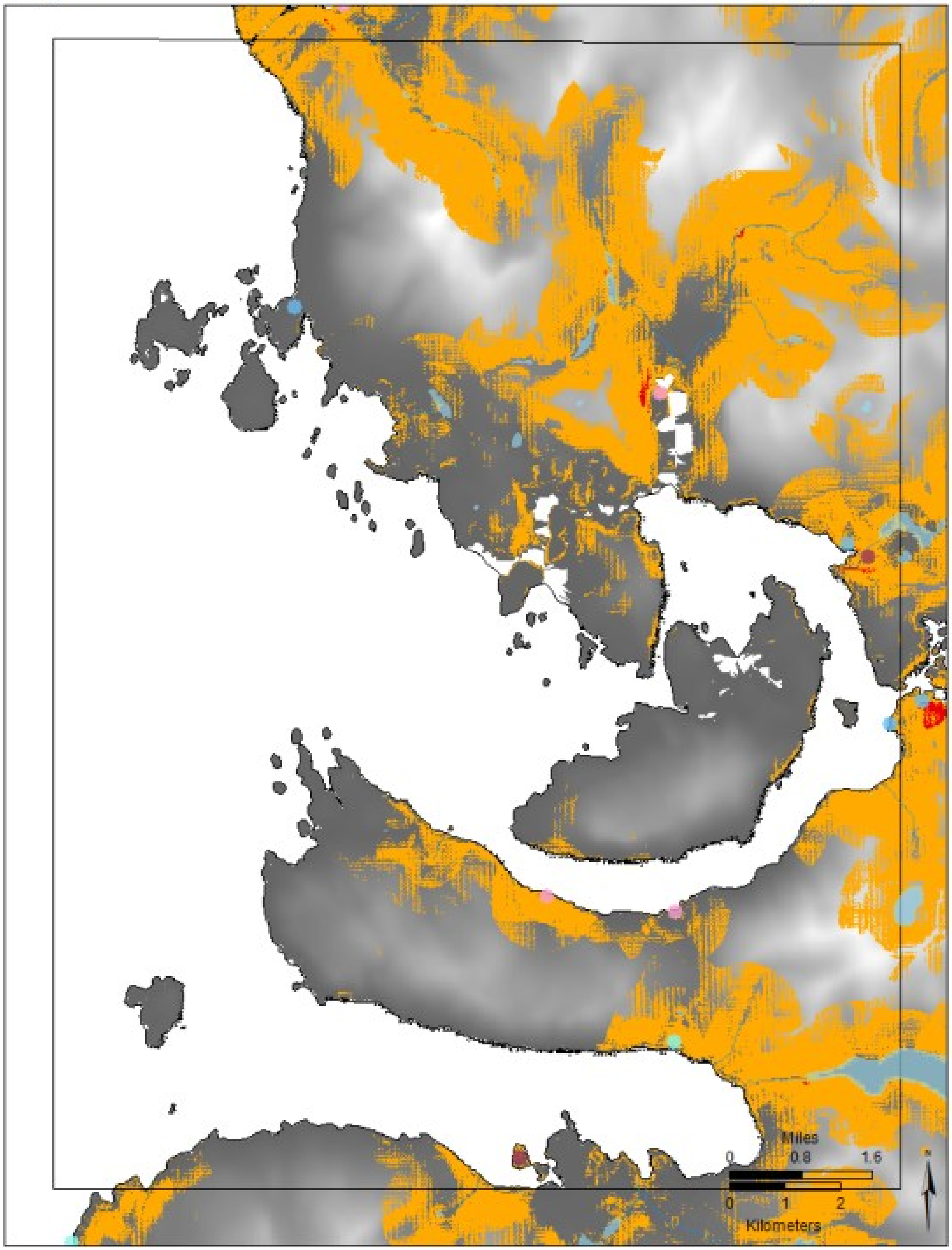
Weight 6 **NWC - modern**



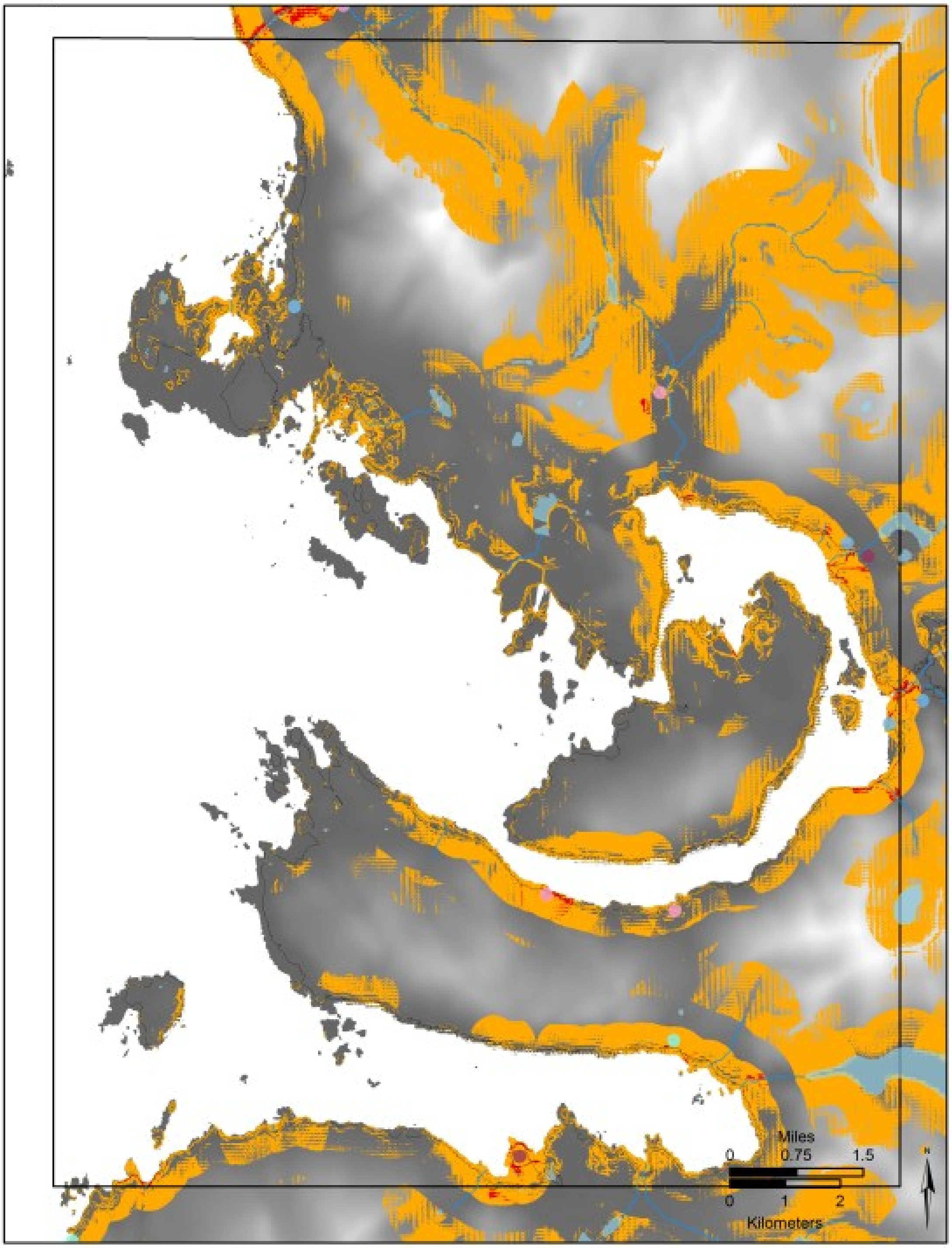
C.13 Weighted Overlay 7



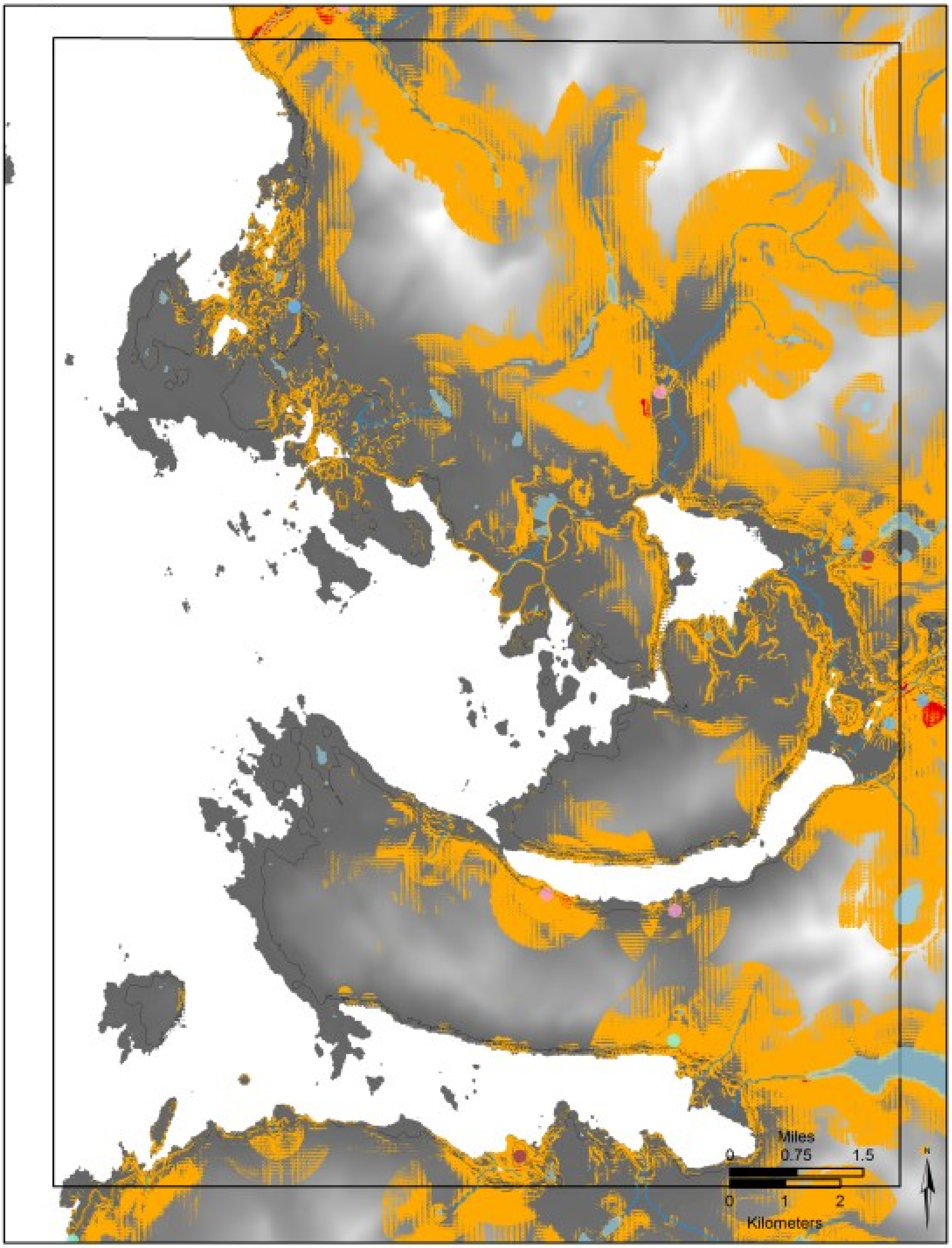
Weight 7 **10,500 cal BP**



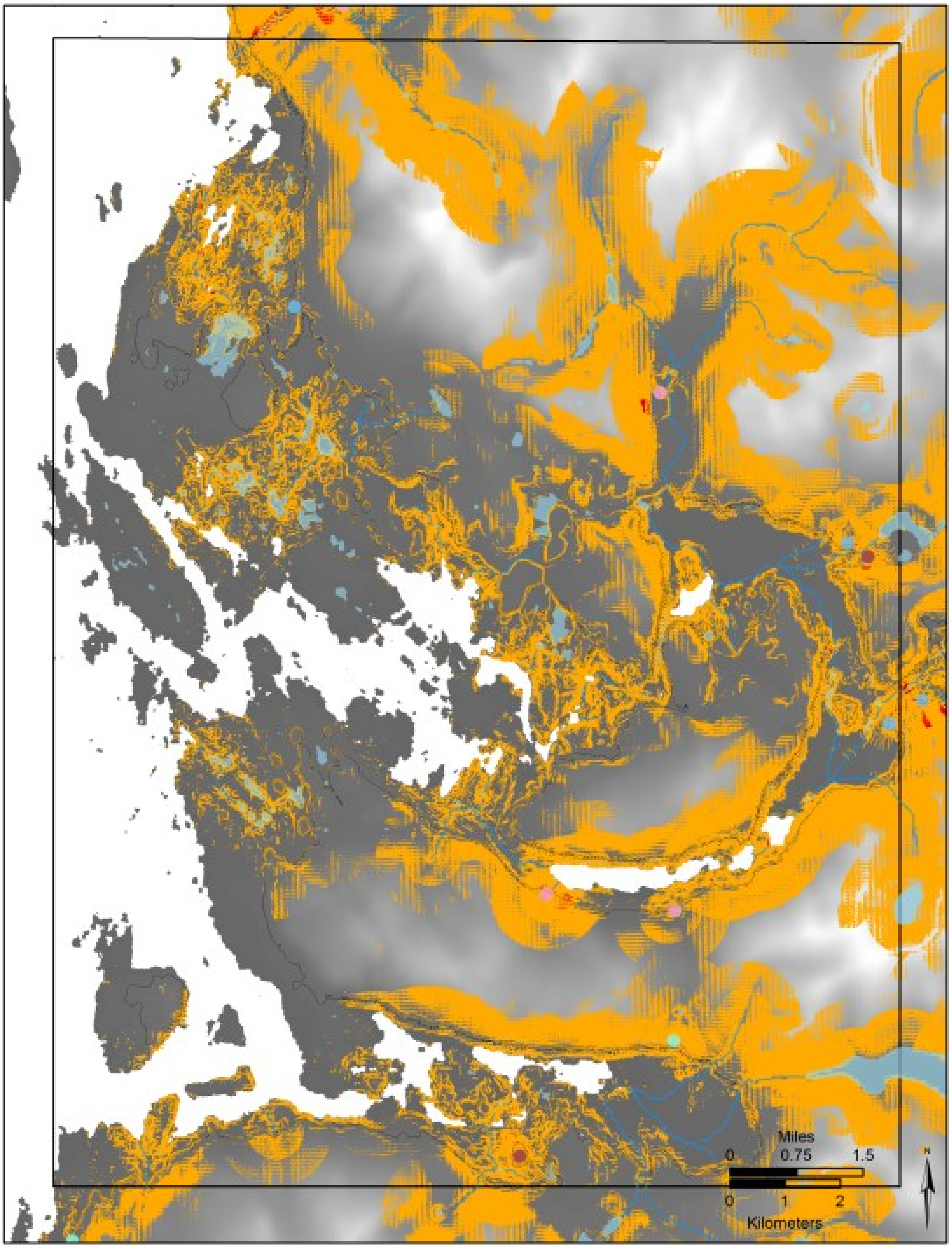
Weight 7 **11,000 cal BP**



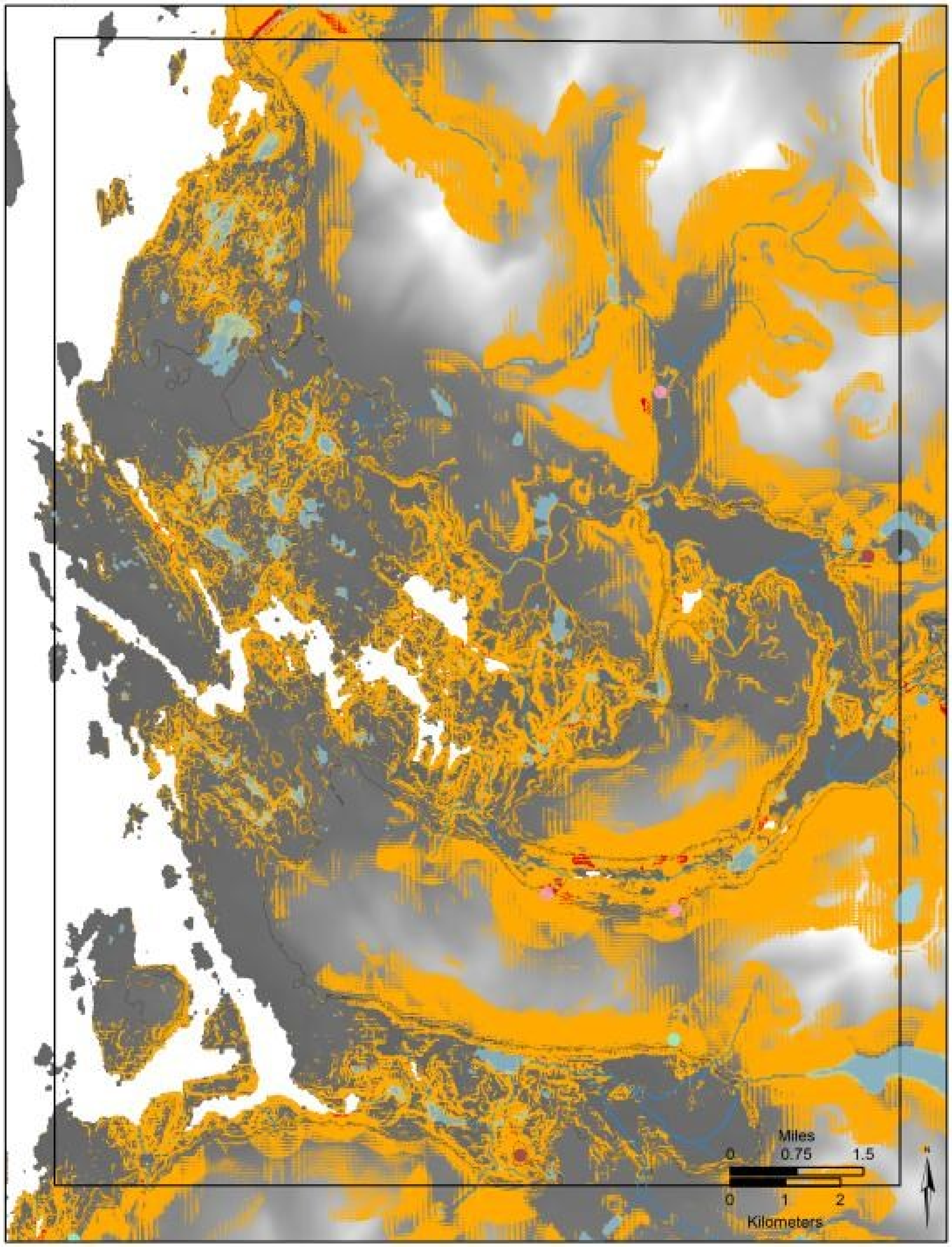
Weight 7 **11,500 cal BP**

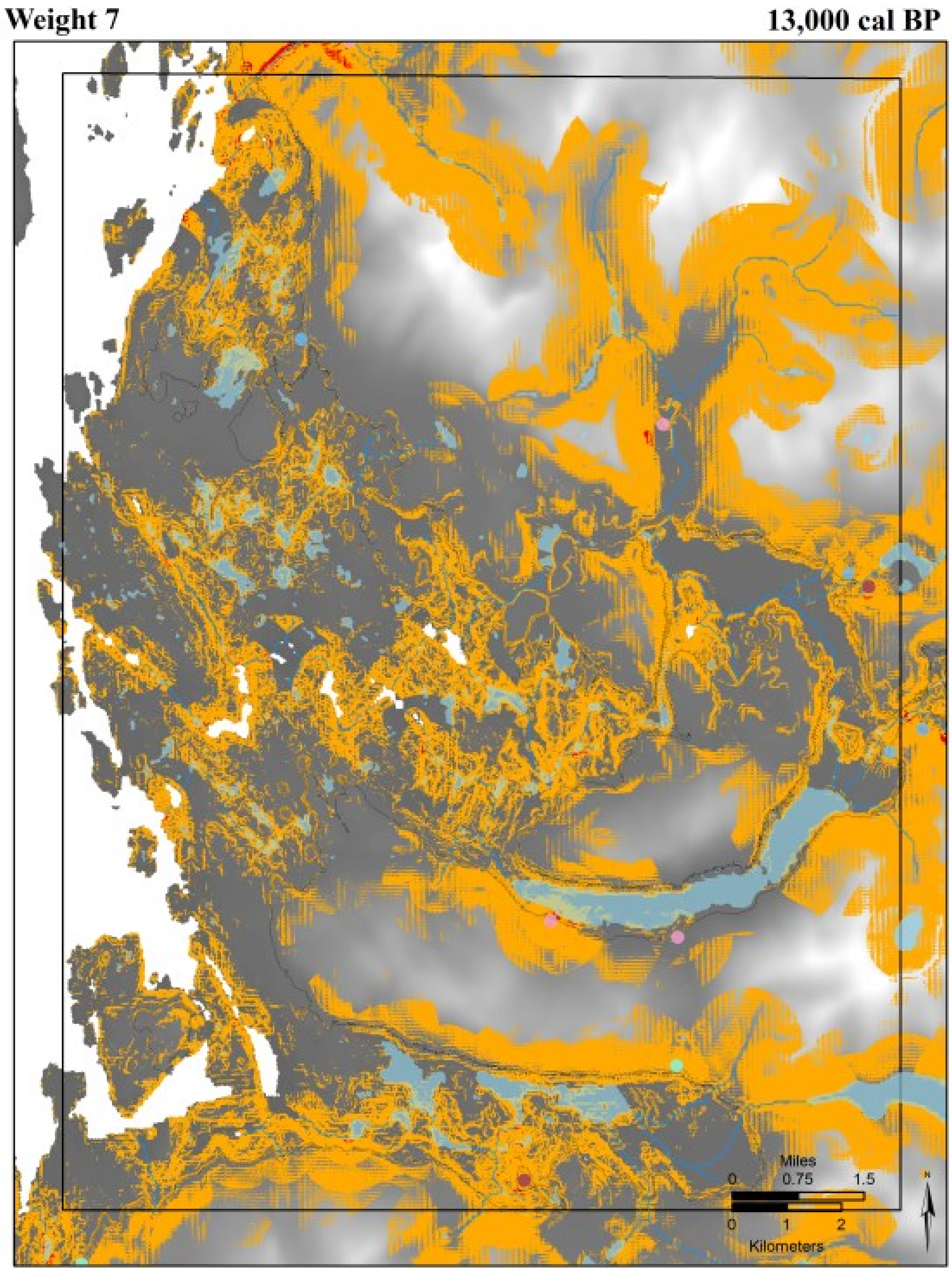


Weight 7 **12,000 cal BP**

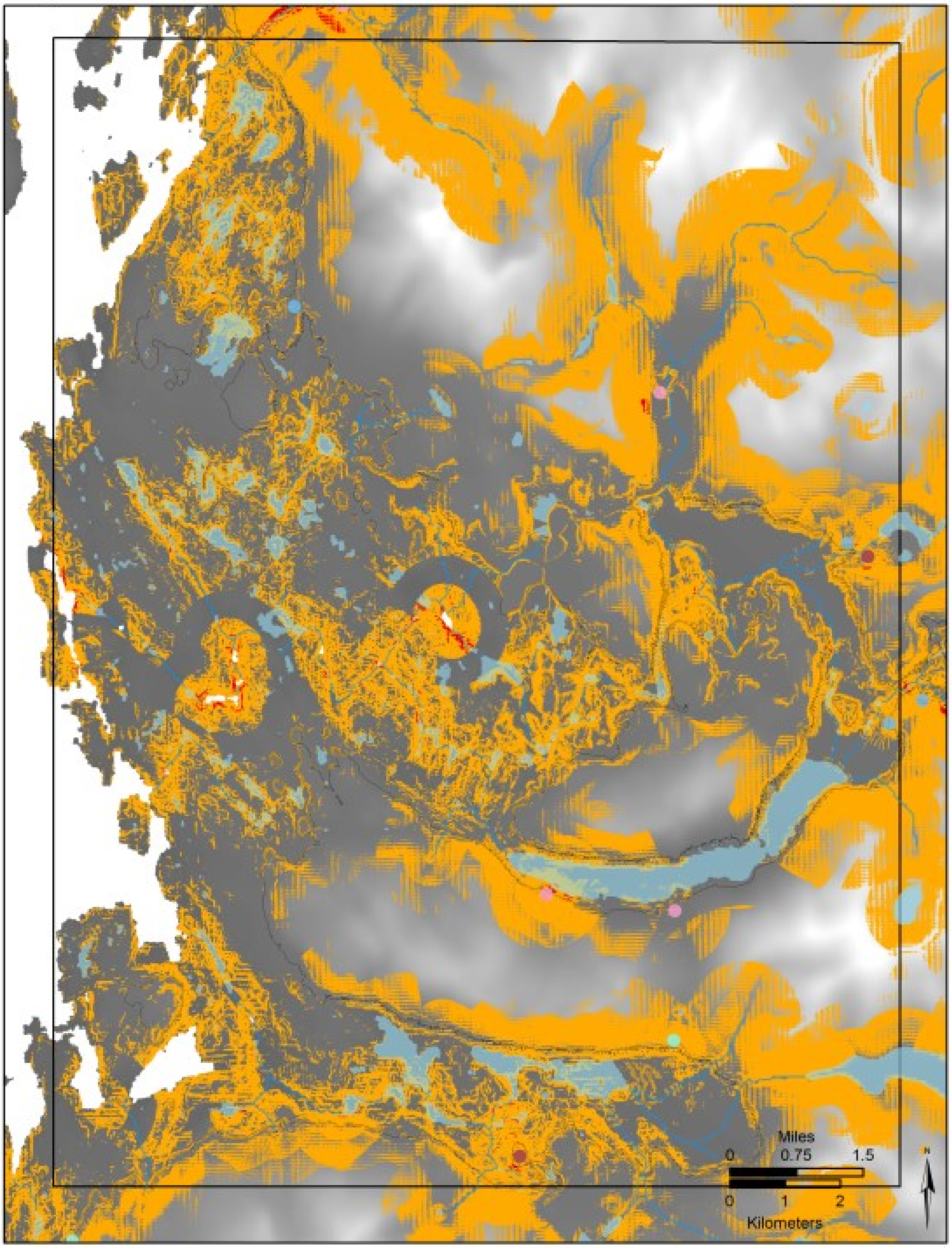


Weight 7 **12,500 cal BP**

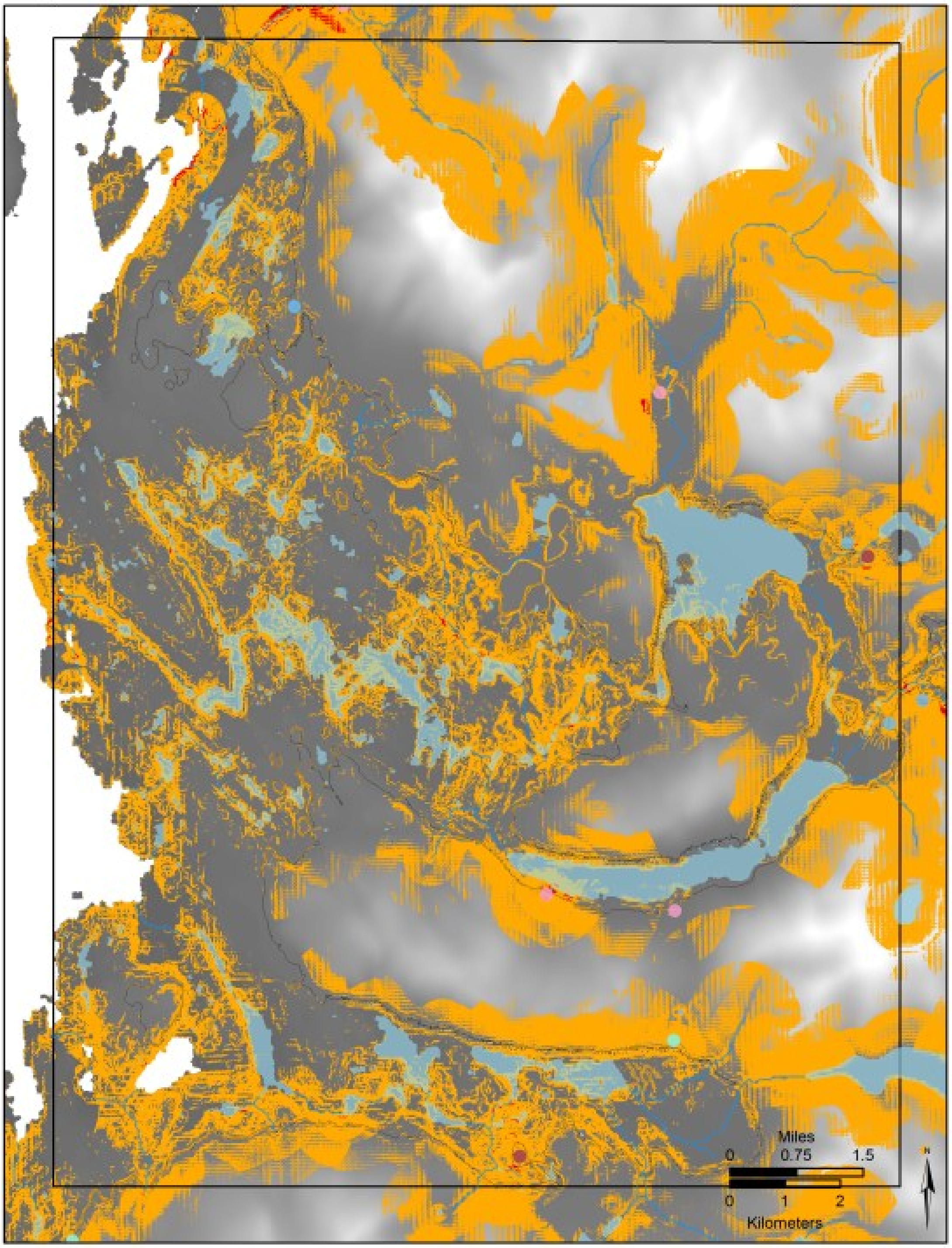



Weight 7
13,000 cal BP
Miles
0
0.75
1.5
0
1
2
Kilometers

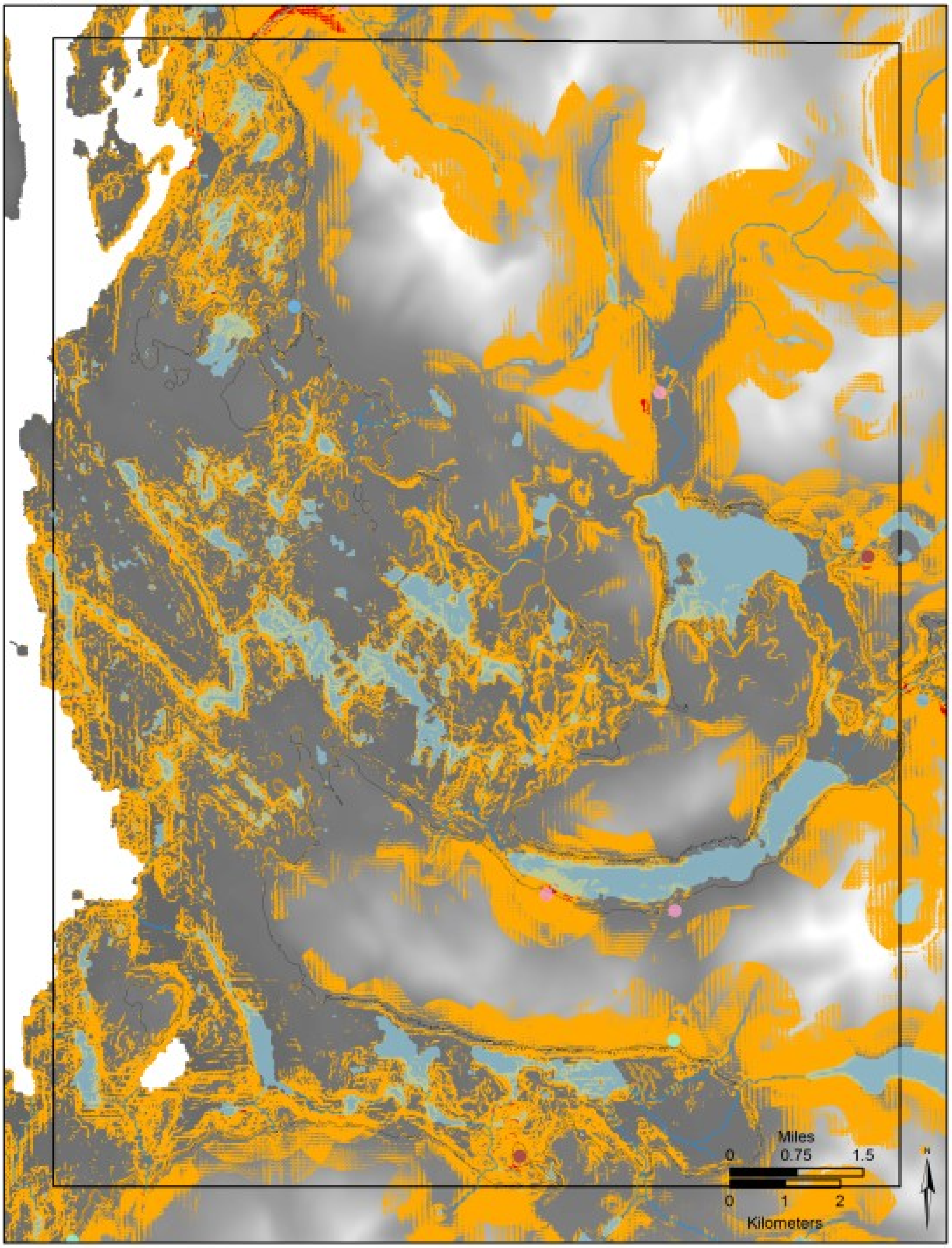
Weight 7 **13,500 cal BP**



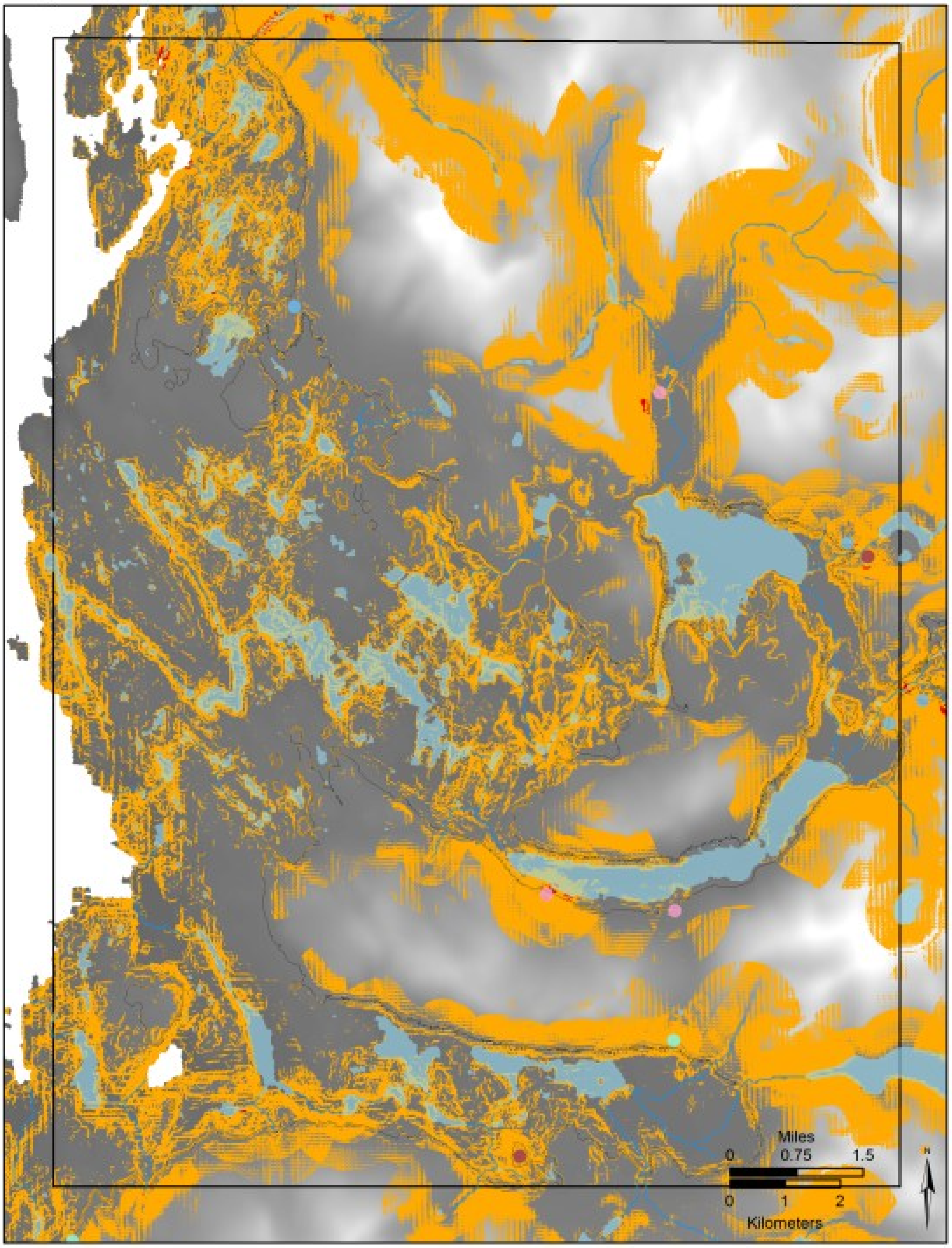
Weight 7 **14,000 cal BP**



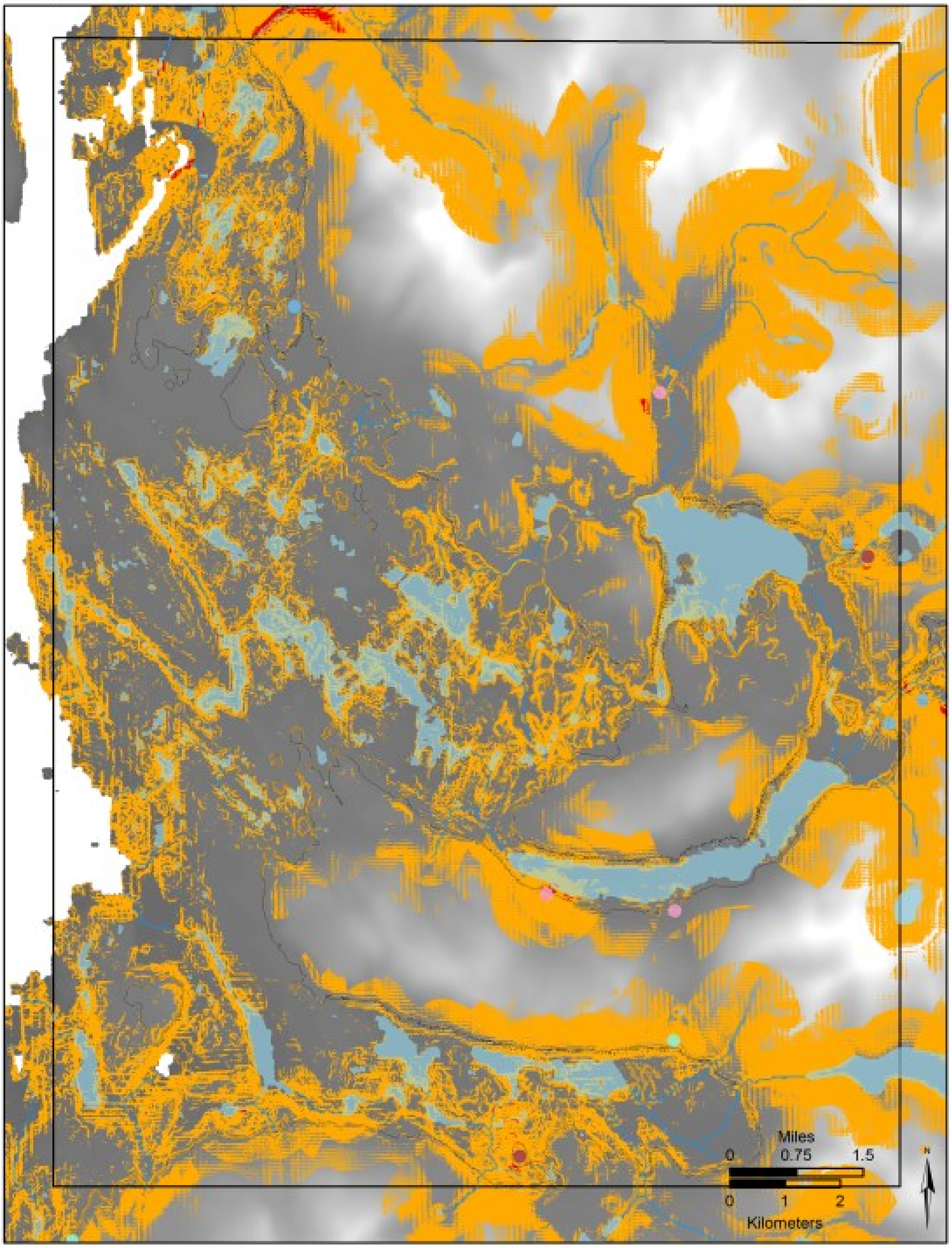
Weight 7 **14,500 cal BP**



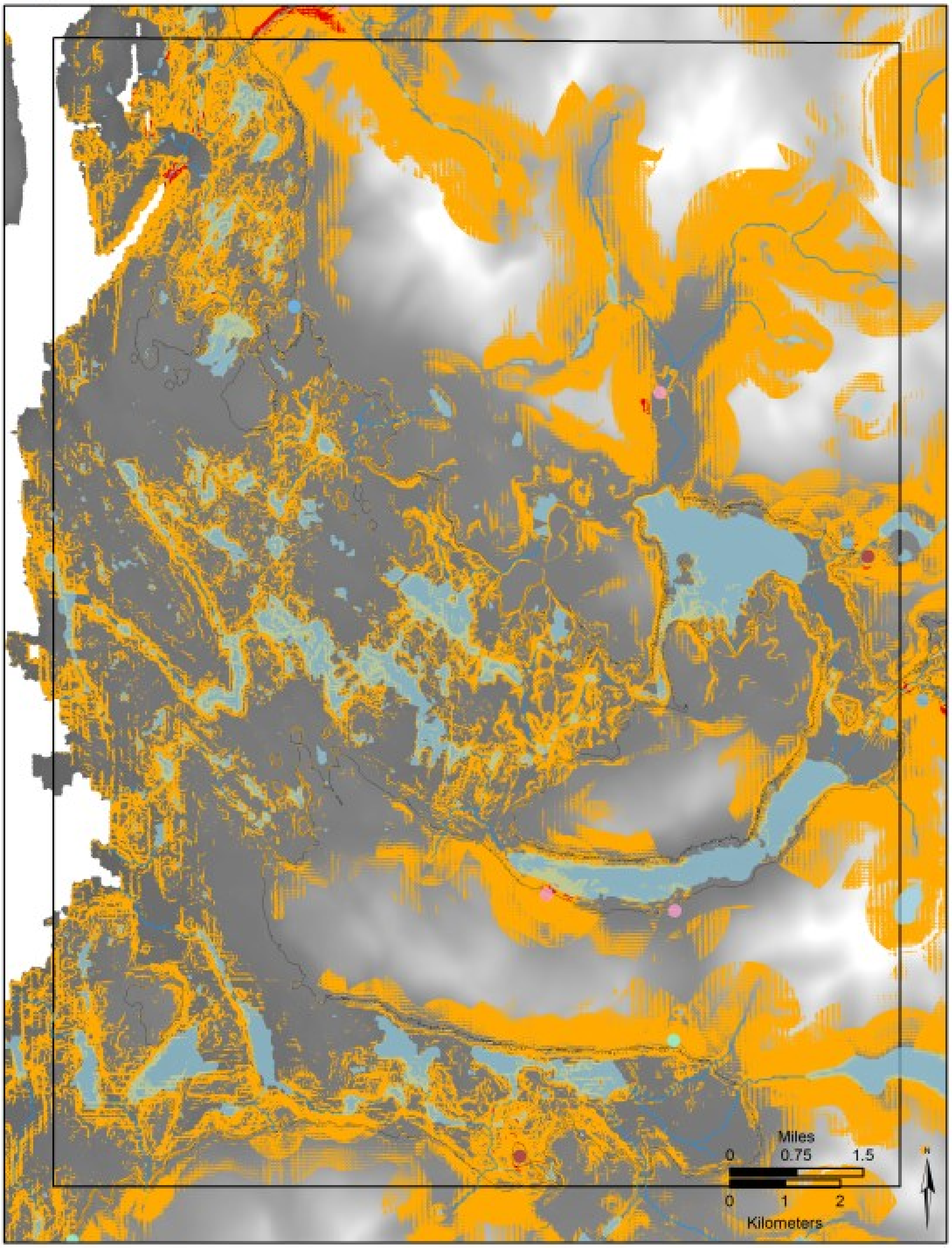
Weight 7 **15,000 cal BP**



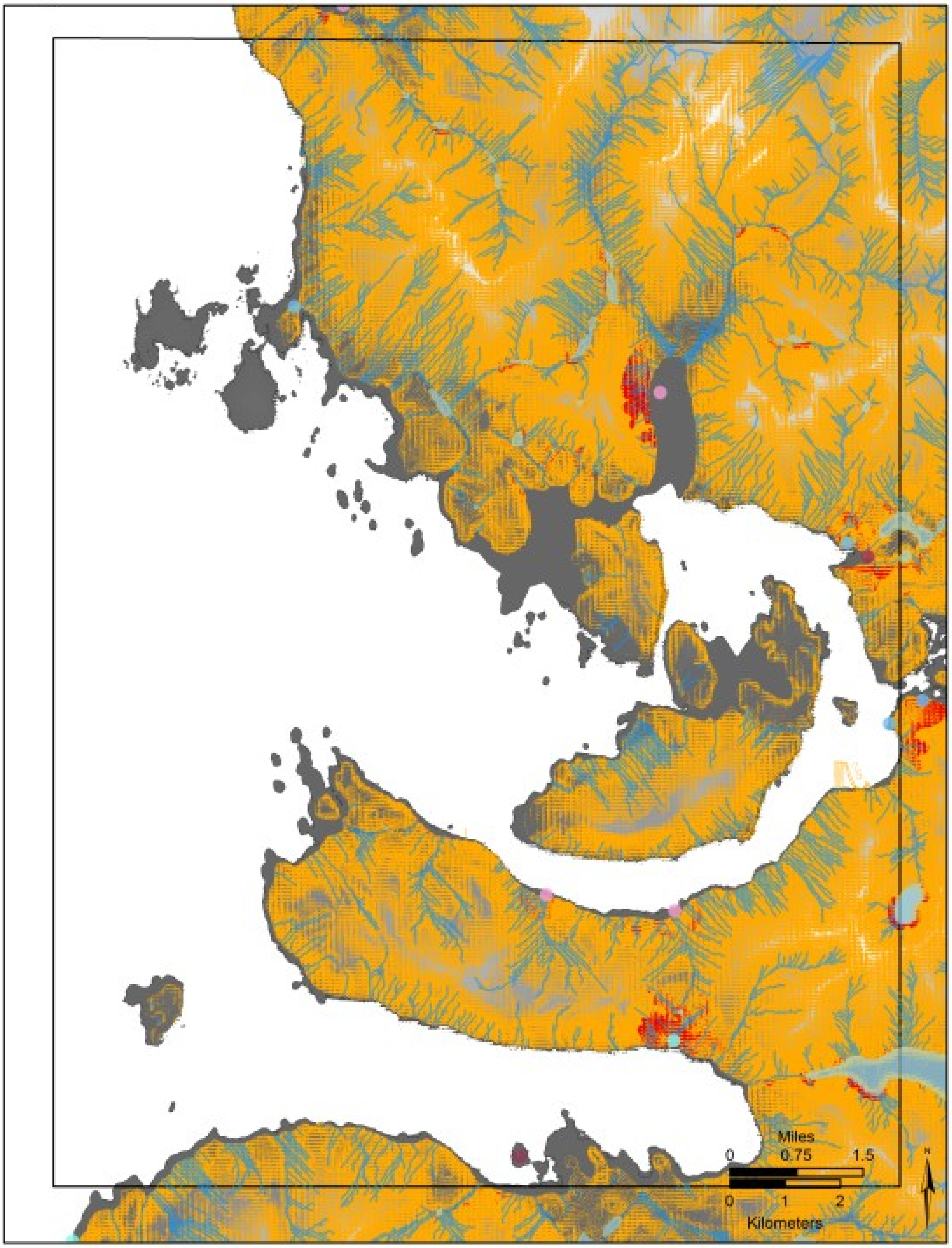
Weight 7 **15,500 cal BP**



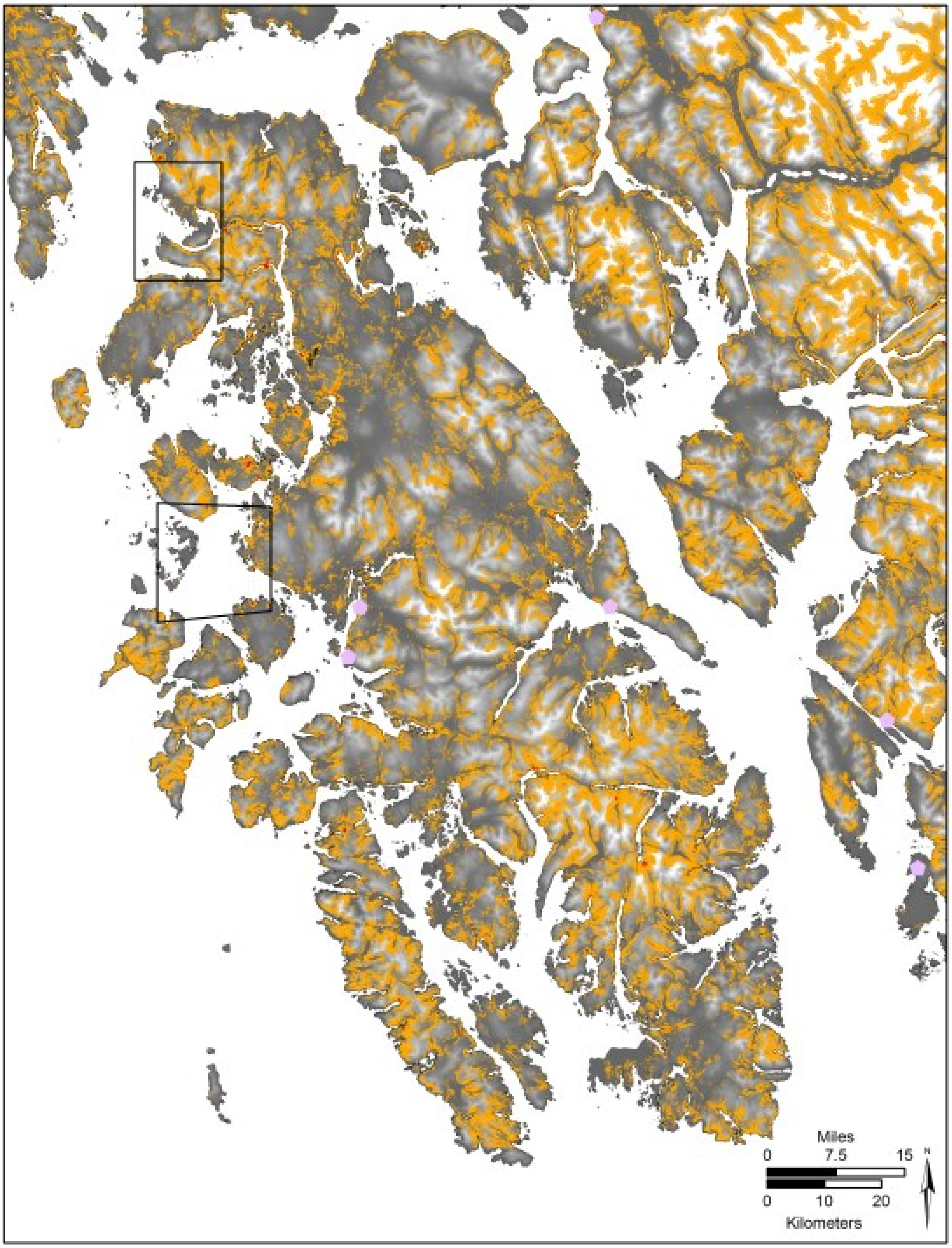
Weight 7 **16,000 cal BP**



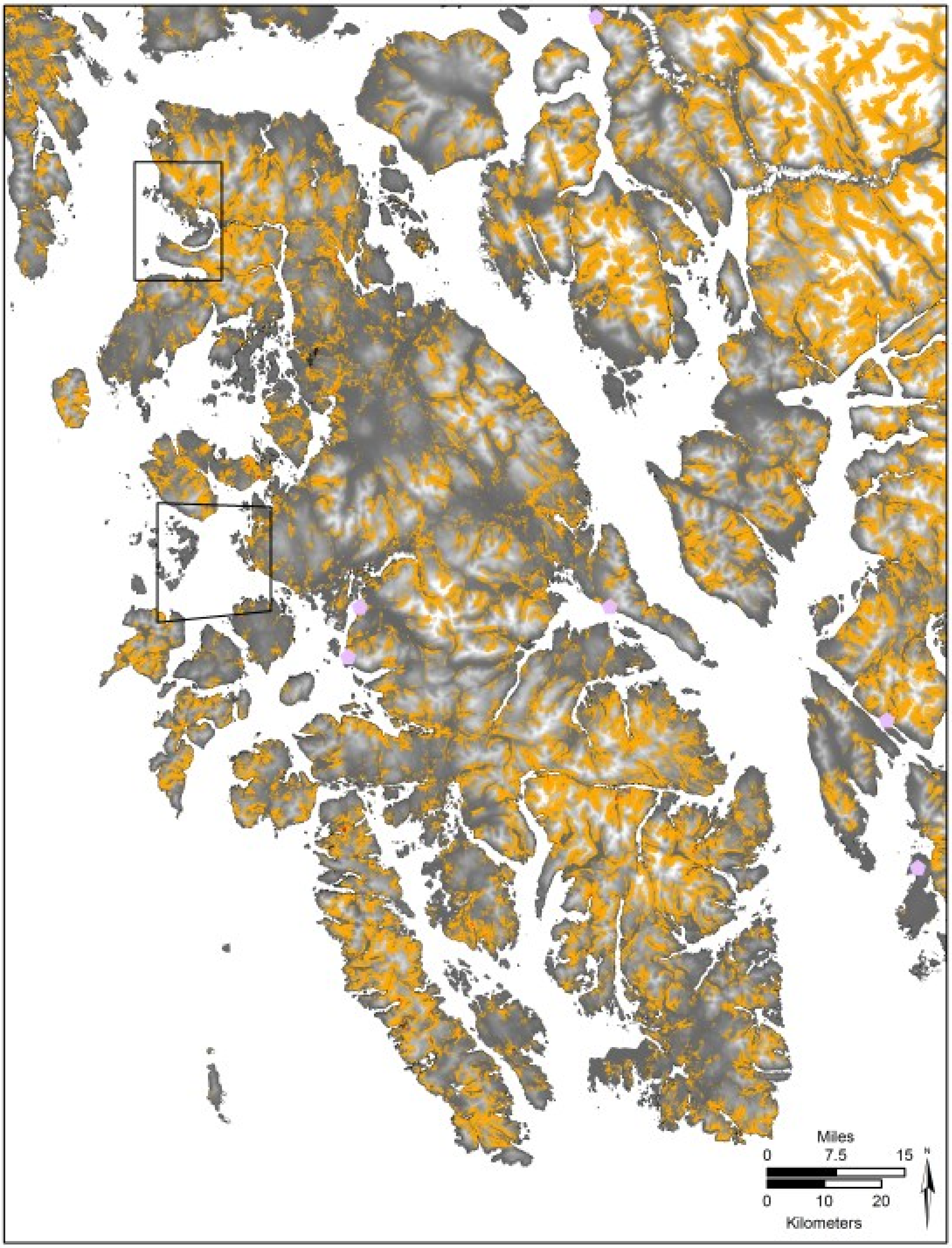
Weight 7 **Modern - Small Area**

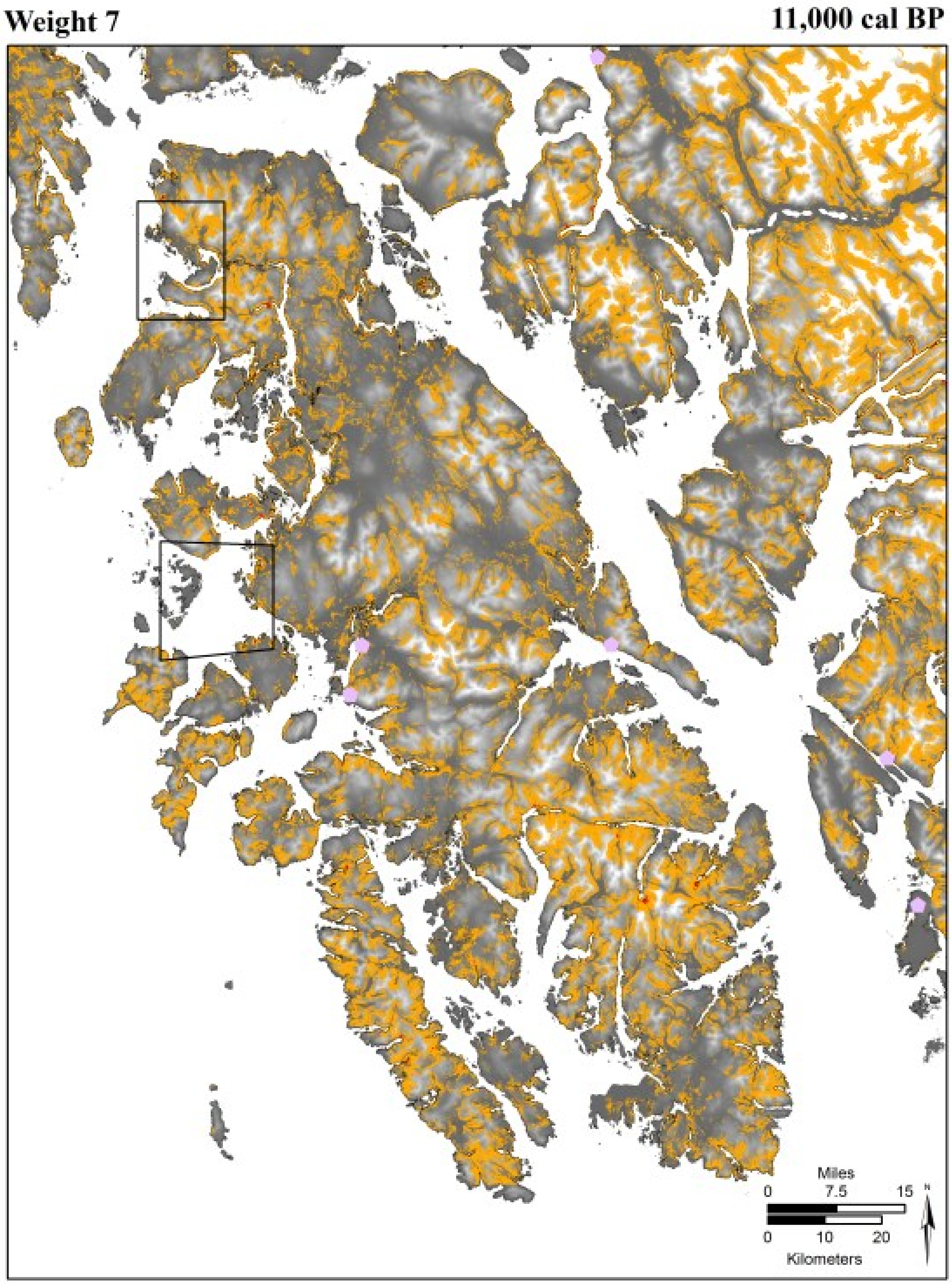


Weight 7 **Modern**

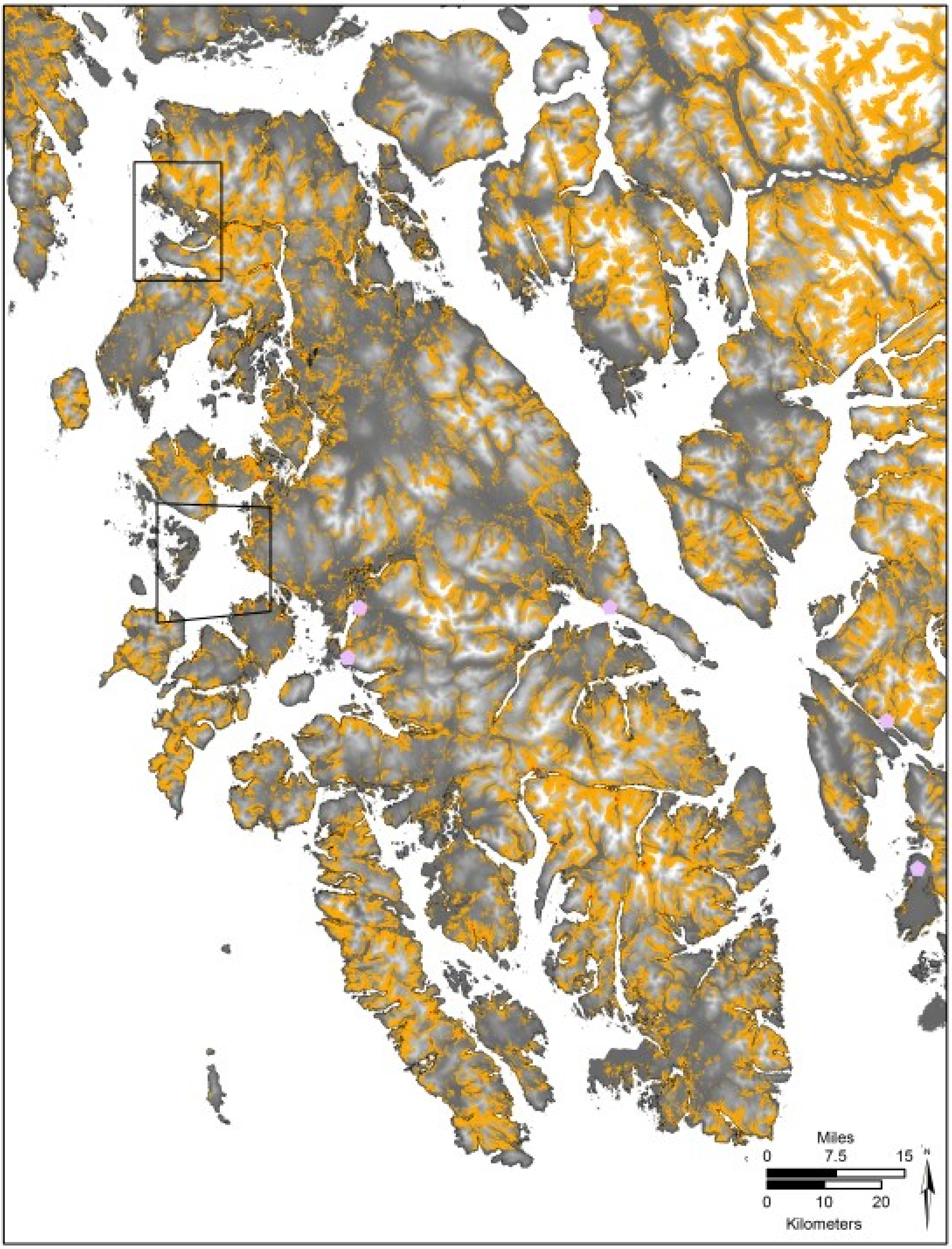


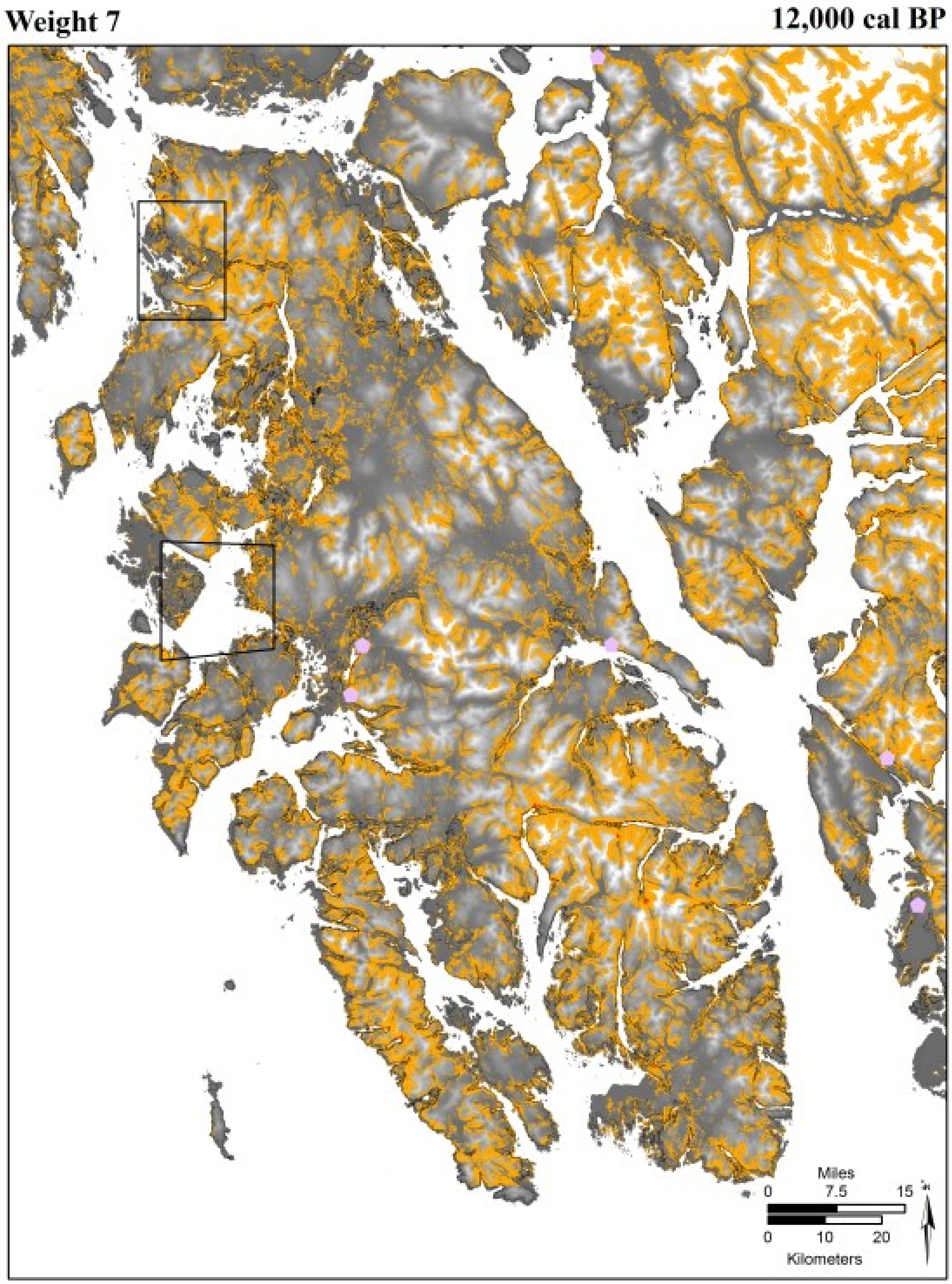
Weight 7 **10,500 cal BP**



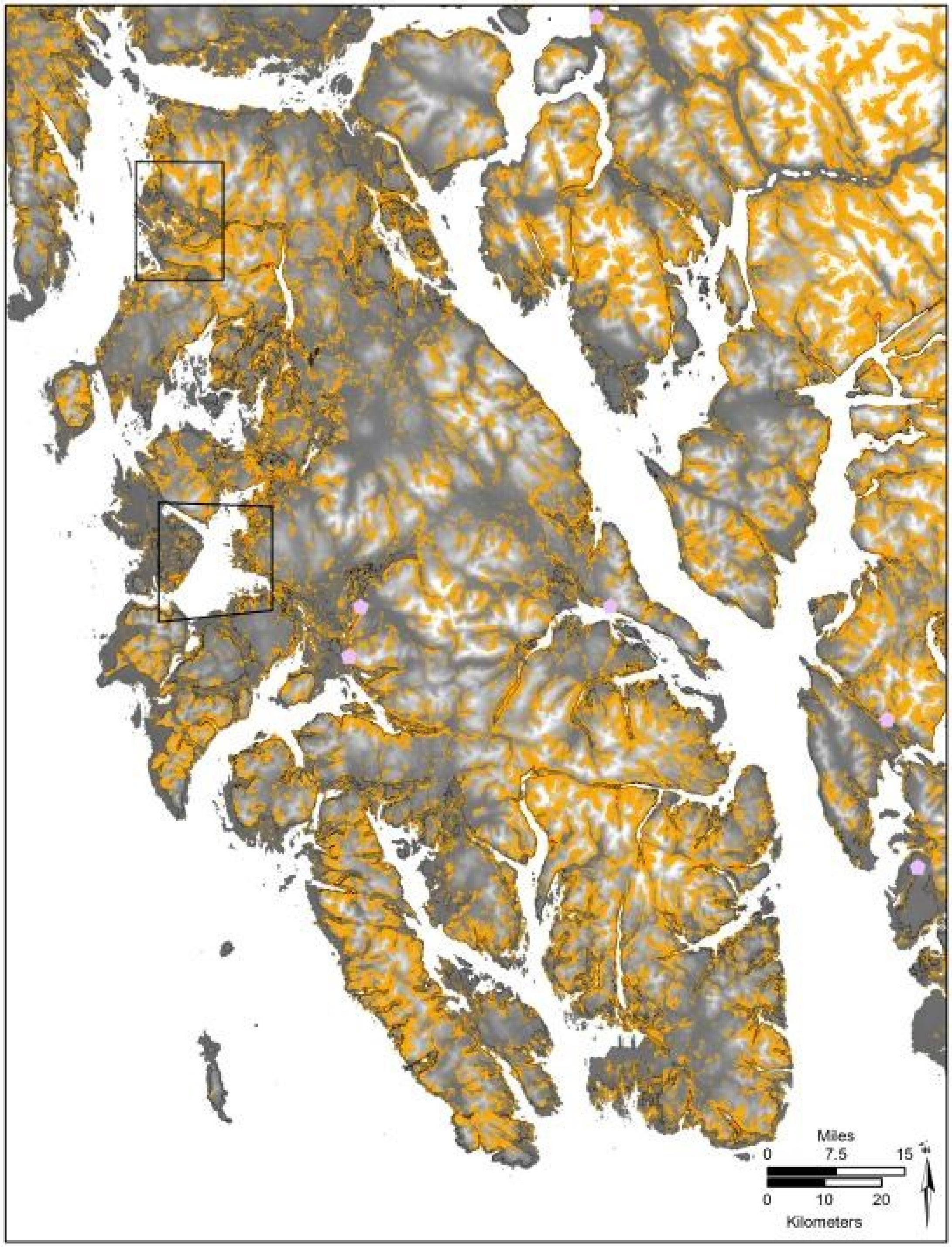

Weight 7
11,000 cal BP
Miles
0
7.5
15
0
10
20
Kilometers
N

Weight 7 **11,500 cal BP**

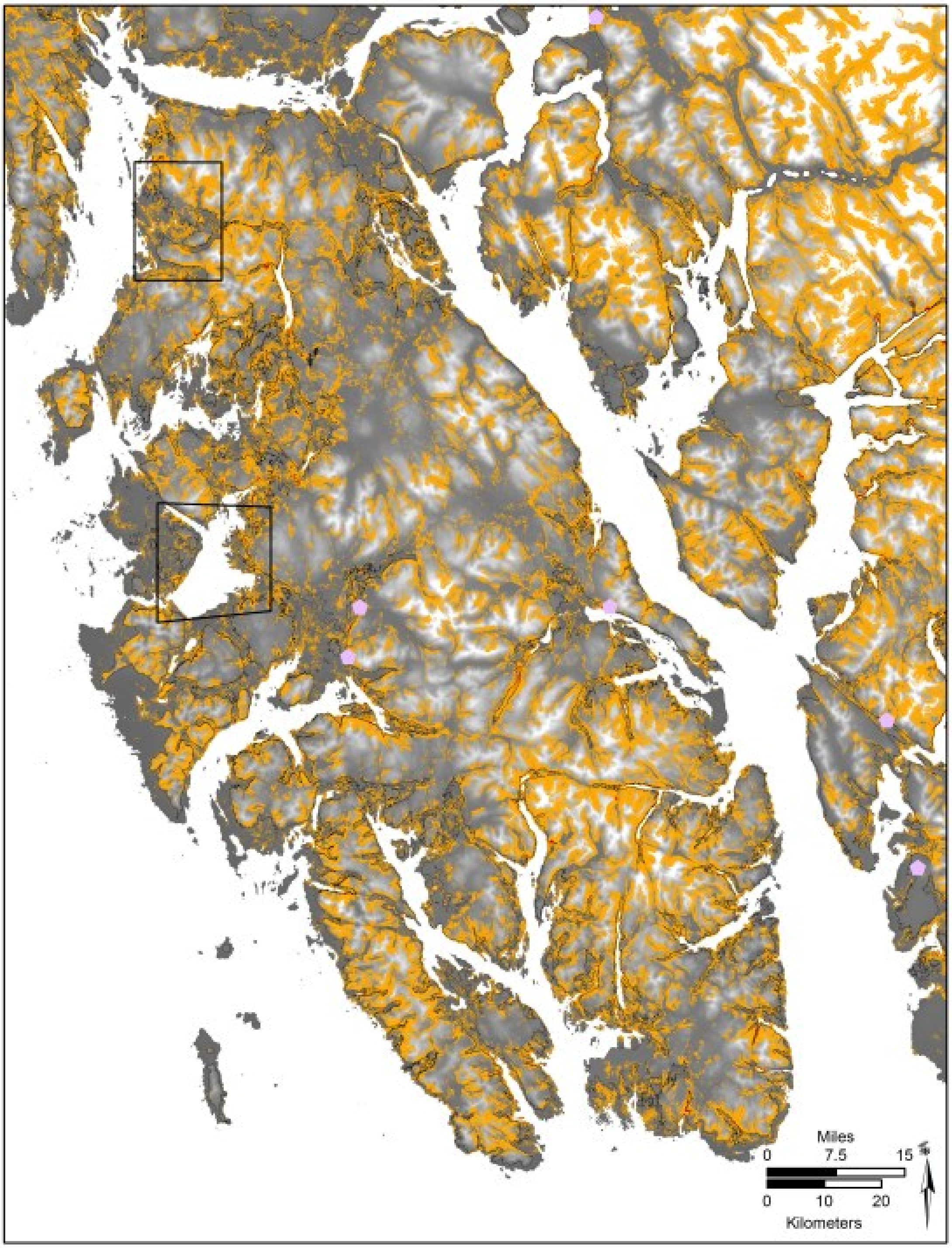



Weight 7
12,000 cal BP
Miles
0
7.5
15
0
10
20
Kilometers

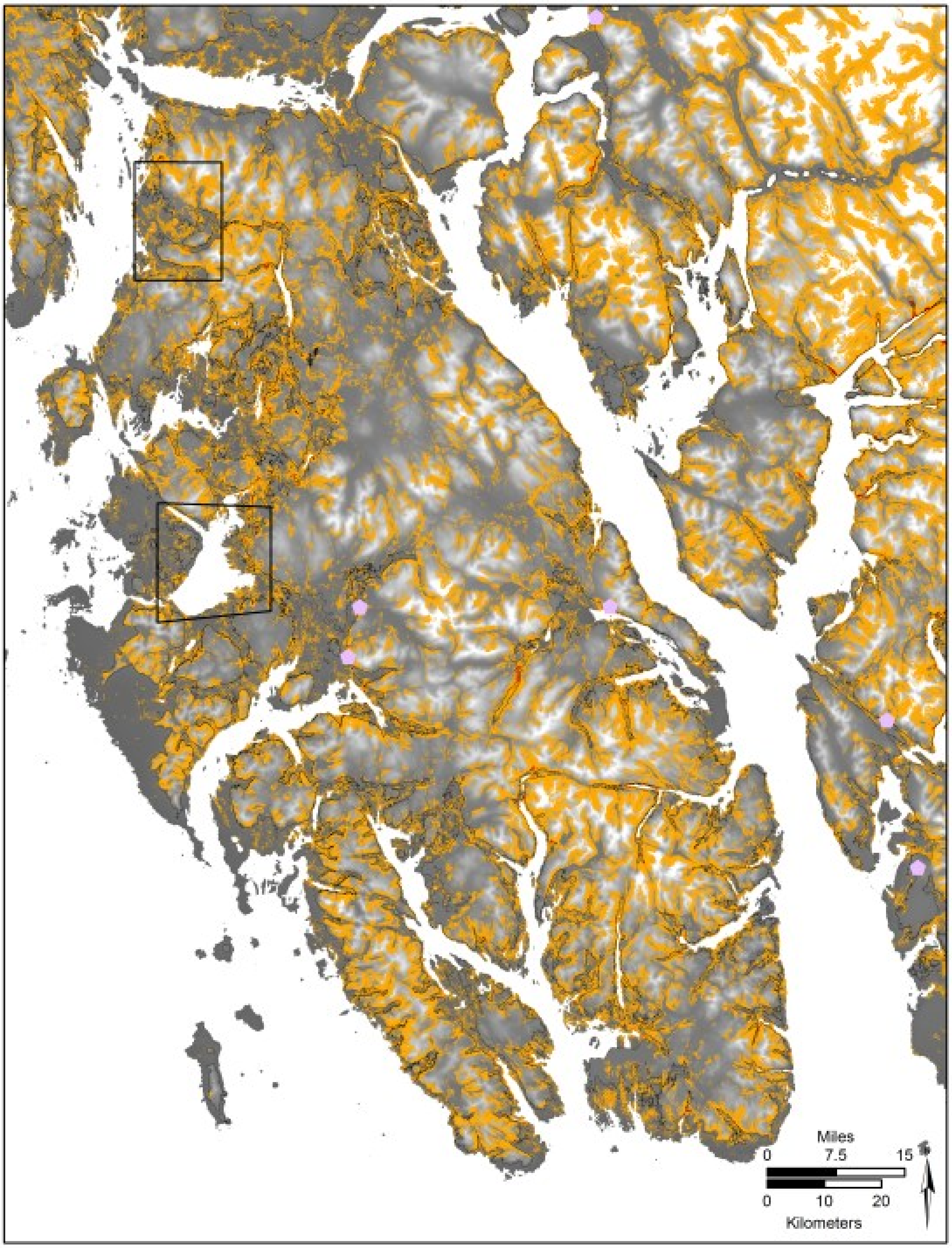
Weight 7 **12,500 cal BP**



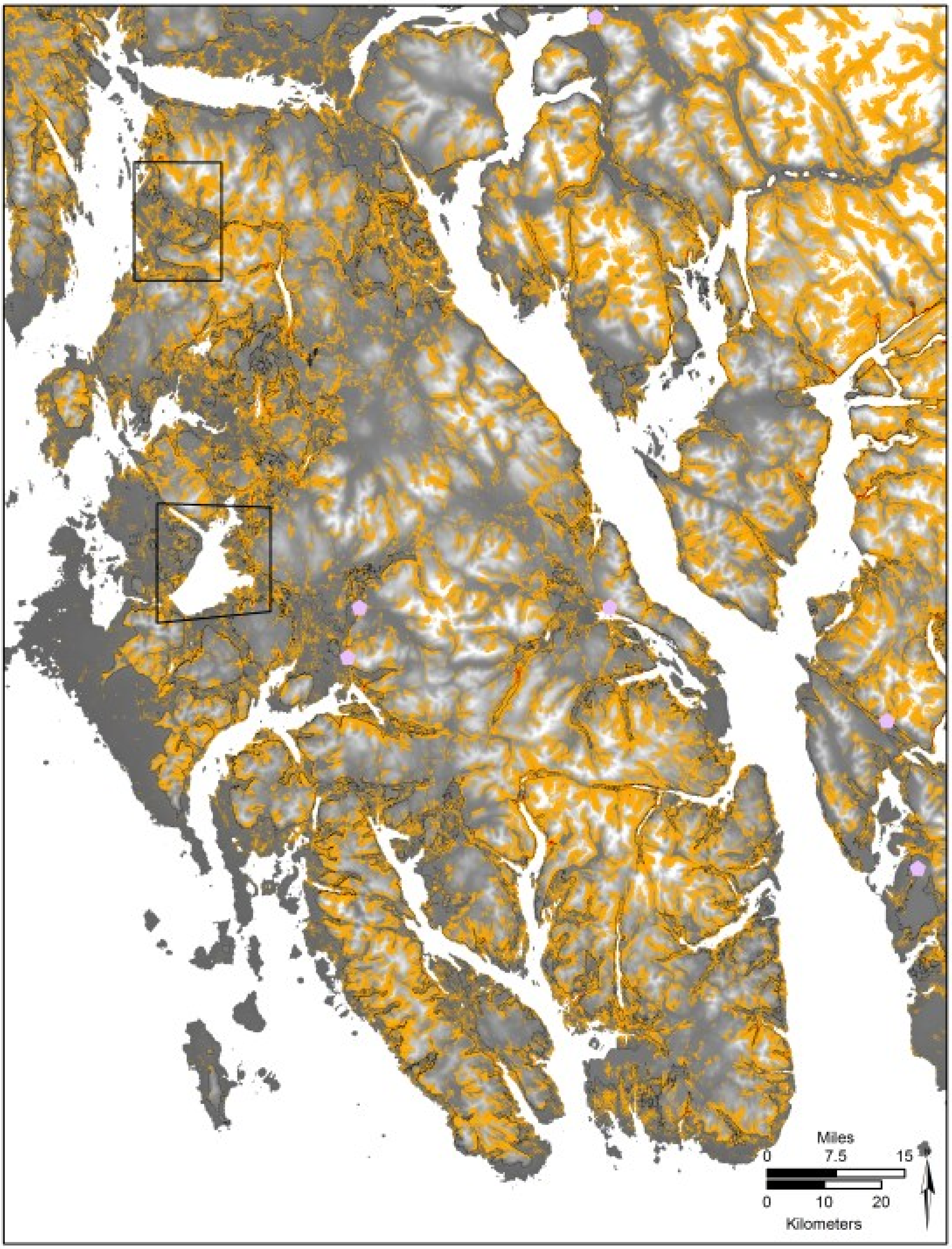
Weight 7 **13,000 cal BP**



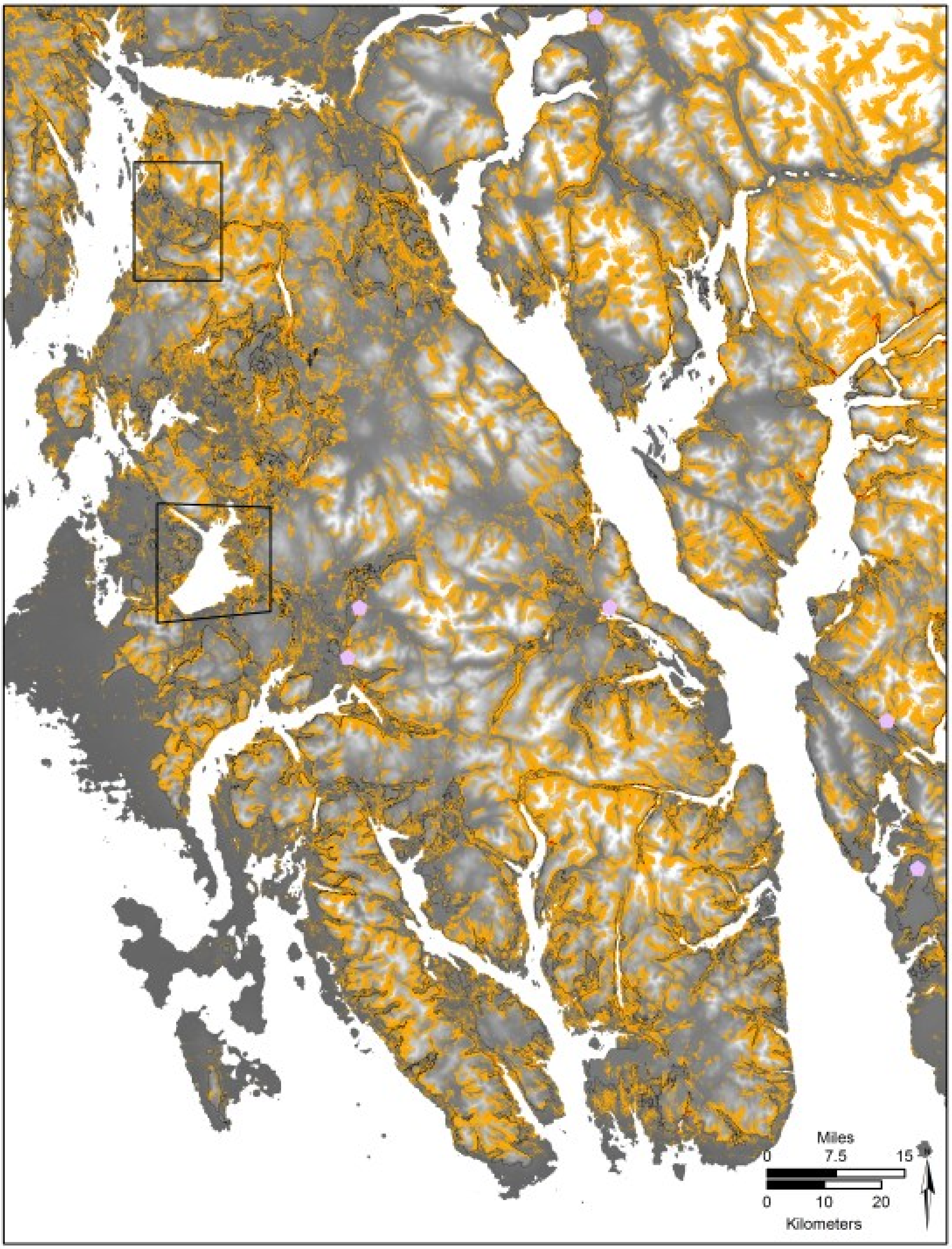
Weight 7 **13,500 cal BP**



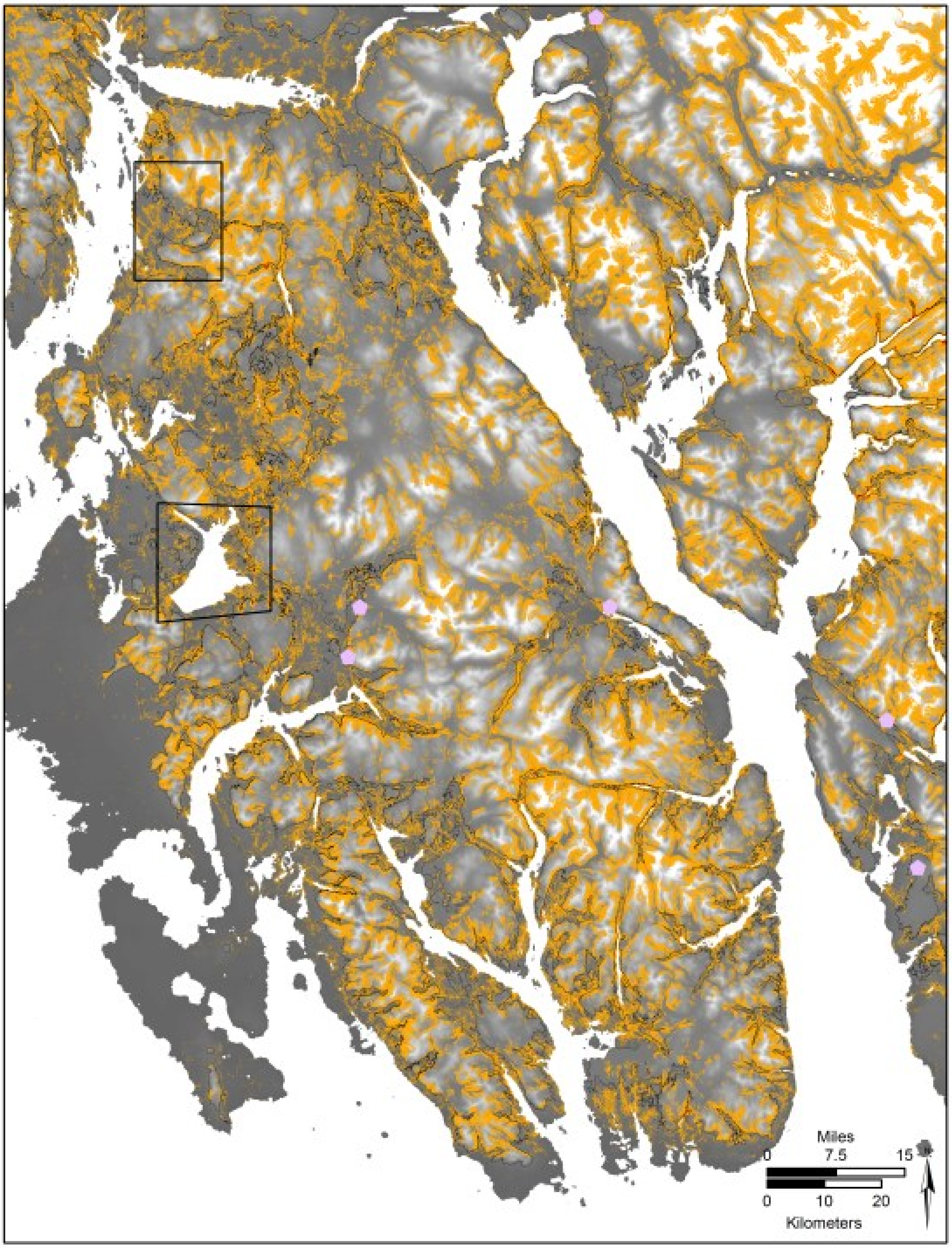
Weight 7 14,000 cal BP



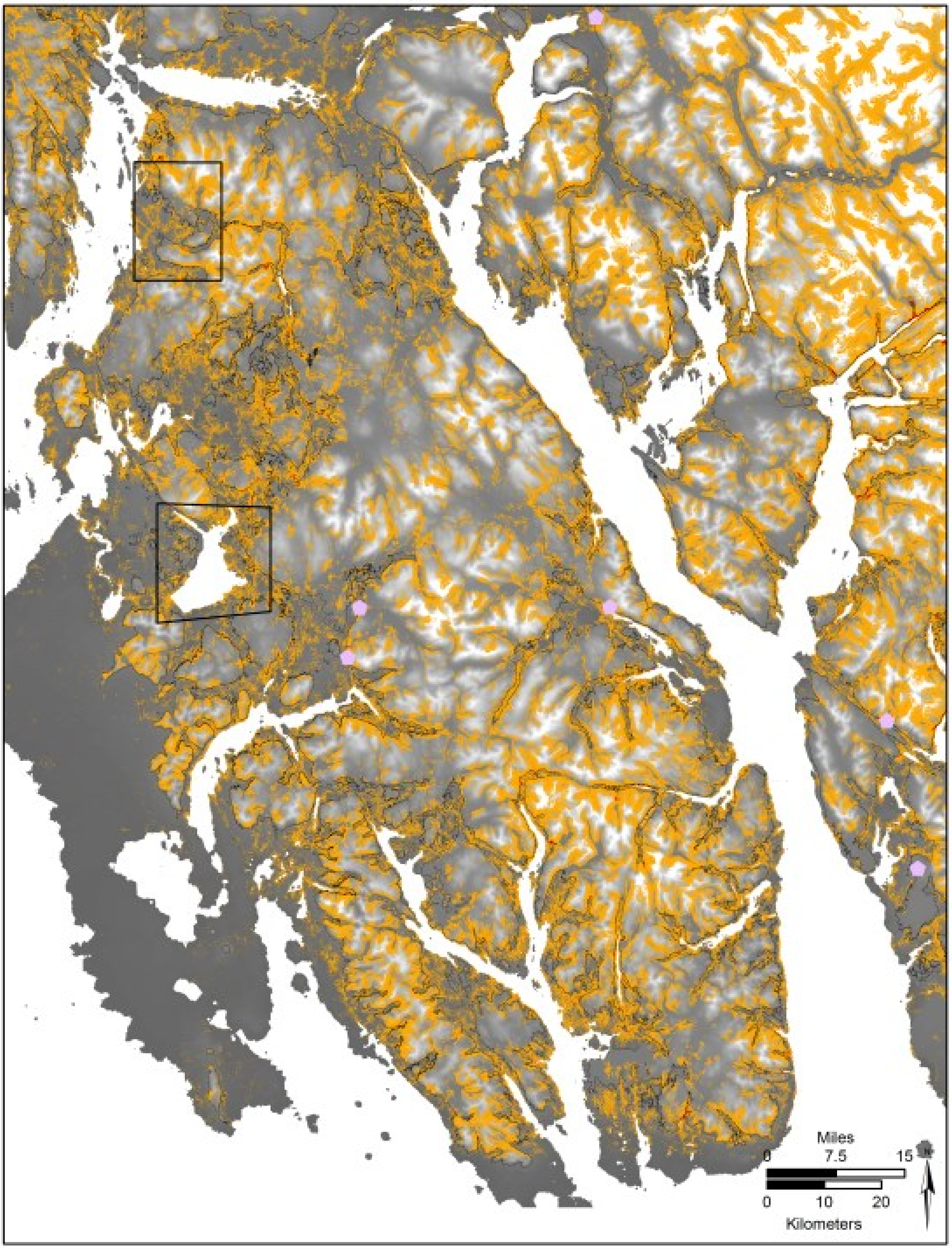
Weight 7 **14,500 cal BP**



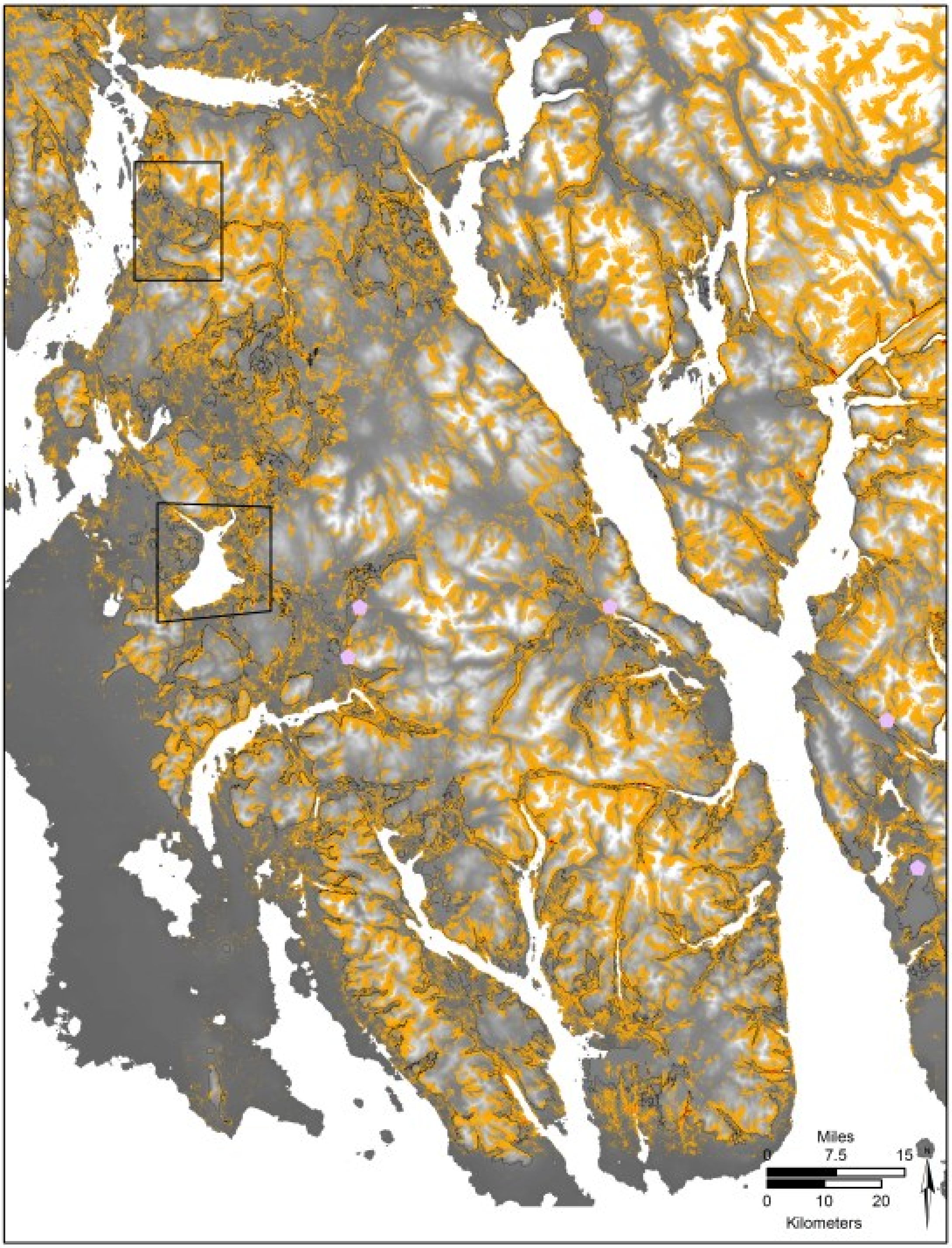
Weight 7 **15,000 cal BP**



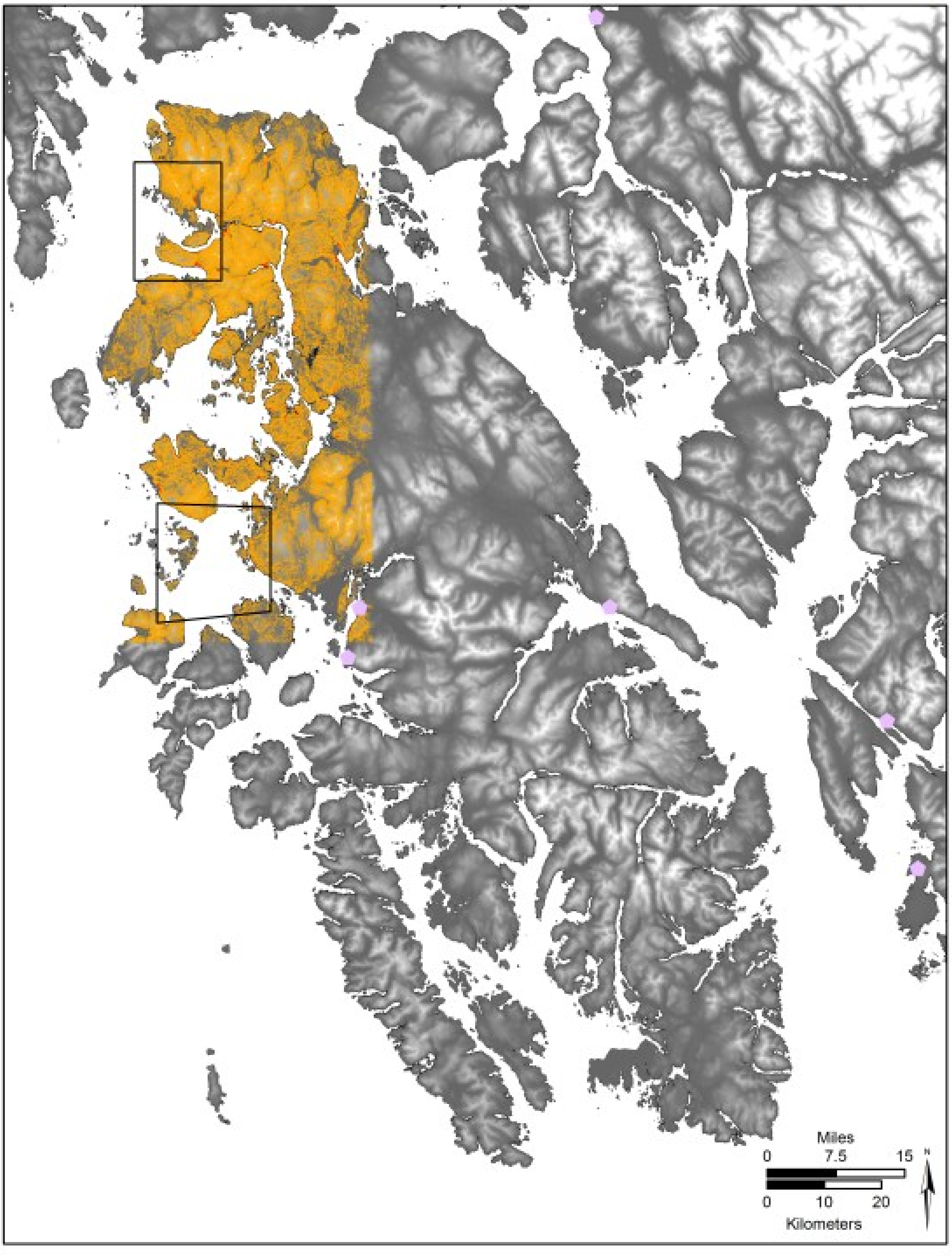
Weight 7 **15,500 cal BP**



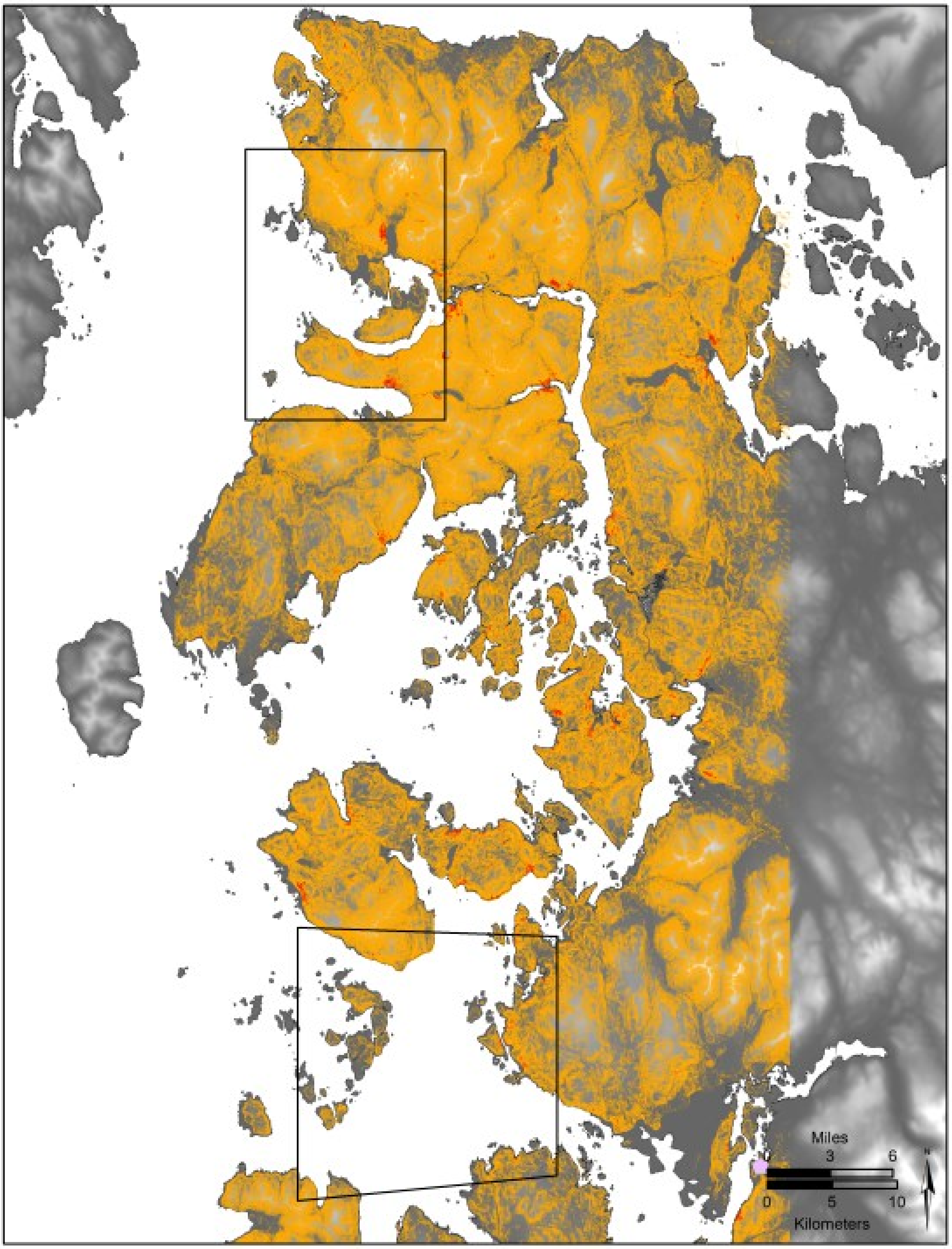
Weight 7 **16,000 cal BP**



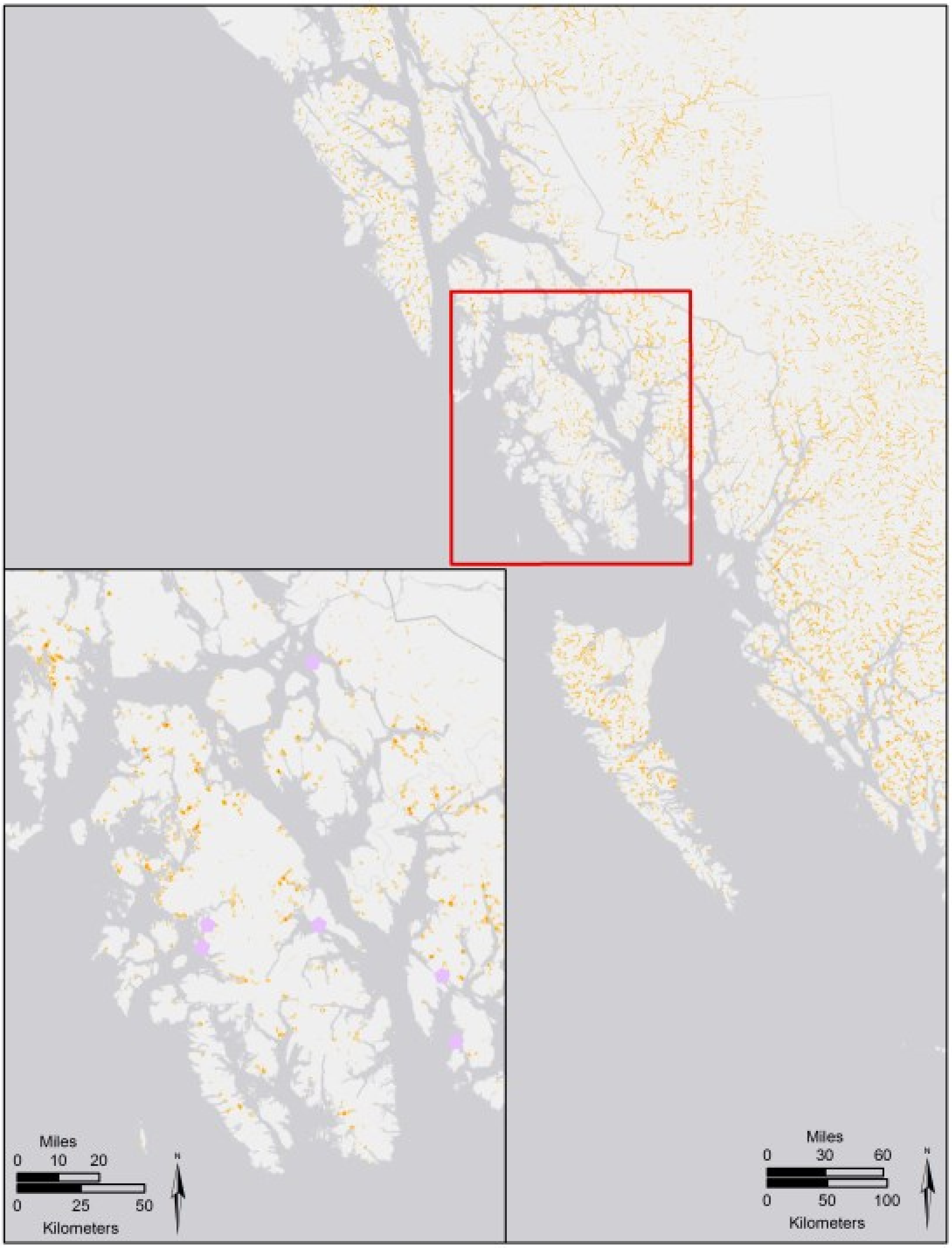
Weight 7 **Modern - Small Area**



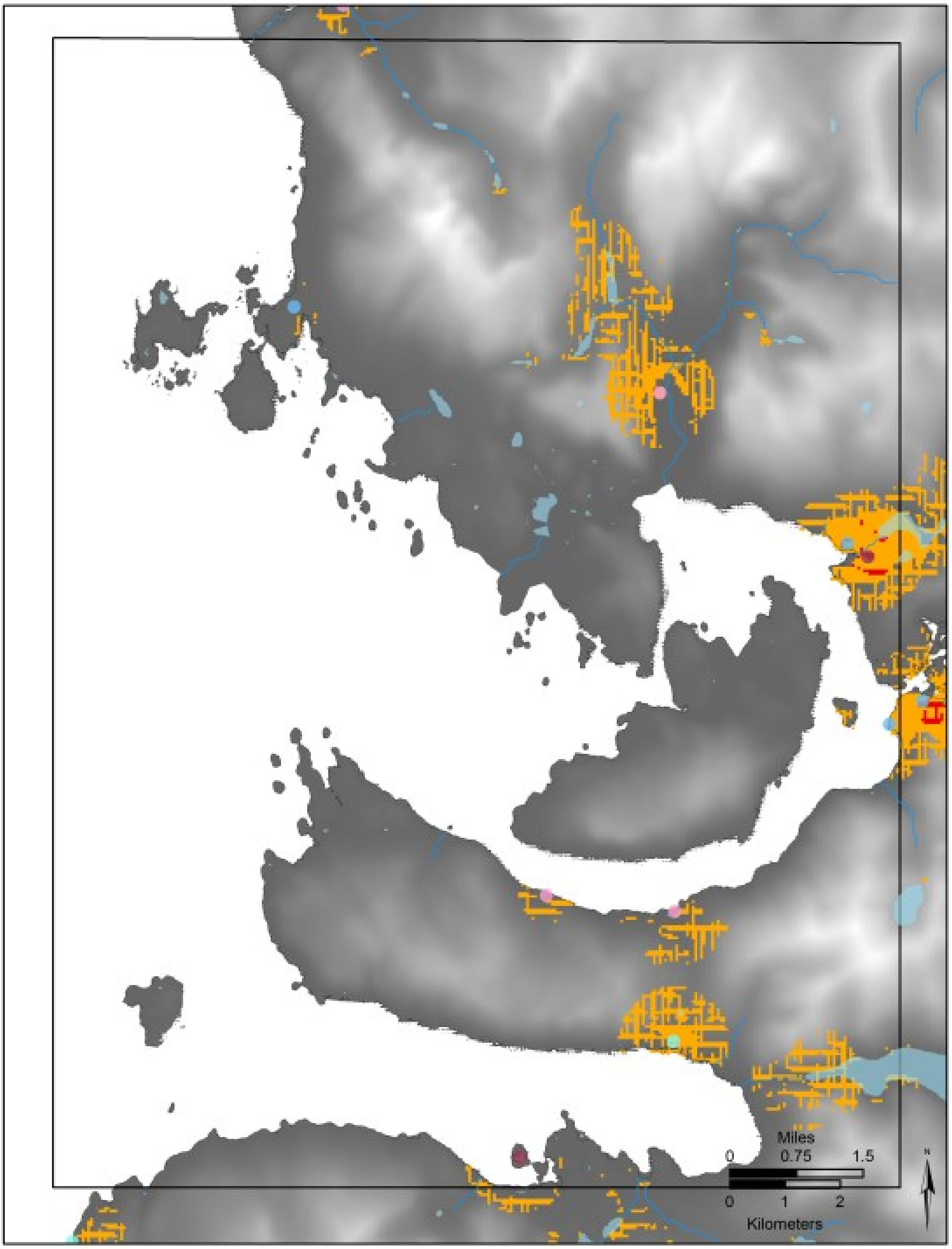
Weight 7 **Modern - Small Area**



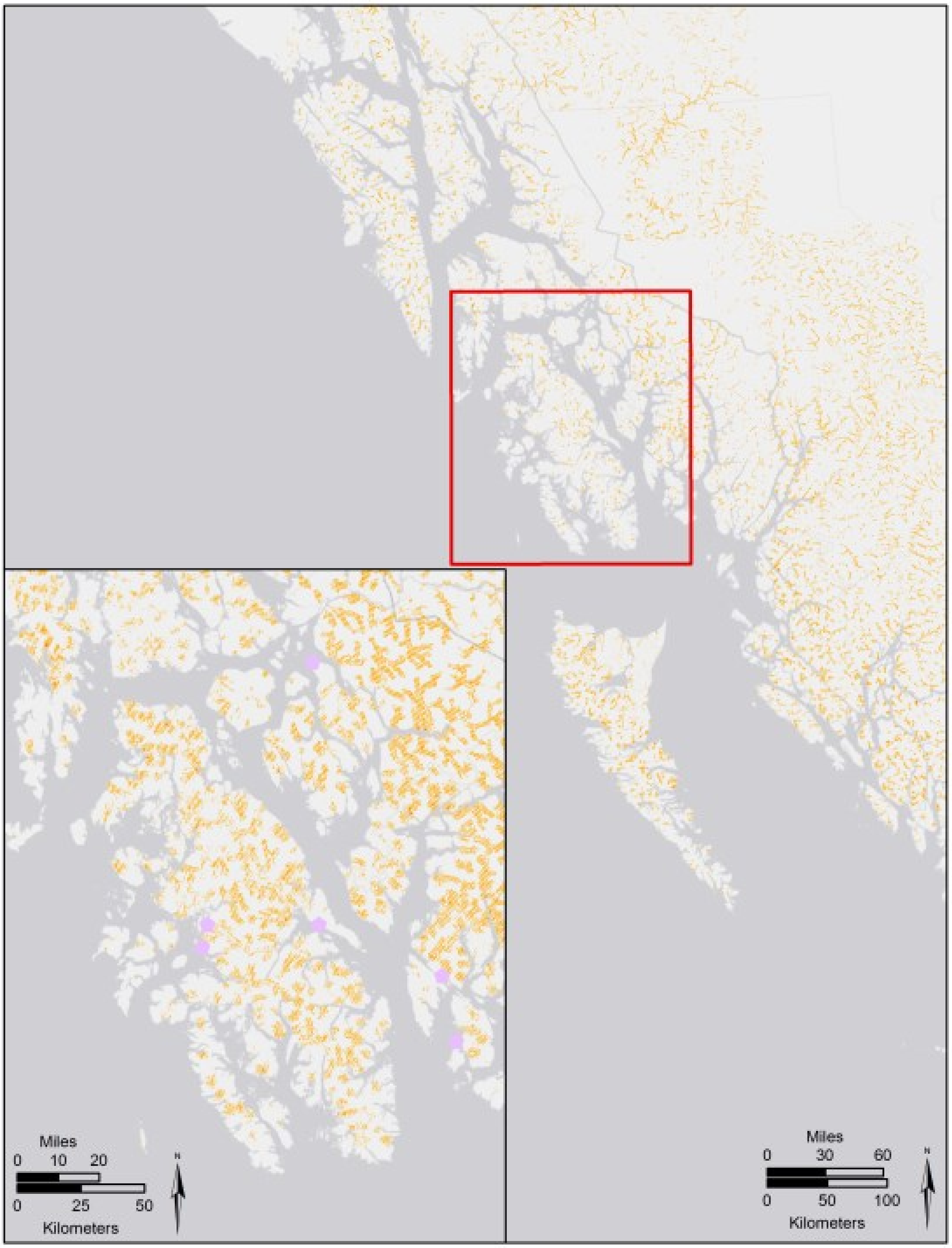
Weight 6 **NWC - modern**



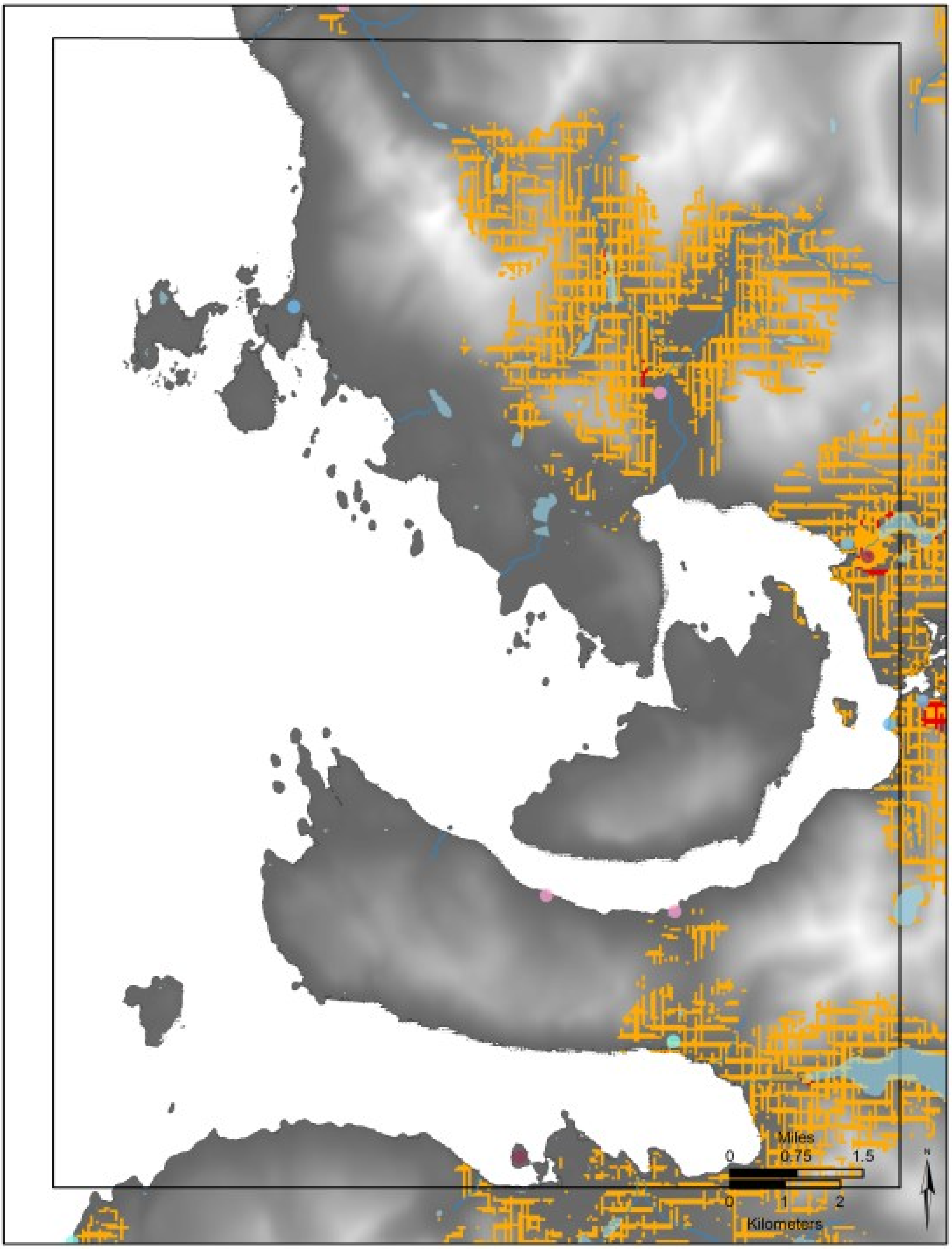
Weight 6 **NWC - modern**



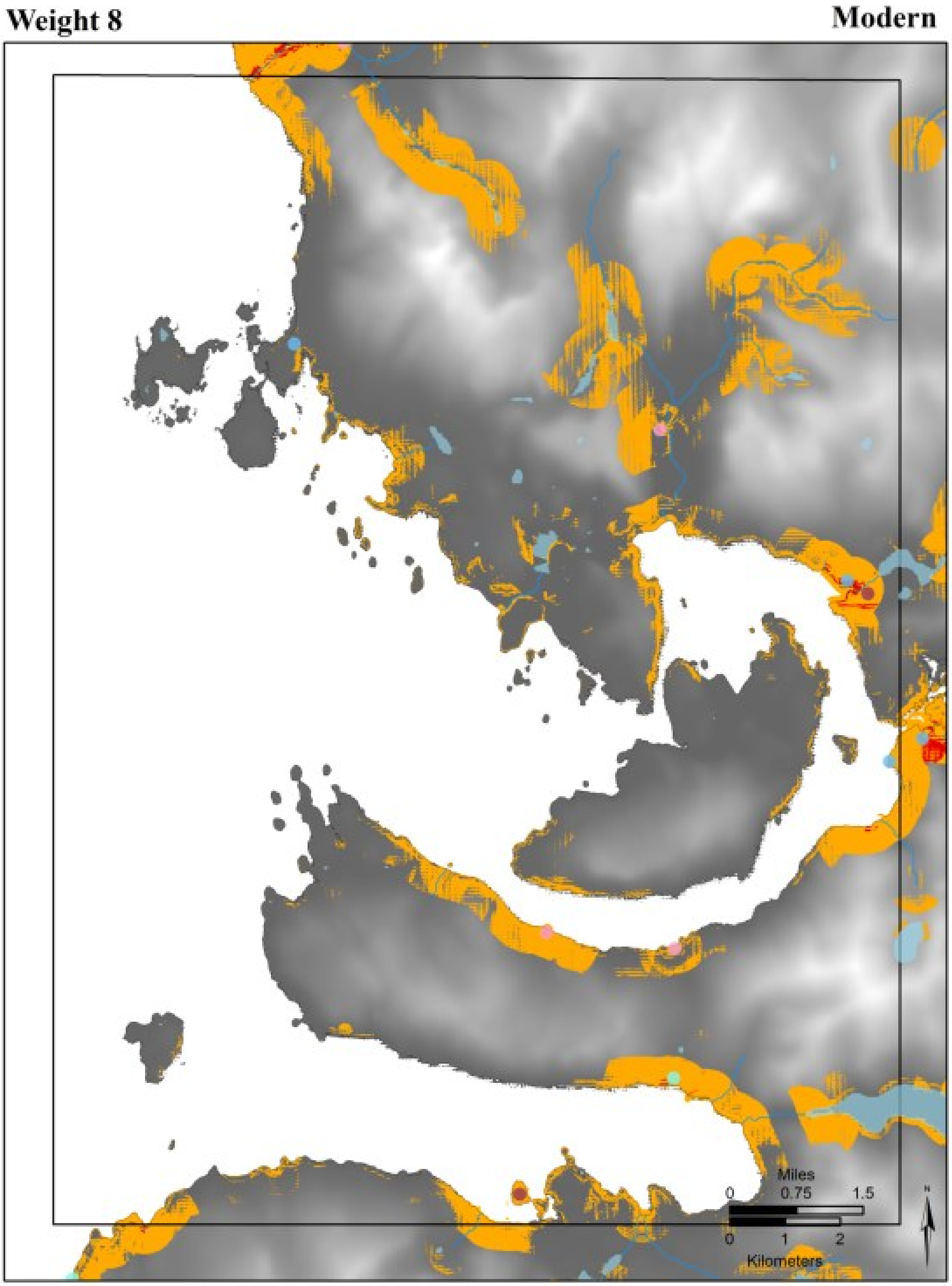
Weight 7 **NWC - modern**



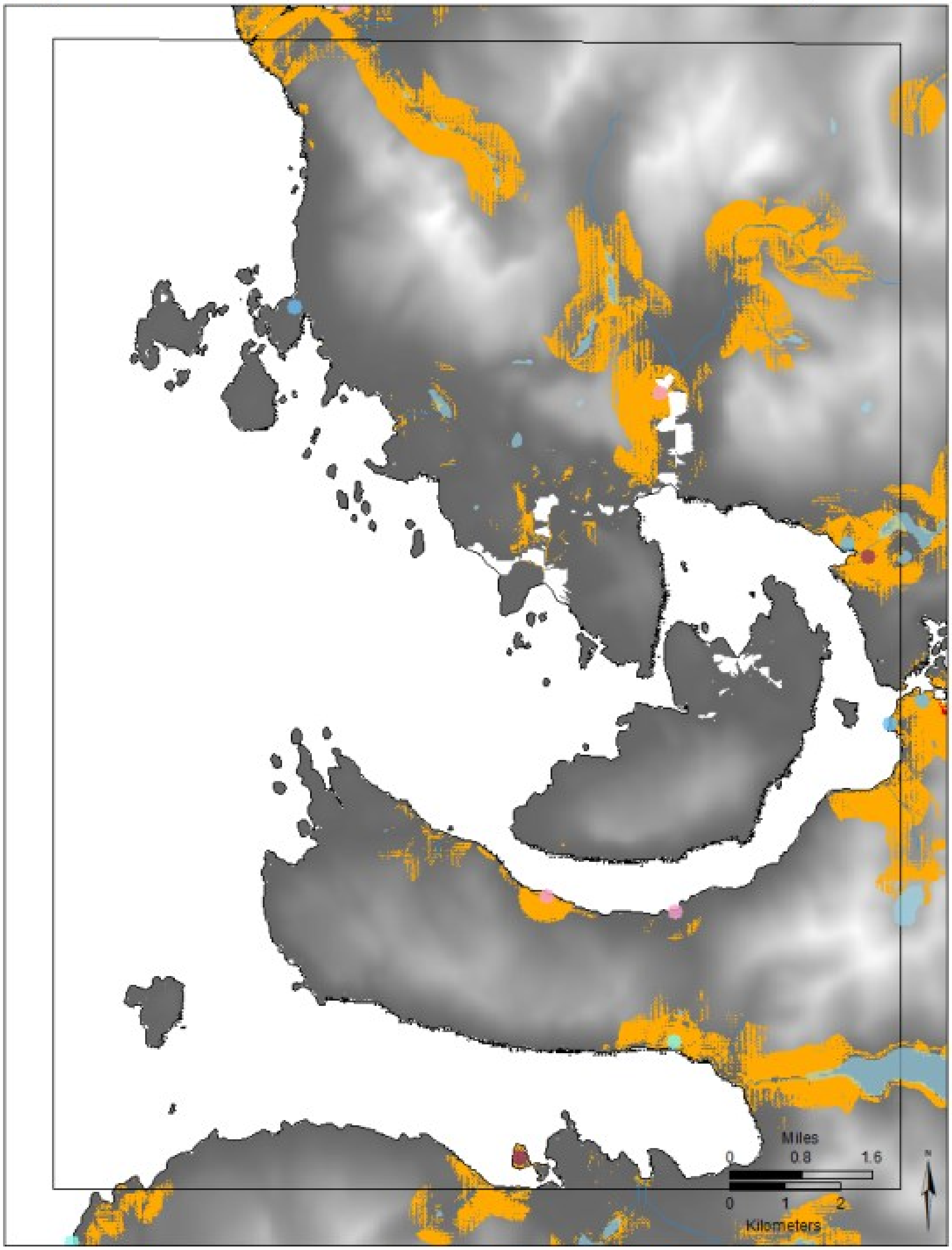
Weight 7 **NWC - modern**



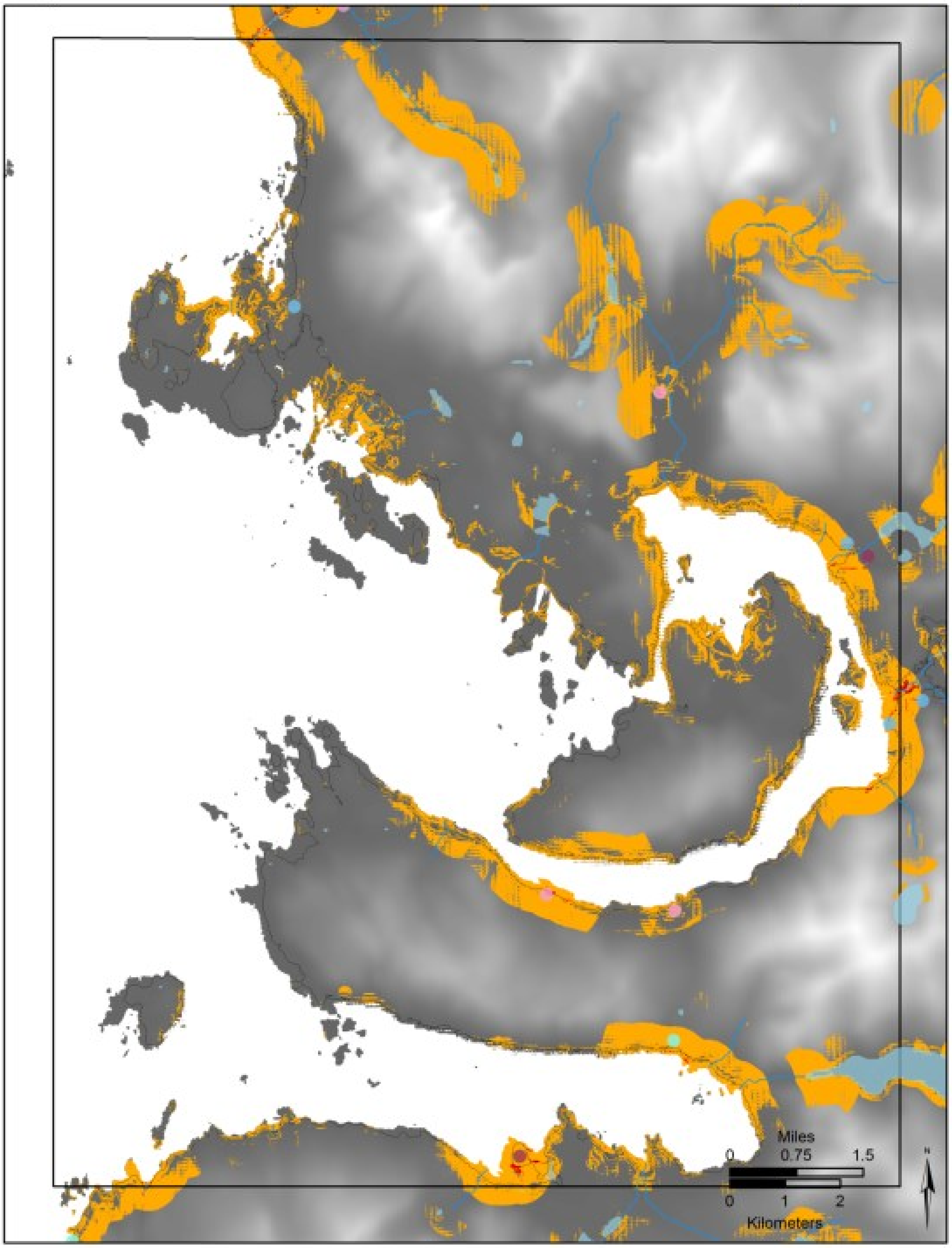
C.14 Weighted Overlay 8



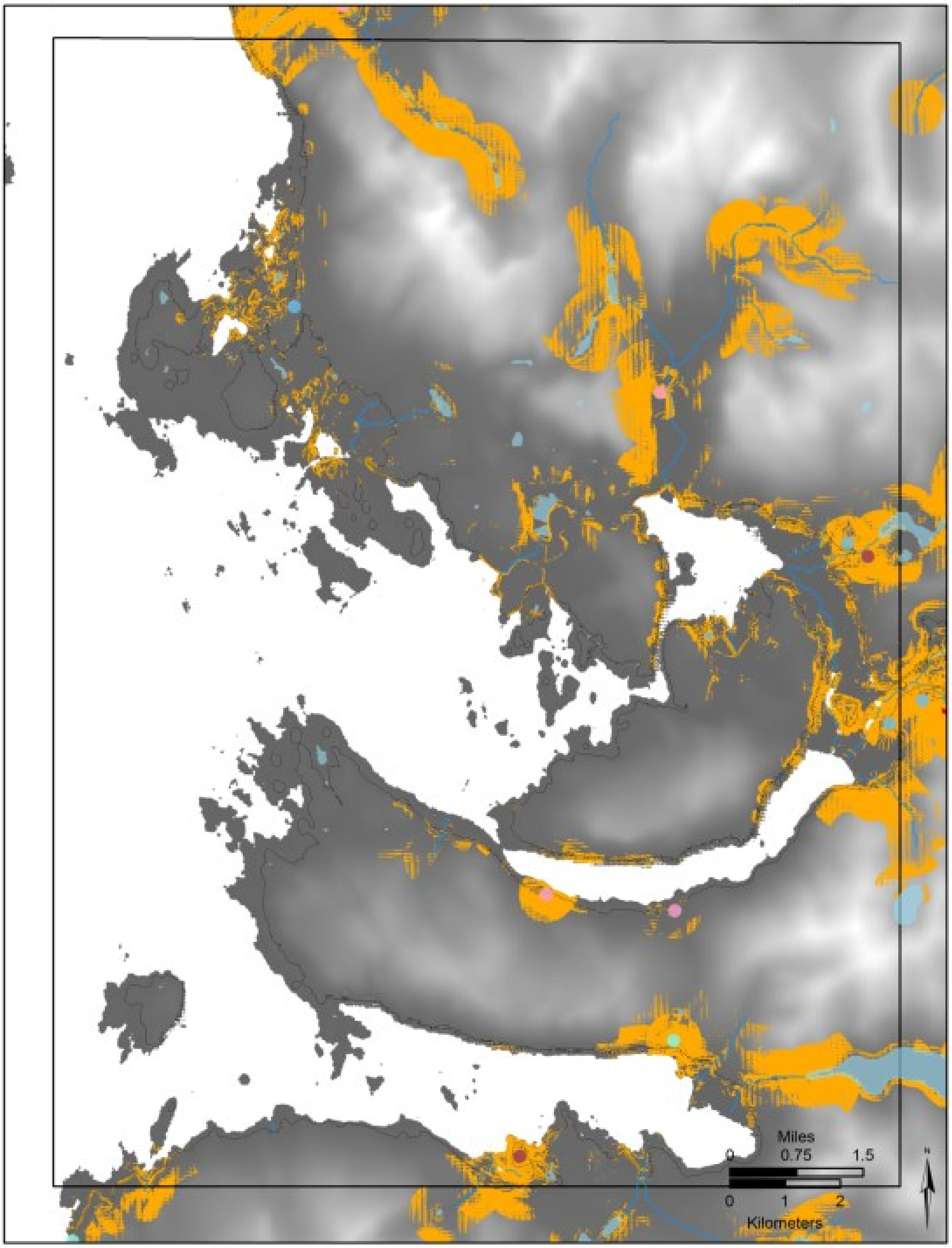
Weight 8 **10,500 cal BP**



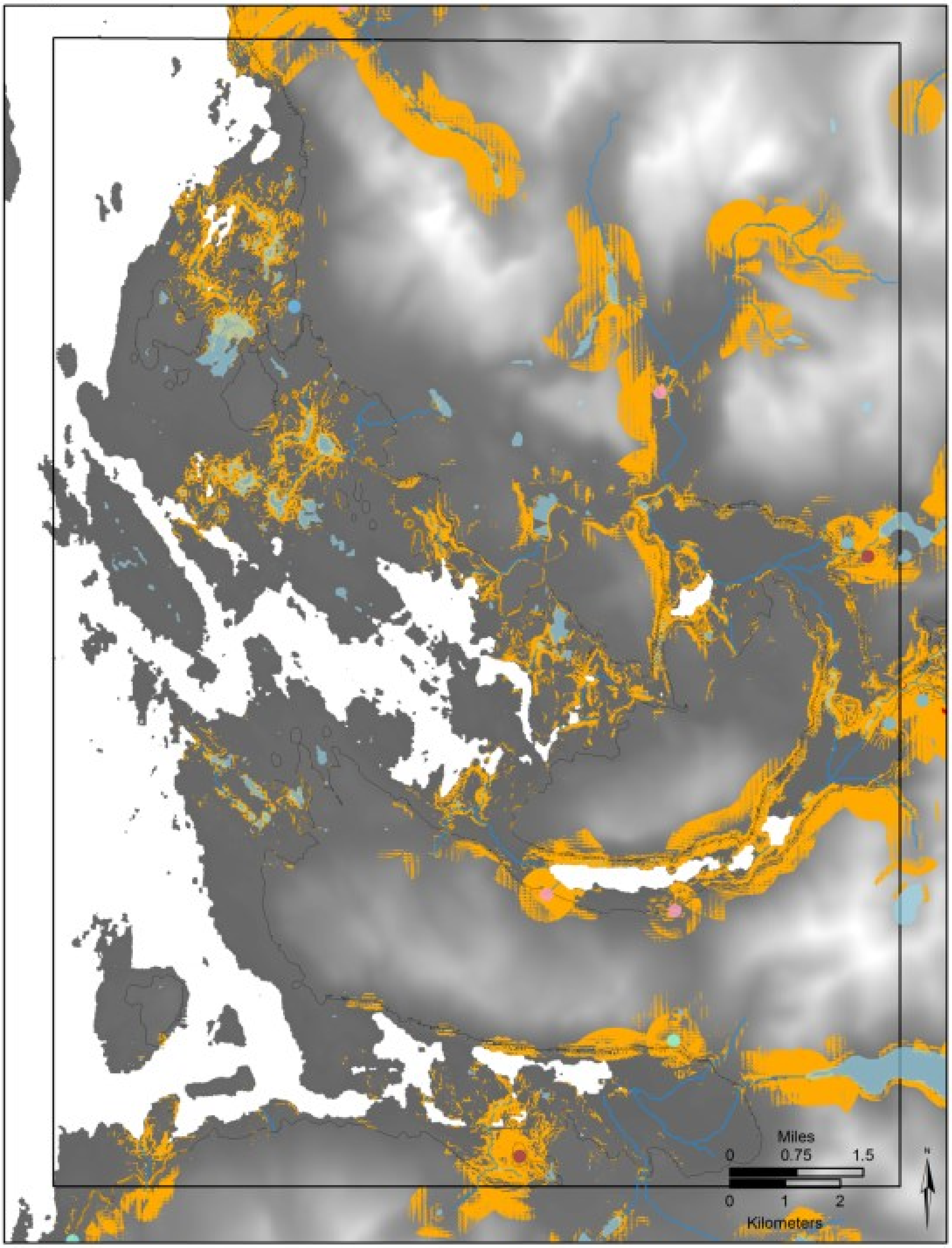
Weight 8 **11,000 cal BP**



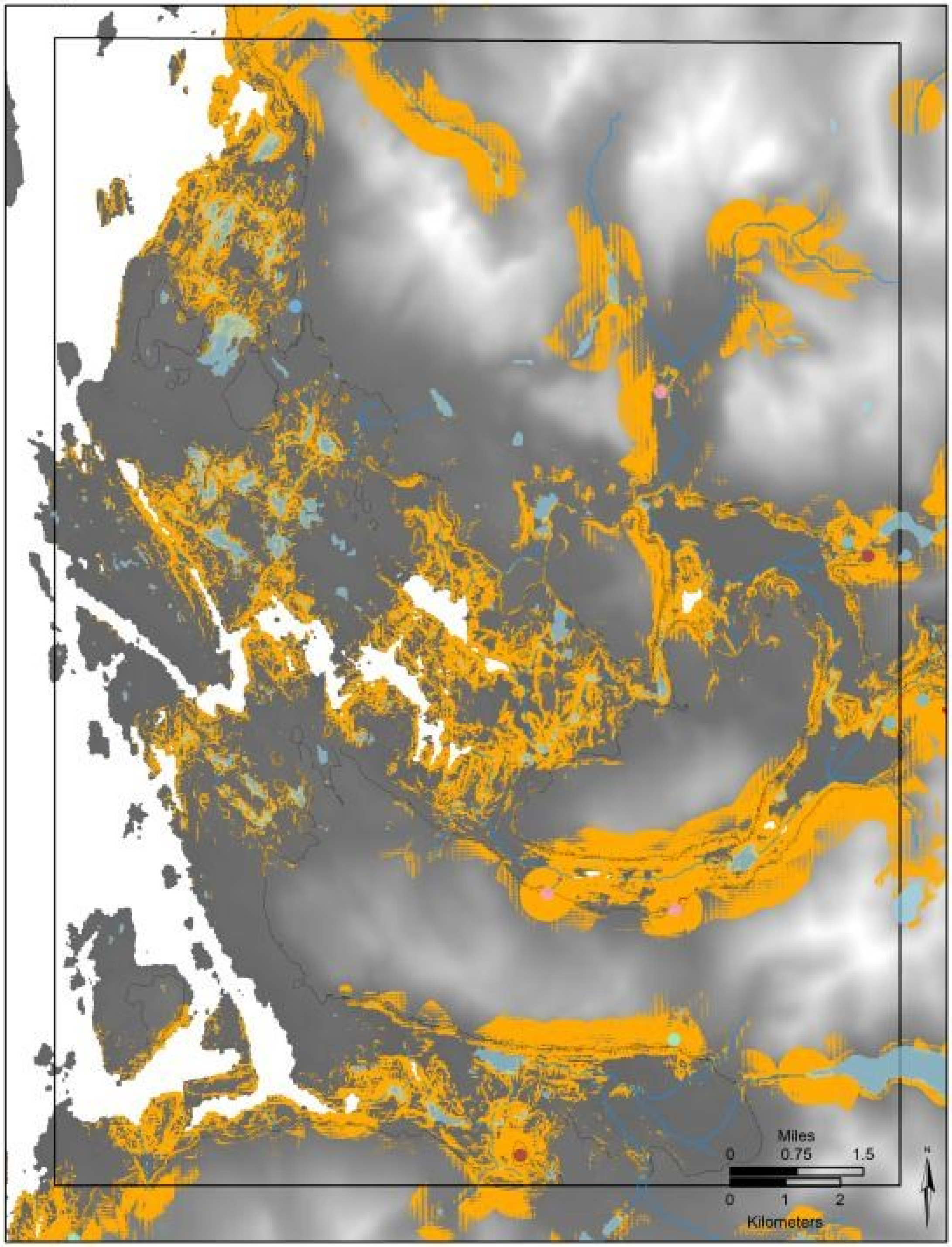
Weight 8 **11,500 cal BP**



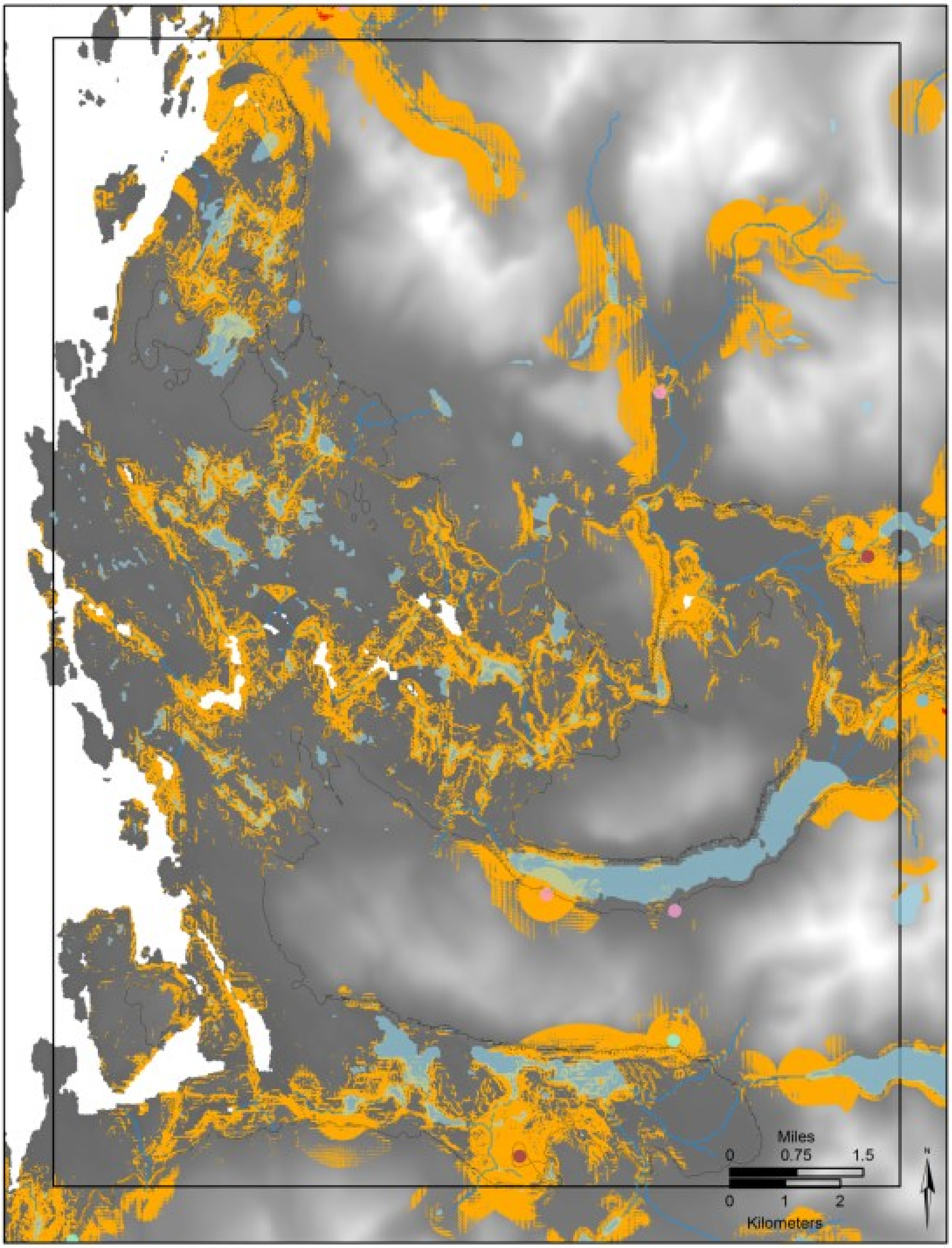
Weight 8 **12,000 cal BP**



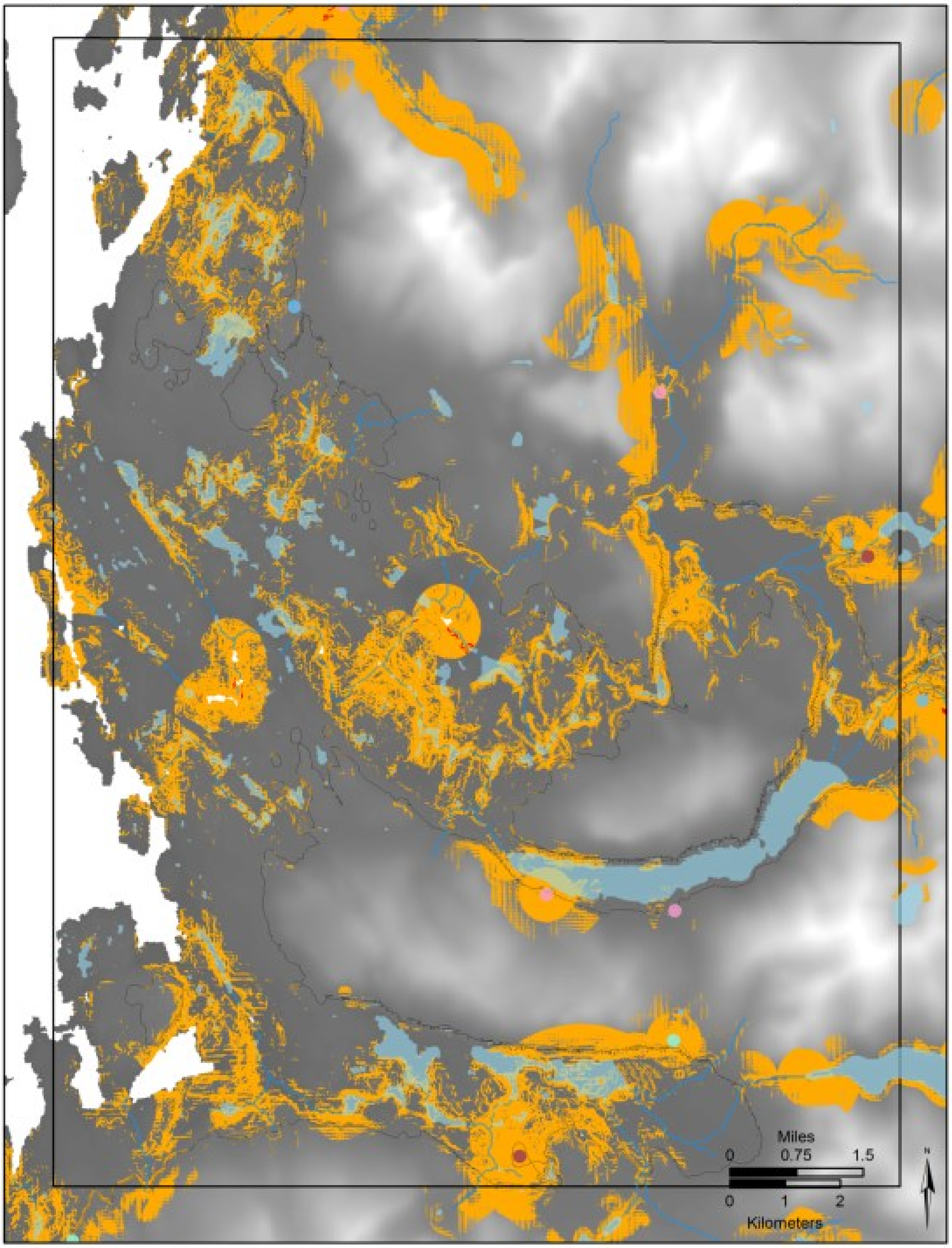
Weight 8 **12,500 cal BP**



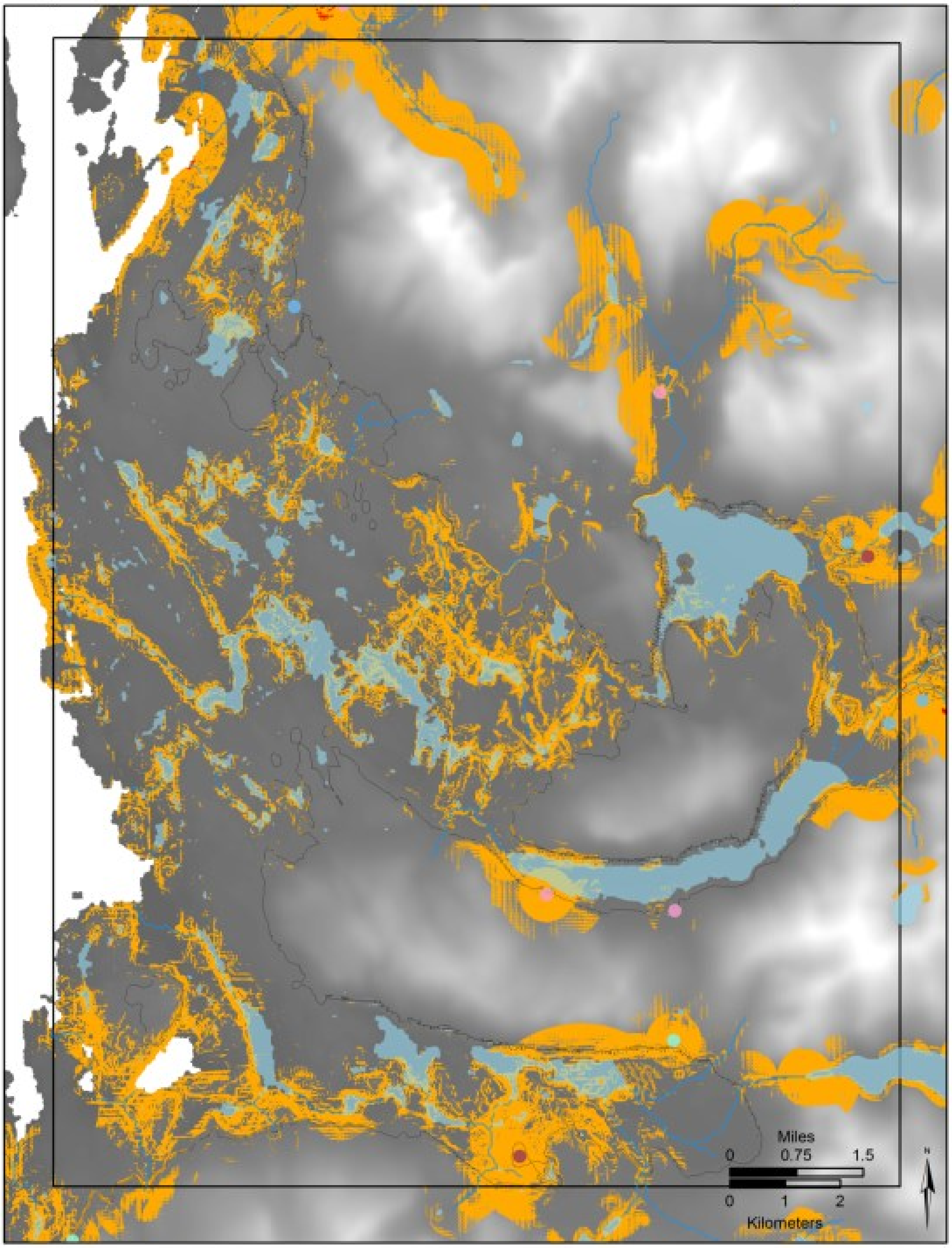
Weight 8 **13,000 cal BP**



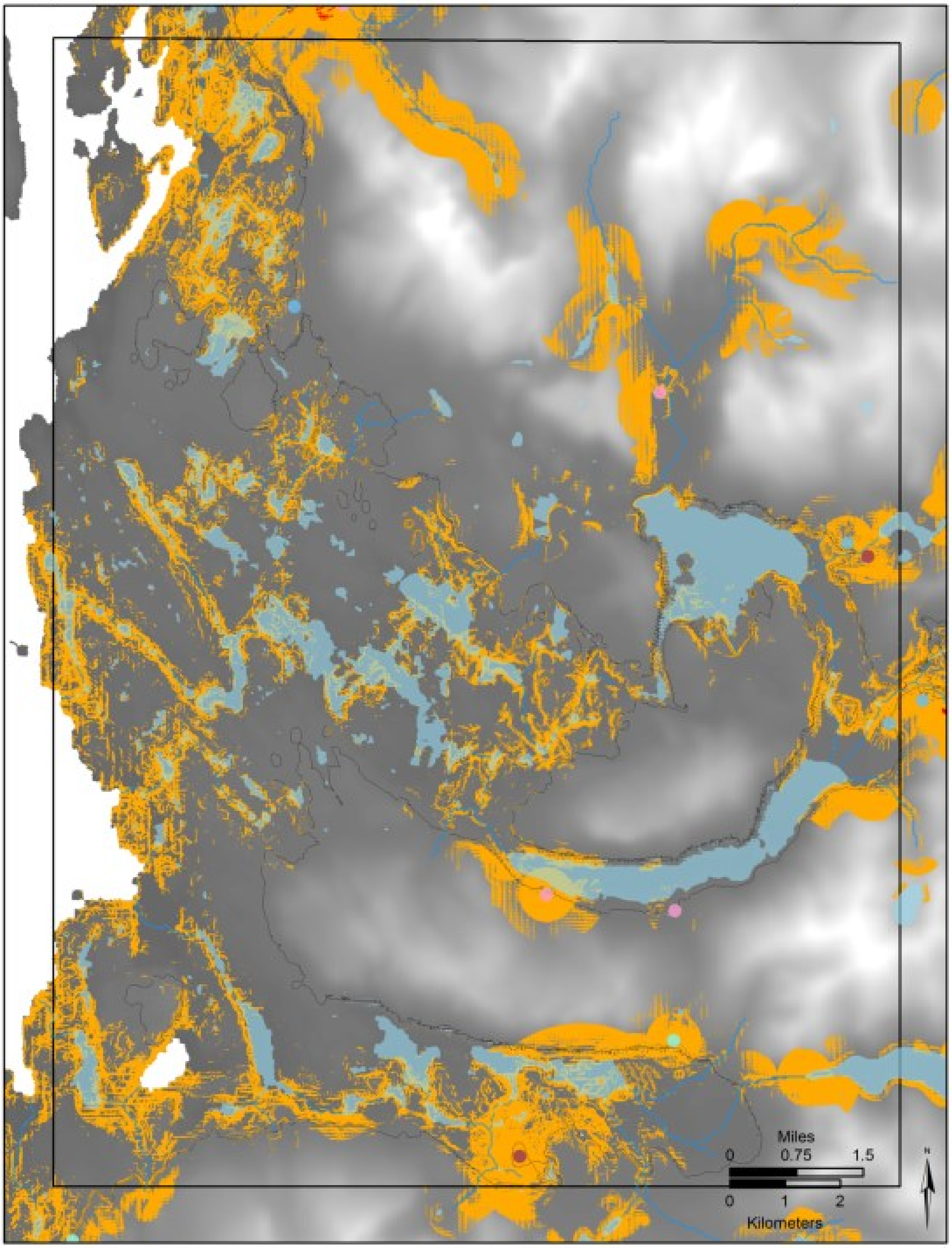
Weight 8 **13,500 cal BP**



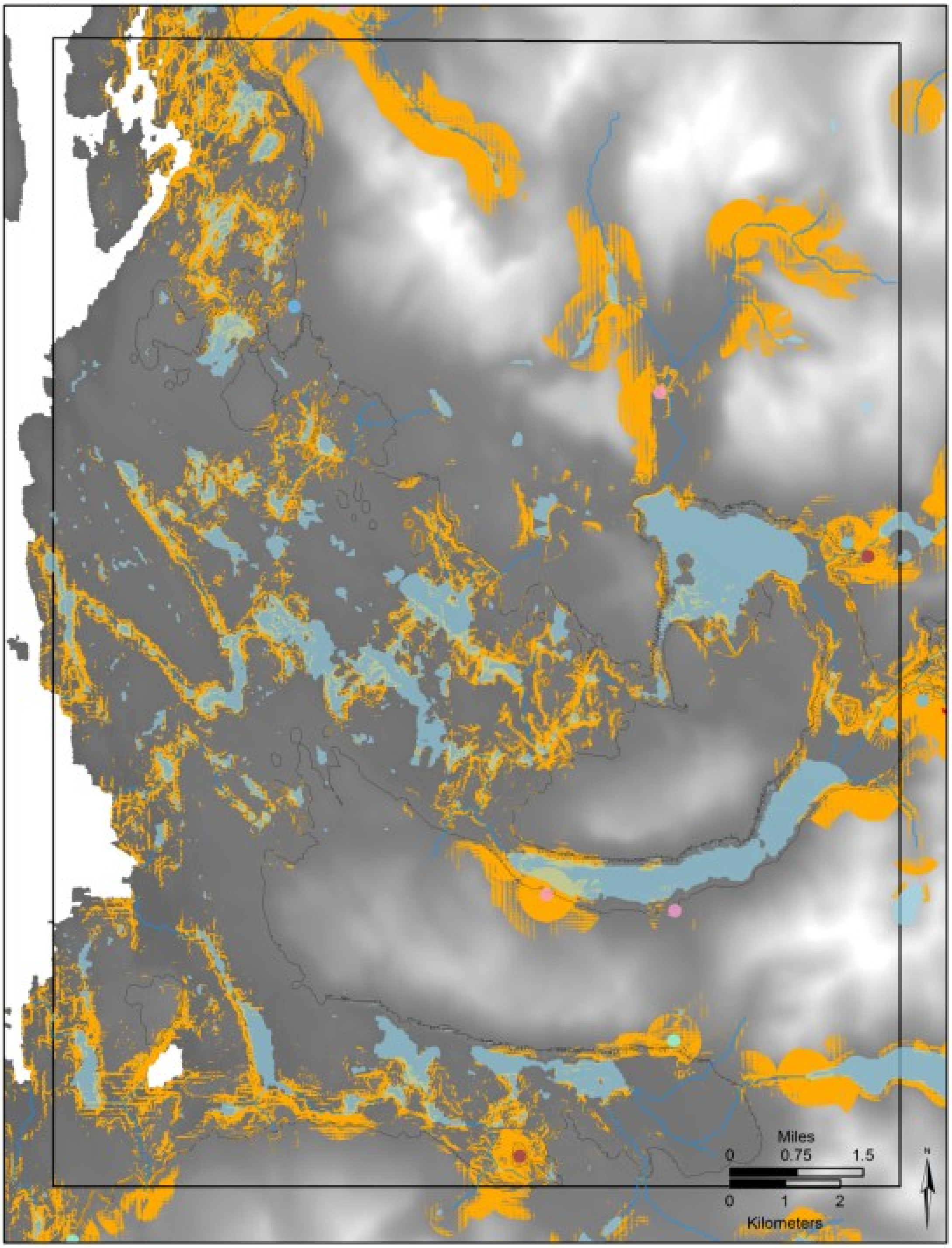
Weight 8 **14,000 cal BP**



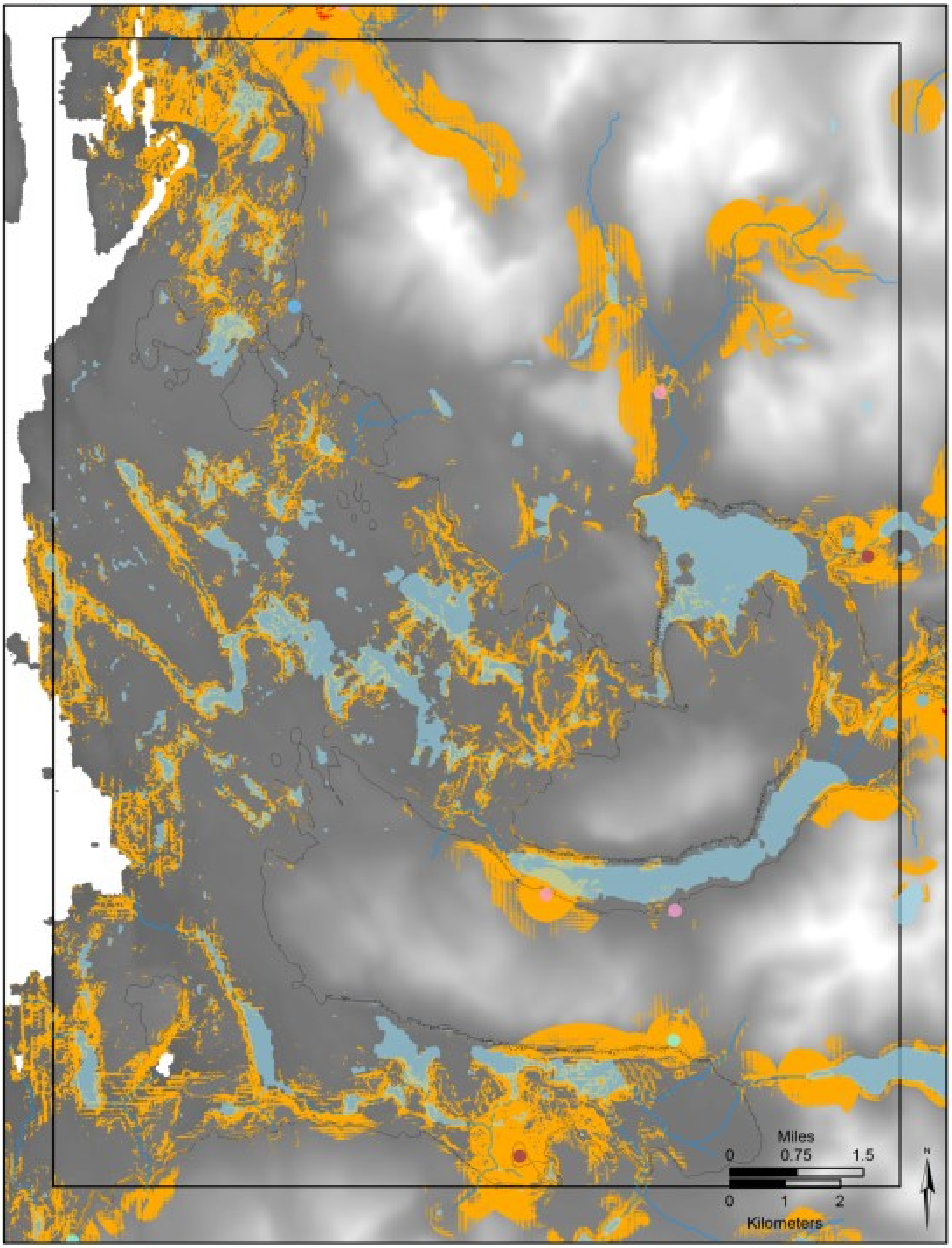
Weight 8 **14,500 cal BP**

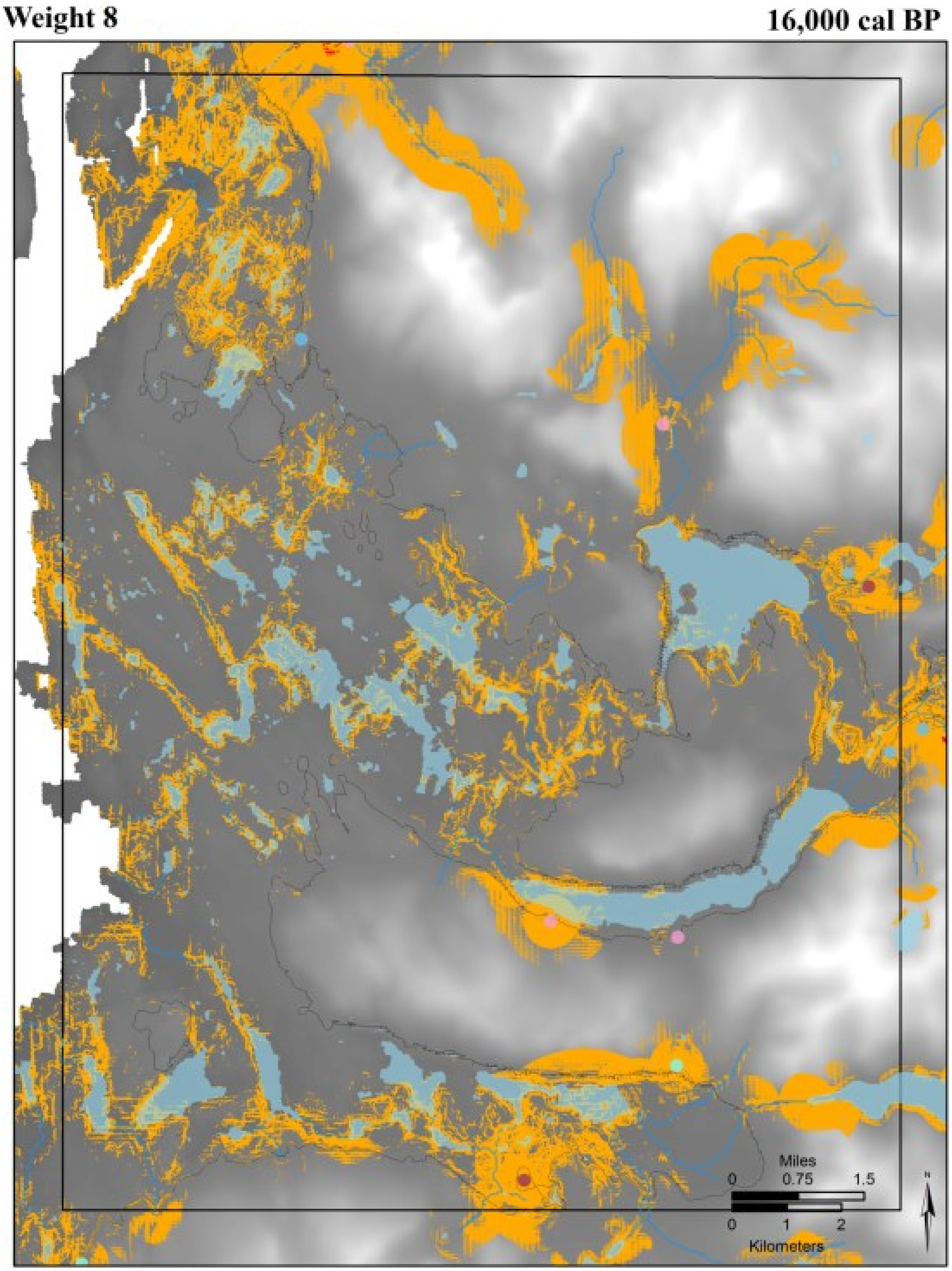


Weight 8 **15,000 cal BP**

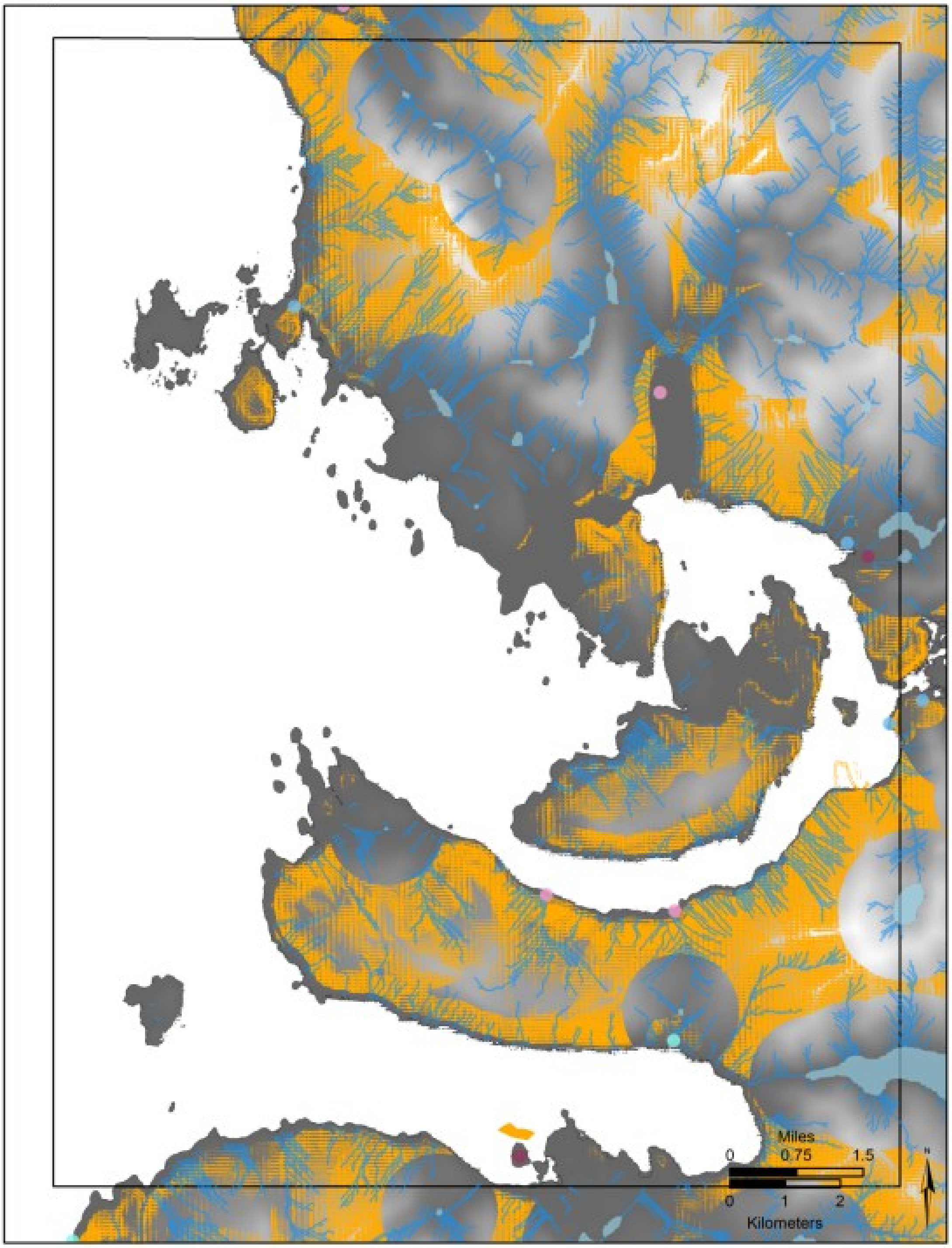


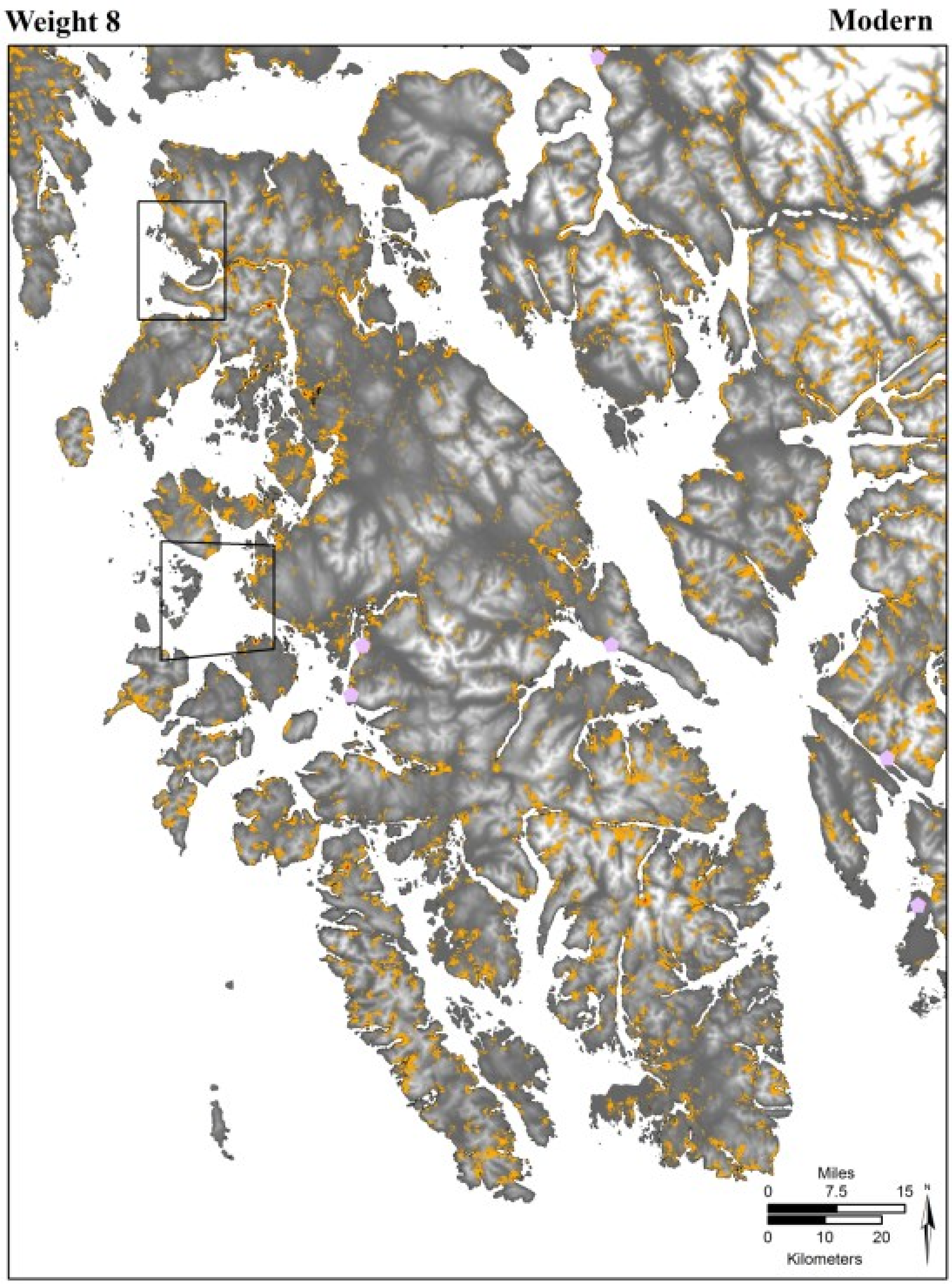
Weight 8 **15,500 cal BP**



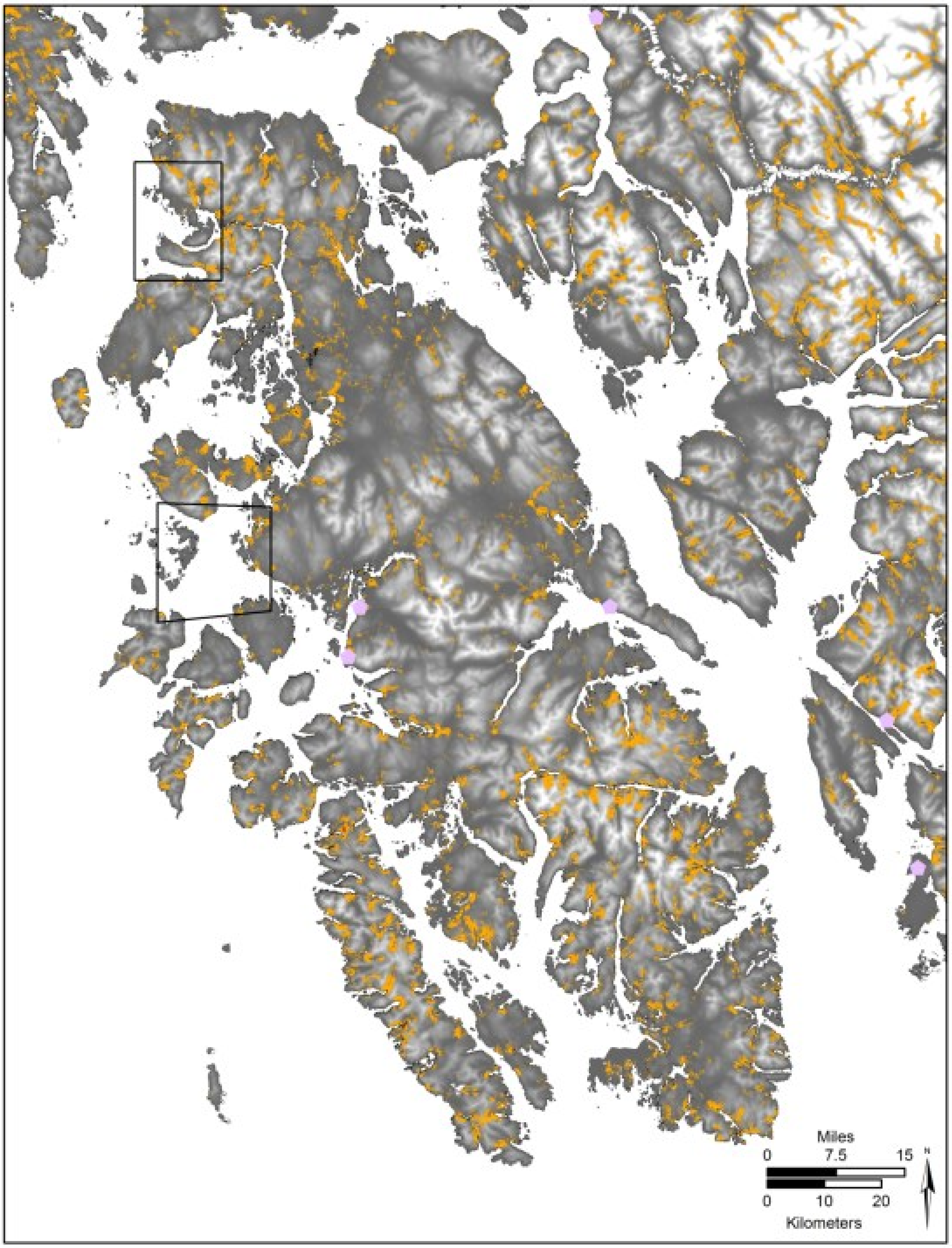

Weight 8
16,000 cal BP
Miles
0
0.75
1.5
0
1
2
Kilometers

Weight 8 **Modern - Small Area**

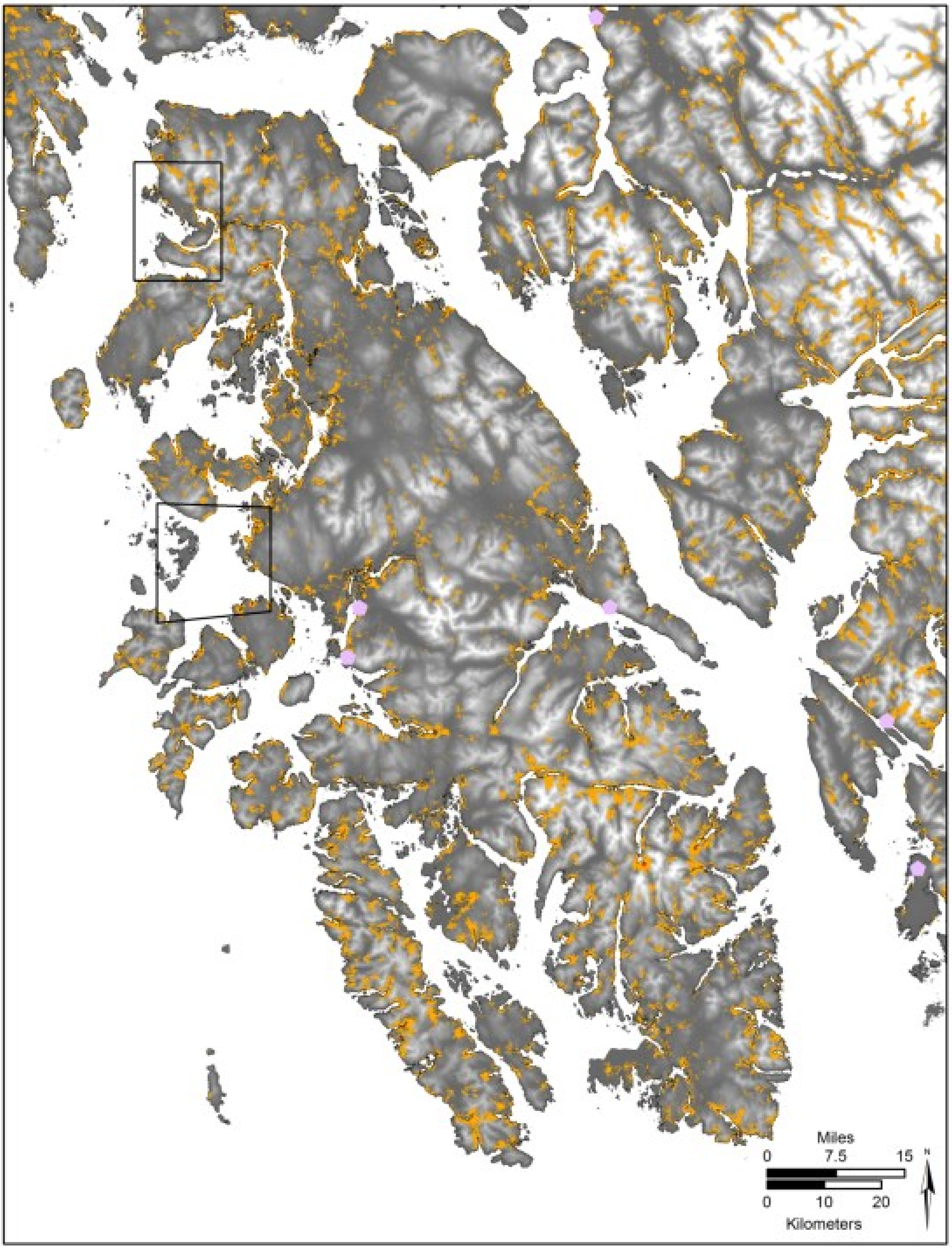



Weight 8
Modern
Miles
0
7.5
15
0
10
20
Kilometers
N

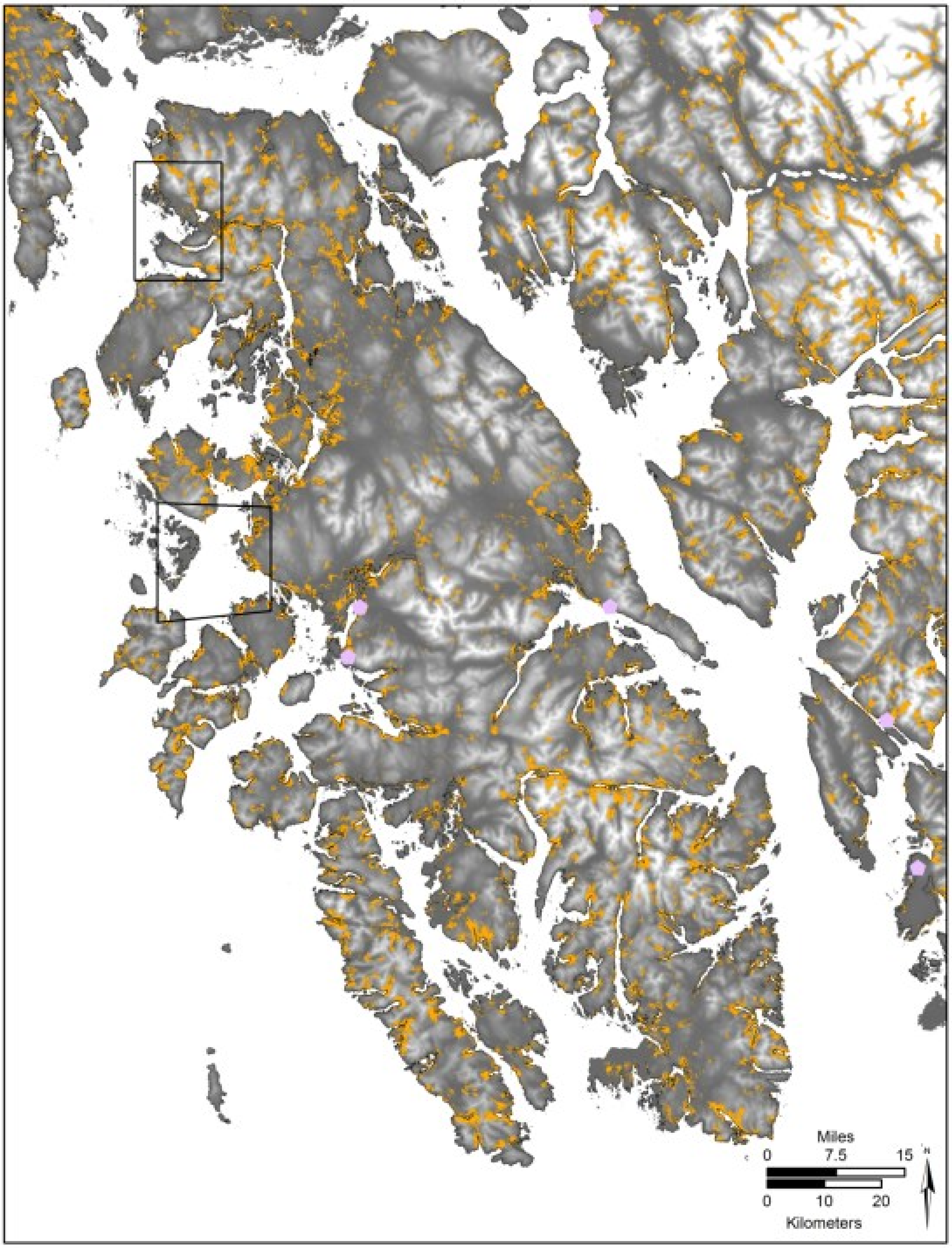
Weight 8 **10,500 cal BP**

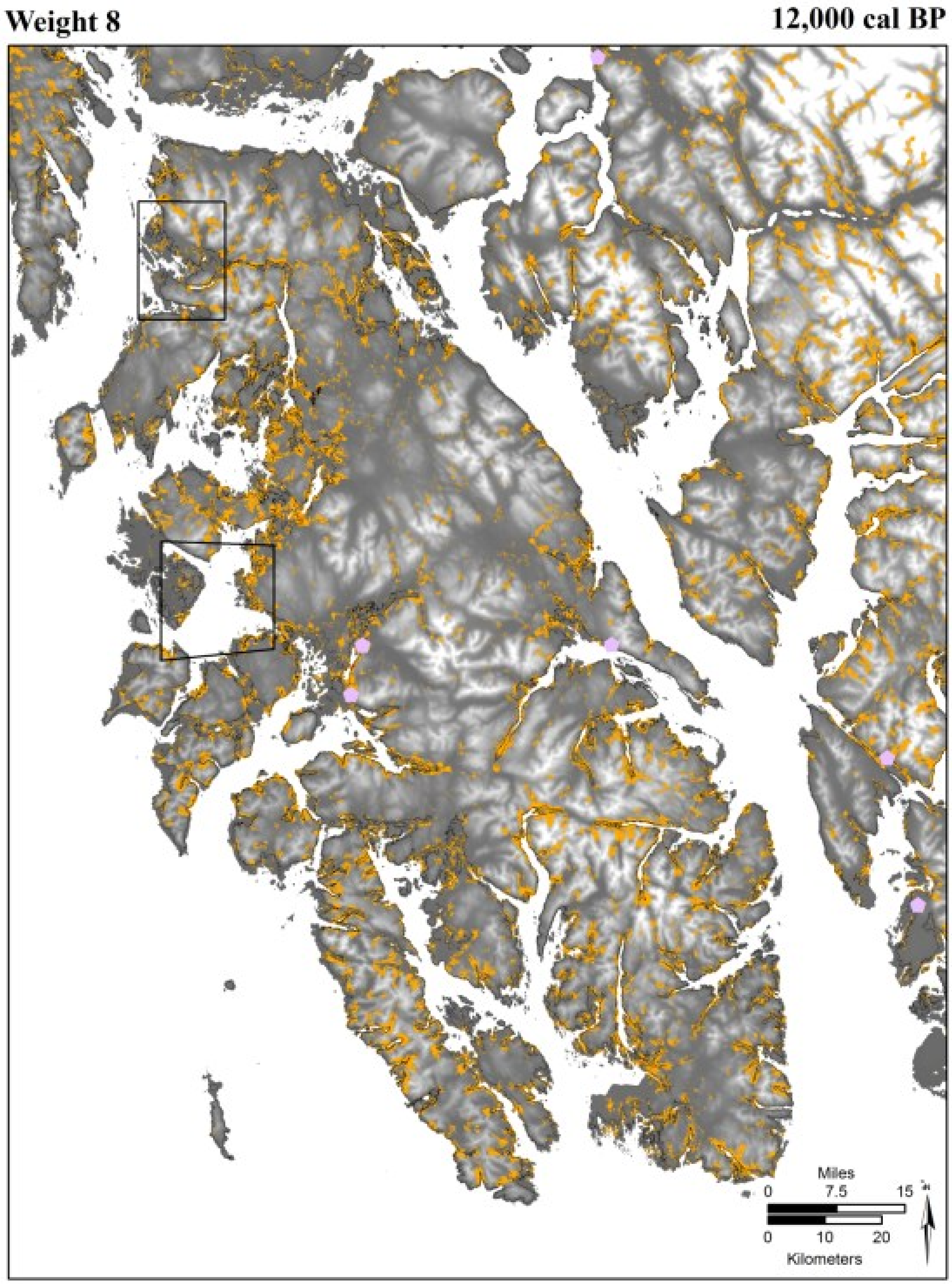


Weight 8 **11,000 cal BP**

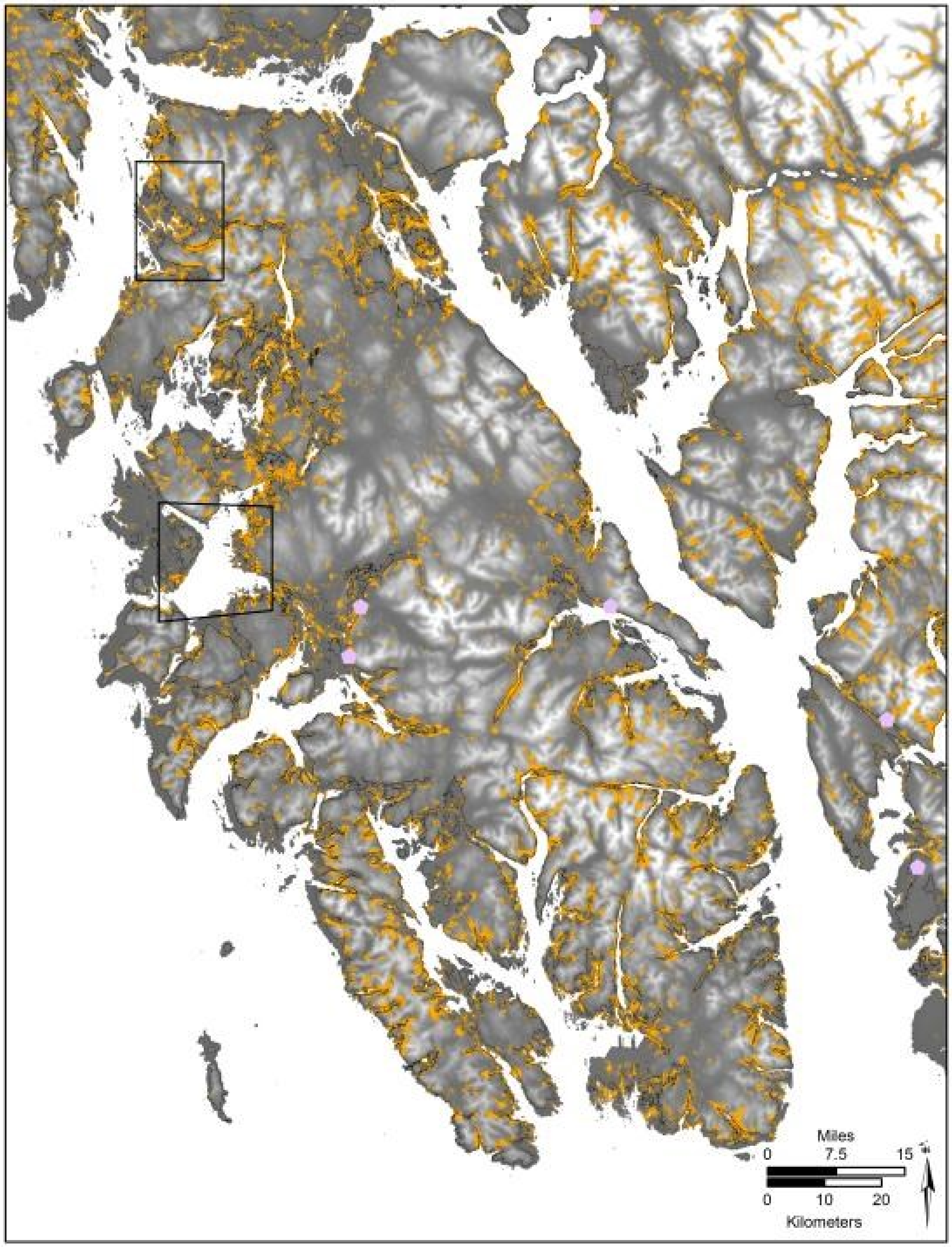


Weight 8 **11,500 cal BP**

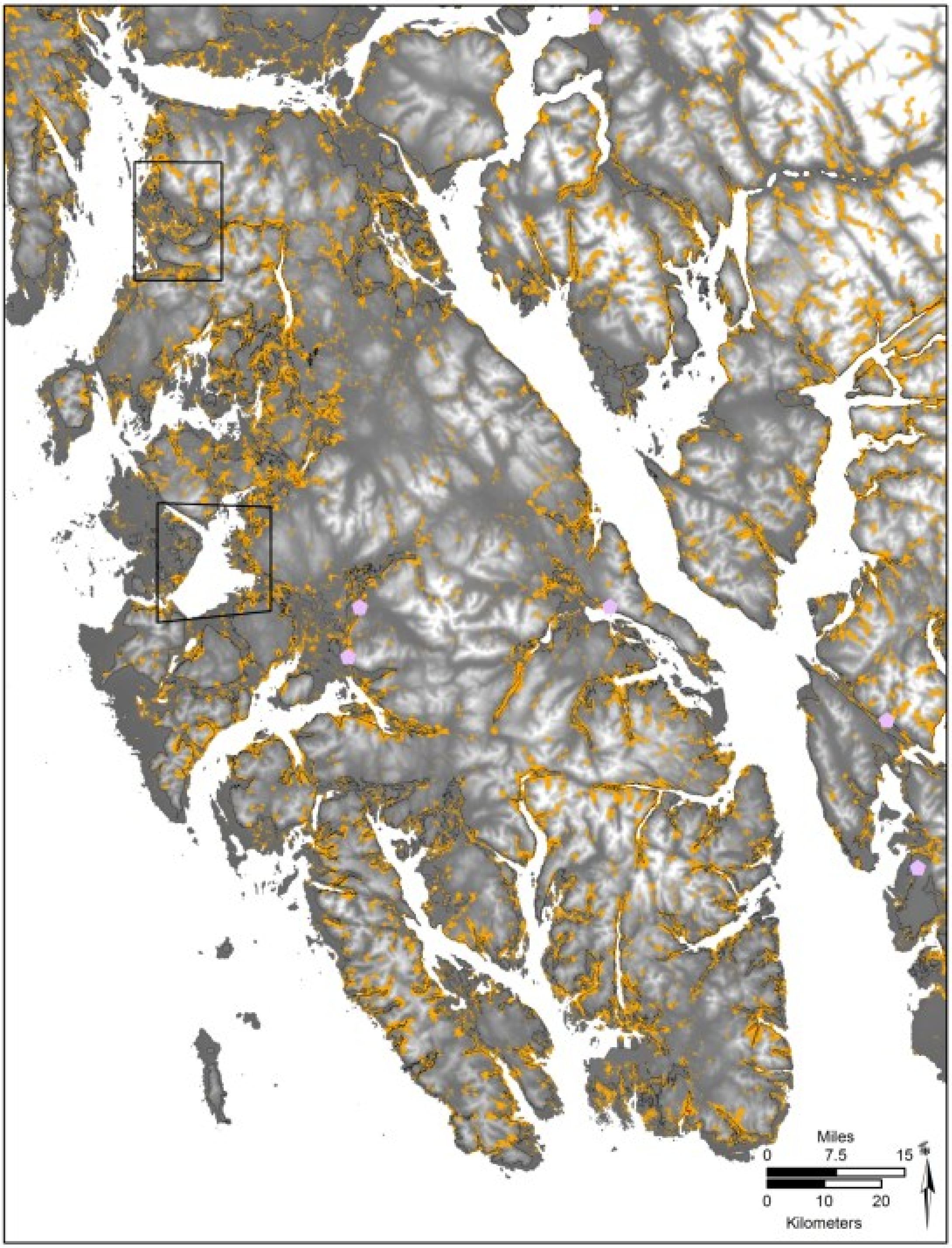



Weight 8
12,000 cal BP
Miles
0 7.5 15
0 10 20
Kilometers

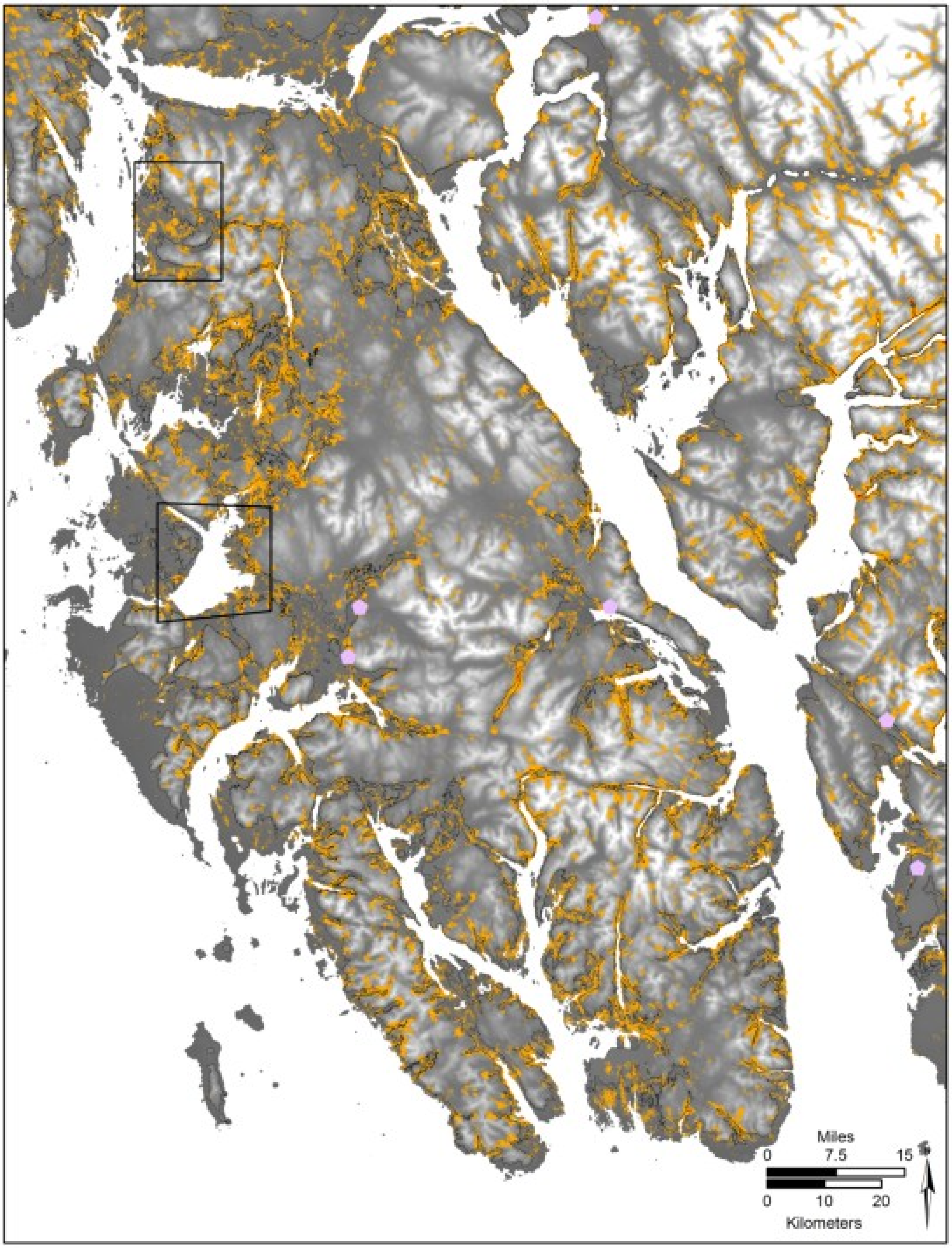
Weight 8 **12,500 cal BP**



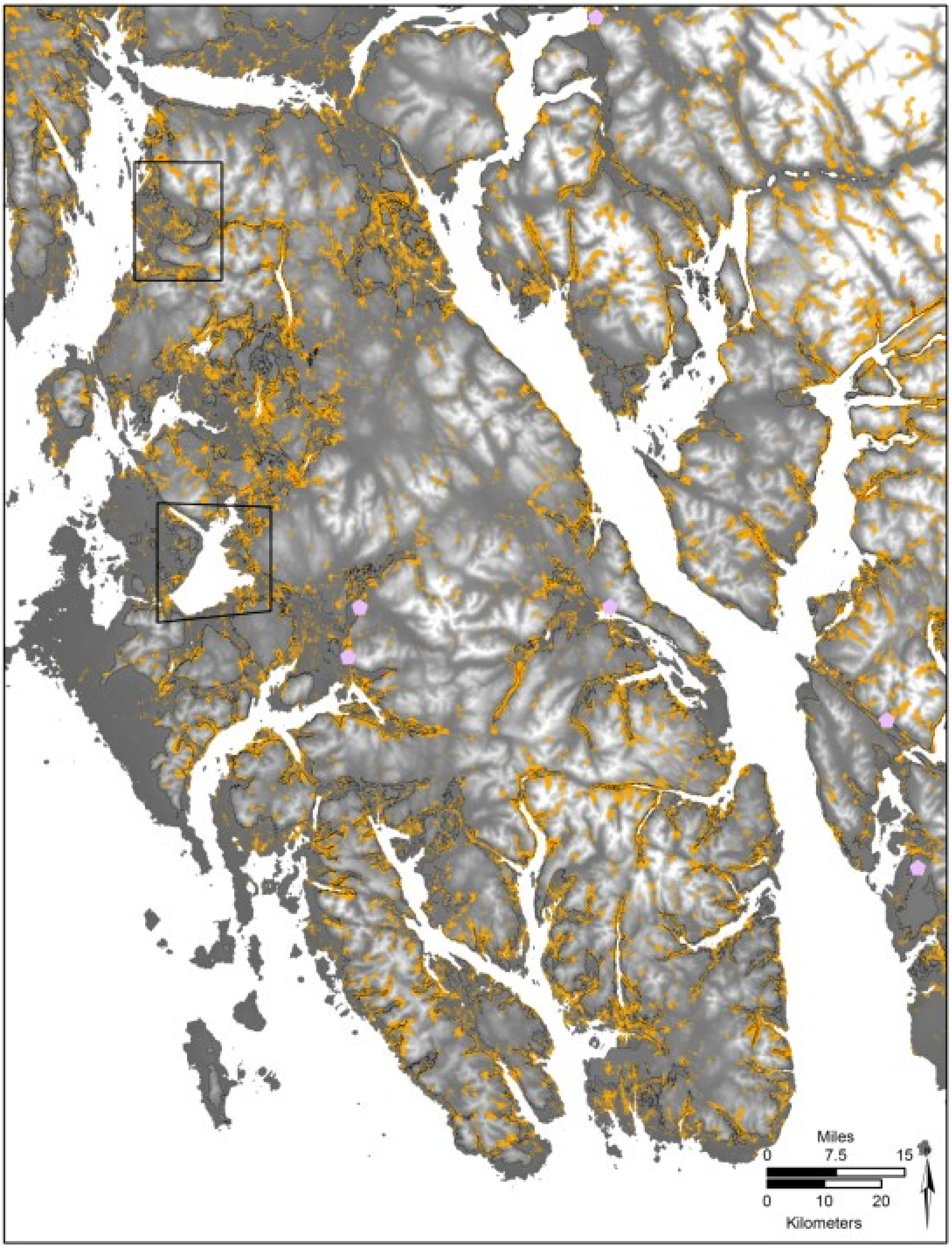
Weight 8 **13,000 cal BP**



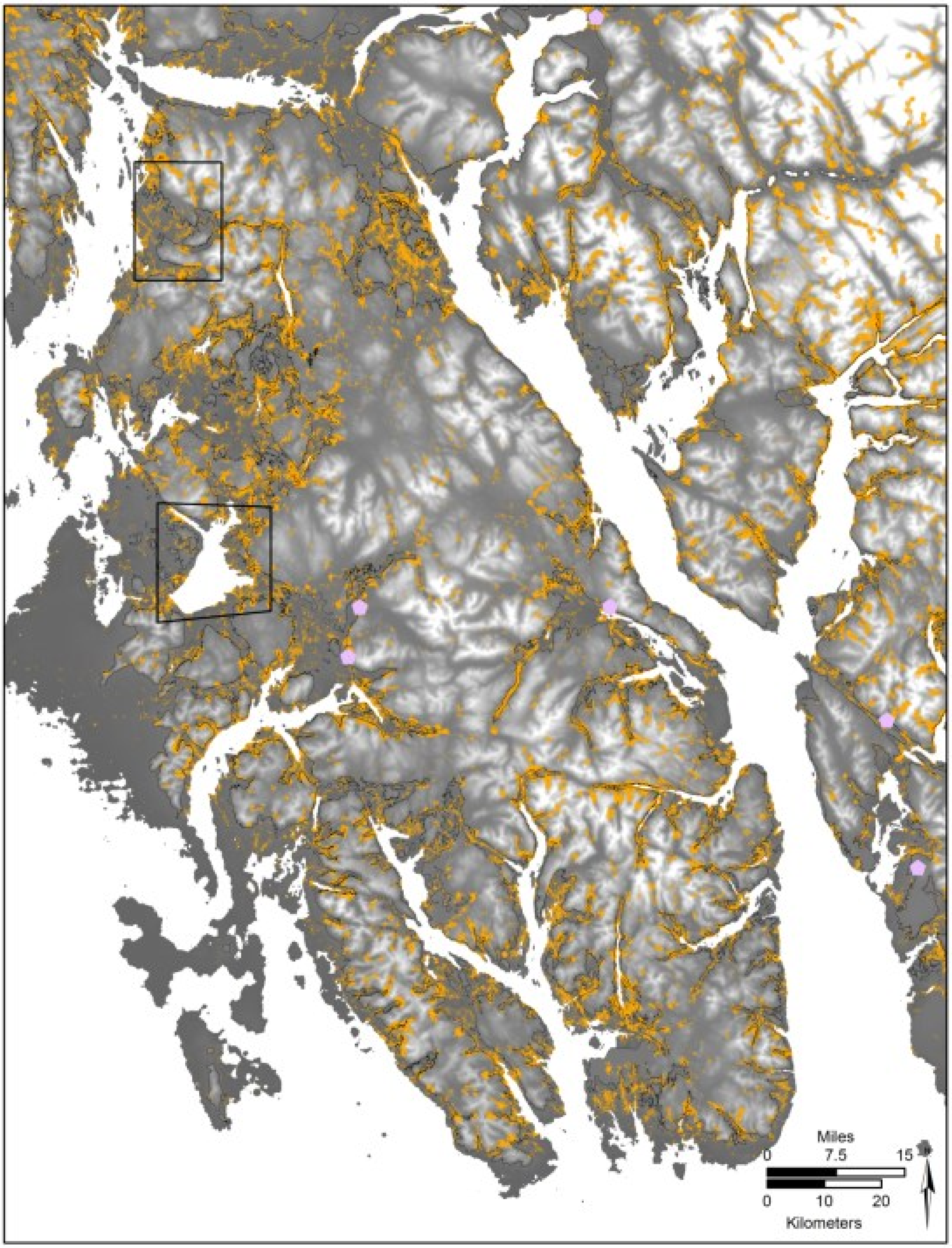
Weight 8 **13,500 cal BP**

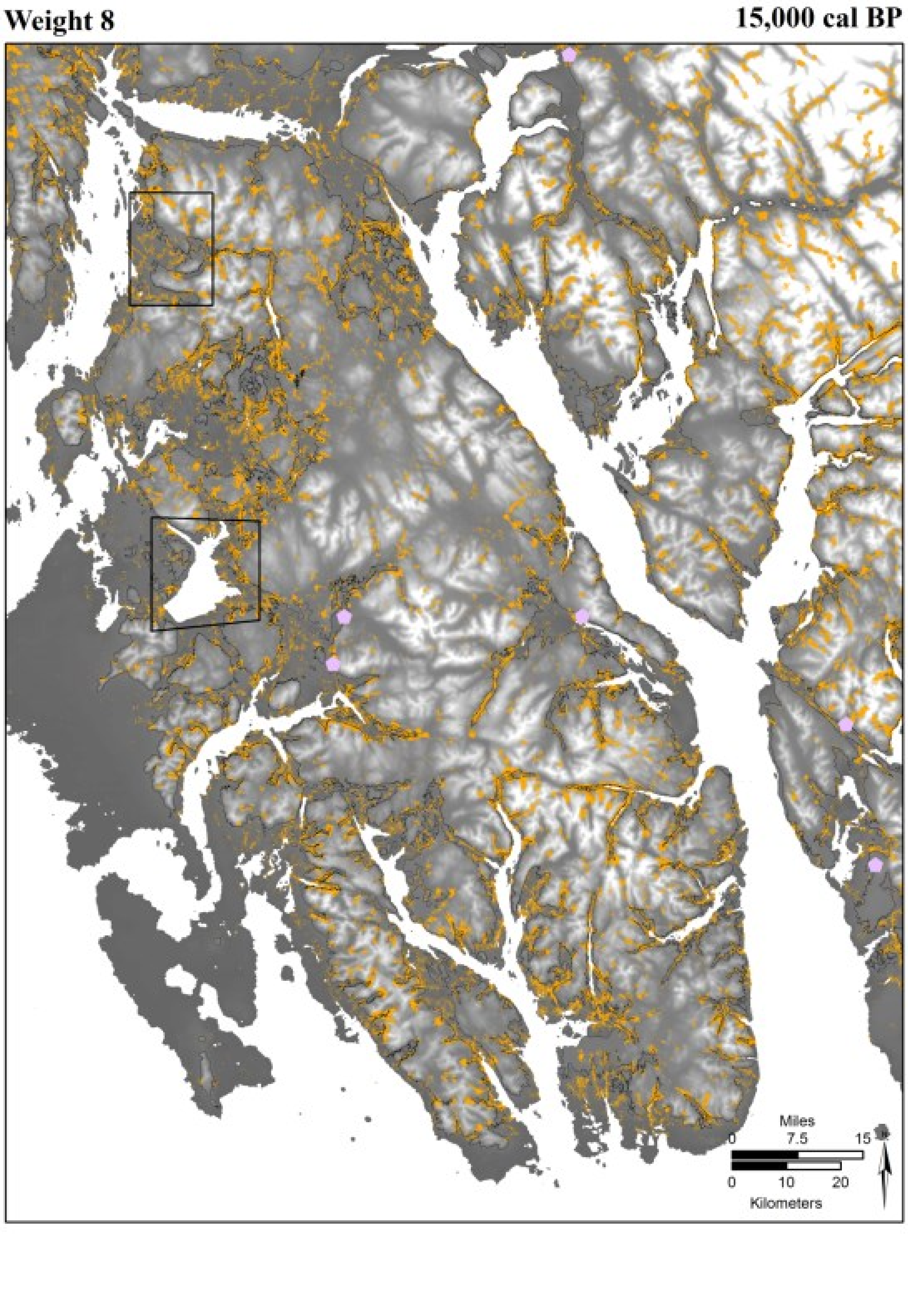


Weight 8 **14,000 cal BP**

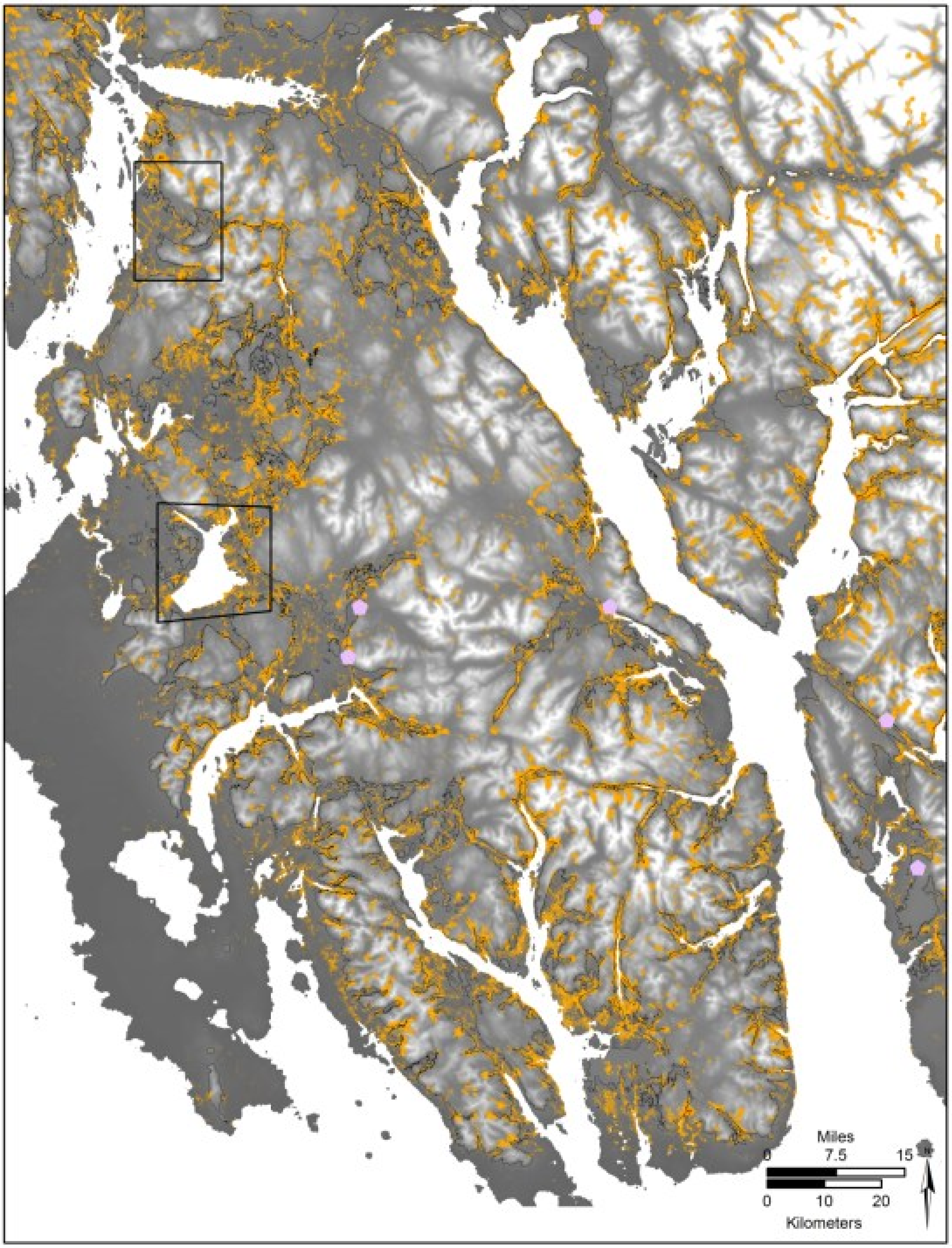


Weight 8 **14,500 cal BP**

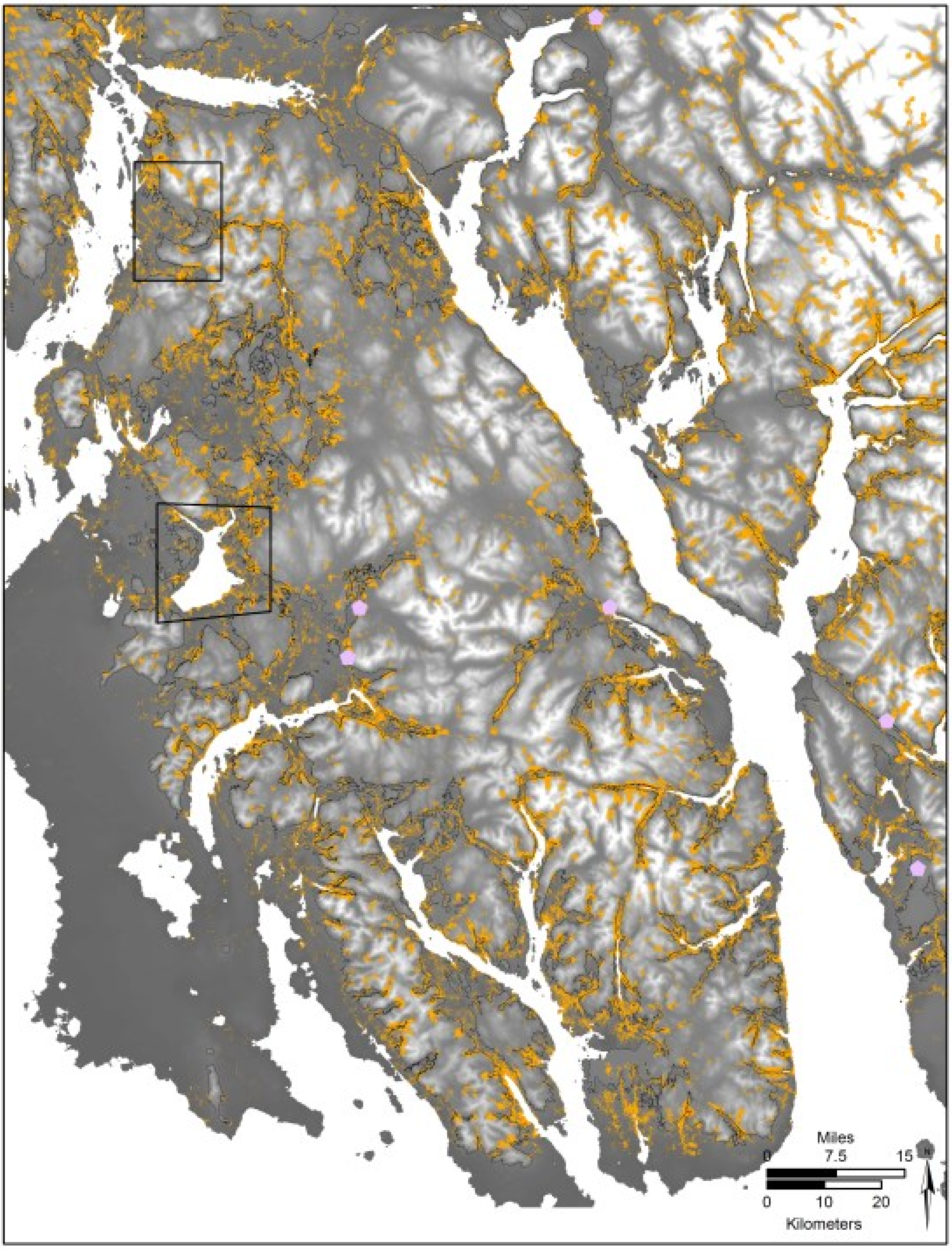



Weight 8
15,000 cal BP
Miles
0
7.5
15
0
10
20
Kilometers

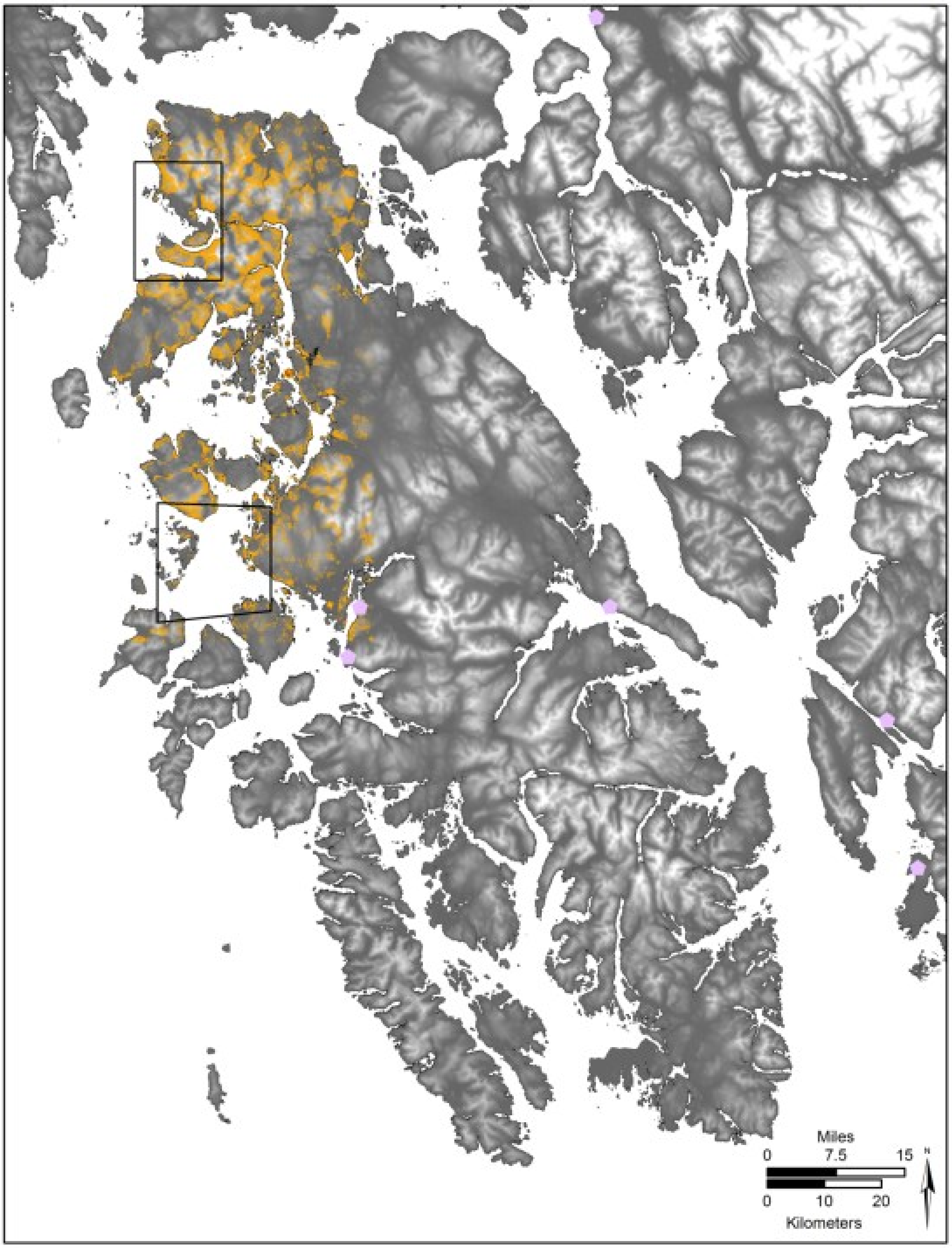
Weight 8 **15,500 cal BP**



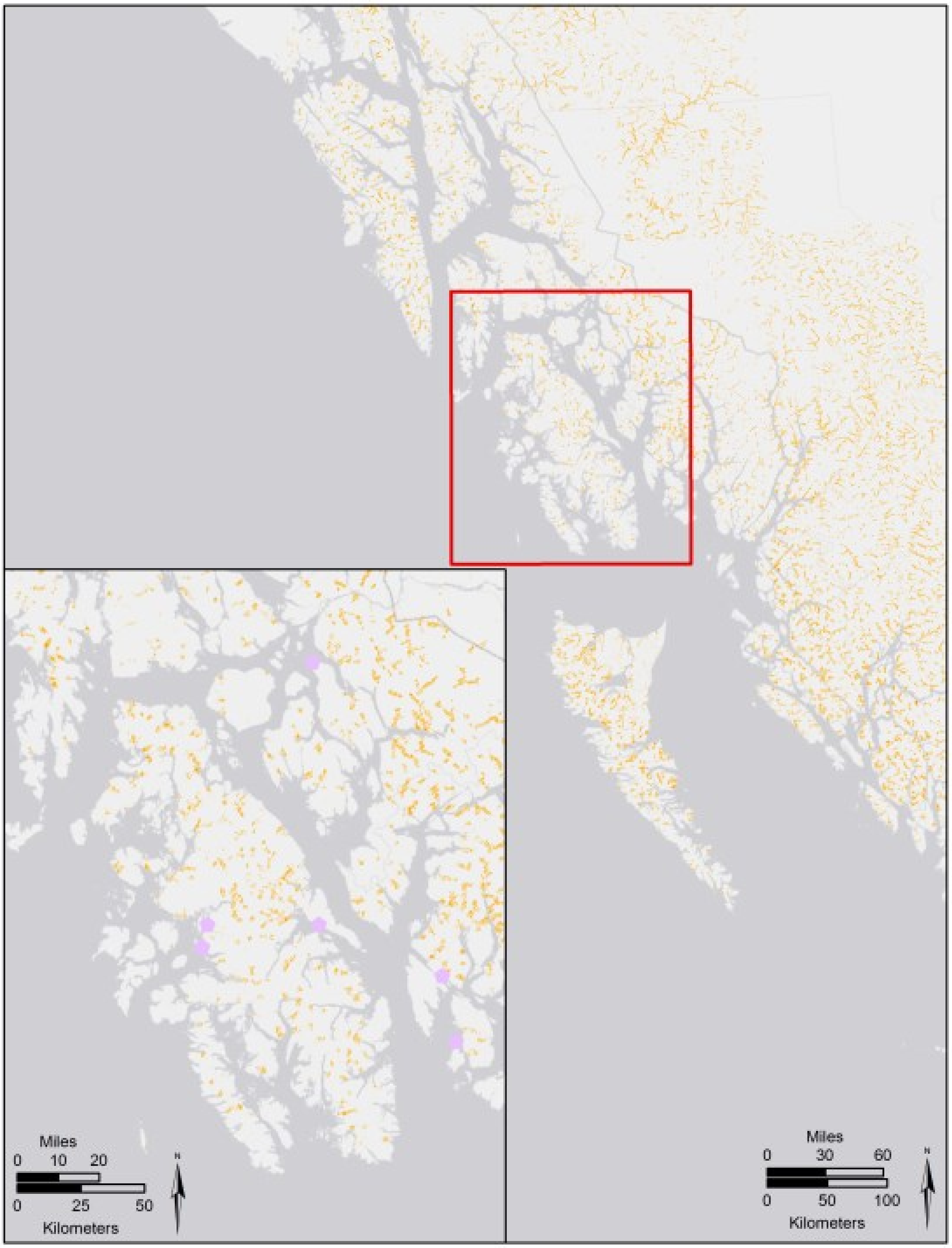
Weight 8 **16,000 cal BP**



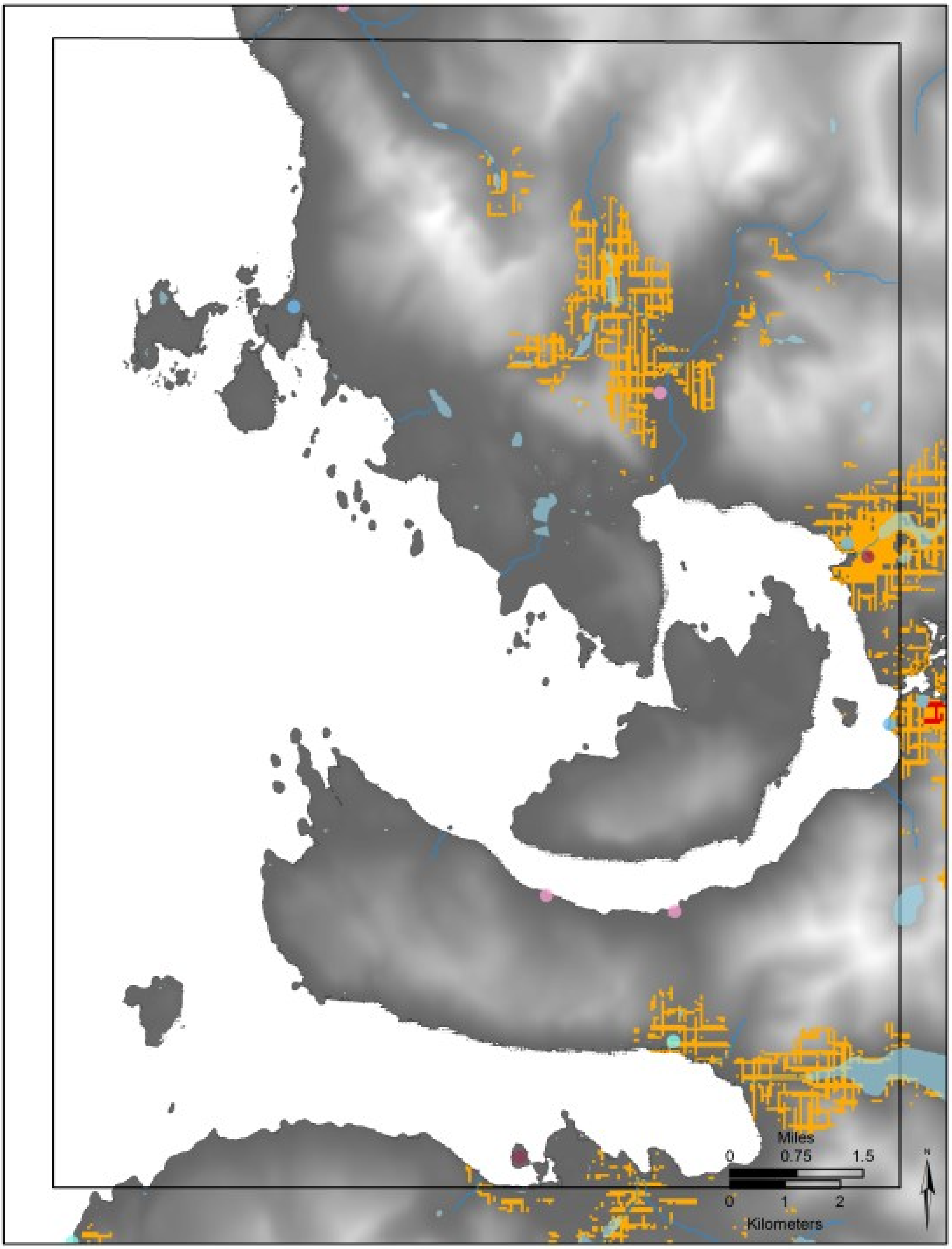
Weight 8 **Modern - Small Area**



Weight 8 **NWC - modern**



Weight 8 **NWC - modern**



Appendix D: Moran's I Statistics

D.1 Moran's I statistical results for weighted overlay 1

		Weight 1					
		250	**500**	**1000**	**1500**	**2000**	**3000**
Y00_0	Moran's Index:	0.799922	0.710138	0.550841	0.460646	0.407630	0.341710
	Expected Index:	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003
	Variance:	0.000001	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	1062.319116	1350.765772	1460.446588	1462.856218	1464.700677	1469.963733
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	1345	205	38	15	7	1
Y10_5	Moran's Index:	0.607653	0.481846	0.362546	0.302489	0.267187	0.224098
	Expected Index:	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003
	Variance:	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
	z-score:	847.722530	969.799755	1016.484379	1006.312285	999.227536	995.502253
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	1185	150	32	15	9	3
Y11_0	Moran's Index:	0.828272	0.749452	0.585110	0.489200	0.430960	0.357995
	Expected Index:	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003
	Variance:	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
	z-score:	1114.453246	1449.176499	1583.120862	1587.441078	1586.338146	1586.924484
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	1402	202	36	16	7	1

		Weight 1					
		250	**500**	**1000**	**1500**	**2000**	**3000**
Y11_5	Moran's Index:	0.636745	0.512670	0.379140	0.316745	0.279066	0.233555
	Expected Index:	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003
	Variance:	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
	z-score:	873.199111	1016.808558	1058.295332	1057.259123	1053.155525	1055.899578
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	1373	190	33	15	8	1
Y12_0	Moran's Index:	0.628076	0.500113	0.363868	0.299973	0.261645	0.215354
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	922.371908	1073.511575	1117.213699	1119.011921	1118.808327	1124.880457
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	1621	212	45	14	5	1
Y12_5	Moran's Index:	0.657688	0.511006	0.363847	0.295830	0.255901	0.209877
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	963.749562	1096.085036	1122.331044	1115.164803	1110.170447	1115.558082
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	1829	210	39	13	4	0
Y13_0	Moran's Index:	0.614578	0.483060	0.344090	0.279677	0.242053	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	943.129063	1091.346532	1122.793188	1116.934733	1114.464751	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	1856	203	38	15	10	

		Weight 1					
		250	**500**	**1000**	**1500**	**2000**	**3000**
Y13_5	Moran's Index:	0.638787	0.498857	0.355438	0.290061	0.252434	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	977.071987	1124.055564	1155.205184	1152.628083	1155.193206	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	1872	226	48	17	9	
Y14_0	Moran's Index:	0.649695	0.511803	0.365588	0.297423	0.257746	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	983.437756	1139.702688	1175.007253	1169.677243	1168.430454	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	1917	222	50	19	10	
Y14_5	Moran's Index:	0.630563	0.487186	0.345340	0.281400	0.243682	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	935.213833	1063.550182	1086.815912	1082.292999	1079.805094	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	1991	258	54	24	14	
Y15_0	Moran's Index:	0.657636	0.495942	0.352674	0.290097	0.252933	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	886.541377	978.373904	987.772599	979.347398	975.165313	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	1885	240	57	26	16	

		Weight 1					
		250	500	1000	1500	2000	3000
Y15_5	Moran's Index:	0.661980	0.527953	0.383105	0.312905	0.270936	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	993.708814	1166.690562	1222.004560	1223.334246	1224.124388	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2223	276	55	22	13	
Y16_0	Moran's Index:	0.626042	0.468989	0.330599	0.269627	0.233452	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	907.490039	999.456841	1013.421111	1007.170205	1002.661008	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2219	292	69	32	17	
Small Area	Moran's Index:	0.643148	0.493641	0.328225	0.247465		
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002		
	Variance:	0.000000	0.000000	0.000000	0.000000		
	z-score:	2008.879112	2488.338831	2698.362402	2728.973373		
	p-value:	0.000000	0.000000	0.000000	0.000000		
	no neighbors	144	17	1	0		
NWC	Moran's Index:	too small for study area	too small for study area	0.592801	0.494434	0.437942	0.371621
	Expected Index:			-0.000003	-0.000003	-0.000003	-0.000003
	Variance:			0.000001	0.000001	0.000001	0.000001
	z-score:			724.664212	732.936443	735.737858	740.032505
	p-value:			0.000000	0.000000	0.000000	0.000000
	no neighbors			761	321	186	69

D.2 Moran's I statistical results for weighted overlay 4

		Weight 4					
		250	**500**	**1000**	**1500**	**2000**	**3000**
Y00_0	Moran's Index:	0.588374	0.505967	0.409463	0.340396		
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001		
	Variance:	0.000000	0.000000	0.000000	0.000000		
	z-score:	1670.240386	2192.077862	2723.290035	2951.745138		
	p-value:	0.000000	0.000000	0.000000	0.000000		
	no neighbors	3263	231	3	1		
Y10_5	Moran's Index:	0.644725	0.551936	0.439522	0.360954		
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001		
	Variance:	0.000000	0.000000	0.000000	0.000000		
	z-score:	1846.645416	2430.082802	3004.032373	3226.221446		
	p-value:	0.000000	0.000000	0.000000	0.000000		
	no neighbors	3087	239	11	5		
Y11_0	Moran's Index:	0.550064	0.473331	0.384282	0.322128		
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001		
	Variance:	0.000000	0.000000	0.000000	0.000000		
	z-score:	1614.058918	2127.388197	2659.839529	2912.270757		
	p-value:	0.000000	0.000000	0.000000	0.000000		
	no neighbors	3275	250	8	3		

		Weight 4					
		250	500	1000	1500	2000	3000
Y11_5	Moran's Index:	0.579264	0.494894	0.396258			
	Expected Index:	-0.000001	-0.000001	-0.000001			
	Variance:	0.000000	0.000000	0.000000			
	z-score:	1765.481420	2331.408141	2920.602606			
	p-value:	0.000000	0.000000	0.000000			
	no neighbors	3224	227	9			
Y12_0	Moran's Index:	0.545087	0.463115	0.370213			
	Expected Index:	-0.000001	-0.000001	-0.000001			
	Variance:	0.000000	0.000000	0.000000			
	z-score:	1749.700289	2317.807274	2925.662175			
	p-value:	0.000000	0.000000	0.000000			
	no neighbors	3293	255	12			
Y12_5	Moran's Index:	0.513663	0.434500	0.350262			
	Expected Index:	-0.000001	-0.000001	-0.000001			
	Variance:	0.000000	0.000000	0.000000			
	z-score:	1578.955736	2083.446135	2647.638434			
	p-value:	0.000000	0.000000	0.000000			
	no neighbors	3817	291	19			
Y13_0	Moran's Index:	0.524668	0.447420				
	Expected Index:	-0.000001	-0.000001				
	Variance:	0.000000	0.000000				
	z-score:	1745.803984	2333.945527				
	p-value:	0.000000	0.000000				
	no neighbors	3488	256				

		Weight 4					
		250	500	1000	1500	2000	3000
Y13_5	Moran's Index:	0.523310	0.445946				
	Expected Index:	-0.000001	-0.000001				
	Variance:	0.000000	0.000000				
	z-score:	1755.539595	2348.095110				
	p-value:	0.000000	0.000000				
	no neighbors	3526	256				
Y14_0	Moran's Index:	0.520573	0.444396				
	Expected Index:	-0.000001	-0.000001				
	Variance:	0.000000	0.000000				
	z-score:	1750.432454	2346.337789				
	p-value:	0.000000	0.000000				
	no neighbors	3663	260				
Y14_5	Moran's Index:						
	Expected Index:						
	Variance:						
	z-score:						
	p-value:						
	no neighbors						
Y15_0	Moran's Index:						
	Expected Index:						
	Variance:						
	z-score:						
	p-value:						
	no neighbors						

		Weight 4					
		250	500	1000	1500	2000	3000
Y15_5	Moran's Index:						
	Expected Index:						
	Variance:						
	z-score:						
	p-value:						
	no neighbors						
Y16_0	Moran's Index:						
	Expected Index:						
	Variance:						
	z-score:						
	p-value:						
	no neighbors						
Small Area	Moran's Index:	0.561781	0.463464	0.364976			
	Expected Index:	-0.000001	-0.000001	-0.000001			
	Variance:	0.000000	0.000000	0.000000			
	z-score:	2465.9177890	3419.1827120	4554.4255660			
	p-value:	0.000000	0.000000	0.000000			
	no neighbors	92	4	1			
NWC	Moran's Index:	too small for study area	too small for study area	0.626953	0.500362	0.410033	0.305128
	Expected Index:			-0.000001	-0.000001	-0.000001	-0.000001
	Variance:			0.000000	0.000000	0.000000	0.000000
	z-score:			1515.095619	1605.260414	1616.389502	1611.111768
	p-value:			0.000000	0.000000	0.000000	0.000000
	no neighbors			1185	265	112	35

D.3 Moran's I statistical results for weighted overlay 7

		Weight 7					
		250	**500**	**1000**	**1500**	**2000**	**3000**
Y00_0	Moran's Index:	0.688485	0.606927	0.473349	0.382233		
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001		
	Variance:	0.000000	0.000000	0.000000	0.000000		
	z-score:	1511.473574	1962.258024	2273.448290	2351.457663		
	p-value:	0.000000	0.000000	0.000000	0.000000		
	no neighbors	3183	271	23	12		
Y10_5	Moran's Index:	0.713707	0.609686	0.452379	0.354952	0.295192	0.226121
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	1550.139915	1961.137204	2182.920637	2198.221498	2194.691155	2198.461875
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	2756	234	11	3	2	0
Y11_0	Moran's Index:	0.694903	0.615122	0.488146	0.397261		
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001		
	Variance:	0.000000	0.000000	0.000000	0.000000		
	z-score:	1554.369334	2030.151926	2398.301911	2504.227827		
	p-value:	0.000000	0.000000	0.000000	0.000000		
	no neighbors	3204	255	20	3		

		Weight 7					
		250	500	1000	1500	2000	3000
Y11_5	Moran's Index:	0.724483	0.613372	0.463956	0.369972	0.309686	
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	1648.304042	2076.156775	2370.671291	2439.977700	2464.931530	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	3030	234	13	1	0	
Y12_0	Moran's Index:	0.677623	0.574924	0.437808	0.351491	0.295345	
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	1604.343675	2038.722688	2367.328377	2469.708015	2517.678437	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	3345	240	15	4	2	
Y12_5	Moran's Index:	0.682731	0.577425	0.439363	0.352749	0.297478	
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	1538.726901	1940.069194	2238.038703	2333.535440	2389.894201	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	3908	282	17	2	0	
Y13_0	Moran's Index:	0.639862	0.532535	0.395405			
	Expected Index:	-0.000001	-0.000001	-0.000001			
	Variance:	0.000000	0.000000	0.000000			
	z-score:	1572.970523	1968.766761	2242.515075			
	p-value:	0.000000	0.000000	0.000000			
	no neighbors	3682	255				

		Weight 7					
		250	500	1000	1500	2000	3000
Y13_5	Moran's Index:	0.631506	0.526324	0.394801	0.314083	0.262863	
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	1562.494728	1960.530101	2259.970175	2350.126855	2397.514186	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	3764	253	22	5	1	
Y14_0	Moran's Index:	0.616834	0.507449	0.376813	0.299029	0.250327	
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	1530.129998	1895.231773	2164.743355	2247.014341	2293.969309	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	3922	254	17	2	1	
Y14_5	Moran's Index:	0.612898	0.502042	0.369394	0.291623	0.243330	
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	1525.150500	1882.065057	2132.298303	2202.915086	2241.944054	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	4145	287	19	5	4	
Y15_0	Moran's Index:	0.630485	0.504309	0.360457	0.280779	0.232557	
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	1569.764850	1896.646596	2092.589202	2135.017964	2157.867163	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	4160	319	26	5	3	

		Weight 7					
		250	500	1000	1500	2000	3000
Y15_5	Moran's Index:	0.637012	0.523284	0.381967	0.300152	0.249232	
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	1593.319905	1973.619747	2222.013600	2289.856457	2323.847692	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	4539	360	32	4	3	
Y16_0	Moran's Index:	0.597776	0.483704	0.351826	0.276096	0.228839	
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	1514.276611	1851.017482	2080.770792	2141.227500	2168.163377	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	4545	379	32	12	8	
Small Area	Moran's Index:	0.539839	0.425713	0.311615	0.247858		
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002		
	Variance:	0.000000	0.000000	0.000000	0.000000		
	z-score:	1863.410890	2385.556368	2907.701846	3051.547996		
	p-value:	0.000000	0.000000	0.000000	0.000000		
	no neighbors	187	10	0	0		
NWC	Moran's Index:	too small for study area	too small for study area	0.479033	0.377512	0.314445	0.243515
	Expected Index:			-0.000001	-0.000001	-0.000001	-0.000001
	Variance:			0.000000	0.000000	0.000000	0.000000
	z-score:			1198.567053	1246.934722	1262.969951	1282.209188
	p-value:			0.000000	0.000000	0.000000	0.000000
	no neighbors			1195	186	84	34

D.4 Moran's I statistical results for weighted overlay 8

		Weight 8					
		250	**500**	**1000**	**1500**	**2000**	**3000**
Y00_0	Moran's Index:	0.818106	0.730169	0.587001	0.498113	0.438805	0.362278
	Expected Index:	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003
	Variance:	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
	z-score:	1040.760916	1315.206433	1458.460503	1480.737921	1481.564403	1474.812907
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	2014	193	25	9	3	2
Y10_5	Moran's Index:	0.733922	0.648605	0.502842	0.419804	0.371121	0.312221
	Expected Index:	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003
	Variance:	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
	z-score:	870.939043	1105.541548	1195.291939	1187.864178	1180.418647	1178.637245
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	1506	179	33	15	6	2
Y11_0	Moran's Index:	0.742288	0.659308	0.542125	0.462736	0.409625	0.340383
	Expected Index:	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003
	Variance:	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
	z-score:	968.228810	1222.148692	1390.054495	1424.382967	1435.653997	1447.151749
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	2150	189	23	4	3	2
Y11_5	Moran's Index:	0.680467	0.550002	0.414312	0.344482	0.301841	0.249670
	Expected Index:	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003	-0.000003
	Variance:	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
	z-score:	907.144208	1053.938211	1115.886806	1120.121245	1120.390151	1126.434118
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	1925	163	20	10	4	2

		Weight 8					
		250	**500**	**1000**	**1500**	**2000**	**3000**
Y12_0	Moran's Index:	0.668636	0.549446	0.413450	0.340492	0.296600	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	961.828908	1149.008877	1239.183340	1253.599306	1263.521708	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2317	192	23	8	5	
Y12_5	Moran's Index:	0.659785	0.522660	0.382458	0.312143	0.269608	0.216912
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	909.899123	1044.950043	1100.763364	1110.776327	1117.338758	1122.101476
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	2739	226	25	8	1	0
Y13_0	Moran's Index:	0.630409	0.505819	0.371728	0.301790	0.260415	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	961.591421	1130.612820	1207.911629	1217.810628	1226.922023	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2656	199	17	7	2	
Y13_5	Moran's Index:	0.629983	0.501996	0.366861	0.298465	0.257210	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	970.121405	1134.919476	1209.043688	1223.168941	1232.009293	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2761	210	31	12	3	

		Weight 8					
		250	500	1000	1500	2000	3000
Y14_0	Moran's Index:	0.600764	0.478083	0.345392	0.279779	0.240143	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	931.709149	1088.741817	1147.453770	1156.296720	1160.349085	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2764	222	25	11	5	
Y14_5	Moran's Index:	0.614003	0.477480	0.343356	0.276109	0.236867	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	952.241184	1089.721334	1145.124768	1146.765602	1150.656237	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2782	218	23	5	2	
Y15_0	Moran's Index:	0.540919	0.386281	0.262517	0.209025	0.177942	0.141673
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	832.099836	878.932070	874.548219	865.369841	859.631378	858.379118
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	2357	190	29	14	7	1
Y15_5	Moran's Index:	0.596976	0.473856	0.346652	0.279655	0.239036	
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	
	z-score:	939.049894	1102.239070	1184.935378	1195.216419	1198.728763	
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	
	no neighbors	2992	253	32	16	9	

		Weight 8					
		250	500	1000	1500	2000	3000
Y16_0	Moran's Index:	0.562400	0.422667	0.300526	0.242034	0.205834	0.162127
	Expected Index:	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002	-0.000002
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	887.053348	985.164629	1030.013304	1036.971714	1034.561242	1029.697119
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	2867	218	37	17	10	2
Deep	Moran's Index:	0.762542	0.655531	0.505108	0.407540	0.345512	0.270985
	Expected Index:	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	1272.3613350	1615.2846960	1849.2963840	1897.4340260	1917.9429820	1949.0280990
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	4087	286	27	8	3	1
Small Area	Moran's Index:	0.552503	0.402185	0.288936	0.230005	0.195688	0.154757
	Expected Index:	-0.000004	-0.000004	-0.000004	-0.000004	-0.000004	-0.000004
	Variance:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	z-score:	1152.4099370	1292.8717750	1397.9342450	1397.8431490	1378.5467090	1391.0499270
	p-value:	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	no neighbors	177	27	3	0	0	
NWC	Moran's Index:	too small for study area	too small for study area	0.627539	0.510169	0.443053	0.367534
	Expected Index:			-0.000003	-0.000003	-0.000003	-0.000003
	Variance:			0.000001	0.000001	0.000001	0.000001
	z-score:			868.345945	873.020919	871.802103	874.800708
	p-value:			0.000000	0.000000	0.000000	0.000000
	no neighbors			761	239	132	46

Appendix E: Kvamme's Gain

E.1 Kvamme's Gain for modern coastline

	POWI 2012				Arch sites				Random				moderately high		
Model	**3**	**4**	**Total Sites**	**% sites**	**3**	**4**	**Total sites**	**% sites**	**3**	**4**	**Total Sites**	**% sites**	**# cells**	**Area of model**	**% area**
y00_0 W1	4	0	9	44%	680	54	923	80%	29	1	863	3%	1387324802	1387327570	3%
y00_0 W1a	4	0	9	44%	581	28	923	66%	124	1	863	14%	6090773731	1795818174	12%
y00_0 W2	4	0	9	44%	477	16	923	53%	156	2	863	18%	7072278659	1517642322	14%
y00_0 W2a	4	0	9	44%	601	34	923	69%	123	2	863	14%	5664239774	1369283404	11%
y00_0 W3	6	0	9	67%	524	63	923	64%	223	20	863	28%	10398486634	1808571998	21%
y00_0 W3a	6	0	9	67%	604	71	923	73%	186	7	863	22%	8715406615	125488768	18%
y00_0 W4	5	0	9	56%	465	44	923	55%	247	21	863	31%	11417712690	1467167298	23%
y00_0 W4a	5	0	9	56%	571	51	923	67%	205	5	863	24%	9334120815	744204148	19%
y00_0 W5	6	0	9	67%	529	40	923	62%	11	2	863	2%	4944727447	649769704	10%
y00_0 W5a	6	0	9	67%	579	48	923	68%	92	1	863	11%	3835657772	459302086	8%
y00_0 W6	5	0	9	56%	662	##	923	98%	18	1	863	2%	1157095881	1157098210	2%
y00_0 W7	4	0	9	44%	643	71	923	77%	127	1	863	15%	6025695115	1730739434	12%
y00_0 W8	4	0	9	44%	702	47	923	81%	47	1	863	6%	2075083390	2075087470	4%
Weight 8 all	2	0	9	22%	315	4	1077	30%	39	0	935	4%	5786404741	1491448604	12%

Model	High			Very High			all high		
	# cells	Area of model	% area	# cells	Area of model	% area	# cells	Area of model	% area
y00_0 W1	6432967.066	6432980	0.10%	0	0	0.00%	1393757769	1393760550	22%
y00_0 W1a	16252077.33	16252110	0.26%	0	0	0.00%	6107025808	1812070284	29%
y00_0 W2	51821375.78	51821480	1.02%	10223349230	1633434260	32.14%	17347449265	3202898062	63%
y00_0 W2a	26508826.7	26508880	0.49%	10223349230	1633434260	29.91%	15914097832	3029226544	55%
y00_0 W3	724203608.4	724205070	11.21%	5999.987937	6000	0.00%	11122696243	2532783068	39%
y00_0 W3a	193909350.8	193909740	7.70%	10223349230	1633434260	64.82%	19132665196	1952832768	77%
y00_0 W4	621353436.8	621354690	12.47%	10599.97869	10600	0.00%	12039076727	2088532588	42%
y00_0 W4a	125701757.2	125702010	2.51%	0	0	0.00%	9459822572	869906158	17%
y00_0 W5	82177424.71	82177590	1.18%	0	0	0.00%	5026904871	731947294	10%
y00_0 W5a	24809330.12	24809380	0.45%	0	0	0.00%	3860467102	484111466	9%
y00_0 W6	26981075.75	26981130	0.67%	0	0	0.00%	1184076957	1184079340	30%
y00_0 W7	23694822.36	23694870	0.37%	0	0	0.00%	6049389937	1754434304	28%
y00_0 W8	8327263.257	8327280	0.13%	0	0	0.00%	2083410653	2083414750	32%
Weight 8 all	28890641.9	28890700	0.44%	0	0	0.00%	5815295383	1520339304	23%

	Total		Known Sites Gain			Random Gain			2012 Survey Gain		
Model	**# cells**	**Area of model**	**3**	**4**	**3+4**	**32**	**43**	**3+44**	**35**	**46**	**3+47**
y00_0 W1	49292171031	6342593012	0.9618	0.9978	0.9644	0.1624	0.8874	0.1866	0.9367	-	0.9364
y00_0 W1a	49292171343	6191222360	0.8037	0.9891	0.8122	0.1400	0.7155	0.1446	0.7220	-	0.7212
y00_0 W2	49292171339	5082910360	0.7224	0.9394	0.3411	0.2063	0.5464	-0.9223	0.6772	-	0.2082
y00_0 W2a	49292171342	5461282520	0.8235	0.9854	0.5307	0.1938	0.7679	-1.2290	0.7414	-	0.2736
y00_0 W3	49292171264	6458304908	0.6284	0.7847	0.6452	0.1836	0.3660	0.1986	0.6836	-	0.6615
y00_0 W3a	49292171325	2519892328	0.7298	0.9489	0.4692	0.1796	0.5150	-0.7356	0.7348	-	0.4178
y00_0 W4	49292171277	4981960312	0.5402	0.7356	0.5571	0.1907	0.4820	0.2135	0.5831	-	0.5604
y00_0 W4a	49292171331	5008839532	0.6939	0.9538	0.7152	0.2028	0.5598	0.2113	0.6591	-	0.6546
y00_0 W5	49292171336	6978104688	0.8250	0.9615	0.8346	-6.8701	0.2806	-5.7700	0.8495	-	0.8470
y00_0 W5a	49292171342	5563828860	0.8760	0.9903	0.8847	0.2701	0.5656	0.2732	0.8833	-	0.8825
y00_0 W6	49292170944	4004102556	0.9673	0.9979	0.9755	-0.1255	0.5276	-0.0911	0.9577	-	0.9568
y00_0 W7	49292171342	6342593012	0.8245	0.9938	0.8414	0.1693	0.5852	0.1726	0.7249	-	0.7239
y00_0 W8	49292170343	6435129716	0.9446	0.9967	0.9479	0.2270	0.8542	0.2401	0.9053	-	0.9049
Weight 8 all	49292156101	6594784596	0.5986	0.8422	0.6017	-1.8143	-	-1.8284	0.4717	-	0.4691

E.2 Kvamme's Gain for small area

	POWI 2012				Arch sites				Random				Moderately high		
Model	**3**	**4**	**Total Sites**	**% sites**	**3**	**4**	**Total sites**	**% sites**	**3**	**4**	**Total Sites**	**% sites**	**# cells**	**Area of model**	**% area**
sm_demW1	6	0	9	67%	114	40	157	98%	19	1	52	38%	887160708.1	887162500	2%
sm_demW1a	4	0	6	67%	107	7	157	73%	27	0	52	52%	1298033802	1298036400	3%
sm_demW2	3	0	6	50%	89	6	157	61%	32	0	52	62%	1562031199	1562034300	3%
sm_demW2a	4	0	6	67%	107	7	157	73%	28	0	52	54%	1483158749	1483161700	3%
sm_demW3	5	0	6	83%	108	11	157	76%	39	4	52	83%	1784475774	1784479300	4%
sm_demW3a	6	0	6	100%	113	18	157	83%	38	1	52	75%	1805707234	1805710800	4%
sm_demW4	3	0	6	50%	88	12	157	64%	29	2	52	60%	1381644543	1381647300	3%
sm_demW4a	3	0	6	50%	96	14	157	70%	29	0	52	56%	1373291059	1373293800	3%
sm_demW5	3	0	6	50%	85	0	157	54%	28	0	52	54%	1547786026	1547789100	3%
sm_demW5a	3	0	6	50%	92	0	157	59%	21	0	52	40%	1172011643	1172014000	2%
sm_demW6	4	0	6	67%	114	43	157	100%	8	0	52	15%	472186649.1	472187600	1%
sm_demW7	5	0	6	83%	113	24	157	87%	30	0	52	58%	1415168579	1415171400	3%
sm_demW8	3	0	9	33%	109	3	333	34%	11	0	98	11%	444645904.9	444646800	1%

	High			Very High			all high		
Model	# cells	Area of model	% area	# cells	Area of model	% area	# cells	Area of model	% area
y00_0 W1	5148989.647	5149000	0.18%	0	0	0.00%	892309697.8	892311500	32%
y00_0 W1a	4639090.673	4639100	0.17%	0	0	0.00%	1302672893	1302675500	47%
y00_0 W2	19433060.93	19433100	0.70%	0	0	0.00%	1581464260	1581467400	57%
y00_0 W2a	7888784.138	7888800	0.28%	0	0	0.00%	11714396764	3124484760	112%
y00_0 W3	295548907.1	295549500	10.59%	0	0	0.00%	12303373912	3713463060	133%
y00_0 W3a	131191436.1	1805710800	64.70%	0	0	0.00%	1936904670	3611427600	129%
y00_0 W4	168504161.6	168504500	6.04%	0	0	0.00%	11773497935	3183586060	114%
y00_0 W4a	42238515.05	42238600	1.51%	0	0	0.00%	1415540174	1415543000	51%
y00_0 W5	22819754.12	22819800	0.82%	0	0	0.00%	1570605780	1570608900	56%
y00_0 W5a	2188795.599	2188800	0.08%	0	0	0.00%	1174200438	1174202800	42%
y00_0 W6	5666288.607	5666300	0.20%	0	0	0.00%	477852937.7	477853900	17%
y00_0 W7	11093077.7	11093100	0.40%	0	0	0.00%	1426261656	1426264500	51%
y00_0 W8	329099.3383	329100	0.01%	0	0	0.00%	444975004.3	444975900	9%

	Total		Known Sites Gain			Random Gain			2012 Survey Gain		
Model	**# cells**	**Area of model**	**3**	**4**	**3+4**	**3**	**4**	**3+4**	**3**	**4**	**3+4**
y00_0 W1	49292162706	2790902084	0.9752	0.9996	0.9815	0.9507	0.9946	0.9529	0.9730	-	0.9728
y00_0 W1a	49292162686	2790902084	0.9614	0.9979	0.9636	0.9493	-	0.9491	0.9605	-	0.9604
y00_0 W2	49292162714	2790902084	0.9441	0.9897	0.9470	0.9485	-	0.9479	0.9366	-	0.9358
y00_0 W2a	49292162704	2790902084	0.9559	0.9964	0.6727	0.9441	-	0.5586	0.9549	-	0.6435
y00_0 W3	49292162746	2790902084	0.9474	0.9144	0.6707	0.9517	0.9221	0.6982	0.9566	-	0.7005
y00_0 W3a	49292162744	2790902084	0.9491	0.9768	0.9529	0.9499	0.8616	0.9476	0.9634	-	0.9607
y00_0 W4	49292162695	2790902084	0.9500	0.9553	0.6250	0.9497	0.9111	0.5993	0.9439	-	0.5223
y00_0 W4a	49292162692	2790902084	0.9544	0.9904	0.9590	0.9500	-	0.9485	0.9443	-	0.9426
y00_0 W5	49292162712	2790902084	0.9420	#####	0.9411	0.9417	-	0.9408	0.9372	-	0.9363
y00_0 W5a	49292162686	2790902084	0.9594	#####	0.9593	0.9411	-	0.9410	0.9524	-	0.9524
y00_0 W6	49292162751	2790902084	0.9868	0.9996	0.9903	0.9377	-	0.9370	0.9856	-	0.9855
y00_0 W7	49292162696	2790902084	0.9601	0.9985	0.9668	0.9502	-	0.9498	0.9655	-	0.9653
y00_0 W8	49292158754	5079257508	0.9724	0.9993	0.9732	0.9196	-	0.9196	0.9729	-	0.9729

E.3 Kvamme's Gain for NWC area

	All sites				Arch sites				Random				moderately high		
Model	**3**	**4**	**Total Sites**	**% sites**	**3**	**4**	**Total sites**	**% sites**	**3**	**4**	**Total Sites**	**% sites**	**# cells**	**Area of model**	**% area**
NWC_W1	262	10	907	30%	328	11	1077	31%	233	14	935	26%	812749000	8127490	2%
NWC_W1a	160	3	907	18%	133	4	1077	13%	54	0	935	6%	2523598500	25235985	6%
NWC_W2	51	2	907	6%	64	2	1077	6%	58	0	935	6%	2536876500	25368765	6%
NWC_W2a	89	3	907	10%	130	3	1077	12%	45	0	935	5%	2024628000	20246280	5%
NWC_W3	80	5	907	9%	121	5	1077	12%	86	4	935	10%	3635809500	36358095	9%
NWC_W3a	100	6	907	12%	141	6	1077	14%	66	1	935	7%	2946698500	29466985	7%
NWC_W4	99	6	907	12%	140	6	1077	14%	66	1	935	7%	2946626000	29466260	7%
NWC_W4a	143	3	907	16%	187	3	1077	18%	103	1	935	11%	4701084500	47010845	11%
NWC_W5	64	2	907	7%	97	2	1077	9%	36	1	935	4%	1737491500	17374915	4%
NWC_W5a	83	3	907	9%	121	3	1077	12%	27	0	935	3%	1354245000	13542450	3%
NWC_W6	94	0	907	10%	116	0	1077	11%	0	0	935	0%	64358500	643585	0%
NWC_W7	178	7	907	20%	239	8	1077	23%	54	0	935	6%	2532138000	25321380	6%
NWC_W8	160	3	907	18%	224	3	1077	21%	17	0	935	2%	836866000	8368660	2%

	High			All High			Total	
Model	**# cells**	**Area of model**	**% area**	**# cells**	**Area of model**	**% area**	**# cells**	**Area of model**
NWC_W1	1777500	17775	4.1808E-05	814526500	8145265	0.019158	42516270000	425162700
NWC_W1a	10351500	103515	0.00024347	2533950000	25339500	0.05959954	42516270000	425162700
NWC_W2	29300500	293005	0.00068916	2566177000	25661770	0.06035753	42516270000	425162700
NWC_W2a	14202000	142020	0.00033404	2038830000	20388300	0.04795411	42516270000	425162700
NWC_W3	261053000	2610530	0.00614007	3896862500	38968625	0.09165579	42516270000	425162700
NWC_W3a	118815500	1188155	0.00279459	3065514000	30655140	0.07210214	42516270000	425162700
NWC_W4	118815500	1188155	0.00279459	3065441500	30654415	0.07210043	42516270000	425162700
NWC_W4a	99326000	993260	0.00233619	4800410500	48004105	0.11290761	42516270000	425162700
NWC_W5	28780500	287805	0.00067693	1766272000	17662720	0.04154344	42516270000	425162700
NWC_W5a	6140500	61405	0.00014443	1360385500	13603855	0.03199682	42516270000	425162700
NWC_W6	0	0	0	64358500	643585	0.00151374	42516270000	425162700
NWC_W7	11043000	110430	0.00025974	2543181000	25431810	0.05981665	42516270000	425162700
NWC_W8	1132500	11325	2.6637E-05	837998500	8379985	0.01971007	42516270000	425162700

	Known Sites Gain			random Gain			All sites		
Model	**3**	**4**	**3+4**	**3**	**4**	**3+4**	**3**	**4**	**3+4**
NWC_W1	0.937231	0.995907	0.939135	0.923289	0.997208	0.927479	0.933823	0.996208	0.936117
NWC_W1a	0.519350	0.934445	0.531469	-0.027739	-	-0.031955	0.663525	0.926390	0.668363
NWC_W2	-0.004107	0.628888	0.015075	0.038105	-	0.026995	-0.061161	0.687466	-0.032911
NWC_W2a	0.605486	0.880081	0.611680	0.010561	-	0.003620	0.514703	0.899010	0.527235
NWC_W3	0.238839	-0.322572	0.216561	0.070265	-0.435242	0.047798	0.030466	-0.113809	0.021979
NWC_W3a	0.470608	0.498371	0.471741	0.018143	-1.612941	-0.006201	0.371381	0.577551	0.383051
NWC_W4	0.466840	0.498371	0.468136	0.018167	-1.612941	-0.006178	0.365046	0.577551	0.377190
NWC_W4a	0.363180	0.161309	0.359992	-0.003731	-1.184336	-0.015083	0.298683	0.293692	0.298581
NWC_W5	0.546255	0.635474	0.548058	-0.061394	0.367071	-0.049814	0.420845	0.693013	0.429092
NWC_W5a	0.716487	0.948151	0.722092	-0.103037	-	-0.108038	0.651926	0.956335	0.662545
NWC_W6	0.985946	-	0.985946	-	-	-	0.985394	-	0.985394
NWC_W7	0.731620	0.965033	0.739180	-0.031217	-	-0.035714	0.696527	0.966346	0.706737
NWC_W8	0.905361	0.990437	0.906486	-0.082589	-	-0.084054	0.888420	0.991947	0.890325

Appendix F: Site Location Statistics

F.1 Part 1: Site name, type, time period, materials, landforms, and location statistics

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
DIX-00013	Kaigani District	up to 5250 BP	UNK		unknown	2	108	11	112	500		
DIX-00024	Brown Bear Rock Petroglyph		Rel	petroglyph	surface	24	220	7	188	500	2000	2000
DIX-00038	Little Daykoo Harbor Village	up to 5250 BP	Sub	harvesting	unknown	8	155	7	313	500	500	500
DIX-00008	Cape Chacon		Rel	petroglyph	surface	20	76	4	38	1000	3000	3000
DIX-00041	Nichols Bay Village	up to 5250 BP	HB		unknown	3	206	4	121	500	1000	1000
DIX-00018	No-Name Cove		Rel	petroglyph	surface			7	455	1000	3000	3000
DIX-00006	Datzkoo Island		Rel	oral tradition - mythology	unknown	10	39	23	132	500	3000	3000
DIX-00033	Brownson Bay Saltery		Sub		unknown			7	100	1000	500	500
DIX-00026	Nichols Creek Wooden Weir	up to 5250 BP	Sub	fishing weir - wood	unknown	13	212	8	481	500	1000	2000
DIX-00060	South Kaigani Petroglyph		Rel	petroglyph	surface	0	-1	5	1218	500	1000	1000
DIX-00062	Red Lichen Cave	up to 5250 BP	Sub	faunal remains	unknown	42	284	13	167	500	>3000	>3000
DIX-00063	Soft Shell Cave	up to 5250 BP	Sub	faunal remains	unknown	54	279	13	187	500	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
DIX-00019	Pond Bay		Rel	petroglyph	surface	13	194	5	557	100	500	500
DIX-00017	Koianglas		UNK		unknown	20	244	9	233	500	1000	1000
DIX-00045	Kelp Passage Midden		Sub	midden	ground	4	300	18	1986	100	500	500
DIX-00065	Hessa Inlet Petroglyph		Rel	petroglyph	surface			10	11	100	500	500
DIX-00052	Crow's Roost Midden		MIX	midden, charcoal	mixed	6	135	22	410	500	>3000	>3000
DIX-00051	Peregrine Rocks Midden		MIX	midden, charcoal	mixed	2	180	22	384	100	>3000	>3000
XPR-00079	Gardner Bay Burial	up to 5250 BP	HR		unknown	1	45	4	162	100	3000	3000
DIX-00053	Elderberry Cave		MIX	faunal remains, midden, charcoal	mixed	14	81	22	333	100	>3000	>3000
DIX-00010	Ham Cove (Crow Island Petroglyph)		Rel	petroglyph	surface	5	180	4	722	500	100	500
DIX-00044	Tay Bay Midden		Sub	midden	ground	20	208	4	305	100	2000	2000
DIX-00028	Hunter Bay Midden Site		MIX	shell midden, canoe skid	mixed	10	3	1	49	2000	2000	2000
DIX-00058	Hunter Bay River Site		UNK		unknown	1	270	3	206	500	100	100
DIX-00009	Gooseneck		Rel	petroglyph	surface	3	348	16	50	100	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
	Harbor											
DIX-00003	Klinkwan (Hlanku'aan)	up to 5250 BP	UNK		unknown	4	210	7	203	1000	2000	2000
DIX-00032	Dix-00032		Sub	fishing weir - stone	unknown	6	186	5	435	500	500	500
DIX-00068	Two Stone Fish Traps Or Rock Alignments		Sub	fishing weir - stone	unknown	7	201	31	150	500	1000	1000
DIX-00015	Klakas	up to 5250 BP	MIX	settlement, CMT	mixed	3	296	5	114	100	3000	3000
XPR-00054	Hall Cove Rock Shelter Burial	up to 5250 BP	MIX	midden, burial	mixed	4	270	9	148	100	500	500
DIX-00048	Se Klakas Inlet Midden		Sub	midden	ground	8	189	3	43	2000	2000	2000
DIX-00047	Se Klakas Inlet Petroglyphs		Rel	petroglyph	surface	24	178	3	60	1000	2000	2000
DIX-00046	Kit-N-Kaboodle Cave (Kit'n'kaboodle Cave)	up to 5250 BP	MIX	midden, habitation	cave	31	219	5	136	100	100	500
DIX-00046	Kit-N-Kaboodle Cave (Kit'n'kaboodle Cave)	up to 5250 BP	MIX	midden, habitation	cave	31	219	5	136	100	100	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPR-00052	Hall Cove Shell Midden	up to 5250 BP	Sub	shell midden	ground	3	281	9	87	500	500	500
DIX-00002	Cordova Bay Village	up to 5250 BP	HB		unknown	7	306	4	45	100	3000	>3000
DIX-00043	Vesta Point Village And Petroglyph	up to 5250 BP	MIX	CD, burial, petroglyph	mixed	1	270	9	153	100	3000	3000
XPR-00053	Hall Cove Estuary Weir	up to 5250 BP	Sub	fish weir	unknown	2	0	3	365	100	500	500
DIX-00031	Dix-00031		Rel	petroglyph	surface	2	288	7	43	100	3000	3000
XPR-00073	Sea Otter Child Creek Weir 2		Sub	fish weir	unknown	0	-1	11	399	500	2000	2000
XPR-00072	Sea Otter Child Creek Weir 1		Sub	fish weir	unknown	5	0	11	587	500	2000	2000
XPR-00074	Save Town Weir		Sub	fish weir	unknown	3	258	11	348	500	1000	1000
DIX-00064	Mabel Bay Fish Trap		Sub	fishing weir - stone	unknown	8	18	11	225	500	500	500
XPR-00071	Wolf Creek Weirs		Sub	fish weir	unknown	7	258	7	1337	500	500	500
XPR-00070	Wolf Creek Traps		Sub	fish weir	unknown	3	45	7	991	500	500	500
XPR-00068	Goose Lake Rock Weirs		Sub		unknown	1	315	4	810	500	1000	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPR-00067	Goose Lake Stake Weir	up to 5250 BP	Sub	fish weir	unknown	2	45	9	819	500	2000	2000
DIX-00014	Kassa	up to 5250 BP	HB	settlement	unknown	10	98	4	1	100	500	500
XPR-00015	Dog Island Midden	up to 5250 BP	Sub	midden	ground	0	-1	7	302	100	500	2000
XPR-00014	Duke Island Midden	up to 5250 BP	Sub	midden	ground	3	135	8	353	500	500	2000
CRG-00351	Crg-00351		UNK		unknown	6	26	9	117	500	500	500
XPR-00048	Hotspur Island Midden	up to 5250 BP	MIX	midden, faunal remains, charcoal, FCR	mixed	1	90	6	112	100	>3000	>3000
CRG-00534	Hassiah Inlet Midden		Sub	shell midden	ground	25	154	6	73	2000	2000	2000
KET-00780	South Double Island Midden		MIX	shell midden, charcoal, FCR	mixed	1	315	8	76	1000	2000	2000
CRG-00350	Kasook Stone Weir #1		Sub	fishing weir	unknown	5	66	6	642	500	100	1000
CRG-00535	Cmts Dunbar Inlet	up to 5250 BP	TU	CMT	unknown	3	296	7	1086	500	1000	1000
KET-00013	Village Island Village (Daasax'akn)	up to 5250 BP	HB		unknown	0	-1	8	212	100	>3000	>3000
CRG-00230	Sakie Bay Cave		UNK		unknown	3	333	12	315	500	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
KET-00010	Cat Island Village And Burial (Old Tongass, Tongass, Tangak)		MIX		unknown	7	180	2	321	100	>3000	>3000
KET-00705	Air Warning Center Garrison [Annette Wwii Hd]	up to 5250 BP	HIST	historic building	surface	3	206	7	86	2000	2000	2000
KET-00022	Tamgas Harbor Petroglyph		Rel	petroglyph	surface	13	165	5	184	2000	500	500
KET-00045	Tamgas Creek Grave Site	up to 5250 BP	HR	burial	ground	20	174	5	173	2000	500	500
KET-00046	Tamgas Creek Petroglyph 2		Rel	petroglyph	surface	15	203	5	173	2000	500	500
CRG-00102	Dunbar Cove Village	up to 5250 BP	HB		unknown	2	270	15	335	500	100	100
CRG-00101	Dunbar Inlet Village	up to 5250 BP	HB		unknown	2	45	3	920	100	500	500
CRG-00030	Keete Inlet Village And Petroglyphs	up to 5250 BP	MIX	camp, petroglyphs	surface	19	132	6	245	1000	100	500
CRG-00094	Cape Lookout Village	up to 5250 BP	MIX	camp, hunting	mixed	11	0	13	93	500	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00382	Disappearance Creek Site		UNK		unknown	5	278	5	284	100	100	500
KET-00229	Leask Site	up to 5250 BP	Sub		unknown	1	225	5	47	100	>3000	>3000
KET-00229	Leask Site	up to 5250 BP	Sub		unknown	1	225	5	47	100	>3000	>3000
KET-00229	Leask Site	up to 5250 BP	Sub		unknown	1	225	5	47	100	>3000	>3000
CRG-00003	Hetta Island Pictographs		Rel	pictograph	surface	23	113	3	20	2000	2000	2000
CRG-00348	Eek Inlet Fish Weir #1		Sub		unknown	2	90	9	58	100	100	100
CRG-00349	Eek Inlet Fish Weir #2		Sub	fishing weir - stone	unknown	10	195	4	239	100	1000	1000
CRG-00393	Kitkun Bay Midden Site		Sub	midden	ground	7	185	7	121	100	500	500
CRG-00108	Hetta Point Petroglyphs		Rel		unknown	12	169	9	49	1000	1000	1000
KET-00447	Cedar House Rock-Shelter		UNK		unknown	1	0	6	244	500	1000	1000
KET-00650	Nehenta Bay Fish Trap		Sub	fish weir - rock	unknown	17	194	3	98	1000	3000	>3000
KET-00016	Dall Bay And Seal Cove Petroglyphs		Rel	petroglyph	surface	5	123	2	39	3000	2000	2000
CRG-00180	Crg-00180		Rel	petroglyph	surface	2	108	1	77	100	500	500
CRG-00014	Sukkwan Village And	up to 5250 BP	MIX		unknown	11	180	1	66	500	3000	3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
	Burial											
CRG-00088	Crg-00088	up to 5250 BP	MIX	camp, hearth, charcoal, shell, bone	cave	17	201	2	284	100	3000	3000
CRG-00088	Crg-00088	up to 5250 BP	MIX	camp, hearth, charcoal, shell, bone	cave	17	201	2	284	100	3000	3000
CRG-00088	Crg-00088	up to 5250 BP	MIX	camp, hearth, charcoal, shell, bone	cave	17	201	2	284	100	3000	3000
CRG-00088	Crg-00088	up to 5250 BP	MIX	camp, hearth, charcoal, shell, bone	cave	17	201	2	284	100	3000	3000
CRG-00088	Crg-00088	up to 5250 BP	MIX	camp, hearth, charcoal, shell, bone	cave	17	201	2	284	100	3000	3000
CRG-00088	Crg-00088	up to 5250 BP	MIX	camp, hearth, charcoal, shell, bone	cave	17	201	2	284	100	3000	3000
CRG-00359	Obsidian Cove Quarry (Suemez Island)	8750-9250 BP	LITH	lithics	quarry	38	173	2	299	100	3000	3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00027	Hydaburg	up to 5250 BP	HB		unknown	0	-1	64	304	1000	3000	3000
KET-00586	Seal Cove Midden #1		Sub	shell midden	ground	0	-1	9	95	100	3000	>3000
KET-00585	South Bostwick Shell Midden		MIX	shell midden, charcoal	mixed	2	341	1	101	100	>3000	>3000
KET-00587	Seal Cove Midden #2		MIX	shell midden, calcined bone, charcoal	mixed	3	135	9	89	100	3000	>3000
CRG-00099	Copper Harbor Pictograph		Rel	petroglyph	surface	8	180	3	43	3000	3000	3000
CRG-00124	North Pass Village	up to 5250 BP	HB		unknown	4	225	4	117	100	500	500
CRG-00034	Saltery Point Petroglyph		Rel	petroglyph	surface	2	270	64	2980	3000	500	2000
KET-00566	Mary's Camp/C.R. Nelson Homestead	up to 5250 BP	HB		unknown	0	-1	1	180	500	500	500
CRG-00376	Big Creek Fish Trap	up to 5250 BP	Sub	fishing weir - wood	unknown	5	278	6	1188	100	100	500
KET-00563	Bostwick Inlet Rock Weir #2		Sub	fish weir - rock	unknown	6	45	1	7	100	2000	2000
KET-00562	Bostwick Inlet Rock Weir #1		Sub	fish weir - rock	unknown	3	63	1	133	100	1000	1000
CRG-00181	Crg-00181		UNK		unknown	26	249	4	47	100	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00339	Crg-00339		Sub	fishing weir - stone	unknown	6	341	4	95	100	500	500
KET-00565	Bostwick Inlet Stake Weir #1	up to 5250 BP	Sub	fish weir - wood	unknown	5	98	1	505	1000	500	1000
CRG-00028	Cholmondeley Sound Fort	up to 5250 BP	HB	fort, refuge	surface	29	145	5	351	100	3000	3000
KET-00564	Bostwick Inlet Rock Weir #3		Sub	fish weir - rock	unknown	3	11	1	555	100	100	500
CRG-00131	Port Refugio Village	up to 5250 BP	HB	camp	unknown	9	141	2	16	1000	2000	2000
KET-00999	Cone Point Pictograph		Rel		unknown	12	300	2	15	3000	>3000	>3000
CRG-00338	Crg-00338		Sub	fishing weir - stone, pier	unknown	4	59	8	103	100	2000	2000
CRG-00396	Chasina Anchorage Midden Site		Sub	midden	ground	4	198	6	223	500	>3000	>3000
CRG-00008	Chasintsev (Chasintsef, Chasintseff, Selenie Chasintsev)	up to 5250 BP	UNK		unknown	1	0	6	32	500	>3000	>3000
CRG-00022	Chasina Anchorage Village	up to 5250 BP	MIX	settlement, pole	surface	25	353	6	55	100	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00049	Sulzer (Sulzer And Associated Prehistoric Site)	up to 5250 BP	UNK		unknown	12	125	10	387	100	100	500
CRG-00391	Beaver Creek Soils		UNK		unknown	36	157	5	138	1000	1000	1000
KET-00750	Thorne Arm Pictographs		Rel		unknown			0	3	2000	3000	3000
CRG-00329	Crg-00329		Sub	fishing weir - stone	unknown	3	45	10	29	500	500	500
CRG-00187	Crg-00187		Tran	canoe landing	surface	12	69	5	31	1000	>3000	>3000
CRG-00320	Crg-00320	up to 5250 BP	TU	CMT	surface	9	141	5	92	1000	>3000	>3000
CRG-00321	Crg-00321	up to 5250 BP	TU	CMT	surface	7	135	5	106	100	>3000	>3000
KET-00746	Carroll Point Pictographs		Rel		unknown	2	341	6	1	1000	2000	2000
CRG-00186	Point Cangrejo Midden 3		Sub	shell midden	ground	15	156	2	13	100	2000	2000
CRG-00185	Point Cangrejo Midden 2		Sub	shell midden	ground	6	45	6	15	100	2000	2000
CRG-00184	Point Cangrejo Midden 1		MIX	activity area, midden, shell	unknown	5	66	8	15	1000	2000	2000
KET-00747	South Carroll Inlet Boat Run		Tran	canoe skid	mixed	5	336	6	39	1000	100	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
KET-00295	Ket-00295		MIX	petroglyph, canoe skid	surface	3	116	3	36	1000	>3000	>3000
CRG-00285	False Island Fish Trap	up to 5250 BP	MIX	fishing weir - stone, CMT	mixed	2	18	87	114	500	100	100
KET-00021	Saxman Petroglyph		Rel	petroglyph	surface	7	248	3	124	1000	>3000	>3000
CRG-00286	Crg-00286		Sub	fishing weir - stone	unknown	1	315	14	262	500	500	500
CRG-00069	Twelve Mile Creek Weir	up to 5250 BP	Sub	fish weir	unknown	2	225	40	1668	500	100	100
CRG-00434	Cable Creek Weir	up to 5250 BP	Sub	fishing weir - wood	unknown	0	-1	14	1370	500	500	500
CRG-00434	Cable Creek Weir	up to 5250 BP	Sub	fishing weir - wood	unknown	0	-1	14	1370	500	500	500
CRG-00231	Pictograph Cave		Rel	petroglyph	surface	4	210	9	224	100	2000	2000
CRG-00288	Crg-00288		Sub	fishing weir - stone	unknown	2	198	14	217	2000	100	500
KET-00077	Herring Bay Petroglyph		Rel	petroglyph	surface	1	315	3	124	500	100	100
CRG-00289	Crg-00289		Sub	fishing weir - stone	unknown	5	188	14	89	2000	500	1000
CRG-00287	Crg-00287		Sub	fishing weir - stone	unknown	2	161	14	527	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00323	Crg-00323		Sub	fishing weir - stone	unknown	15	256	8	12	2000	2000	2000
CRG-00322	Crg-00322		Sub	fishing weir - stone	unknown	5	270	5	104	100	100	500
CRG-00171	Mckenzie Inlet Midden	up to 5250 BP	HB	midden	unknown	17	272	9	8	100	2000	2000
CRG-00171	Mckenzie Inlet Midden	up to 5250 BP	HB	midden	unknown	17	272	9	8	100	2000	2000
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000
CRG-00381	Wolf's Lair Cave	up to 5250 BP	MIX	midden	cave	46	184	9	349	500	>3000	>3000
CRG-00037	Trocadero Bay Petroglyphs	up to 5250 BP	Rel	petroglyph	surface	6	215	14	128	1000	1000	1000
CRG-00037	Trocadero Bay Petroglyphs	up to 5250 BP	Rel	petroglyph	surface	6	215	14	128	1000	1000	1000
CRG-00283	Crg-00283		Sub	fishing weir - stone	unknown	7	168	14	266	1000	100	500
KET-00299	Chief Johnson Totem Burial	up to 5250 BP	HR		unknown	5	225	5	135	100	100	500
KET-00658	Grant Cove Rock Shelter And Midden	up to 5250 BP	MIX	shelter, shell midden, charcoal	mixed	2	251	9	86	100	500	500
CRG-00324	Crg-00324		MIX	midden, FCR, CMT	mixed	4	135	9	210	2000	100	500
KET-00748	South Carroll Inlet Pictographs		Rel		unknown	18	209	2	25	1000	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00325	Crg-00325	up to 5250 BP	TU	CMT	surface	2	180	9	142	2000	1000	1000
KET-00523	Ketchikan Lake Stone Fish Trap		Sub		unknown	3	63	3	1044	500	100	100
CRG-00290	Crg-00290	up to 5250 BP	TU	CMT	surface	6	305	5	54	2000	2000	2000
KET-00749	Pictographs Near Rock Point		Rel		unknown	54	172	2	8	2000	3000	3000
CRG-00282	North Canoe Point Trap		Sub	fishing weir - stone	unknown	20	214	17	150	2000	2000	2000
CRG-00292	Crg-00292	up to 5250 BP	TU	CMT	surface	12	243	7	204	500	3000	3000
KET-00428	Thorne-Snipe Fish Trap		Sub	fish weir	unknown	2	90	1	118	1000	100	500
CRG-00377	Mckenzie Mouth Midden	up to 5250 BP	Sub	shell midden	ground	21	99	1	66	2000	2000	2000
CRG-00377	Mckenzie Mouth Midden	up to 5250 BP	Sub	shell midden	ground	21	99	1	66	2000	2000	2000
CRG-00130	Port Mayoral Village	up to 5250 BP	HB	CD, posts	unknown	7	168	7	146	100	3000	3000
CRG-00342	Crg-00342	up to 5250 BP	MIX	shell midden, CMT	mixed	10	213	2	156	100	2000	2000
CRG-00342	Crg-00342	up to 5250 BP	MIX	shell midden, CMT	mixed	10	213	2	156	100	2000	2000
CRG-00256	Real Marina South		Sub	fishing weir - stone	unknown	6	26	10	62	100	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00255	Crg-00255		Tran	canoe skid - stone	surface	5	188	7	52	1000	3000	3000
KET-00427	Spit Point Fish Trap		Sub	fish weir	unknown	4	0	2	74	100	100	500
CRG-00254	Crg-00254		Tran	canoe skid	surface	3	206	7	78	500	3000	3000
CRG-00264	Muerte Island Canoe Runs		Tran	canoe skid	surface	2	18	5	62	500	2000	2000
CRG-00553	Cape Cambon Petroglyph		Rel	petroglyph	surface	13	278	10	106	500	2000	2000
KET-00302	Risa' Rock Shelter	up to 5250 BP	MIX	burial, midden	rock shelter	18	135	6	646	2000	2000	2000
KET-00302	Risa' Rock Shelter	up to 5250 BP	MIX	burial, midden	rock shelter	18	135	6	646	2000	2000	2000
KET-00426	Gnat Cove Middens		MIX	midden, house pit	mixed	12	266	7	82	1000	3000	3000
KET-00422	Gnat Cove Point Middens	up to 5250 BP	Sub	midden	ground	18	250	7	94	1000	3000	3000
KET-00422	Gnat Cove Point Middens	up to 5250 BP	Sub	midden	ground	18	250	7	94	1000	3000	3000
CRG-00327	Rancheria	up to 5250 BP	UNK		unknown	0	-1	11	63	2000	>3000	>3000
CRG-00253	Real Marina North		Sub	fishing weir - stone	unknown	4	30	5	176	2000	500	500
CRG-00326	Crg-00326		Tran	canoe skid - stone	surface	0	-1	32	47	2000	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
KET-00303	Refuge Cove Site	up to 5250 BP	Sub	midden	ground	3	296	3	57	100	2000	2000
KET-00303	Refuge Cove Site	up to 5250 BP	Sub	midden	ground	3	296	3	57	100	2000	2000
KET-00303	Refuge Cove Site	up to 5250 BP	Sub	midden	ground	3	296	3	57	100	2000	2000
KET-00986	Ward Creek Stake Weir	up to 5250 BP	Sub	fish weir - wood	unknown	4	180	7	493	500	500	500
CRG-00020	Old Kasaan (Chat-Chee-Nie, Gasan, Kasian, Haade, Skowl)	up to 5250 BP	UNK		unknown	12	90	5	73	1000	>3000	>3000
CRG-00023	Noyes Island Pictograph (Cape Addington Petroglyph)		MIX	burials, pictograph, midden, shell	mixed	1	0	3	79	100	>3000	>3000
CRG-00460	Amagura Point Site	up to 5250 BP	Sub	shell midden	ground	30	156	3	86	2000	3000	3000
KET-00348	Nicholas Midden	up to 5250 BP	Sub	midden	ground	12	200	6	73	2000	2000	2000
CRG-00252	Arrecife Point Iii		Sub	fishing weir - stone	unknown	8	127	7	284	100	2000	2000
CRG-00250	Arrecife Point I		Sub	fishing weir - stone	unknown	6	215	7	287	100	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
KET-00436	Mop-Pop Fish Trap		Sub		unknown	20	156	1	291	100	2000	2000
CRG-00251	Arrecife Point Ii		Sub	fishing weir - stone	unknown	0	-1	7	308	500	2000	2000
KET-00017	George Inlet Petroglyphs		Rel	petroglyph	surface	8	74	2	5	100	500	500
CRG-00188	Crg-00188	up to 5250 BP	HB	midden, charcoal	rock shelter	20	176	3	309	100	2000	2000
CRG-00259	North Reef Point		Sub	fishing weir - stone	unknown	6	116	7	126	100	500	500
CRG-00475	Cave With Evidence Of Human Occupation		HB		cave	20	214	3	436	1000	500	1000
CRG-00459	Ballpark Island Midden		MIX	shell midden, faunal remains	mixed	7	323	14	130	500	2000	2000
CRG-00257	Lulu Island West		Sub	fishing weir - stone	unknown	2	180	10	66	>3000	100	500
KET-00424	Rusty Metal Midden	up to 5250 BP	Sub	midden	ground	20	252	5	174	1000	3000	3000
CRG-00024	Craig Petroglyphs (Shelter Cove Petroglyphs)		Rel	petroglyphs	surface	2	288	5	247	100	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00001	Grindall Passage Village	up to 5250 BP	HB		unknown	20	112	5	52	2000	>3000	>3000
CRG-00241	Crg-00241 (San Clemente)		MIX	fishing trap, canoe skid	mixed	6	215	16	193	100	500	500
CRG-00076	Crg-00076	up to 5250 BP	Tran	canoe, landing	surface	16	92	6	344	100	2000	2000
KET-00107	North Osten Cove Fish Acquisistion Site (Stone Fish Weir)	up to 5250 BP	MIX	fish weir, rock wall, canoe skid, midden	mixed	5	171	13	60	2000	500	500
CRG-00240	Point Cuerbo (Butler Bay)		MIX	fishing trap - stone, canoe skid	mixed	6	144	4	58	2000	100	100
CRG-00538	Deishuaan		LITH	lithic	unknown	10	156	4	220	500	500	500
CRG-00361	Crab Bay Weir	up to 5250 BP	Sub	fishing weir	unknown	2	71	4	203	500	500	500
CRG-00293	Moonlight Bay Trap		Sub	fishing weir - stone	unknown	3	243	3	34	3000	500	500
CRG-00294	Moonlight Bay Canoe Run		Tran	canoe skid - stone	surface	10	246	3	15	3000	500	500
CRG-00261	Lulu Island Rock Alignments		Rel		unknown	3	225	14	88	3000	500	500
CRG-00263	Craig North Trap		Sub	fishing weir - stone	unknown	4	45	9	192	100	100	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00063	North Fish Egg Island Village	up to 5250 BP	HB		unknown	9	38	8	79	1000	3000	3000
CRG-00242	Fern Point Complex		Sub	fishing weir - stone	unknown	7	330	8	19	1000	500	500
CRG-00258	Alargate Rocks Fish Trap		Sub	fishing weir - stone	unknown	1	0	3	124	2000	500	500
CRG-00249	Point Delgado Housepit		MIX	house pit, CD	mixed	5	225	7	75	500	1000	1000
KET-00078	White River Site		LITH	isolated find	unknown	3	63	6	553	100	1000	1000
CRG-00328	Crg-00328		MIX	shell midden, FCR, charcoal	mixed	10	11	6	3	3000	3000	3000
KET-00352	First Waterfall Fishtrap		Sub		unknown	4	270	6	29	1000	100	100
CRG-00046	Crg-00046 Midden Deposit		MIX	activity area, midden	mixed	19	236	9	5	2000	3000	3000
CRG-00243	Little Shakan Stone Weir (Northeast San Fernando)	up to 5250 BP	Sub	fishing weir - stone	unknown	2	108	3	129	100	3000	3000
CRG-00311	Crg-00311		Tran	canoe skid	surface	6	263	26	382	500	>3000	>3000
CRG-00312	Crg-00312		Tran	canoe skid	surface	10	246	26	357	500	>3000	>3000
CRG-00309	Crg-00309		MIX	canoe skid, midden	mixed	7	84	2	574	500	3000	3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00536	Pt Polocano Midden		Sub	shell midden	ground	27	157	66	226	1000	3000	3000
CRG-00310	Crg-00310		Tran	canoe skid	surface	8	164	26	581	500	3000	3000
KET-00423	Marble Creek Midden	up to 5250 BP	Sub	midden	ground	4	198	8	136	100	3000	3000
CRG-00146	Wadleigh Island Garden And Burial	up to 5250 BP	MIX		unknown	0	-1	9	616	100	2000	2000
KET-00351	Settler Cove Fish Weir	up to 5250 BP	Sub	fish weir	unknown	1	225	8	61	2000	500	500
CRG-00239	Klawock Mill Trap		Sub	fish trap - stone	unknown	3	296	9	206	100	1000	1000
CRG-00363	Klawock River Weir #2	up to 5250 BP	Sub	fishing weir	unknown	0	-1	8	18	1000	500	500
CRG-00362	Klawock River Weir #1	up to 5250 BP	Sub	fishing weir	unknown	0	-1	8	19	1000	500	500
CRG-00248	South Garcia Cove		Sub	fishing weir - stone	unknown	2	288	38	43	1000	100	100
CRG-00431	Crg-00431		Sub	midden	ground	0	-1	8	23	1000	500	500
CRG-00364	Klawock River Weir #3	up to 5250 BP	Sub	fishing weir	unknown	0	-1	8	25	1000	500	500
CRG-00330	Crg-00330		MIX	midden, canoe skid, petroglyph	mixed	6	206	9	1114	500	1000	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00366	Klawock River Weir #5	up to 5250 BP	Sub	fishing weir	unknown			8	83	100	500	500
CRG-00365	Klawock River Weir #4	up to 5250 BP	Sub	fishing weir	unknown	0	-1	8	78	1000	500	500
CRG-00119	Klawock Village (Klawock River Falls Village And Fishtrap)	up to 5250 BP	HB		unknown	0	-1	8	357	1000	500	500
CRG-00045	Salmonberry Island Battle Site	up to 5250 BP	HB	battle site, midden	mixed	3	191	8	878	2000	500	1000
CRG-00347	Klawock Lake Hatchery Site		Sub	shell midden, bone	ground	2	198	8	2302	3000	500	1000
CRG-00308	Crg-00308		Tran	canoe skid	surface	4	30	9	1496	500	1000	1000
CRG-00018	Chief Son-I-Hat's Whale House And Totems	up to 5250 BP	MIX		unknown	1	180	10	121	2000	500	500
CRG-00247	Northeast Garcia Cove	up to 5250 BP	Tran	canoe skid	surface	3	243	5	150	2000	1000	1000
CRG-00244	Santa Lucia		Sub	fishing weir - stone	unknown	0	-1	2	30	>3000	100	100
CRG-00307	Crg-00307		Tran	canoe skid	surface	6	234	3	1577	500	500	500
CRG-00016	Klawock Burial	up to 5250 BP	HR		unknown	1	270	7	11	100	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00246	San Pasqual (San Pascual)		Sub	fishing weir - stone	unknown	9	90	4	43	100	100	100
CRG-00306	Abbess Island West		MIX	canoe skid, shell midden	mixed	0	-1	8	453	500	2000	2000
CRG-00531	Shell Midden	up to 5250 BP	Sub	shell midden	ground	11	165	10	133	2000	500	500
KET-00079	South Shelter Weir		Sub	fish weir	unknown	11	82	5	158	1000	500	500
KET-00296	Back Island 1		MIX	midden, CD, faunal, FCR, CMT	mixed	4	288	9	79	500	>3000	>3000
CRG-00577	Fish Traps		Sub	fishing weir	unknown	3	348	4	323	100	2000	2000
KET-00791	Back Island Shell Midden # 3	up to 5250 BP	MIX	shell midden, fauna, charcoal	mixed	6	215	9	107	500	>3000	>3000
KET-00297	Back Island 2	up to 5250 BP	MIX	midden, FCR, canoe skid	mixed	3	26	9	122	500	3000	3000
KET-00298	Back Island Cmt	up to 5250 BP	TU	CMT	surface	5	203	9	146	100	>3000	>3000
CRG-00360	Klawock South Runway Weir		Sub	fishing weir	unknown	4	71	7	403	500	500	500
CRG-00061	Karta River Falls		HB	midden	ground	21	82	6	1865	100	500	500
KET-00015	Shelter Cove Fish Trap (Carroll Inlet		MIX	fish weir, CMT	mixed	8	65	3	241	1000	100	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
	Petroglyphs)											
CRG-00406	Canoe Landings		Tran	canoe landing	surface	3	191	5	365	500	2000	2000
CRG-00305	Crg-00305	up to 5250 BP	MIX	canoe skid, CMT	surface	0	-1	2	55	3000	1000	1000
CRG-00402	Old Midden	up to 5250 BP	MIX	shell midden, FCR, faunal	mixed	3	191	8	544	500	2000	2000
CRG-00402	Old Midden	up to 5250 BP	MIX	shell midden, FCR, faunal	mixed	3	191	8	544	500	2000	2000
CRG-00405	Terrace Midden	up to 5250 BP	MIX	shell midden, fish vertebrae, charcoal	mixed	1	90	5	645	100	2000	2000
CRG-00405	Terrace Midden	up to 5250 BP	MIX	shell midden, fish vertebrae, charcoal	mixed	1	90	5	645	100	2000	2000
CRG-00029	Karta Bay West Petroglyphs		Rel	petroglyphs	surface	5	56	11	47	100	1000	1000
CRG-00403	Notch Midden	up to 5250 BP	MIX	shell midden, charcoal, faunal	mixed	2	288	8	339	100	500	500
CRG-00403	Notch Midden	up to 5250 BP	MIX	shell midden, charcoal, faunal	mixed	2	288	8	339	100	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00304	Crg-00304	up to 5250 BP	TU	CMT	surface	0	-1	2	65	3000	2000	2000
CRG-00303	Crg-00303		MIX	midden, FCR, shell, CMT	mixed	8	0	0	11	3000	2000	2000
CRG-00194	Crg-00194		UNK		unknown	4	225	8	368	1000	500	500
CRG-00404	Single Habitation Midden	up to 5250 BP	Sub	shell midden	ground	3	153	8	472	100	500	500
CRG-00407	Gravel Midden	up to 5250 BP	MIX	shell midden, CMT	mixed	2	108	8	74	2000	500	500
CRG-00313	Crg-00313	up to 5250 BP	Sub	fishing weir - stone	unknown	19	75	2	200	100	2000	2000
CRG-00064	Mound Point Petroglyph		Rel	petroglyph	surface	21	150	1	62	100	2000	2000
CRG-00052	Mound Point Fort	up to 5250 BP	MIX	fort, midden, CMT	mixed	6	83	3	37	100	2000	2000
CRG-00439	Little Salt Creek Weir	up to 5250 BP	Sub	fishing weir	unknown	0	-1	3	1242	100	500	500
CRG-00439	Little Salt Creek Weir	up to 5250 BP	Sub	fishing weir	unknown	0	-1	3	1242	100	500	500
CRG-00408	Cove Midden	up to 5250 BP	MIX	shell midden, faunal	mixed	5	225	8	34	3000	1000	1000
CRG-00438	Little Salt Se Weir	up to 5250 BP	Sub	fishing weir	unknown	5	213	4	1049	500	100	500
CRG-00334	Little Salt Lake Stone Weir	up to 5250 BP	Sub	fishing weir - stone & wood	unknown	0	-1	1	646	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00334	Little Salt Lake Stone Weir	up to 5250 BP	Sub	fishing weir - stone & wood	unknown	0	-1	1	646	500	500	500
CRG-00334	Little Salt Lake Stone Weir	up to 5250 BP	Sub	fishing weir - stone & wood	unknown	0	-1	1	646	500	500	500
CRG-00334	Little Salt Lake Stone Weir	up to 5250 BP	Sub	fishing weir - stone & wood	unknown	0	-1	1	646	500	500	500
CRG-00334	Little Salt Lake Stone Weir	up to 5250 BP	Sub	fishing weir - stone & wood	unknown	0	-1	1	646	500	500	500
CRG-00334	Little Salt Lake Stone Weir	up to 5250 BP	Sub	fishing weir - stone & wood	unknown	0	-1	1	646	500	500	500
CRG-00440	Little Salt Lake Fish Weir District	up to 5250 BP	Sub		unknown	0	-1	4	764	100	500	500
CRG-00336	Crg-00336	up to 5250 BP	Sub	fishing weir - wood	unknown	0	-1	1	736	100	500	500
CRG-00335	Crg-00335	up to 5250 BP	Sub	fishing weir - wood	unknown	0	-1	4	542	500	500	500
CRG-00335	Crg-00335	up to 5250 BP	Sub	fishing weir - wood	unknown	0	-1	4	542	500	500	500
CRG-00437	Little Salt N Weir	up to 5250 BP	Sub	fishing weir	unknown	2	45	4	472	500	1000	1000
CRG-00437	Little Salt N Weir	up to 5250 BP	Sub	fishing weir	unknown	2	45	4	472	500	1000	1000
CRG-00436	Little Salt Nw Weir	up to 5250 BP	Sub	fishing weir	unknown	0	-1	3	418	500	1000	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00372	San Lorenzo Island Midden		Sub	midden	unknown	4	18	2	155	500	>3000	>3000
CRG-00435	Little Salt Camp		LITH	lithics, FCR	unknown	3	258	4	283	100	1000	1000
CRG-00343	Crg-00343		Sub	fishing weir - stone	unknown	3	258	6	91	3000	3000	3000
CRG-00190	Crg-00190		Tran	canoe landing	surface	1	0	3	38	1000	2000	2000
CRG-00337	Crg-00337	up to 5250 BP	Sub	fishing weir - wood	unknown	5	98	8	2212	500	500	500
CRG-00265	Lenderman Cove Petroglyph Site		Rel	petroglyph	surface	17	154	11	9	100	3000	3000
CRG-00191	Crg-00191		MIX	canoe landing, midden, camp	mixed	3	45	1	47	100	2000	2000
KET-00418	Carroll Inlet Pictograph		Rel	pictograph	surface	12	266	2	60	100	2000	2000
CRG-00409	Defensive Area	up to 5250 BP	MIX	shell midden, refuge	mixed	6	324	7	190	100	500	500
CRG-00409	Defensive Area	up to 5250 BP	MIX	shell midden, refuge	mixed	6	324	7	190	100	500	500
CRG-00409	Defensive Area	up to 5250 BP	MIX	shell midden, refuge	mixed	6	324	7	190	100	500	500
CRG-00302	Crg-00302		MIX	canoe skid, petroglyph, CMT	mixed	2	45	0	120	500	1000	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00332	Crg-00332		Tran	canoe skid - stone	surface	0	-1	5	54	100	500	500
CRG-00441	Stone Fish Trap		Sub	fishing weir - stone	unknown	0	-1	11	467	2000	500	500
CRG-00331	Crg-00331		Sub	fishing weir - stone	unknown	7	185	14	162	500	500	500
CRG-00333	Crg-00333		Sub	fishing weir - wood	unknown	3	116	5	170	100	100	500
CRG-00033	Salt Chuck Petroglyph		Rel		unknown	8	254	3	117	1000	500	500
KET-00026	Naha River		LITH		unknown	9	85	1	840	100	100	500
CRG-00410	Stone Fish Trap And Canoe Run		MIX	fishing weir, canoe skid - stone	mixed	0	-1	0	152	1000	2000	2000
CRG-00319	Crg-00319		Sub	fishing weir - wood	unknown	2	198	11	265	2000	500	500
CRG-00009	St Philip Island Village (Bobs Place, Shangu)	up to 5250 BP	HB		unknown	2	225	7	61	100	3000	3000
CRG-00318	Crg-00318	up to 5250 BP	Sub	fishing weir - wood	unknown	3	225	11	258	2000	1000	1000
KET-00954	Loring Petroglyph		Rel		unknown	1	270	7	51	100	500	500
KET-00953	Loring Midden		Sub		unknown	6	186	7	102	100	500	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00317	Crg-00317	up to 5250 BP	Sub	fishing weir - wood	unknown	1	270	11	156	2000	1000	1000
KET-00976	Loring Townsite	up to 5250 BP	HB		unknown	12	180	7	144	100	1000	1000
CRG-00299	Crg-00299	up to 5250 BP	MIX	fishing weir, shell midden	mixed	1	0	0	132	1000	2000	3000
CRG-00316	Crg-00316	up to 5250 BP	Sub	fishing weir - wood	unknown	5	180	11	174	2000	1000	1000
CRG-00298	Crg-00298	13250-13750 BP, 13250-13750 BP";, up to 5250 BP	MIX	canoe landing, shell midden, fishing weir	mixed	12	206	0	235	1000	2000	3000
CRG-00298	Crg-00298	13250-13750 BP, 13250-13750 BP";, up to 5250 BP	MIX	canoe landing, shell midden, fishing weir	mixed	12	206	0	235	1000	2000	3000
CRG-00301	Crg-00301		Tran	canoe skid	surface	2	108	7	39	1000	3000	3000
CRG-00314	Crg-00314	up to 5250 BP	Sub	fishing weir - wood	unknown	0	-1	11	170	2000	500	500
CRG-00315	Crg-00315	up to 5250 BP	Sub	fishing weir - wood	unknown	6	243	11	274	2000	1000	2000
CRG-00168	Nagasay Cove Site		UNK		unknown	9	45	387	29	100	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00373	Launch Passage Midden		Sub	midden	unknown	3	191	3	44	100	>3000	>3000
CRG-00297	Crg-00297		Tran	canoe skid	surface	6	263	6	78	1000	2000	2000
KET-00102	Ket-00102		UNK		unknown	10	266	5	36	1000	2000	2000
CRG-00296	Crg-00296		Tran	canoe skid	surface	20	241	6	135	1000	2000	2000
CRG-00295	Crg-00295		Tran	canoe skid - stone	surface	13	242	6	132	1000	1000	1000
CRG-00411	Old Rock-Shelter	up to 5250 BP	MIX	shell midden, charcoal	rock shelter	5	213	6	140	100	1000	1000
CRG-00412	Cove Middens	up to 5250 BP	MIX	shell midden, charcoal	mixed	12	90	1	259	100	1000	1000
CRG-00412	Cove Middens	up to 5250 BP	MIX	shell midden, charcoal	mixed	12	90	1	259	100	1000	1000
CRG-00374	Anguilla Bay Midden		Sub	fishing weir - stone	unknown	7	180	0	104	1000	>3000	>3000
KET-00505	Raymond Cove Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	0	-1	4	543	100	500	500
CRG-00300	Crg-00300		Tran	canoe skid	surface	21	159	4	160	100	3000	3000
CRG-00414	Stone Fish Weirs		Sub	fishing weir - stone	unknown	2	0	26	61	100	1000	1000
KET-00789	Escape Point Pictograph		Rel		unknown	4	149	10	34	>3000	3000	3000
KET-00506	Granite Creek Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	5	326	4	842	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00090	Crg-00090	up to 5250 BP	MIX	camp, midden, canoe landing, fish weir	mixed	2	251	9	178	2000	500	500
CRG-00415	Stone Fish Weir Complex		Sub	fishing weir - stone	unknown	6	135	26	144	500	500	500
KET-00283	Nendissawat Midden	up to 5250 BP	Sub	shell midden	ground	4	198	10	38	500	2000	2000
KET-00283	Nendissawat Midden	up to 5250 BP	Sub	shell midden	ground	4	198	10	38	500	2000	2000
CRG-00413	Possible Midden		MIX	shell midden	mixed	17	195	6	104	500	1000	1000
KET-00504	Helm Creek Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	0	-1	10	222	500	2000	2000
CRG-00416	Knob Midden		MIX	shell midden, charcoal, FCR	mixed	1	315	26	66	1000	500	500
CRG-00529	Microblade Site		LITH		unknown	2	45	14	677	100	500	500
CRG-00192	Crg-00192		MIX	camp, midden, canoe landing	mixed	0	-1	1	86	500	1000	1000
CRG-00193	Crg-00193		HB	CD, house pit	unknown	4	300	1	46	100	1000	1000
KET-00448	Carroll Creek Fish Weir No. 2	up to 5250 BP	Sub	fish weir, food procurement	unknown	0	-1	10	461	100	500	500
CRG-00417	Fish Trap And Weir		Sub	fishing weir - stone	unknown	3	11	26	133	100	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00035	Thorne Bay Petroglyphs		Rel	petroglyph	surface	6	153	5	43	1000	2000	2000
CRG-00418	Campsite Midden	up to 5250 BP	Sub		surface	6	263	7	29	100	500	500
CRG-00418	Campsite Midden	up to 5250 BP	Sub		surface	6	263	7	29	100	500	500
KET-00449	Carroll Creek Fish Weir No. 1		Sub		unknown	23	127	10	1236	100	500	500
CRG-00224	Crg-00224	up to 5250 BP	MIX	midden, activity area, shell, charcoal	mixed	0	-1	7	86	100	500	500
CRG-00224	Crg-00224	up to 5250 BP	MIX	midden, activity area, shell, charcoal	mixed	0	-1	7	86	100	500	500
CRG-00225	Crg-00225		Sub	fish weir - stone	unknown	4	300	11	206	100	500	500
CRG-00521	Thorne Bay Midden		Sub	midden	ground	9	243	4	64	2000	1000	1000
CRG-00420	Bead Midden		Sub		unknown	0	-1	6	182	100	1000	1000
CRG-00421	Isthmus Midden	up to 5250 BP	MIX	shell midden, charcoal	mixed	8	189	6	139	100	1000	1000
CRG-00421	Isthmus Midden	up to 5250 BP	MIX	shell midden, charcoal	mixed	8	189	6	139	100	1000	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00167	Crg-00167		MIX	CD, petroglyph, house pit	mixed	5	236	5	44	3000	3000	3000
CRG-00466	Grass Creek Fish Weir	up to 5250 BP	Sub	fishing weir - wood	unknown	1	135	7	99	2000	500	500
CRG-00547	Thorne Bay Sort Yard	up to 5250 BP	Sub	fish smoking area	unknown	3	135	1	61	100	500	500
CRG-00177	Thorne River Site	5250-5750 BP, 7250-7750 BP, 7750-8250 BP	LITH	lithic, core, microblade	ground	0	-1	4	3854	100	500	500
CRG-00177	Thorne River Site	5250-5750 BP, 7250-7750 BP, 7750-8250 BP	LITH	lithic, core, microblade	ground	0	-1	4	3854	100	500	500
CRG-00177	Thorne River Site	5250-5750 BP, 7250-7750 BP, 7750-8250 BP	LITH	lithic, core, microblade	ground	0	-1	4	3854	100	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00177	Thorne River Site	5250-5750 BP, 7250-7750 BP, 7750-8250 BP	LITH	lithic, core, microblade	ground	0	-1	4	3854	100	500	500
KET-00508	Point Francis Cove Hearth	up to 5250 BP	MIX	hearth, charcoal, FCR	mixed	3	153	3	135	100	1000	1000
CRG-00433	Silver Hole Site	5250-5750 BP	MIX	fishing weir, basket	mixed	0	-1	4	664	100	1000	1000
CRG-00433	Silver Hole Site	5250-5750 BP	MIX	fishing weir, basket	mixed	0	-1	4	664	100	1000	1000
CRG-00433	Silver Hole Site	5250-5750 BP	MIX	fishing weir, basket	mixed	0	-1	4	664	100	1000	1000
CRG-00433	Silver Hole Site	5250-5750 BP	MIX	fishing weir, basket	mixed	0	-1	4	664	100	1000	1000
CRG-00423	Burnt Cedar Middens	up to 5250 BP	MIX	shell midden, CMT	mixed	4	251	3	26	1000	3000	3000
CRG-00371	Nossuk Bay Fish Weir		Sub	fishing weir - wood	unknown	2	108	6	266	500	500	500
CRG-00370	Nasaak Bay Midden		Sub	midden	unknown	8	170	6	398	500	500	500
CRG-00426	Multi-Use Rock-Shelter		MIX		unknown	11	140	11	88	1000	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00158	Crg-00158		MIX	house pit, midden, FCR, CMT, charcoal	mixed	7	126	4	88	2000	3000	3000
CRG-00340	Crg-00340		LITH	isolated find	unknown	3	168	4	3411	500	100	100
KET-00287	Ket-00287		LITH		unknown	0	-1	2	127	500	2000	2000
CRG-00427	Ancient Midden	up to 5250 BP	MIX	shell midden, faunal, charcoal	mixed	3	206	6	116	100	1000	1000
CRG-00427	Ancient Midden	up to 5250 BP	MIX	shell midden, faunal, charcoal	mixed	3	206	6	116	100	1000	1000
CRG-00428	Ancient Midden	up to 5250 BP	MIX	midden, faunal remains, charcoal, modified bone	mixed	0	-1	6	83	100	1000	1000
CRG-00428	Ancient Midden	up to 5250 BP	MIX	midden, faunal remains, charcoal, modified bone	mixed	0	-1	6	83	100	1000	1000
CRG-00429	Single Occupation Midden	up to 5250 BP	MIX	shell midden, charcoal, faunal remains	mixed	3	78	6	52	100	1000	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00424	Rock-Shelter	up to 5250 BP	MIX	shell midden, charcoal	rock shelter	24	279	3	21	2000	>3000	>3000
KET-00100	Traitors Cove Canoe Landing And Middens		MIX	midden, canoe skid	mixed	19	257	4	97	2000	3000	3000
CRG-00198	Crg-00198		MIX	canoe landing, cairn	mixed	16	315	6	7	100	500	500
CRG-00425	Large Cove Middens	up to 5250 BP	MIX	shell midden, faunal	mixed	4	161	11	112	100	>3000	>3000
CRG-00425	Large Cove Middens	up to 5250 BP	MIX	shell midden, faunal	mixed	4	161	11	112	100	>3000	>3000
KET-00936	Traitors Cove Entrance Midden		MIX	shell midden, FCR	mixed	3	315	2	27	1000	2000	3000
CRG-00087	Crg-00087		HB	activity area, midden	mixed	2	198	5	20	1000	3000	3000
CRG-00197	Crg-00197		Sub	shell midden	ground	4	341	3	43	100	2000	2000
KET-01008	Ket-01008	up to 5250 BP	TU	CMT	surface	14	84	8	404	1000	2000	2000
CRG-00086	Crg-00086	up to 5250 BP	MIX	camp, midden, faunal remains, canoe skids	mixed	3	225	3	20	500	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00086	Crg-00086	up to 5250 BP	MIX	camp, midden, faunal remains, canoe skids	mixed	3	225	3	20	500	2000	2000
CRG-00174	Crg-00174	up to 5250 BP	Tran	canoe landing	surface	2	90	16	40	1000	3000	3000
CRG-00196	Crg-00196	up to 5250 BP	HB	house pit, midden, shell, bone	mixed	3	78	3	76	500	2000	2000
CRG-00196	Crg-00196	up to 5250 BP	HB	house pit, midden, shell, bone	mixed	3	78	3	76	500	2000	2000
CRG-00085	Crg-00085		Rel	petroglyph	surface			3	8	1000	>3000	>3000
KET-00347	Kuchdaa Jamboree		UNK		unknown	7	101	12	91	100	500	500
CRG-00447	Holes-In-The-Wall Shelter		MIX	shell midden, burnt bone	rock shelter	8	225	9	384	1000	2000	2000
KET-00790	South Club Point Shell Midden	up to 5250 BP	MIX	shell midden, charcoal, FCR	mixed	3	45	9	94	500	2000	3000
CRG-00195	Crg-00195	up to 5250 BP	Sub	fish trap	surface	13	323	6	29	1000	1000	1000
CRG-00445	Dead Tree Midden		Sub	shell midden	ground	0	-1	9	312	1000	2000	2000
CRG-00078	Crg-00078	up to 5250 BP	MIX	CD, midden, fish weir	mixed	1	315	6	527	100	100	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00183	Crg-00183		Tran	canoe landing	surface	0	-1	9	30	1000	1000	1000
CRG-00150	Crg-00150	up to 5250 BP	MIX	CMT, totem bases, burial, mound	mixed	10	303	6	120	100	100	500
CRG-00059	Crg-00059		MIX	shell, midden, FCR	unknown	0	-1	4	65	1000	2000	2000
CRG-00084	Crg-00084	up to 5250 BP	HR	burial	rock shelter	8	279	3	12	100	2000	2000
CRG-00557	Black Bear Creek Stake Weir #3	up to 5250 BP	Sub	fishing weir - wood	unknown	8	195	7	1552	500	500	500
CRG-00556	Black Bear Creek Stake Weir # 2	up to 5250 BP	Sub	fishing weir - wood	unknown	5	98	7	1135	500	500	500
CRG-00039	Warm Chuck Inlet Petroglyphs		Rel	petroglyph	surface			3	77	1000	500	500
CRG-00178	Crg-00178	up to 5250 BP	MIX	fishing, trap, stakes	mixed	0	-1	7	594	100	500	500
CRG-00077	Crg-00077		Rel	petroglyph	surface	8	120	6	49	100	500	1000
CRG-00096	Chuck Creek Village And Burial (Warm Chuck Village)	up to 5250 BP	MIX		unknown	2	180	3	165	100	100	500
CRG-00219	Crg-00219	up to 5250 BP	HR	burial	rock shelter	1	135	4	43	100	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
KET-00289	Ket-00289		HB		unknown	3	116	2	50	100	1000	1000
CRG-00205	Crg-00205		HB	midden	unknown	44	196	6	41	100	500	500
CRG-00217	Crg-00217	up to 5250 BP	Tran	canoe	surface	0	-1	1	84	2000	2000	2000
CRG-00114	Kauda Point Burial	up to 5250 BP	HR		unknown	4	108	8	47	2000	2000	2000
CRG-00218	Crg-00218		Rel	carved tree - whale	surface	4	225	2	26	1000	1000	1000
KET-00290	Port Stewart Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	6	144	7	368	500	100	500
CRG-00237	Chuck Lake	5250-5750 BP, 6750-7250 BP, 7250-7750 BP, 7750-8250 BP, 8250-8750 BP, 8750-9250	MIX	midden, lithic remains, faunal remains	mixed	0	-1	3	1063	500	1000	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00237	Chuck Lake	5250-5750 BP, 6750-7250 BP, 7250-7750 BP, 7750-8250 BP, 8250-8750 BP, 8750-9250	MIX	midden, lithic remains, faunal remains	mixed	0	-1	3	1063	500	1000	500
CRG-00237	Chuck Lake	5250-5750 BP, 6750-7250 BP, 7250-7750 BP, 7750-8250 BP, 8250-8750 BP, 8750-9250	MIX	midden, lithic remains, faunal remains	mixed	0	-1	3	1063	500	1000	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00237	Chuck Lake	5250-5750 BP, 6750-7250 BP, 7250-7750 BP, 7750-8250 BP, 8250-8750 BP, 8750-9250	MIX	midden, lithic remains, faunal remains	mixed	0	-1	3	1063	500	1000	500
CRG-00237	Chuck Lake	5250-5750 BP, 6750-7250 BP, 7250-7750 BP, 7750-8250 BP, 8250-8750 BP, 8750-9250	MIX	midden, lithic remains, faunal remains	mixed	0	-1	3	1063	500	1000	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00237	Chuck Lake	5250-5750 BP, 6750-7250 BP, 7250-7750 BP, 7750-8250 BP, 8250-8750 BP, 8750-9250	MIX	midden, lithic remains, faunal remains	mixed	0	-1	3	1063	500	1000	500
CRG-00237	Chuck Lake	5250-5750 BP, 6750-7250 BP, 7250-7750 BP, 7750-8250 BP, 8250-8750 BP, 8750-9250	MIX	midden, lithic remains, faunal remains	mixed	0	-1	3	1063	500	1000	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00237	Chuck Lake	5250-5750 BP, 6750-7250 BP, 7250-7750 BP, 7750-8250 BP, 8250-8750 BP, 8750-9250	MIX	midden, lithic remains, faunal remains	mixed	0	-1	3	1063	500	1000	500
CRG-00369	Warm Chuck Stone Trap		Sub	fishing weir	unknown	5	225	27	7	1000	1000	1000
KET-00788	Bushy Point Cove Pictograph # 2		Rel		unknown	6	305	7	43	3000	3000	>3000
KET-00061	Traitors Cove Petroglyphs		Rel	petroglyph	surface	16	138	12	148	1000	500	500
KET-00787	Bushy Point Cove Pictograph # 1		Rel		unknown	21	291	7	17	3000	>3000	>3000
CRG-00036	North Tonowek Burial	up to 5250 BP	MIX	burial, poles	mixed	1	90	7	80	100	500	500
CRG-00144	Tonowek Narrows Village	up to 5250 BP	HB		unknown	25	203	3	66	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00367	Warm Chuck Northwest Weir	up to 5250 BP	Sub	fishing weir	unknown	0	-1	24	349	1000	100	500
CRG-00344	Crg-00344	up to 5250 BP	HR	burials, crypts, CD	ground	0	-1	1	50	1000	>3000	>3000
CRG-00169	Cape Lynch		UNK		unknown	6	225	13	91	100	3000	3000
CRG-00075	Crg-00075		MIX	canoe, landing, fish weir	mixed	15	166	27	47	1000	2000	2000
CRG-00368	Warm Chuck North Weir	up to 5250 BP	Sub	fishing weir	unknown	3	116	27	226	1000	2000	2000
CRG-00236	Rosie's Rockshelter	up to 5250 BP	MIX	faunal remains, lithics - tools	rock shelter	14	327	4	163	100	2000	2000
CRG-00236	Rosie's Rockshelter	up to 5250 BP	MIX	faunal remains, lithics - tools	rock shelter	14	327	4	163	100	2000	2000
CRG-00236	Rosie's Rockshelter	up to 5250 BP	MIX	faunal remains, lithics - tools	rock shelter	14	327	4	163	100	2000	2000
CRG-00236	Rosie's Rockshelter	up to 5250 BP	MIX	faunal remains, lithics - tools	rock shelter	14	327	4	163	100	2000	2000
CRG-00236	Rosie's Rockshelter	up to 5250 BP	MIX	faunal remains, lithics - tools	rock shelter	14	327	4	163	100	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00461	Baichtals Burn (Fossil Beaches)	8250-8750 BP, 8750-9250 BP	MIX	charcoal, lithics, fossil beaches	mixed	3	206	27	395	1000	2000	2000
CRG-00461	Baichtals Burn (Fossil Beaches)	8250-8750 BP, 8750-9250 BP	MIX	charcoal, lithics, fossil beaches	mixed	3	206	27	395	1000	2000	2000
CRG-00461	Baichtals Burn (Fossil Beaches)	8250-8750 BP, 8750-9250 BP	MIX	charcoal, lithics, fossil beaches	mixed	3	206	27	395	1000	2000	2000
CRG-00444	Midden Deposit		Sub	shell midden	ground	1	225	2	24	100	3000	3000
CRG-00203	Crg-00203		HB	midden	unknown	12	180	3	43	1000	500	500
CRG-00032	Port Alice Site And Petroglyphs	up to 5250 BP	MIX		unknown	7	209	6	76	1000	1000	1000
CRG-00170	Crg-00170	up to 5250 BP	MIX	CD, house pit, canoe landing	mixed	9	270	6	40	100	500	1000
CRG-00234	Crg-00234		LITH	lithic scatter - flakes	unknown	7	84	5	838	100	100	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00235	Crg-00235	7750-8250 BP, 8250-8750 BP, 8750-9250 BP, up to 5250 BP	LITH	lithic scatter - flakes	unknown	5	123	5	470	100	500	1000
CRG-00235	Crg-00235	7750-8250 BP, 8250-8750 BP, 8750-9250 BP, up to 5250 BP	LITH	lithic scatter - flakes	unknown	5	123	5	470	100	500	1000
CRG-00238	Crg-00238		UNK		unknown	0	-1	5	89	500	100	500
CRG-00202	Crg-00202		HB	midden	unknown	15	206	0	71	1000	3000	3000
CRG-00200	Crg-00200		UNK		unknown	0	-1	5	88	1000	3000	3000
CRG-00569	Rice Creek Terrace Shell Midden	5250-5750 BP, 5750-6750 BP	Sub	shell midden	ground	1	45	10	258	100	1000	1000
CRG-00569	Rice Creek Terrace Shell Midden	5250-5750 BP, 5750-6750 BP	Sub	shell midden	ground	1	45	10	258	100	1000	1000
CRG-00569	Rice Creek Terrace Shell Midden	5250-5750 BP, 5750-6750 BP	Sub	shell midden	ground	1	45	10	258	100	1000	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00569	Rice Creek Terrace Shell Midden	5250-5750 BP, 5750-6750 BP	Sub	shell midden	ground	1	45	10	258	100	1000	1000
CRG-00569	Rice Creek Terrace Shell Midden	5250-5750 BP, 5750-6750 BP	Sub	shell midden	ground	1	45	10	258	100	1000	1000
CRG-00569	Rice Creek Terrace Shell Midden	5250-5750 BP, 5750-6750 BP	Sub	shell midden	ground	1	45	10	258	100	1000	1000
CRG-00552	New Staney Creek Midden		Sub	midden	ground	3	11	11	371	100	500	500
CRG-00549	Kladein Flats Fish Weir	up to 5250 BP	Sub	fishing weir	unknown	0	-1	15	119	100	1000	1000
CRG-00474	Union Point Boat/Canoe Run		Tran		unknown	5	188	2	46	1000	2000	2000
CRG-00378	Port Alice Cave	up to 5250 BP	Sub	midden	ground	1	0	8	78	100	2000	2000
KET-00099	Neets Bay Petroglyph		Rel	petroglyph	surface	14	163	13	81	100	100	100
CRG-00471	Vixen Harbor Midden	up to 5250 BP	Sub	shell midden	ground	4	59	8	172	500	500	500
CRG-00471	Vixen Harbor Midden	up to 5250 BP	Sub	shell midden	ground	4	59	8	172	500	500	500
CRG-00279	Staney Creek Trap		Sub	fishing trap - stone	unknown	2	251	15	107	100	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00469	Vixen Inlet Stake Weir Complex	up to 5250 BP	Sub	fishing weir	unknown	2	315	6	15	100	500	500
CRG-00469	Vixen Inlet Stake Weir Complex	up to 5250 BP	Sub	fishing weir	unknown	2	315	6	15	100	500	500
CRG-00280	Staney Creek Weir	up to 5250 BP	Sub	fishing weir - wood	unknown	5	255	11	74	500	1000	1000
CRG-00548	South Staney Fish Weir	up to 5250 BP	Sub	fishing weir	unknown	0	-1	10	313	1000	2000	2000
CRG-00470	Shaada-Sik'ch Village (Vixen Harbor Seasonal Village)	up to 5250 BP	HB	midden	ground	1	45	8	339	100	100	500
CRG-00470	Shaada-Sik'ch Village (Vixen Harbor Seasonal Village)	up to 5250 BP	HB	midden	ground	1	45	8	339	100	100	500
CRG-00383	S'eek Noowoo Rockshelter	up to 5250 BP	Sub		rock shelter	11	225	11	247	100	1000	1000
CRG-00383	S'eek Noowoo Rockshelter	up to 5250 BP	Sub		rock shelter	11	225	11	247	100	1000	1000
CRG-00468	Hunters Camp Midden	up to 5250 BP	Sub	shell midden	ground	9	206	6	168	100	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00468	Hunters Camp Midden	up to 5250 BP	Sub	shell midden	ground	9	206	6	168	100	500	500
CRG-00040	Staney Creek Burials (73acn1341)	up to 5250 BP	HR	burial	rock shelter	7	185	11	827	1000	1000	1000
CRG-00543	Vixen Inlet Trap		Sub	fishing weir	unknown	2	71	6	105	1000	100	500
CRG-00214	Crg-00214		Sub	fish weir - stone	unknown	1	45	2	113	1000	2000	2000
CRG-00526	Crg-00526		MIX	midden, rock alignment	mixed	4	90	4	70	2000	1000	1000
KET-00786	Nose Point Pictograph		Rel		unknown	21	240	8	16	1000	3000	3000
CRG-00380	Kussan Point Fish Traps And 49 Cmts		MIX	fishing weir, CMT	mixed	2	0	6	138	1000	1000	1000
CRG-00495	Crg-00495		HB		rock shelter	7	270	8	55	100	2000	2000
CRG-00212	Crg-00212		Sub	fishing traps, stone	unknown	1	225	14	98	500	100	100
CRG-00211	Crg-00211	up to 5250 BP	Sub	canoe cradle, logs, chips	surface	2	315	5	47	100	500	500
CRG-00213	Crg-00213		Sub	shell midden	ground	8	164	75	199	100	500	500
CRG-00083	Crg-00083		HB	midden, activity area	mixed	5	203	6	88	100	1000	1000
CRG-00209	Crg-00209		UNK		unknown	5	278	7	648	500	1000	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00484	Fish Weir	up to 5250 BP	Sub	fishing weir	unknown	4	161	7	518	500	1000	1000
CRG-00504	Klinau Island Trap		Sub	fishing weir - stone	unknown	3	153	24	176	100	3000	3000
CRG-00457	Big Echo Rock-Shelter		MIX	shell midden, fauna, charcoal	rock shelter	13	40	21	57	1000	500	500
CRG-00281	Klinau East Traps		Sub	fishing trap - stone	unknown	2	225	24	77	500	2000	2000
CRG-00081	Crg-00081	up to 5250 BP	MIX	fishing camp, midden, fish weir, stone	mixed	3	191	6	123	1000	100	500
CRG-00456	Harpoon Rockshelter		MIX	midden, bone artifacts	rock shelter	3	225	21	50	1000	100	100
CRG-00233	Crg-00233		Sub	fishing weir - stone	unknown	2	90	3	61	100	3000	3000
CRG-00491	Crg-00491	up to 5250 BP	MIX	midden, CMT	mixed	5	194	12	204	100	500	500
KET-00470	Spacious Bay Fish Traps		Sub	fish weir - stone	unknown	8	52	10	84	>3000	1000	1000
CRG-00232	Crg-00232		Sub	fishing weir - stone	unknown	21	201	17	36	100	3000	3000
CRG-00458	Guhao Inlet Entrance Midden		MIX	shell midden, lithics	mixed	4	225	21	151	1000	100	500
CRG-00485	Crg-00485	up to 5250 BP	MIX	midden, CMT	mixed	2	45	1	111	1000	1000	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00223	Little Ratz Harbor Weir		Sub	fishing weir - stone	unknown	10	168	15	218	500	500	500
KET-00098	Ket-00098 (Shrimp Island Midden)		Sub	midden	ground	1	0	1	122	100	2000	3000
CRG-00559	Glass Ball Cave		Sub	midden	cave	20	47	7	103	500	2000	2000
CRG-00486	Crg-00486		Sub	midden	ground	8	170	1	120	100	1000	1000
CRG-00080	Crg-00080	up to 5250 BP	HR	burial	cave	0	-1	10	65	1000	3000	3000
CRG-00278	South Gutchi Midden		Sub	shell midden	ground	5	135	6	108	500	1000	1000
CRG-00277	Gutchi Creek Stakes	up to 5250 BP	Sub	fish trap - wood	unknown	4	198	7	384	500	500	1000
CRG-00276	Gutchi Creek Trap		Sub	fish trap - stone	unknown	7	216	7	66	500	100	1000
CRG-00275	Gutchi Cove Trap		Sub	fish trap - stone	unknown	2	251	7	55	500	500	1000
CRG-00268	West Kaikli Trap		Sub	fishing weir - stone	unknown	3	348	1	137	1000	1000	1000
CRG-00273	Gutchi Entrance Midden		Sub	shell midden	ground	0	-1	6	72	100	500	500
CRG-00274	Gutchi Entrance Trap		Sub	fish trap - stone	unknown	16	4	6	46	500	500	500
KET-00785	Gedney Island Pictograph		Rel		unknown	3	206	6	20	3000	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00123	Naukati Creek Village	up to 5250 BP	MIX	fish weir, stone	mixed	2	45	6	108	1000	500	500
CRG-00041	Tuxekan (Taqdjikan, Tuxeau, Tuxecan, Tuxican, Tuqdjkan)	up to 5250 BP	UNK		unknown	10	219	4	93	2000	3000	3000
CRG-00269	East Kaikli Trap		Sub	fish trap - stone	unknown	3	168	6	115	100	1000	1000
CRG-00528	Cabin And Midden	up to 5250 BP	MIX		unknown	0	-1	9	20	100	500	500
CRG-00270	Wildman Rock-Shelter		MIX	shell midden	rock shelter	5	188	6	292	100	1000	1000
KET-01004	Hassler Island Pictograph		Rel		unknown	39	176	1	21	2000	>3000	>3000
CRG-00136	Tuxekan Island Village And Skookumchuck Burial	up to 5250 BP	HB		unknown	12	149	4	85	1000	3000	>3000
CRG-00054	Yatuk Creek Rock-Shelter	up to 5250 BP	MIX	lithics, midden	rock shelter	31	112	6	789	500	100	100
CRG-00054	Yatuk Creek Rock-Shelter	up to 5250 BP	MIX	lithics, midden	rock shelter	31	112	6	789	500	100	100
KET-01000	Hassler Island Midden		MIX	midden, faunal	mixed	13	188	2	128	1000	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
				remains								
CRG-00397	North Tuxekan Island Midden Site 1		Sub	midden	ground	47	132	1	89	100	3000	>3000
CRG-00398	North Tuxekan Island Midden Site 2		Sub	midden	ground	10	151	7	58	100	>3000	>3000
CRG-00525	Ratz Harbor Weir	up to 5250 BP	Sub	fishing weir - wood	unknown	3	315	10	450	500	500	500
CRG-00510	Yatuk Creek Cmt Grove	up to 5250 BP	TU	CMT	unknown	3	296	6	1533	100	500	500
KET-01002	Convenient Cove Canoe/Boat Run		Sub	midden	ground	19	126	8	106	100	>3000	>3000
KET-01003	Convenient Cove Midden		Sub	midden	ground	14	122	9	103	100	3000	3000
CRG-00455	Dargun Point Midden		Sub		unknown	8	180	4	174	100	3000	3000
CRG-00518	Resting Place Cave	up to 5250 BP	MIX	human bones, marine shell	cave	12	215	4	288	100	2000	2000
KET-00344	Black Island Rock-Shelter		UNK		unknown	3	135	4	57	100	3000	3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00516	Stand Up Cave (Standing Up Cave)	up to 5250 BP	MIX	marine shell, animal bones, FCR	cave	36	225	4	217	500	2000	2000
CRG-00387	Dargun Point		UNK		unknown	8	270	4	145	100	2000	2000
CRG-00453	West Kassan Island Midden		MIX	midden, charcoal	mixed	15	190	4	58	1000	>3000	>3000
CRG-00452	Rock-Shelter Burial		HR		unknown	10	241	4	76	1000	>3000	>3000
CRG-00517	Survey Cove Cave	up to 5250 BP	MIX	marine shell, fish bone	cave	2	90	4	412	100	500	500
CRG-00515	Father's Day Rockshelter	up to 5250 BP	MIX	marine shell, animal bones, FCR	rock shelter	37	246	4	247	100	3000	3000
CRG-00074	Crg-00074	up to 5250 BP	MIX	canoe, landing, CMT	mixed	4	225	4	49	100	>3000	>3000
CRG-00113	Kassan Island Village	up to 5250 BP	HB		unknown	12	276	4	63	1000	>3000	>3000
CRG-00514	Hh Cave #2	up to 5250 BP	MIX	marine shell, human bones, FCR	cave	29	114	4	334	500	3000	3000
CRG-00513	Hh Cave #1	up to 5250 BP	MIX	marine shell, mammal bone	cave	6	144	4	376	100	3000	3000
CRG-00454	East Kassan Island Midden		MIX	shell midden, faunal	mixed	2	90	4	41	100	3000	3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
KET-00058	Syble Legend Site		UNK		unknown	56	222	4	72	2000	2000	2000
CRG-00073	Crg-00073	up to 5250 BP	MIX	canoe, landing, CMT, adze	mixed	4	239	4	151	100	>3000	>3000
CRG-00542	Emerald Bay Pictograph		Rel		unknown	14	295	4	120	1000	2000	2000
KET-00935	Yes Bay Fish Traps		Sub		unknown	6	198	4	43	100	100	100
KET-00278	Yes Bay Cannery (Yess Bay, Mcdonald)	up to 5250 BP	Sub		unknown	9	122	4	112	100	500	500
CRG-00166	Crg-00166		MIX	camp, fish weir, midden, shell, CMT	mixed	0	-1	4	238	2000	>3000	>3000
CRG-00058	Brownson Midden		MIX	midden, shell, charcoal, FCR	mixed	8	155	4	119	1000	>3000	>3000
CRG-00056	Brownson Island		MIX	midden, CMT	mixed	4	239	4	77	2000	3000	3000
CRG-00266	Sarkar Creek Alignments		Sub	fishing weir - stone	unknown	6	6	4	64	500	100	500
CRG-00267	Sarkar Creek Village	up to 5250 BP	HB		unknown	6	173	4	378	500	100	500
CRG-00206	Crg-00206		Tran	canoe landing	surface	3	315	4	19	1000	500	500
CRG-00541	Eaton Point		Rel		unknown	7	216	4	20	1000	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
	Pictograph											
CRG-00172	Crg-00172		UNK		unknown	8	80	4	137	2000	100	500
CRG-00375	Sarkar Lake Garden Site Mauls		Sub		unknown	4	161	4	12	1000	500	500
CRG-00207	Crg-00207		UNK		unknown	0	-1	4	89	1000	500	500
KET-00524	Lake Mcdonald Site	up to 5250 BP	Sub	midden	ground	3	45	4	1480	500	500	500
KET-00524	Lake Mcdonald Site	up to 5250 BP	Sub	midden	ground	3	45	4	1480	500	500	500
CRG-00208	Crg-00208		UNK		unknown	5	203	4	112	100	500	500
CRG-00164	Sarkar Cove Entrance	up to 5250 BP	UNK		unknown	3	296	4	34	500	500	500
CRG-00164	Sarkar Cove Entrance	up to 5250 BP	UNK		unknown	3	296	4	34	500	500	500
CRG-00164	Sarkar Cove Entrance	up to 5250 BP	UNK		unknown	3	296	4	34	500	500	500
CRG-00164	Sarkar Cove Entrance	up to 5250 BP	UNK		unknown	3	296	4	34	500	500	500
CRG-00260	Elwood Village And Cemetery		MIX		unknown	4	225	4	69	500	2000	2000
KET-00933	West Behm Narrows Pictograph		Rel		unknown	51	124	4	19	2000	3000	3000
KET-00067	Ket-00067		Rel	petroglyph	surface	16	7	4	19	100	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
KET-00063	Cow Creek Weirs (& Canoe/Boat Run)		MIX		unknown	2	341	4	231	500	100	500
CRG-00352	Sweetwater Lake	up to 5250 BP	MIX	lithic, CMT, charcoal	mixed	2	288	4	4439	500	500	500
CRG-00173	Crg-00173		HB	CD, house pit	mixed	13	98	4	93	100	500	500
KET-00940	Jake's Pictograph In Bell Arm		Rel		unknown	56	171	4	12	3000	3000	3000
KET-00066	Ket-00066		Rel	petroglyph	surface	11	277	4	8	2000	2000	2000
CRG-00221	Crg-00221		HB	midden	unknown	0	-1	4	2889	100	500	500
KET-00932	East Behm Narrows Pictograph		Rel		unknown			4	2	2000	2000	2000
CRG-00511	Van Sant Cove Shell Midden		Sub	shell midden	ground	6	153	4	247	100	100	500
CRG-00220	Crg-00220		HB	midden	unknown	3	168	4	2587	100	100	500
KET-00065	Ket-00065		Rel	petroglyph	surface	5	255	4	14	1000	2000	2000
CRG-00047	Tokeen (Old Tokeen, Tok-Hene, Tokhin, Tokhini)	up to 5250 BP	HB		unknown	2	0	4	53	1000	2000	2000
CRG-00160	Crg-00160		MIX	burial, stone piles	mixed	2	180	4	58	1000	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
CRG-00079	Crg-00079		MIX	camp, midden, canoe, landing, trap, CMT	mixed	10	261	4	61	100	2000	2000
KET-00064	Ket-00064		Rel	petroglyph	surface	7	158	4	1	2000	3000	3000
PET-00410	Kushtaka Cave (Black Bear With Bone Spear Point)	9250-9750 BP	MIX	bear skeleton, harpoon	cave	11	309	4	315	1000	1000	1000
PET-00410	Kushtaka Cave (Black Bear With Bone Spear Point)	9250-9750 BP	MIX	bear skeleton, harpoon	cave	11	309	4	315	1000	1000	1000
PET-00410	Kushtaka Cave (Black Bear With Bone Spear Point)	9250-9750 BP	MIX	bear skeleton, harpoon	cave	11	309	4	315	1000	1000	1000
PET-00410	Kushtaka Cave (Black Bear With Bone Spear Point)	9250-9750 BP	MIX	bear skeleton, harpoon	cave	11	309	4	315	1000	1000	1000
PET-00410	Kushtaka Cave (Black Bear With Bone Spear Point)	9250-9750 BP	MIX	bear skeleton, harpoon	cave	11	309	4	315	1000	1000	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
KET-00560	Bailey Bay Midden		MIX	shell midden, charcoal	mixed	30	92	4	59	2000	1000	1000
KET-00094	Lake Mcdonald Pictographs		Rel	pictograph - animals & canoes	surface	3	191	4	3614	500	1000	500
KET-00955	Bell Arm Pictograph		Rel		unknown	45	147	4	54	1000	3000	3000
PET-00471	Pet-00471		Sub	midden	ground	10	309	4	267	1000	500	500
KET-00095	Bailey Bay Fish Weir	up to 5250 BP	Sub	fish weir	unknown	2	90	4	169	1000	100	500
PET-00218	Grassy Lake Fish Weir		Sub	fish weir	unknown	2	270	4	995	500	1000	1000
KET-00559	Short Bay Boat/Canoe Run		Tran	canoe skid	surface	18	263	4	16	2000	3000	3000
PET-00067	Coffman Cove Site	up to 5250 BP	MIX	midden, faunal remains, burials	mixed	3	258	4	73	1000	500	1000
PET-00067	Coffman Cove Site	up to 5250 BP	MIX	midden, faunal remains, burials	mixed	3	258	4	73	1000	500	1000
PET-00067	Coffman Cove Site	up to 5250 BP	MIX	midden, faunal remains,	mixed	3	258	4	73	1000	500	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
				burials								
PET-00067	Coffman Cove Site	up to 5250 BP	MIX	midden, faunal remains, burials	mixed	3	258	4	73	1000	500	1000
PET-00067	Coffman Cove Site	up to 5250 BP	MIX	midden, faunal remains, burials	mixed	3	258	4	73	1000	500	1000
PET-00067	Coffman Cove Site	up to 5250 BP	MIX	midden, faunal remains, burials	mixed	3	258	4	73	1000	500	1000
PET-00067	Coffman Cove Site	up to 5250 BP	MIX	midden, faunal remains, burials	mixed	3	258	4	73	1000	500	1000
PET-00067	Coffman Cove Site	up to 5250 BP	MIX	midden, faunal remains, burials	mixed	3	258	4	73	1000	500	1000
PET-00067	Coffman Cove Site	up to 5250 BP	MIX	midden, faunal remains, burials	mixed	3	258	4	73	1000	500	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00067	Coffman Cove Site	up to 5250 BP	MIX	midden, faunal remains, burials	mixed	3	258	4	73	1000	500	1000
PET-00067	Coffman Cove Site	up to 5250 BP	MIX	midden, faunal remains, burials	mixed	3	258	4	73	1000	500	1000
PET-00067	Coffman Cove Site	up to 5250 BP	MIX	midden, faunal remains, burials	mixed	3	258	4	73	1000	500	1000
PET-00067	Coffman Cove Site	up to 5250 BP	MIX	midden, faunal remains, burials	mixed	3	258	4	73	1000	500	1000
PET-00122	Tenass Passage Fish Trap And Midden		MIX	fish weir, midden, CMT	mixed	12	186	4	176	100	2000	2000
PET-00470	Pet-00470		Sub	midden	ground	2	0	4	82	1000	500	500
PET-00472	Pet-00472		Sub	midden	ground	1	135	4	535	3000	100	1000
KET-00097	Anchor Pass Stake Weir	up to 5250 BP	Sub		unknown	5	213	4	89	2000	500	500
PET-00467	The Luck Point Site		MIX	midden, burial	ground	5	270	4	173	100	500	1000
PET-00468	Pet-00468		Sub	midden	ground	2	198	4	298	100	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00556	Buried Midden At Coffman Cove Ferry Terminal	up to 5250 BP	MIX	shell midden, camp, burial	mixed	11	255	4	29	100	1000	1000
KET-00305	Fitzgibbon Cove Midden/Hearth	up to 5250 BP	MIX	midden, hearth	mixed	0	-1	4	72	1000	>3000	>3000
KET-00096	Ket-00096		Tran	canoe landing	surface	47	162	4	68	1000	2000	2000
PET-00541	Pet-00541	8250-8750 BP, 8750-9250 BP	Sub	fish weir	unknown	7	5	4	511	500	100	100
PET-00541	Pet-00541	8250-8750 BP, 8750-9250 BP	Sub	fish weir	unknown	7	5	4	511	500	100	100
XBC-00057	Short Bay Weir		Sub		unknown	0	-1	4	77	100	500	500
PET-00473	Pet-00473		Sub	midden	ground	3	315	4	102	500	1000	1000
PET-00219	Mabel Creek Stone Fish Trap	8750-9250 BP	MIX	fish weir, cairn	mixed	6	288	4	110	100	500	500
PET-00219	Mabel Creek Stone Fish Trap	8750-9250 BP	MIX	fish weir, cairn	mixed	6	288	4	110	100	500	500
PET-00217	Beak Terrace Charcoal		UNK		unknown	8	300	4	389	1000	2000	2000
XBC-00044	Anchor Pass/Bell Arm Fish Weir		Sub		unknown	0	-1	4	21	100	100	100

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
	Complex											
PET-00170	Hatchery Creek Fish Trap		Sub	fish weir	unknown	9	135	4	977	500	1000	1000
XBC-00053	Burroughs Bay Pictograph 3		Rel		unknown	32	141	4	46	1000	3000	3000
PET-00026	Ruins Point		Rel	petroglyph	surface			4	21	1000	2000	2000
XBC-00054	Grant Creek Burial	up to 5250 BP	HR		unknown	25	98	4	3	500	2000	2000
PET-00144	Pet-00144		MIX		unknown	4	59	4	681	500	1000	1000
PET-00208	Mb-1	up to 5250 BP	UNK		unknown	2	180	4	130	100	100	500
PET-00583	Stone Hearth Midden		MIX	shell midden, charcoal, FCR	mixed	5	90	4	125	1000	1000	1000
PET-00531	Two Loons Midden	up to 5250 BP	Sub	midden	ground	0	-1	4	85	100	100	100
PET-00530	Navy Creek Stone Arc		Sub	fish weir - stone	unknown	9	32	4	171	100	100	500
PET-00480	Pet-00480		MIX	midden, CMT	mixed	2	288	4	392	500	500	500
PET-00558	Goose Midden	up to 5250 BP	Sub	midden	ground	1	315	4	255	500	500	1000
PET-00209	Dt 1 (False Island Midden)		Sub		unknown	2	0	4	47	1000	2000	2000
PET-00225	Thorne Island Fish Trap		Sub	fish weir	unknown	2	288	4	197	100	3000	3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00016	Devilfish Bay Petroglyph		Rel	petroglyph	surface	44	176	4	44	500	500	500
PET-00142	East Rocky Bay Fishtraps And Midden		Sub	fish weir, midden	unknown	5	213	4	322	1000	100	500
PET-00029	Shipley Bay Pictographs		Rel	petroglyph	surface	4	198	4	103	100	1000	1000
PET-00141	West Rocky Bay Midden		Sub		unknown	2	341	4	864	500	100	100
PET-00175	Pet-00175		Sub		unknown	29	93	4	163	100	500	500
PET-00321	Whale Passage Midden		Sub	midden	ground	16	155	4	91	100	2000	2000
PET-00176	Neck Creek Fish Trap		Sub	fish weir	unknown	31	78	4	166	500	500	500
PET-00222	Cantil Site	up to 5250 BP	MIX	midden, burial	mixed	20	162	4	200	500	2000	2000
PET-00174	Pet-00174		Sub		unknown	25	195	4	81	500	2000	2000
PET-00206	Windsock Fish Weir Complex (Snoose Creek Weir)	8750-9250 BP	Sub	fish weir	unknown	2	198	4	323	500	1000	1000
PET-00206	Windsock Fish Weir Complex (Snoose Creek Weir)	8750-9250 BP	Sub	fish weir	unknown	2	198	4	323	500	1000	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00206	Windsock Fish Weir Complex (Snoose Creek Weir)	8750-9250 BP	Sub	fish weir	unknown	2	198	4	323	500	1000	1000
PET-00206	Windsock Fish Weir Complex (Snoose Creek Weir)	8750-9250 BP	Sub	fish weir	unknown	2	198	4	323	500	1000	1000
PET-00206	Windsock Fish Weir Complex (Snoose Creek Weir)	8750-9250 BP	Sub	fish weir	unknown	2	198	4	323	500	1000	1000
PET-00147	Johnson Cove Midden And Cabin	up to 5250 BP	MIX		unknown	23	231	4	919	100	500	500
PET-00071	Southwest Cove Petroglyphs		Rel	petroglyph	surface	10	123	4	121	100	500	500
PET-00178	Old Shakan	up to 5250 BP	Sub	garden	unknown	5	75	4	45	100	3000	3000
PET-00324	Shakan Strait Midden & Garden Site		Sub	midden, garden	mixed	5	0	4	48	2000	100	100
PET-00466	Whale Pass Stone Tidal Fish Trap		Sub	fish weir	unknown	1	225	4	197	100	500	500
PET-00072	Whale Passage Site		Sub	shell midden	ground	13	216	4	351	100	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00107	Whale Passage Petroglyph (Punk Rock Site)		MIX	petroglyph, fish weir	mixed	6	186	4	341	100	100	500
PET-00121	Roadcut Midden		Sub	midden	ground	38	248	4	730	100	1000	1000
PET-00270	Blashke Islands 2		MIX	midden, CMT	mixed	12	40	4	163	100	1000	1000
PET-00070	Ernest Sound Petroglyphs		Rel	petroglyph	surface	8	170	4	82	100	2000	2000
PET-00269	Blashke Islands 1		MIX	midden, canoe skid	mixed	3	63	4	33	100	500	500
XPA-00085	Kell Bay Isthmus	up to 5250 BP	MIX	shell midden, adze, CMT	mixed	3	135	4	208	100	2000	2000
PET-00581	Southeast Cove Petroglyphs - West		Rel	petroglyph	surface	5	123	4	101	500	3000	3000
PET-00112	Dead Pit Burial	up to 5250 BP	HR		unknown	4	270	4	21	2000	2000	2000
PET-00017	Sutter Creek Petroglyphs (Dry Pass)		Rel		unknown	12	35	4	125	100	500	500
PET-00106	Southeast Cove Outpost (Yenakatannu)	up to 5250 BP	HB	fort	unknown	7	248	4	2	1000	3000	3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00030	Southeast Cove Petroglyphs (Rock Point)		Rel		unknown	12	234	4	8	1000	2000	2000
PET-00138	North Mosman Midden		Sub	midden	ground	6	135	4	36	100	500	500
PET-00066	Pet-00066		UNK		unknown	3	168	4	267	500	500	500
PET-00317	El Capitan Passage Stone Tidal Weir		Sub	fish weir	unknown	27	164	4	115	500	1000	1000
PET-00189	El Capitan Cave Site 1	5250-5750 BP, 5750-6250 BP, up to 5250 BP	MIX	lithic, faunal	cave	38	191	4	395	1000	2000	2000
PET-00189	El Capitan Cave Site 1	5250-5750 BP, 5750-6250 BP, up to 5250 BP	MIX	lithic, faunal	cave	38	191	4	395	1000	2000	2000
PET-00574	Mosman Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	0	-1	4	727	500	100	100
XBC-00043	Alpine Cairns		Rel	fork cairn	unknown	27	301	4	7028	1000	2000	3000
XPA-00048	Kell Bay Petroglyph		Rel	petroglyph	surface	4	288	4	93	100	1000	1000
PET-00258	Bluff Island Burial	up to 5250 BP	HR	burial	rock shelter	20	160	4	105	500	>3000	>3000
PET-00323	Caulder		MIX	midden, CMT	mixed	11	209	4	231	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
	Midden											
PET-00210	Ltf Midden		Sub		unknown	10	183	4	65	100	500	500
PET-00391	Spenc Point Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	3	348	4	35	1000	500	1000
PET-00319	Exchange Cove Weir Complex	up to 5250 BP	Sub	fish weir	unknown	6	198	4	1639	500	100	100
PET-00319	Exchange Cove Weir Complex	up to 5250 BP	Sub	fish weir	unknown	6	198	4	1639	500	100	100
PET-00056	Cedar Source Site	up to 5250 BP	TU		unknown	10	176	4	53	1000	2000	2000
PET-00261	Middle Island Fur Farm	up to 5250 BP	Sub		unknown	26	355	4	110	500	>3000	>3000
PET-00479	Pet-00479		MIX	midden, CMT	mixed	16	274	4	783	2000	2000	2000
PET-00251	Middle Islands Site		Rel	petroglyph	surface	28	140	4	49	100	>3000	>3000
PET-00180	Calder Bay Fish Trap	up to 5250 BP	Sub	fish weir	unknown	0	-1	4	1645	100	500	1000
XBC-00005	Point Warde Petroglyph		Rel	petroglyph	surface			4	15	1000	2000	2000
PET-00215	Duckbill Creek Fish Weirs	up to 5250 BP	Sub	fish weir	unknown	0	-1	4	182	100	1000	1000
PET-00215	Duckbill Creek Fish Weirs	up to 5250 BP	Sub	fish weir	unknown	0	-1	4	182	100	1000	1000
PET-00589	North Middle Island Cmt	up to 5250 BP	HR		unknown	17	241	4	140	500	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00094	South Anita Midden 2		Sub	midden	ground	10	151	4	86	3000	3000	3000
XBC-00004	Anan Creek Petroglyphs		Rel	petroglyph	surface	1	45	4	2270	100	100	500
PET-00093	Duckbill Midden Site (South Anita Midden 1)		Sub		unknown	5	0	4	51	100	2000	2000
PET-00191	Crow Point Site (Anita Shell Midden)	up to 5250 BP	MIX	midden, camp	mixed	0	-1	4	83	2000	3000	3000
PET-00191	Crow Point Site (Anita Shell Midden)	up to 5250 BP	MIX	midden, camp	mixed	0	-1	4	83	2000	3000	3000
PET-00191	Crow Point Site (Anita Shell Midden)	up to 5250 BP	MIX	midden, camp	mixed	0	-1	4	83	2000	3000	3000
PET-00191	Crow Point Site (Anita Shell Midden)	up to 5250 BP	MIX	midden, camp	mixed	0	-1	4	83	2000	3000	3000
PET-00216	Overnight Campsite	up to 5250 BP	HB	campfire	unknown	4	59	4	45	1000	1000	1000
PET-00024	Olive Cove Petroglyph Site		Rel	petroglyph	surface	5	336	4	31	100	1000	1000
XBC-00030	Eagle River Fish Weir		Sub		unknown	9	231	4	2352	100	100	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XBC-00045	Anan Creek Fish Trap		Sub	fish weir	unknown	0	-1	4	1021	100	100	500
PET-00134	Anita Fishtrap (Fish Trap Creek Site)	up to 5250 BP	Sub	fish weir, midden	mixed	11	251	4	108	2000	1000	1000
PET-00134	Anita Fishtrap (Fish Trap Creek Site)	up to 5250 BP	Sub	fish weir, midden	mixed	11	251	4	108	2000	1000	1000
PET-00134	Anita Fishtrap (Fish Trap Creek Site)	up to 5250 BP	Sub	fish weir, midden	mixed	11	251	4	108	2000	1000	1000
PET-00134	Anita Fishtrap (Fish Trap Creek Site)	up to 5250 BP	Sub	fish weir, midden	mixed	11	251	4	108	2000	1000	1000
PET-00179	Caxan'k		UNK		unknown	5	351	4	191	1000	3000	3000
PET-00240	Kindergarten Bay Rock Alignments		Sub	fish weir	unknown	3	225	4	661	1000	1000	1000
PET-00135	North Anita Midden 1 (Knoll Shell Midden)		Sub	midden, fish weir	mixed	29	173	4	206	1000	100	500
XBC-00039	Hoya Rock Formation		LITH	rock formation	unknown	0	-1	4	1026	500	500	500
XBC-00042	Small Log Crib	up to 5250 BP	HB	log crib	unknown	1	45	4	1429	500	100	100
PET-00062	Shrubby Village		HB		unknown	15	203	4	145	500	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XBC-00041	Bradfield Canal Fish Trap	up to 5250 BP	Sub	fish weir	unknown	11	29	4	1341	500	100	100
PET-00051	Shell Midden Site		Sub		unknown	4	180	4	135	100	2000	2000
PET-00006	Old Town (Kotslit-An, Old Wrangell, Deserted Village)	up to 5250 BP	HB		unknown	3	206	4	67	2000	3000	3000
PET-00573	Quiet Harbor Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	3	206	4	1557	500	500	1000
PET-00557	Pet-00557		LITH	lithic	unknown	8	99	4	1270	2000	2000	2000
XBC-00029	Harding River Fishtraps	up to 5250 BP	Sub	fish weir - wood	unknown	1	135	4	858	100	500	500
XBC-00006	Harding River Camp	up to 5250 BP	HB		unknown	6	144	4	1075	500	500	1000
XBC-00015	Campbell Creek Fish Weir	up to 5250 BP	Sub	fish weir	unknown	1	270	4	739	2000	2000	2000
PET-00048	Thoms Lake Trail Village (Thoms Aw-Aw)	up to 5250 BP	HB		unknown	4	251	4	137	1000	1000	2000
XBC-00012	Tom Creek Fish Traps	up to 5250 BP	Sub	fish weir	unknown	5	81	4	862	500	100	100
XBC-00008	Hanks Midden		MIX	midden, CD	mixed	8	195	4	770	100	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00098	Anita Bay Fort (Katsqu'nu)	up to 5250 BP	HB	fort	unknown	15	201	4	94	500	500	500
PET-00098	Anita Bay Fort (Katsqu'nu)	up to 5250 BP	HB	fort	unknown	15	201	4	94	500	500	500
XBC-00010	Frank Creek Midden		Sub	midden	ground	14	232	4	874	1000	500	1000
XBC-00027	Frank's Creek Fishweir	up to 5250 BP	Sub	fish weir	unknown	3	191	4	995	100	100	500
PET-00172	Turn Point Site		Sub	fish weir	mixed	2	180	4	137	2000	1000	1000
PET-00340	Turn Island Point #1 (Schaefer's Midden)		Sub	shell midden	ground	5	293	4	24	2000	2000	2000
PET-00341	Turn Island Point #1 (Rak's Midden)		Sub	shell midden	ground	1	225	4	47	2000	2000	2000
XBC-00034	Marten Creek Midden		Sub	midden	ground	15	198	4	1642	100	500	2000
PET-00128	Pet-00128	up to 5250 BP	MIX	shell midden, charcoal, FCR	mixed	11	71	4	1365	100	500	500
PET-00173	Zimovia Midden		Sub	midden	ground	4	239	4	52	1000	2000	2000
PET-00329	Hole-in-the-Wall Weir	up to 5250 BP	Sub	fish weir	unknown	0	-1	4	341	2000	100	500
PET-00214	South Bay Midden Site		Sub	midden	ground	5	213	4	2	1000	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00127	Pet-00127		UNK		unknown	3	315	4	718	100	100	1000
PET-00213	Dog Salmon Creek Site		LITH	lithic scatter	unknown	2	0	4	124	1000	500	500
PET-00126	Pet-00126	up to 5250 BP	MIX	midden, garden, fish weir	mixed	7	225	4	736	100	500	1000
PET-00126	Pet-00126	up to 5250 BP	MIX	midden, garden, fish weir	mixed	7	225	4	736	100	500	1000
PET-00187	Red Bay Weir	up to 5250 BP	Sub	fish weir	unknown	0	-1	4	380	1000	100	500
PET-00187	Red Bay Weir	up to 5250 BP	Sub	fish weir	unknown	0	-1	4	380	1000	100	500
PET-00187	Red Bay Weir	up to 5250 BP	Sub	fish weir	unknown	0	-1	4	380	1000	100	500
PET-00187	Red Bay Weir	up to 5250 BP	Sub	fish weir	unknown	0	-1	4	380	1000	100	500
PET-00554	Pet-00554	up to 5250 BP	Sub	fish weir - wood	unknown	4	59	4	495	100	1000	1000
PET-00182	Pet-00182	up to 5250 BP	Sub	fish weir	unknown	3	348	4	1150	500	100	100
PET-00246	Stikine Strait Pictograph And Bentwood Box	up to 5250 BP	Rel	pictograph, bentwood box	surface	43	127	4	724	100	500	1000
PET-00184	Pet-00184	up to 5250 BP	Sub	fish weir	unknown	3	168	4	1485	500	500	500
XPA-00032	Port Malmesbury Caves (Ton Caves)		UNK		unknown	24	321	4	97	500	2000	2000
PET-00201	Rock Pile		Rel		unknown	7	233	4	77	2000	3000	3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00266	Port Beauclerc Village	up to 5250 BP	HB	settlement	unknown	6	26	4	219	500	500	500
PET-00202	Otter Site	up to 5250 BP	Sub	midden	ground	3	45	4	53	1000	3000	3000
PET-00202	Otter Site	up to 5250 BP	Sub	midden	ground	3	45	4	53	1000	3000	3000
PET-00185	Pet-00185		UNK		unknown	7	68	4	601	100	500	500
PET-00186	Pet-00186		Sub	fish weir	unknown	1	270	4	553	100	500	1000
PET-00125	Pet-00125	up to 5250 BP	MIX	shell midden, charcoal, FCR	mixed	4	288	4	71	2000	3000	3000
PET-00125	Pet-00125	up to 5250 BP	MIX	shell midden, charcoal, FCR	mixed	4	288	4	71	2000	3000	3000
PET-00333	Eo #1 Area B		Sub	midden	ground	11	209	4	204	500	2000	2000
PET-00207	Eo #1 District		UNK		unknown	6	6	4	209	500	2000	2000
PET-00334	Eo #1 Area C		Sub	midden	ground	6	35	4	215	500	2000	2000
PET-00332	Eo #1 Area A [Pa]	8250-8750 BP, 8750-9250 BP	Sub	midden	mixed	10	266	4	277	500	2000	2000
PET-00332	Eo #1 Area A [Pa]	8250-8750 BP, 8750-9250 BP	Sub	midden	mixed	10	266	4	277	500	2000	2000
PET-00035	Mack Dunn Petroglyph		Rel	petroglyph	surface	5	278	4	1	3000	2000	2000
PET-00203	HRA Fish Weir	up to 5250 BP	Sub		unknown	12	100	4	380	2000	3000	3000
PET-00235	Snow Passage Rock		LITH	rock alignment	unknown	5	165	4	54	100	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
	Alignments											
PET-00553	Pet-00553		UNK		unknown	6	333	4	822	500	1000	2000
PET-00408	On Your Knees Cave	5250-5750 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP, up to 5250 BP	MIX	human remains, faunal remains	cave	4	300	4	389	2000	>3000	>3000
PET-00408	On Your Knees Cave	5250-5750 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP, up to 5250 BP	MIX	human remains, faunal remains	cave	4	300	4	389	2000	>3000	>3000
PET-00408	On Your Knees Cave	5250-5750 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP, up to 5250 BP	MIX	human remains, faunal remains	cave	4	300	4	389	2000	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00408	On Your Knees Cave	5250-5750 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP, up to 5250 BP	MIX	human remains, faunal remains	cave	4	300	4	389	2000	>3000	>3000
PET-00408	On Your Knees Cave	5250-5750 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP, up to 5250 BP	MIX	human remains, faunal remains	cave	4	300	4	389	2000	>3000	>3000
PET-00408	On Your Knees Cave	5250-5750 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP, up to 5250 BP	MIX	human remains, faunal remains	cave	4	300	4	389	2000	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00408	On Your Knees Cave	5250-5750 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP, up to 5250 BP	MIX	human remains, faunal remains	cave	4	300	4	389	2000	>3000	>3000
PET-00408	On Your Knees Cave	5250-5750 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP, up to 5250 BP	MIX	human remains, faunal remains	cave	4	300	4	389	2000	>3000	>3000
PET-00408	On Your Knees Cave	5250-5750 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP, up to 5250 BP	MIX	human remains, faunal remains	cave	4	300	4	389	2000	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00408	On Your Knees Cave	5250-5750 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP, up to 5250 BP	MIX	human remains, faunal remains	cave	4	300	4	389	2000	>3000	>3000
PET-00408	On Your Knees Cave	5250-5750 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP, up to 5250 BP	MIX	human remains, faunal remains	cave	4	300	4	389	2000	>3000	>3000
PET-00344	King George Stone Fish Weir		Sub	fish weir	unknown	0	-1	4	524	100	100	500
PET-00205	Straight Creek Fish Weirs	up to 5250 BP	Sub		unknown	0	-1	4	93	2000	500	500
PET-00205	Straight Creek Fish Weirs	up to 5250 BP	Sub		unknown	0	-1	4	93	2000	500	500
PET-00399	Paul Fish Trap	up to 5250 BP	Sub	fish weir - wood	unknown	0	-1	4	189	500	500	500
PET-00399	Paul Fish Trap	up to 5250 BP	Sub	fish weir - wood	unknown	0	-1	4	189	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00389	North Bight Midden	up to 5250 BP	Sub	midden	ground	3	296	4	221	100	100	500
PET-00389	North Bight Midden	up to 5250 BP	Sub	midden	ground	3	296	4	221	100	100	500
PET-00400	Sandberg Petroglyph		Rel		unknown	5	180	4	259	100	500	500
PET-00343	Promontory And Pebble Beach Midden		Sub	midden	ground	5	90	4	69	100	1000	1000
XPA-00216	Xpa-00216	up to 5250 BP	Sub	fish weir	unknown	6	116	4	2713	500	500	500
PET-00398	Little Midden		Sub	midden	ground	8	52	4	39	100	1000	1000
XPA-00217	Xpa-00217	up to 5250 BP	Sub	fish weir	unknown	2	270	4	2928	500	100	100
PET-00347	Honeymoon Creek Fish Trap	up to 5250 BP	Sub	fish weir	unknown	0	-1	4	47	100	500	500
PET-00347	Honeymoon Creek Fish Trap	up to 5250 BP	Sub	fish weir	unknown	0	-1	4	47	100	500	500
PET-00018	Etolin Island Petroglyph Site		Rel	petroglyph	surface			4	20	2000	3000	3000
PET-00415	South Reid Fish Weir	up to 5250 BP	Sub	fish weir	unknown	11	352	4	63	2000	2000	2000
PET-00412	Bear Midden		Sub	midden	ground	8	225	4	58	2000	2000	2000
XPA-00210	South Thetis Fish Camp And Fossil Shell	up to 5250 BP	MIX	shell, fish camp	mixed	7	225	4	508	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
	Locality [Pa+]											
XPA-00209	Xpa-00209		MIX	CMT, fish camp	mixed	3	333	4	435	100	500	500
XPA-00211	Xpa-00211 (Fish Weir And Fossil Shell Locality) [Pa+]	up to 5250 BP	MIX	fish weir, shell	mixed	0	-1	4	366	100	100	500
XPA-00164	Mccallum's Fish Weir	up to 5250 BP	Sub	fish weir	unknown	8	232	4	1294	500	500	500
PET-00015	Blake Channel Petroglyph Site (Berg Bay Petroglyph Site)		Rel	petroglyph	surface	32	93	4	11785	100	1000	1000
XPA-00208	Xpa-00208		MIX	CMT, fish camp	mixed	2	251	4	392	1000	500	500
XPA-00191	Xpa-00191	up to 5250 BP	MIX	CMT, fish camp	mixed	3	281	4	1128	500	500	500
XPA-00212	Xpa-00212	up to 5250 BP	MIX	CMT, fish camp	mixed	4	210	4	321	100	500	500
XPA-00218	Xpa-00218		Sub	midden	ground	4	30	4	972	500	500	500
XPA-00195	Xpa-00195	up to 5250 BP	MIX	CMT, fish camp	mixed	2	180	4	992	500	100	100
PET-00079	Reid Bay Camp		Sub	midden	ground	7	180	4	40	100	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00207	Xpa-00207	up to 5250 BP	MIX	midden, fish camp, CMT	mixed	10	123	4	234	100	1000	1000
PET-00159	Meter Bight Petroglyph		Rel	petroglyph	surface	3	168	4	212	100	1000	1000
XPA-00206	Xpa-00206		MIX	cache pit, CMT	mixed	7	150	4	198	100	500	500
XPA-00213	Xpa-00213	up to 5250 BP	MIX	CMT, activity area, fish camp	mixed	3	315	4	464	100	500	1000
XPA-00192	Xpa-00192		MIX	CMT, fish camp	mixed	1	270	4	628	100	500	500
XPA-00193	Xpa-00193		Sub	midden	ground	2	45	4	361	1000	500	500
XPA-00205	Yi's Fish Weir	up to 5250 BP	Sub	fish weir	unknown	1	135	4	1057	100	100	500
PET-00234	Clarence Strait Fish Weirs		Sub	fish weir	unknown	13	273	4	20	100	500	500
PET-00158	Stikine Strait Petroglyphs		Rel	petroglyph	surface	22	157	4	108	2000	2000	2000
PET-00057	Venus Cove Site		UNK		unknown	4	0	4	12594	500	500	500
XPA-00204	Xpa-00204	up to 5250 BP	Sub	fish weir	unknown	12	270	4	790	100	500	500
XPA-00215	Xpa-00215	up to 5250 BP	MIX	CMT, activity area, fish camp	mixed	9	85	4	309	100	1000	1000
PET-00233	Activity Cove Site	up to 5250 BP	Sub	fish weir - stone	unknown	10	156	4	126	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00214	Xpa-00214		MIX	CMT, activity area, fish camp	mixed	8	285	4	402	100	500	1000
XPA-00230	Xpa-00230	up to 5250 BP	MIX	midden, camp	mixed	33	139	4	261	100	500	500
XPA-00228	Xpa-00228	up to 5250 BP	MIX	CMT, camp	mixed	4	90	4	1105	500	500	2000
PET-00482	Lawyers Cave (Phalange Phreatic Tube)		MIX	faunal remains, human remains	cave	22	212	4	15296	100	500	500
XPA-00231	Xpa-00231		MIX	CMT, midden	mixed	1	45	4	240	100	1000	1000
XPA-00163	Last Stop Midden		MIX	midden, CMT	mixed	3	135	4	476	100	1000	1000
XPA-00186	Xpa-00186		Sub	midden	ground	18	29	4	339	2000	1000	1000
PET-00414	Wood Stakes	up to 5250 BP	Sub	wooden stakes	unknown	12	234	4	101	100	500	500
PET-00462	Pet-00462	up to 5250 BP	Sub	fish weir - wood	unknown	5	213	4	16602	500	100	100
PET-00462	Pet-00462	up to 5250 BP	Sub	fish weir - wood	unknown	5	213	4	16602	500	100	100
XPA-00245	Xpa-00245		MIX	midden, fish camp	mixed	3	135	4	1257	1000	100	2000
XPA-00244	Xpa-00244		MIX	midden, camp	mixed	4	210	4	1241	1000	100	2000
XPA-00168	Xpa-00168		MIX	midden, fish camp	mixed	5	90	4	1305	500	500	500
XPA-00242	Xpa-00242		MIX	midden, camp	mixed	5	156	4	598	500	1000	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00169	Xpa-00169		UNK		unknown	2	251	4	882	500	100	500
XPA-00243	Xpa-00243		MIX	midden, camp	mixed	12	63	4	990	500	2000	2000
PET-00231	Low Tide Fish Weir	up to 5250 BP	Sub	fish weir	unknown	0	-1	4	33	100	100	100
XPA-00202	Xpa-00202		Sub	midden	ground	0	-1	4	477	500	500	500
PET-00034	Shoemaker Bay Petroglyph Site		Rel	petroglyph	surface	0	-1	4	20	100	100	100
XPA-00152	Xpa-00152		Sub	midden	ground	0	-1	4	396	100	2000	2000
XPA-00151	Xpa-00151		Sub	midden	ground	3	116	4	390	100	1000	1000
XPA-00157	Xpa-00157		Sub	midden	ground	2	71	4	750	100	500	1000
XPA-00038	Xpa-00038 (Lisa Point Site)		MIX	midden, garden, CMT, CD	mixed	6	333	4	602	100	500	1000
XPA-00185	Xpa-00185		MIX	midden, camp	mixed	2	18	4	631	1000	1000	1000
XPA-00194	Xpa-00194		Sub	midden	ground	8	24	4	1657	500	1000	1000
PET-00230	Point St John Fish Weir		Sub	fish weir	unknown	10	315	4	112	500	2000	2000
XPA-00190	Xpa-00190		Sub	midden	ground	3	206	4	1781	500	1000	1000
XPA-00156	Xpa-00156		Sub	midden	ground	11	334	4	695	500	500	1000
XPA-00154	Xpa-00154		Sub	midden	ground	16	163	4	638	500	500	1000
XPA-00149	Xpa-00149		Sub	midden, garden	mixed	2	341	4	881	500	1000	2000
XPA-00155	Xpa-00155		Sub	midden	ground	9	116	4	715	500	1000	1000
PET-00212	Pet-00212	up to 5250 BP	Sub	fish weir	unknown	19	239	4	400	500	500	500
XPA-00150	Xpa-00150		Sub	midden	ground	8	189	4	419	100	500	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00069	Thetis Bay Village	up to 5250 BP	HB		unknown	3	45	4	656	100	1000	1000
XPA-00158	Running Dog Shell Midden		Sub	midden	ground	9	180	4	473	100	500	500
XPA-00184	Xpa-00184		Sub	midden	ground	5	90	4	442	1000	2000	2000
PET-00360	Point Barrie Driftwood Canoe		Tran		unknown	0	-1	4	987	100	3000	3000
XPA-00147	Xpa-00147		Sub	midden	ground	10	225	4	505	1000	1000	2000
XPA-00183	Xpa-00183		MIX	midden, camp	mixed	18	90	4	559	1000	2000	2000
PET-00498	St. John Wood Stake Fish Trap	up to 5250 BP	Sub	fish weir - wood	unknown	0	-1	4	742	100	500	500
XPA-00171	Xpa-00171		MIX	midden, camp	mixed	21	50	4	900	100	500	2000
XPA-00159	Xpa-00159		Sub	midden	ground	17	228	4	280	100	500	500
PET-00544	Pet-00544		Rel	petroglyph	surface	3	225	4	167	100	3000	3000
XPA-00148	Broken Knife Midden		Sub	midden	ground	4	135	4	661	1000	2000	2000
XPA-00173	Xpa-00173		MIX	midden, camp	mixed	2	90	4	623	100	500	1000
XPA-00172	Xpa-00172		MIX	midden, camp	mixed	7	281	4	751	500	500	1000
XPA-00039	Xpa-00039 (Herring Bone Village)	up to 5250 BP	MIX	house pit, midden, canoe skid	mixed	3	243	4	895	500	1000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00039	Xpa-00039 (Herring Bone Village)	up to 5250 BP	MIX	house pit, midden, canoe skid	mixed	3	243	4	895	500	1000	2000
XPA-00174	Xpa-00174		MIX	midden, camp	mixed	3	45	4	447	100	500	500
XPA-00166	Pfeffer's Midden		MIX	midden, camp	mixed	16	145	4	648	100	500	500
XPA-00178	Xpa-00178		Sub	midden	ground	3	26	4	729	100	500	1000
XPA-00251	Xpa-00251		Sub	midden	ground	15	79	4	447	100	2000	2000
XPA-00175	Xpa-00175		MIX	midden, camp	mixed	5	90	4	510	1000	500	500
XPA-00176	Xpa-00176		MIX	midden, camp	mixed	5	56	4	543	1000	500	500
XPA-00234	Xpa-00234		UNK		unknown	17	87	4	449	100	2000	2000
XPA-00177	Xpa-00177		Sub	midden	ground	10	86	4	595	100	500	500
XPA-00252	Xpa-00252		Sub	midden	ground	4	71	4	474	1000	500	500
XPA-00179	Xpa-00179		MIX	midden, camp	mixed	7	29	4	943	100	1000	1000
XPA-00030	Tebenkof Bay Village (Tebenkov Bay Totem)	up to 5250 BP	HB		unknown	4	149	4	418	1000	500	500
XPA-00182	Xpa-00182		Sub	midden	ground	3	78	4	571	100	500	1000
XPA-00250	Xpa-00250		UNK		unknown	0	-1	4	403	100	3000	3000
XPA-00181	Xpa-00181		MIX	midden, camp	mixed	4	329	4	635	100	500	1000
XPA-00161	Xpa-00161		MIX	midden, CMT	mixed	5	270	4	1249	500	1000	1000
XPA-00180	Xpa-00180		Sub	midden	ground	20	66	4	676	100	1000	1000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00122	Secluded Cove Stone Alignment		Sub	fish weir	unknown	2	18	4	2863	500	1000	1000
XPA-00249	Xpa-00249		UNK		unknown	5	203	4	857	1000	>3000	>3000
XPA-00232	Xpa-00232	up to 5250 BP	MIX	CMT, camp	mixed	21	145	4	871	100	>3000	>3000
XPA-00233	Xpa-00233		UNK		unknown	13	183	4	983	1000	>3000	>3000
PET-00404	East Douglas Fish Weirs And Rock Alignment	up to 5250 BP	Sub	fish weir - wood & rock	unknown	0	-1	4	251	1000	500	500
XPA-00248	Xpa-00248		UNK		unknown	9	32	4	761	100	>3000	>3000
PET-00078	No Name Midden		Sub	midden	ground	14	205	4	71	100	500	500
PET-00535	Pet-00535		UNK		unknown	12	243	4	104	100	>3000	>3000
XPA-00167	Xpa-00167		MIX	midden, camp	mixed	15	243	4	467	100	2000	2000
PET-00405	Stone Adze Midden		MIX	shell midden, charcoal	mixed	4	135	4	136	1000	3000	3000
PET-00406	Nearend Site		MIX	shell midden, charcoal	mixed	1	90	4	111	100	3000	3000
XPA-00123	Xpa-00123		Sub	fish weir	unknown	3	243	4	3583	500	100	100
PET-00351	Kushneahin Creek Depressions		MIX	CD, CMT	mixed	2	341	4	225	100	500	500
PET-00370	Little Totem Crescent Midden		Sub	midden	ground	0	-1	4	185	500	2000	3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00376	False Island Midden		MIX	shell midden	ground	2	198	4	91	100	3000	3000
XPA-00029	Elena Bay Village	up to 5250 BP	HB		unknown	11	240	4	443	1000	1000	1000
PET-00033	Wrangell Glyph		Rel	petroglyph	surface	0	-1	4	51	2000	500	500
PET-00371	West Shore Midden		MIX	shell midden, bone, charcoal, tooth	mixed	3	243	4	197	100	2000	2000
XPA-00108	Xpa-00108		Sub	midden	ground	4	288	4	513	1000	2000	2000
PET-00380	Rocky Bight Midden		MIX	shell midden, charcoal	mixed	7	168	4	134	1000	2000	2000
PET-00379	Dry Bight Midden		MIX	shell midden, FCR	mixed	5	156	4	152	1000	2000	2000
PET-00381	Long Line Midden		MIX	shell midden, FCR	mixed	4	315	4	26	1000	2000	2000
XPA-00028	Gap Point Village (Kalhin'an)	up to 5250 BP	MIX	midden, house pit	mixed	19	114	4	700	1000	2000	2000
PET-00382	Hawk Midden		Sub	shell midden	ground	2	341	4	43	1000	2000	2000
PET-00375	Central Douglas Fish Weir Complex	up to 5250 BP	Sub	fish weir - wood	unknown	0	-1	4	134	500	500	500
PET-00364	Douglas Bay Fish Traps	up to 5250 BP	Sub	fish weir - wood	unknown	0	-1	4	43	1000	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00409	Sal's Site		MIX	shell midden, FCR	mixed	2	90	4	46	100	2000	2000
PET-00401	Gumboat Midden (Gumboot Midden)		Sub	midden	ground	7	185	4	96	100	2000	2000
XPA-00107	Xpa-00107		Sub	midden	ground	14	78	4	703	500	2000	2000
PET-00372	Little Totem Village		MIX	midden, settlement, CD	mixed	10	293	4	4	500	2000	2000
PET-00369	Douglas Bay Stone Fish Weir		Sub	fish weir	unknown	0	-1	4	34	1000	100	100
PET-00023	Mill Creek Village Site	up to 5250 BP	HB		unknown	9	218	4	6871	500	100	100
XPA-00226	Xpa-00226	up to 5250 BP	MIX	CMT, camp	mixed	24	170	4	656	1000	500	1000
XPA-00196	Xpa-00196		Sub	midden	ground	17	191	4	754	1000	2000	2000
PET-00104	Point Shekesti Burial	up to 5250 BP	Rel	totem pole	surface	6	333	4	40	2000	2000	2000
XPA-00146	Elena Point Site		Sub	midden	ground	3	225	4	1630	500	1000	500
XPA-00145	Secluded Bay Midden		Sub	midden	ground	3	296	4	2347	100	500	500
XPA-00188	Xpa-00188	up to 5250 BP	MIX	midden, refuge rock	mixed	8	127	4	1373	500	500	500
XPA-00227	Xpa-00227		MIX	CMT, camp	mixed	2	270	4	843	100	2000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00106	First Cove Village	up to 5250 BP	MIX	midden, house pit, CMT	mixed	24	168	4	988	100	2000	2000
XPA-00106	First Cove Village	up to 5250 BP	MIX	midden, house pit, CMT	mixed	24	168	4	988	100	2000	2000
PET-00074	No Name Camp		Sub	midden	ground	0	-1	4	55	100	2000	2000
XPA-00111	Xpa-00111		UNK		unknown	15	100	4	974	1000	1000	1000
XPA-00189	Xpa-00189		Sub	midden	ground	15	341	4	1622	500	1000	500
XPA-00138	Elena Bay Fort	up to 5250 BP	MIX	midden, defensive	mixed	8	245	4	869	100	500	500
PET-00378	Another Midden		MIX	shell midden, CMT	mixed	2	71	4	248	100	500	500
XPA-00139	Xpa-00139		Sub	midden	ground	9	94	4	918	100	500	500
XPA-00110	Xpa-00110		Sub	midden	ground	27	90	4	1093	100	500	500
PET-00384	Fantasy Island Midden		MIX	shell midden, FCR	ground	1	315	4	84	500	1000	1000
XPA-00141	Xpa-00141	up to 5250 BP	Sub	midden	ground	1	225	4	1468	100	1000	1000
XPA-00141	Xpa-00141	up to 5250 BP	Sub	midden	ground	1	225	4	1468	100	1000	1000
PET-00377	Lookout Midden		MIX	shell midden, charcoal	mixed	8	80	4	137	1000	500	500
XPA-00118	Xpa-00118		UNK		unknown	5	261	4	1374	500	500	500
PET-00084	Conclusion Fur Farm	up to 5250 BP	Sub		unknown	9	302	4	155	2000	>3000	>3000
XPA-00113	Xpa-00113		HB	house pit	ground	1	0	4	1450	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00116	Broken Village Site		MIX	midden, house pit	ground	2	270	4	1503	100	500	500
XPA-00132	Secluded Cove Weir 2	up to 5250 BP	Sub	fish weir	unknown	14	2	4	3771	500	100	100
XPA-00142	Xpa-00142		Sub	midden	ground	4	90	4	1900	500	2000	2000
XPA-00109	Xpa-00109		Sub	midden	ground	10	98	4	1665	100	500	500
XPA-00143	Xpa-00143		Sub	midden	ground	12	273	4	2944	100	500	500
XPA-00115	Xpa-00115		Sub	midden	ground	0	-1	4	1534	100	500	500
XPA-00140	Dead Eagle Site		Sub	midden	ground	7	150	4	1820	500	500	500
XPA-00114	Miller Fort Site		Sub	midden, cache pit	ground	2	180	4	1633	100	500	500
XPA-00131	Secluded Cove Weir 1	up to 5250 BP	Sub	fish weir	unknown	10	188	4	3979	500	500	500
PET-00367	Totem Bluff Midden		Sub	midden	ground	4	120	4	84	100	1000	2000
XPA-00229	Xpa-00229	up to 5250 BP	TU	CMT	surface	21	129	4	1743	100	500	500
PET-00368	Historic Camp Furniture		HB	furniture	unknown	8	180	4	77	100	1000	2000
XPA-00112	Hidden Cove Village	up to 5250 BP	MIX	midden, house pit	mixed	15	213	4	1762	100	500	1000
XPA-00112	Hidden Cove Village	up to 5250 BP	MIX	midden, house pit	mixed	15	213	4	1762	100	500	1000
XPA-00197	Happy Cove Midden 1		Sub	midden	ground	12	190	4	1113	100	1000	2000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00521	Pet-00521		Sub	shell midden	ground	5	336	4	256	500	100	100
XPA-00200	Xpa-00200		UNK		unknown	0	-1	4	655	100	2000	2000
XPA-00144	Lost Midden Site		Sub	midden	ground	10	171	4	3092	100	100	500
XPA-00239	Xpa-00239		MIX	midden, camp	mixed	3	191	4	1036	500	2000	2000
XPA-00130	Aleck's Creek Weir	up to 5250 BP	Sub	fish weir	unknown	8	114	4	4204	100	100	500
XPA-00224	Xpa-00224	up to 5250 BP	MIX	CMT, camp, activity area	mixed	12	69	4	1935	500	100	100
XPA-00050	Alecks Creek Village	up to 5250 BP	HB		unknown	3	45	4	3733	500	500	100
XPA-00009	Tebenkof Bay Petroglyph		Rel	petroglyph	surface			4	166	1000	1000	1000
XPA-00240	Xpa-00240		MIX	midden, camp	mixed	2	315	4	1083	100	2000	2000
XPA-00198	Xpa-00198		Sub	midden	ground	5	66	4	1507	500	1000	1000
XPA-00241	Xpa-00241		MIX	midden, camp	mixed	7	248	4	975	100	2000	2000
PET-00411	Pet-00411	up to 5250 BP	MIX	midden, canoe skid	mixed	4	239	4	29	1000	3000	3000
PET-00411	Pet-00411	up to 5250 BP	MIX	midden, canoe skid	mixed	4	239	4	29	1000	3000	3000
PET-00032	North Wrangell Petroglyphs (Wrangell Petroglyphs)		Rel	petroglyph	surface	5	98	4	67	1000	3000	3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00117	Xpa-00117		MIX	midden, house pit, cache pit	ground	13	86	4	2359	500	2000	2000
XPA-00199	Happy Cove Fish Weir And Fish Camp	up to 5250 BP	MIX	fish weir	mixed	10	135	4	1739	100	1000	1000
PET-00365	East Totem Midden		MIX	shell midden, charcoal	mixed	20	193	4	440	1000	500	500
PET-00500	Petroglyphs		Rel	petroglyph	surface	11	45	4	7	1000	1000	1000
PET-00366	Mable Site		Sub	midden	ground	0	-1	4	781	100	100	500
PET-00551	Alecks Creek Portage Trail		Tran		unknown	5	188	4	1357	100	500	500
XPA-00126	Xpa-00126		Sub	fish weir	unknown	0	-1	4	3738	500	500	500
XPA-00129	Garth's Midden Site		Sub	midden	ground	3	191	4	4105	500	500	500
PET-00374	Two Maiden Middens		MIX	shell midden, charcoal	mixed	2	180	4	927	100	500	500
XPA-00127	Xpa-00127		UNK		unknown	7	225	4	3694	500	500	500
XPA-00125	Xpa-00125		Sub	fish weir	unknown	10	140	4	4054	500	500	500
PET-00013	Babbler Point Petroglyphs		Rel	petroglyph	surface	7	143	4	2148	100	1000	1000
PET-00245	Eastern Passage Petroglyph 2		Rel	petroglyph	surface	5	165	4	2267	100	1000	1000
XPA-00128	Xpa-00128		Sub	midden	ground	0	-1	4	3759	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00344	Alecks Creek Portage Trail		Tran		unknown	30	326	4	3285	100	2000	2000
XPA-00223	Xpa-00223	up to 5250 BP	MIX	CMT, activity area	mixed	11	165	4	3344	100	2000	2000
PET-00361	Skiff Island South Midden		MIX	shell midden, charcoal	mixed	32	272	4	50	100	1000	1000
PET-00486	Totem Creek Fish Weir	up to 5250 BP	Sub	fish weir	unknown	1	225	4	1792	500	500	500
PET-00362	Skiff Island North Midden		MIX	shell midden, charcoal	mixed	37	305	4	105	500	1000	1000
XPA-00222	Xpa-00222	up to 5250 BP	MIX	CMT, activity area	mixed	2	108	4	4009	500	1000	1000
XPA-00137	Peter's Fish Camp	up to 5250 BP	HB	camp	unknown	24	266	4	5257	100	1000	1000
XPA-00237	Piledriver Shell Midden 2		MIX	midden, CMT	mixed	5	326	4	870	500	1000	1000
PET-00349	Three Middens		Sub	midden	ground	14	357	4	140	500	500	1000
XPA-00221	Xpa-00221	up to 5250 BP	MIX	CMT, activity area, fish camp	mixed	0	-1	4	5718	100	1000	1000
XPA-00246	Piledriver Fish Camp 2	up to 5250 BP	MIX	CMT, camp	mixed	3	11	4	1312	1000	100	500
XPA-00007	Piledriver Cove		Rel	pictograph, petroglyph	surface	0	-1	4	1313	1000	100	500
XPA-00238	Piledriver Fish	up to 5250 BP	MIX	CMT, fish	mixed	6	6	4	1414	1000	100	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
	Camp 1			camp								
PET-00014	Eastern Passage Petroglyphs		Rel	petroglyph	surface	16	231	4	564	2000	3000	3000
XPA-00235	Xpa-00235		MIX	CMT, camp	mixed	0	-1	4	1219	1000	500	1000
XPA-00236	Piledriver Shell Midden 1		MIX	midden, camp	mixed	5	270	4	1451	1000	500	1000
XPA-00134	North Elena Bay Midden		Sub	midden	ground	0	-1	4	7006	500	500	500
XPA-00135	Devils Club Midden		Sub	midden	ground	8	198	4	7053	100	500	500
XPA-00133	Elena Bay Fish Camp 1	up to 5250 BP	HB	camp	unknown	3	63	4	6876	500	500	500
XPA-00165	Xpa-00165		UNK		unknown	1	135	4	7270	500	100	100
XPA-00120	Big Creek Stone Alignment		Sub	fish weir	unknown	4	59	4	7540	500	500	500
PET-00359	Lovelace Lagoon Hearth		MIX	hearth, burnt bone	mixed	0	-1	4	63	100	500	500
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500
XPA-00119	Hidden Falls (Big Creek Weir)	6750-7250 BP, 8750-9250 BP, 9250-9750 BP, 9750-10250 BP	Sub	fish weir	unknown	2	0	4	7425	500	500	500

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00121	Big Creek Fish Camp		Sub		unknown	10	146	4	7659	100	500	500
PET-00353	Lovelace Creek Fish Trap	up to 5250 BP	Sub	fish trap - wood	unknown	6	153	4	366	500	500	500
PET-00348	Lovelace Creek Shell Midden		MIX	midden, CMT	mixed	0	-1	4	491	500	500	500
PET-00358	Nicodemus Pepper		Sub	midden	ground	0	-1	4	416	100	500	500
PET-00457	Seclusion Village		Sub	midden	ground	2	180	4	151	100	500	500
PET-00456	Sumner Creek Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	2	90	4	7	1000	100	100
PET-00456	Sumner Creek Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	2	90	4	7	1000	100	100
PET-00456	Sumner Creek Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	2	90	4	7	1000	100	100
PET-00456	Sumner Creek Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	2	90	4	7	1000	100	100
PET-00456	Sumner Creek Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	2	90	4	7	1000	100	100
PET-00456	Sumner Creek Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	2	90	4	7	1000	100	100
PET-00456	Sumner Creek Fish Weir	up to 5250 BP	Sub	fish weir - wood	unknown	2	90	4	7	1000	100	100

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00458	Salt Lagoon Fish Weir	up to 5250 BP	Sub	fish weir	unknown	5	261	4	36	100	500	500
PET-00549	Pet-00549		Sub	fish weir	unknown	3	243	4	102	100	>3000	>3000
PET-00559	Wood Stake Fish Weir	up to 5250 BP	Sub		unknown	0	-1	4	211	100	500	500
PET-00021	Kadin Island Petroglyph Site		Rel	petroglyph	surface	9	32	4	1353	100	1000	3000
PET-00102	Eastern Passage Village And Petroglyph Site	up to 5250 BP	Rel	petroglyph	surface	9	270	4	2239	500	500	500
PET-00354	Lovelace Bay Village	up to 5250 BP	HB	village	unknown	7	225	4	151	500	2000	2000
PET-00355	Lovelace Bay Middens		Sub	midden	ground	2	180	4	228	500	2000	2000
PET-00356	Keku Strait Midden		Sub	midden	ground	8	245	4	143	100	2000	2000
PET-00357	Rock Cairn Site		Rel		unknown	0	-1	4	28	100	3000	3000
PET-00455	Sumner Creek Fish Trap	up to 5250 BP	Sub	fish weir - wood	beach	8	239	4	266	2000	500	500
PET-00249	Harvey Creek Fish Weir	up to 5250 BP	Sub	fish weir	unknown	7	240	4	162	1000	100	500
XPA-00100	Foskin's Midden		Sub	midden	ground	13	57	4	239	2000	3000	3000
XPA-00041	Pillar Fort	up to 5250 BP	HB		unknown	10	168	4	57	2000	3000	3000
PET-00460	Mile Village	up to 5250 BP	Sub	midden	ground	0	-1	4	42	2000	3000	3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
PET-00418	Boulder Midden		Sub	midden	ground	0	-1	4	88	100	1000	1000
PET-00419	Hillar Midden		Sub	midden	ground	9	175	4	90	500	1000	1000
PET-00087	Threemile Midden		Sub	midden	ground	2	90	4	92	1000	1000	1000
PET-00256	Threemile Arm Site		UNK		unknown	0	-1	4	95	1000	500	500
PET-00420	Hillar Creek Fish Weirs		Sub	fish weir	unknown	4	45	4	445	500	100	100
XPA-00026	Pillars Weir		Sub		unknown	2	288	4	65	100	>3000	>3000
PET-00417	Wind Point Midden		Sub	midden	ground	3	168	4	119	2000	500	500
XPA-00027	Bay Of Pillars Village (Pillars Garden)	up to 5250 BP	Sub		unknown	3	168	4	176	100	3000	3000
PET-00031	Stikine River Mouth Petroglyphs		Rel	petroglyph	surface	5	336	4	5044	3000	500	2000
PET-00550	Portage Trail		Tran		unknown	1	180	4	1852	1000	500	1000
PET-00073	Camden Creek Petroglyph (East Port Camden Creek)		Rel	petroglyph	surface	20	76	4	258	100	500	500
PET-00045	Duncan Canal Village (Duncan Garden)	up to 5250 BP	HB		unknown	3	243	4	101	3000	>3000	>3000

Site Number	Site Name	Time Period	Site Type	Materials	Landforms	Slope	Aspect	Sinuosity	Distance Coast	Distance Lake	Distance Site	Distance Tributary
XPA-00024	Berry Bush Area	up to 5250 BP	Sub		unknown	8	195	4	85	500	>3000	>3000
XPA-00051	Bay Of Pillars Portage		Tran		unknown	0	-1	4	1054	1000	500	1000
XPA-00023	Rowan Village (South Shore Midden)	up to 5250 BP	HB		unknown	0	-1	4	93	100	>3000	>3000
XPA-00093	Rowan Bay South Island		MIX	midden, CD, house pit	mixed	1	45	4	88	500	>3000	>3000
XPA-00062	Rowan Bay Burial (Indian Doctor Burial And Totem)	up to 5250 BP	MIX	midden, garden, burial	mixed	0	-1	4	60	100	>3000	>3000
XPA-00043	Camden Fishtrap	up to 5250 BP	Sub	fish weir	unknown	22	178	4	185	100	1000	1000

F.2 Part 2: Weighted overlay site statistics

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
DIX-00013														3
DIX-00024	3	3	3	3	3	3	4	4	3	3	4	3	3	3
DIX-00038	3	3	3	3	3	3	3	3	3	3	4	3	3	3
DIX-00008	3	3	2	2	2	2	3	3	2	2	3	3	3	3
DIX-00041	3	3	3	3	3	3	3	3	3	3	3	3	3	3
DIX-00018	1	1	1	1	1	1	1	1	1	2	2	1	2	3
DIX-00006	3	3	3	3	3	3	3	3	2	3	3	3	3	3
DIX-00033	2	2	2	2	2	2	2	2	2	3	3	2	2	3
DIX-00026	3	3	3	3	3	3	3	3	3	3	4	3	3	3
DIX-00060	2	2	2	2	3	3	2	2	3	3	3	2	3	3
DIX-00062	3	3	2	2	2	3	3	3	2	2	3	3	3	3
DIX-00063	3	3	3	3	3	3	3	3	2	2	3	3	3	3
DIX-00019														3
DIX-00017														3
DIX-00045	3	3	3	3	3	3	2	3	3	3	3	3	3	3
DIX-00065	3	3	3	3	3	3	3	3	3	3	3	3	3	3
DIX-00052	2	2	2	2	2	2	2	2	2	2	3	2	2	2
DIX-00051	2	2	1	2	1	2	2	2	1	2	3	2	2	2
XPR-00079	2	2	2	2	2	2	2	2	2	2	3	2	2	2
DIX-00053	3	3	2	2	2	3	3	3	2	2	3	3	3	3
DIX-00010														3
DIX-00044	3	3	3	3	3	3	3	3	3	3	4	3	3	3
DIX-00028														3
DIX-00058	3	3	3	3	4	4	3	3	4	4	4	3	3	3
DIX-00009	3	3	3	3	3	3	3	3	3	3	3	3	3	3
DIX-00003														2
DIX-00032	3	3	3	3	3	3	3	3	3	3	4	3	3	3
DIX-00068	3	3	3	3	3	3	3	3	3	3	3	3	3	3
DIX-00015	2	2	2	2	2	2	2	2	2	2	3	2	2	3
XPR-00054	3	3	3	3	3	3	2	3	3	3	3	3	3	3
DIX-00048	3	2	2	2	2	2	2	2	2	2	3	3	2	3
DIX-00047														3
DIX-00046	4	4	4	4	4	4	4	4	3	4	4	4	4	3
DIX-00046	4	4	4	4	4	4	4	4	3	4	4	4	4	3
XPR-00052	3	3	3	3	3	3	3	3	3	3	4	3	3	3
DIX-00002														2
DIX-00043	2	2	2	2	2	2	2	2	2	2	3	2	2	3
XPR-00053	3	3	3	3	3	3	3	3	3	3	3	3	3	3
DIX-00031	2	2	2	2	2	2	2	2	2	2	3	2	2	2

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
XPR-00073	2	2	2	2	2	2	2	2	2	3	3	2	2	2
XPR-00072	3	3	2	3	3	3	3	3	2	3	3	3	3	2
XPR-00074	3	3	2	3	3	3	2	3	3	3	3	3	3	3
DIX-00064	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPR-00071	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPR-00070														3
XPR-00068														2
XPR-00067	2	2	2	2	2	3	2	2	2	3	3	2	3	2
DIX-00014	4	4	4	4	4	4	4	4	4	4	4	4	4	3
XPR-00015														3
XPR-00014	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00351	3	3	3	3	3	4	3	3	3	3	4	3	3	3
XPR-00048	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00534														3
KET-00780	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00350														3
CRG-00535	3	3	3	3	3	3	2	3	3	3	3	3	3	3
KET-00013	2	2	1	2	1	2	1	2	1	2	3	2	2	2
CRG-00230	3	3	3	3	3	3	3	3	3	3	3	3	3	3
KET-00010	2	2	2	2	2	2	2	2	2	2	3	2	2	2
KET-00705	2	2	2	2	2	2	2	2	2	2	3	2	2	2
KET-00022														3
KET-00045														3
KET-00046														3
CRG-00102	3	3	3	3	3	3	3	3	4	4	4	3	3	3
CRG-00101	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00030	4	4	3	4	4	4	4	4	3	3	4	4	4	3
CRG-00094	2	2	2	2	2	2	2	3	2	2	3	2	3	3
CRG-00382	4	3	3	3	4	4	3	4	3	3	4	4	4	3
KET-00229	2	2	1	2	1	1	1	2	2	2	2	2	2	2
KET-00229	2	2	1	2	1	1	1	2	2	2	2	2	2	2
KET-00229	2	2	1	2	1	1	1	2	2	2	2	2	2	2
CRG-00003	3	3	3	3	3	3	3	3	2	2	3	3	3	3
CRG-00348	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00349	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00393	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00108	3	3	3	3	3	3	3	3	3	3	3	3	3	3
KET-00447	2	3	2	3	3	3	2	2	3	3	3	2	3	3
KET-00650	3	2	2	2	2	2	3	3	2	2	3	3	3	3
KET-00016	3	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00180	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
CRG-00014	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CRG-00088	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00088	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00088	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00088	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00088	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00088	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00359	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CRG-00027														2
KET-00586	2	2	2	2	2	2	2	2	2	2	3	2	2	2
KET-00585	2	2	2	2	2	2	2	2	2	2	3	2	2	3
KET-00587	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00099	2	2	2	2	2	2	2	2	1	2	3	2	2	3
CRG-00124	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00034	3	2	2	2	2	2	2	2	2	2	3	2	2	2
KET-00566	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00376	3	3	3	3	4	4	3	3	4	4	4	3	3	3
KET-00563	3	3	3	3	3	3	3	3	3	3	3	3	3	3
KET-00562	3	3	2	3	3	3	2	3	3	3	3	3	3	3
CRG-00181	3	3	3	3	3	3	4	4	3	3	4	4	3	3
CRG-00339	4	3	3	4	3	4	3	3	4	4	4	4	4	3
KET-00565	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00028	3	3	3	3	3	3	3	3	2	3	3	3	3	3
KET-00564	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00131														3
KET-00999	3	2	2	2	2	2	2	2	1	1	3	2	2	3
CRG-00338	3	2	2	2	2	2	2	2	2	3	3	3	3	2
CRG-00396	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00008	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00022	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00049	4	4	3	4	4	4	4	4	3	3	4	4	4	3
CRG-00391														3
KET-00750	2	1	1	1	1	1	1	1	1	1	2	1	2	3
CRG-00329	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00187	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00320	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00321	2	2	2	2	2	2	3	3	2	2	3	3	3	3
KET-00746	2	2	1	2	1	2	1	1	2	2	2	2	2	3
CRG-00186	3	3	2	3	2	3	3	3	2	3	3	3	3	3
CRG-00185	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00184	3	2	2	2	2	2	2	2	2	2	3	2	3	2

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
KET-00747	4	3	3	3	3	3	3	3	3	3	4	3	3	3
KET-00295	2	2	2	2	1	2	2	2	1	2	3	2	2	3
CRG-00285	3	3	3	3	3	3	2	3	3	3	3	3	3	3
KET-00021	2	2	2	2	2	2	2	2	1	2	3	2	2	3
CRG-00286	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00069	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00434	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CRG-00434	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CRG-00231	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CRG-00288	3	2	2	2	2	2	2	2	2	3	3	2	2	3
KET-00077	3	3	3	3	3	3	3	3	4	4	4	3	3	3
CRG-00289	3	2	2	2	2	2	2	2	2	2	3	3	2	3
CRG-00287	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00323	3	3	3	3	3	3	3	3	2	2	3	3	3	3
CRG-00322	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00171	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00171	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00381	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00037	3	3	2	3	3	3	3	3	2	3	3	3	3	3
CRG-00037	3	3	2	3	3	3	3	3	2	3	3	3	3	3
CRG-00283	4	3	3	3	3	3	3	3	3	3	4	4	3	3
KET-00299														3
KET-00658	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00324	3	2	2	2	2	3	2	2	3	3	3	3	3	2
KET-00748														3
CRG-00325	3	2	2	2	2	2	2	2	2	2	3	2	2	2
KET-00523	3	3	3	3	4	4	3	3	4	4	4	3	3	3
CRG-00290	3	2	2	2	2	2	2	2	2	2	3	2	2	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
KET-00749	3	2	2	2	2	2	3	3	2	2	3	3	3	3
CRG-00282	3	2	2	2	2	2	3	3	2	2	3	3	2	3
CRG-00292	3	3	3	3	3	3	3	3	2	3	4	3	3	3
KET-00428	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00377	3	3	3	3	3	3	3	3	2	2	4	3	3	3
CRG-00377	3	3	3	3	3	3	3	3	2	2	4	3	3	3
CRG-00130	2	2	2	2	2	2	2	2	2	2	3	2	3	2
CRG-00342	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00342	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00256	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00255	2	2	2	2	2	2	2	3	2	2	3	3	3	2
KET-00427	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00254	2	2	2	2	2	2	2	2	2	2	3	2	3	3
CRG-00264	3	3	2	3	3	3	2	3	3	3	3	3	3	3
CRG-00553	3	3	3	3	3	3	3	3	3	3	3	3	3	3
KET-00302														2
KET-00302														2
KET-00426	3	2	2	2	2	2	3	3	2	2	3	3	3	3
KET-00422	3	2	2	2	2	2	3	3	2	2	3	3	3	3
KET-00422	3	2	2	2	2	2	3	3	2	2	3	3	3	3
CRG-00327	2	1	1	1	1	1	1	1	1	1	2	1	2	3
CRG-00253	3	2	2	3	3	3	2	2	3	3	3	3	3	3
CRG-00326	2	2	1	1	1	1	1	2	1	1	2	2	2	3
KET-00303														2
KET-00303														2
KET-00303														2
KET-00986	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00020	3	3	2	3	2	2	3	3	2	2	3	3	3	3
CRG-00023	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00460	3	2	2	2	2	2	3	3	2	2	3	3	3	3
KET-00348	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00252	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00250	3	3	2	3	2	3	3	3	2	3	3	3	3	3
KET-00436	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00251	2	2	2	2	2	3	2	2	2	3	3	2	3	3
KET-00017	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00188	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00259	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00475	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00459														3
CRG-00257														3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
KET-00424	3	3	2	2	2	3	3	3	2	2	3	3	3	3
CRG-00024														2
CRG-00001	3	2	2	2	2	2	3	3	2	2	3	3	3	3
CRG-00241														3
CRG-00076	3	3	3	3	3	3	3	3	3	3	3	3	3	3
KET-00107	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00240														3
CRG-00538														3
CRG-00361														3
CRG-00293	3	2	2	2	2	3	2	2	2	2	3	3	3	3
CRG-00294	4	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00261	3	2	2	2	2	3	2	2	2	2	3	3	3	3
CRG-00263	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00063	3	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00242	3	3	2	3	3	3	2	2	3	3	3	3	3	3
CRG-00258	3	2	2	3	3	3	2	2	3	3	3	3	3	2
CRG-00249	3	3	3	3	3	3	3	3	3	3	4	3	3	3
KET-00078														2
CRG-00328	3	2	2	2	2	2	2	2	2	2	3	3	2	3
KET-00352	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00046	3	2	2	2	2	2	3	3	2	2	3	3	3	3
CRG-00243	2	2	2	2	2	2	2	3	2	2	3	2	3	2
CRG-00311	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00312	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00309	3	3	2	3	3	3	3	3	2	2	3	3	3	3
CRG-00536														3
CRG-00310	2	2	2	2	2	2	3	3	2	2	3	3	3	3
KET-00423	2	2	2	2	2	2	2	2	2	2	3	2	3	2
CRG-00146	2	2	2	2	2	2	2	2	2	2	3	2	2	2
KET-00351	3	2	2	2	2	2	2	2	2	3	3	2	3	2
CRG-00239	3	3	2	3	3	3	2	3	3	3	3	3	3	3
CRG-00363	3	2	2	3	3	3	2	2	3	3	3	3	3	3
CRG-00362	3	2	2	3	3	3	2	2	3	3	3	3	3	3
CRG-00248	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00431	3	2	2	3	3	3	2	2	3	3	3	3	3	3
CRG-00364	3	2	2	3	3	3	2	2	3	3	3	3	3	3
CRG-00330	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00366	2	2	2	2	2	2	2	2	3	3	3	2	3	3
CRG-00365	3	2	2	3	3	3	2	2	3	3	3	3	3	3
CRG-00119	3	2	2	2	3	3	2	2	3	3	3	3	3	3
CRG-00045														2

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
CRG-00347	3	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00308	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00018	3	2	2	2	3	3	2	2	2	3	3	3	3	3
CRG-00247	3	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00244	3	2	2	2	2	2	2	2	2	2	3	3	3	3
CRG-00307	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00016	2	2	2	2	2	2	2	2	3	3	3	2	3	3
CRG-00246	4	4	4	4	4	4	4	4	4	4	4	4	4	4
CRG-00306	2	2	2	2	2	2	2	2	2	3	3	2	3	2
CRG-00531	3	3	3	3	3	3	3	3	3	3	3	3	3	3
KET-00079	4	3	3	3	3	3	3	3	3	3	4	4	3	3
KET-00296	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00577														2
KET-00791	2	2	2	2	2	2	2	3	2	2	3	2	3	3
KET-00297	2	2	2	2	2	2	2	2	2	2	3	2	3	3
KET-00298	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00360	3	3	3	3	3	4	3	3	3	3	4	3	3	3
CRG-00061	3	3	3	3	3	3	3	3	3	3	4	3	3	3
KET-00015	4	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00406	2	2	2	2	2	3	2	2	3	3	3	2	3	2
CRG-00305	3	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00402	2	3	2	3	3	3	3	3	2	3	3	3	3	3
CRG-00402	2	3	2	3	3	3	3	3	2	3	3	3	3	3
CRG-00405	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00405	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00029	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00403	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00403	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00304	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00303	3	2	2	2	2	2	2	2	2	2	3	3	2	3
CRG-00194														2
CRG-00404	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00407	3	3	2	3	3	3	2	2	3	3	3	3	3	3
CRG-00313	3	3	2	3	3	3	3	3	2	2	3	3	3	3
CRG-00064	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00052	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00439	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00439	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00408	3	2	2	2	2	2	2	3	2	2	3	3	3	3
CRG-00438	3	3	3	3	4	4	3	3	3	3	4	3	3	3
CRG-00334	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
CRG-00334	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00334	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00334	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00334	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00334	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00440	3	2	2	3	3	3	2	2	3	3	3	3	3	3
CRG-00336	3	3	2	3	3	3	2	2	3	3	3	3	3	3
CRG-00335														3
CRG-00335														3
CRG-00437														3
CRG-00437														3
CRG-00436	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00372	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00435														3
CRG-00343	2	2	1	2	1	1	2	2	1	1	2	2	2	3
CRG-00190	3	2	2	2	2	2	2	2	2	3	3	3	3	3
CRG-00337	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00265	3	3	2	2	2	3	3	3	2	2	3	3	3	3
CRG-00191	3	2	2	2	2	3	3	3	2	2	3	3	3	3
KET-00418	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00409	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00409	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00409	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00302														3
CRG-00332														3
CRG-00441	3	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00331	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00333	3	3	3	3	3	3	3	3	3	3	4	3	3	2
CRG-00033	3	3	2	3	3	3	2	3	3	3	3	3	3	3
KET-00026	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00410	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00319	3	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00009	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00318	3	2	2	2	2	2	2	2	2	2	3	2	2	2
KET-00954	3	3	3	3	3	3	2	3	3	3	3	3	3	2
KET-00953	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00317	2	2	2	2	2	2	2	2	2	2	3	2	2	2
KET-00976	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00299	3	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00316	3	2	2	2	2	3	2	2	2	2	3	3	3	3
CRG-00298	3	2	2	2	2	2	2	2	2	2	3	3	3	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
CRG-00298	3	2	2	2	2	2	2	2	2	2	3	3	3	3
CRG-00301	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00314														3
CRG-00315	3	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00168	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00373	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00297	3	2	2	2	2	3	3	3	2	2	3	3	3	3
KET-00102	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CRG-00296	3	3	2	3	3	3	3	3	2	2	3	3	3	3
CRG-00295	3	3	2	3	3	3	3	3	2	3	3	3	3	2
CRG-00411	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00412	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00412	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00374														2
KET-00505														3
CRG-00300	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CRG-00414	3	3	2	3	3	3	2	3	3	3	3	3	3	3
KET-00789	2	1	1	1	1	1	1	2	1	1	2	2	2	2
KET-00506														3
CRG-00090	3	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00415	3	3	3	3	3	3	3	3	3	3	3	3	3	3
KET-00283	2	2	2	3	2	3	2	3	3	3	3	3	3	3
KET-00283	2	2	2	3	2	3	2	3	3	3	3	3	3	3
CRG-00413	3	3	3	3	3	3	3	3	3	3	4	3	3	3
KET-00504	2	2	2	2	2	2	2	2	3	3	3	2	3	3
CRG-00416	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00529	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00192	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00193	3	3	3	3	3	3	2	3	3	3	3	3	3	3
KET-00448	3	3	2	3	3	3	2	2	3	3	3	3	3	3
CRG-00417	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00035														3
CRG-00418	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00418	3	3	3	3	3	3	3	3	3	3	4	3	3	3
KET-00449	4	3	3	3	4	4	4	4	3	3	4	4	3	3
CRG-00224	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00224	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00225	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00521														3
CRG-00420	2	2	2	2	2	2	2	2	3	3	3	2	3	3
CRG-00421	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
CRG-00421	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00167	2	2	1	2	1	1	2	2	1	1	2	2	2	2
CRG-00466	3	2	2	2	2	2	2	2	2	3	3	2	3	3
CRG-00547	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00177	2	2	2	2	3	3	2	2	3	3	3	2	2	2
CRG-00177	2	2	2	2	3	3	2	2	3	3	3	2	2	2
CRG-00177	2	2	2	2	3	3	2	2	3	3	3	2	2	2
CRG-00177	2	2	2	2	3	3	2	2	3	3	3	2	2	2
KET-00508	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00433														2
CRG-00433														2
CRG-00433														2
CRG-00433														2
CRG-00423	3	2	2	2	2	2	3	3	2	2	3	3	3	3
CRG-00371	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00370	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00426	3	2	2	2	2	2	2	3	2	2	3	3	3	3
CRG-00158	3	3	2	2	2	2	3	3	2	2	3	3	3	3
CRG-00340	3	3	3	3	4	4	3	3	3	3	4	3	3	3
KET-00287	2	2	2	2	2	2	2	2	3	3	3	2	3	3
CRG-00427														3
CRG-00427														3
CRG-00428	3	3	3	3	3	3	2	3	3	3	3	3	3	2
CRG-00428	3	3	3	3	3	3	2	3	3	3	3	3	3	2
CRG-00429	3	3	3	3	3	3	2	3	3	3	3	3	3	2
CRG-00424	3	2	2	2	2	2	3	3	2	2	3	3	3	3
KET-00100	3	2	2	2	2	2	2	3	2	2	3	3	2	3
CRG-00198	4	3	3	3	4	4	3	4	3	3	4	4	4	3
CRG-00425														3
CRG-00425														3
KET-00936	3	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00087	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00197	3	2	2	2	2	2	2	2	2	3	3	3	3	2
KET-01008														3
CRG-00086	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00086	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00174	2	2	1	2	1	2	1	2	2	2	2	2	2	3
CRG-00196	3	3	2	3	3	3	2	3	3	3	3	3	3	3
CRG-00196	3	3	2	3	3	3	2	3	3	3	3	3	3	3
CRG-00085														3
KET-00347	3	3	3	3	3	3	3	3	3	3	4	3	3	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
CRG-00447	3	3	2	3	3	3	3	3	2	2	3	3	3	2
KET-00790														2
CRG-00195	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00445	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00078	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00183	3	2	2	2	2	2	2	2	2	3	3	2	3	3
CRG-00150	4	4	3	4	4	4	4	4	3	3	4	4	4	4
CRG-00059	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00084	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00557	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00556	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00039	2	2	2	2	2	2	2	2	3	3	3	2	2	3
CRG-00178	3	2	2	3	3	3	2	2	3	3	3	3	3	3
CRG-00077	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00096	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00219	3	3	3	3	2	3	3	3	3	3	3	3	3	2
KET-00289	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00205														3
CRG-00217	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00114	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00218	3	2	2	2	2	3	2	2	2	3	3	3	3	3
KET-00290	3	3	3	3	4	4	3	3	4	4	4	4	4	3
CRG-00237	2	2	2	3	3	3	2	2	3	3	3	2	3	3
CRG-00237	2	2	2	3	3	3	2	2	3	3	3	2	3	3
CRG-00237	2	2	2	3	3	3	2	2	3	3	3	2	3	3
CRG-00237	2	2	2	3	3	3	2	2	3	3	3	2	3	3
CRG-00237	2	2	2	3	3	3	2	2	3	3	3	2	3	3
CRG-00237	2	2	2	3	3	3	2	2	3	3	3	2	3	3
CRG-00237	2	2	2	3	3	3	2	2	3	3	3	2	3	3
CRG-00237	2	2	2	3	3	3	2	2	3	3	3	2	3	3
CRG-00369	3	2	2	3	2	3	2	3	3	3	3	3	3	3
KET-00788	3	2	2	2	1	2	2	2	1	2	3	2	2	2
KET-00061	3	3	3	3	3	3	3	3	3	3	4	3	3	3
KET-00787	3	2	2	2	2	2	3	3	1	2	3	3	2	3
CRG-00036	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00144	4	4	4	4	4	4	4	4	4	4	4	4	4	3
CRG-00367	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00344	2	2	1	2	1	1	1	2	1	2	2	2	2	2
CRG-00169	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00075	3	3	2	3	3	3	3	3	2	2	3	3	3	3
CRG-00368	3	2	2	2	2	2	2	2	2	2	3	3	2	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
CRG-00236	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00236	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00236	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00236	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00236	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00461	3	2	2	2	2	2	2	2	2	2	3	3	2	3
CRG-00461	3	2	2	2	2	2	2	2	2	2	3	3	2	3
CRG-00461	3	2	2	2	2	2	2	2	2	2	3	3	2	3
CRG-00444	2	2	2	2	2	2	2	2	2	2	3	2	3	2
CRG-00203	4	3	3	3	3	3	3	3	3	3	4	4	3	3
CRG-00032	3	2	2	2	2	3	2	2	2	3	3	3	3	2
CRG-00170	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00234	3	3	3	3	3	4	3	3	3	3	4	3	3	3
CRG-00235	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00235	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00238	3	3	3	3	3	3	3	3	4	4	4	3	3	3
CRG-00202														3
CRG-00200														2
CRG-00569	3	2	2	3	2	3	2	2	3	3	3	2	3	2
CRG-00569	3	2	2	3	2	3	2	2	3	3	3	2	3	2
CRG-00569	3	2	2	3	2	3	2	2	3	3	3	2	3	2
CRG-00569	3	2	2	3	2	3	2	2	3	3	3	2	3	2
CRG-00569	3	2	2	3	2	3	2	2	3	3	3	2	3	2
CRG-00569	3	2	2	3	2	3	2	2	3	3	3	2	3	2
CRG-00552	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00549	2	2	2	2	2	2	2	2	3	3	3	2	3	2
CRG-00474	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00378	3	2	2	2	2	2	2	2	2	3	3	3	3	2
KET-00099	4	3	3	4	4	4	4	4	4	4	4	4	4	3
CRG-00471	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00471	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00279	3	2	2	2	2	3	2	3	2	2	3	3	3	3
CRG-00469	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00469	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00280	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00548	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00470	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00470	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00383	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00383	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00468	3	3	3	3	3	3	3	3	3	3	4	3	3	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
CRG-00468	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00040	3	3	3	3	3	3	3	3	2	2	3	3	3	3
CRG-00543	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00214														2
CRG-00526	3	3	2	3	2	3	2	3	3	3	3	3	3	2
KET-00786	3	3	3	3	3	3	3	3	2	2	3	3	3	3
CRG-00380	3	2	2	2	2	3	2	2	2	3	3	3	3	2
CRG-00495	3	3	2	3	2	3	3	3	2	3	3	3	3	3
CRG-00212	3	3	3	3	3	3	3	3	4	4	3	3	3	3
CRG-00211	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00213	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00083	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00209														3
CRG-00484														3
CRG-00504	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00457	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00281	2	2	2	2	2	3	2	2	3	3	3	2	3	3
CRG-00081	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00456	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00233	3	2	2	2	2	2	2	3	2	2	3	3	3	3
CRG-00491														3
KET-00470	3	2	2	2	2	2	2	2	2	2	3	3	2	3
CRG-00232	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00458	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00485	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CRG-00223	3	3	3	3	3	3	3	3	3	3	3	3	3	3
KET-00098	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00559														3
CRG-00486	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00080	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00278	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00277	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00276	3	3	3	3	3	3	3	3	3	4	4	4	3	3
CRG-00275	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CRG-00268	3	2	2	2	2	3	2	2	2	2	3	3	3	2
CRG-00273	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CRG-00274	4	4	3	4	4	4	4	4	4	4	4	4	4	3
KET-00785														2
CRG-00123	3	2	2	3	3	3	2	2	3	3	3	3	3	2
CRG-00041	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00269	3	2	2	3	3	3	2	2	3	3	3	3	3	2

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
CRG-00528	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CRG-00270	3	2	2	3	3	3	2	2	3	3	3	3	3	2
KET-01004	3	2	2	2	2	2	3	3	2	2	3	3	2	3
CRG-00136	3	3	2	2	2	2	3	3	2	2	3	3	3	3
CRG-00054	4	4	4	4	4	4	4	4	4	4	4	4	4	4
CRG-00054	4	4	4	4	4	4	4	4	4	4	4	4	4	4
KET-01000	2	2	2	2	2	2	2	2	1	2	3	2	2	3
CRG-00397	3	3	3	3	3	3	3	3	2	2	3	3	3	3
CRG-00398	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00525														3
CRG-00510	3	3	3	3	3	3	2	3	3	3	3	3	3	3
KET-01002	2	2	2	2	2	2	3	3	2	2	3	3	3	3
KET-01003	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CRG-00455	2	2	2	2	2	2	2	3	2	2	3	3	3	2
CRG-00518	3	3	3	3	3	3	3	3	3	3	4	3	3	3
KET-00344	2	2	2	2	2	2	2	2	2	2	3	2	3	2
CRG-00516	3	3	3	3	3	3	4	4	3	3	4	4	3	3
CRG-00387	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00453	3	3	2	2	2	2	3	3	2	2	3	3	3	3
CRG-00452	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00517	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00515	3	3	2	3	2	3	3	3	2	2	3	3	3	3
CRG-00074	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00113	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00514	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00513	2	2	2	2	2	2	2	3	2	2	3	3	3	2
CRG-00454	2	2	2	2	2	2	2	2	2	2	3	2	3	2
KET-00058	3	3	3	3	3	3	3	3	2	3	3	3	3	4
CRG-00073	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CRG-00542	3	3	3	3	3	3	3	3	2	2	3	3	3	3
KET-00935	4	3	3	4	4	4	3	3	4	4	4	4	4	3
KET-00278	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00166	2	1	1	1	1	1	1	1	1	1	2	1	2	2
CRG-00058	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00056	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CRG-00266	4	4	4	4	4	4	4	4	4	4	4	4	4	3
CRG-00267	4	4	4	4	4	4	4	4	4	4	4	4	4	3
CRG-00206	4	3	3	3	3	4	3	4	3	3	4	4	4	3
CRG-00541	3	3	2	3	2	3	3	3	2	3	3	3	3	3
CRG-00172	4	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00375	3	3	3	3	3	3	3	3	3	3	4	3	3	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
CRG-00207	3	3	3	3	3	3	2	2	3	3	3	3	3	3
KET-00524	3	3	3	3	3	3	3	3	3	3	3	3	3	3
KET-00524	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CRG-00208	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00164	3	3	3	4	4	4	3	3	4	4	4	4	4	3
CRG-00164	3	3	3	4	4	4	3	3	4	4	4	4	4	3
CRG-00164	3	3	3	4	4	4	3	3	4	4	4	4	4	3
CRG-00164	3	3	3	4	4	4	3	3	4	4	4	4	4	3
CRG-00260	3	3	3	3	3	3	3	3	3	3	3	3	3	3
KET-00933	3	3	3	3	2	3	3	3	2	2	3	3	3	3
KET-00067	4	4	3	4	4	4	4	4	4	4	4	4	4	3
KET-00063	3	3	3	3	3	3	3	3	4	4	4	3	3	3
CRG-00352	2	2	2	3	3	3	2	2	3	3	3	3	3	3
CRG-00173	4	4	3	4	4	4	4	4	4	4	4	4	4	3
KET-00940	3	3	2	2	2	2	3	3	2	2	3	3	3	3
KET-00066	3	3	3	3	3	3	3	3	2	2	3	3	3	3
CRG-00221	3	3	2	3	3	3	2	3	3	3	3	3	3	3
KET-00932	2	2	1	2	1	2	1	1	2	2	2	2	2	3
CRG-00511	3	3	3	3	3	3	3	3	3	3	4	3	3	3
CRG-00220	3	3	3	3	3	3	2	3	3	3	3	3	3	3
KET-00065	3	3	2	3	2	3	3	3	2	3	3	3	3	3
CRG-00047	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CRG-00160	3	2	2	2	2	2	2	2	2	2	3	3	3	3
CRG-00079	3	3	3	3	3	3	3	3	3	3	3	3	3	3
KET-00064	3	2	2	2	2	2	3	3	2	2	3	3	3	3
PET-00410	4	3	3	3	3	3	3	3	3	3	4	4	3	3
PET-00410	4	3	3	3	3	3	3	3	3	3	4	4	3	3
PET-00410	4	3	3	3	3	3	3	3	3	3	4	4	3	3
PET-00410	4	3	3	3	3	3	3	3	3	3	4	4	3	3
PET-00410	4	3	3	3	3	3	3	3	3	3	4	4	3	3
KET-00560	4	3	3	3	3	3	3	3	3	3	4	4	3	3
KET-00094	3	3	3	3	3	3	3	3	3	3	3	3	3	3
KET-00955	3	3	3	3	3	3	3	3	2	2	3	3	3	3
PET-00471	3	3	3	3	3	3	3	3	3	3	4	3	3	3
KET-00095	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00218														3
KET-00559	3	2	2	2	2	2	3	3	2	2	3	3	3	3
PET-00067	3	3	2	3	2	3	2	2	3	3	3	3	3	3
PET-00067	3	3	2	3	2	3	2	2	3	3	3	3	3	3
PET-00067	3	3	2	3	2	3	2	2	3	3	3	3	3	3
PET-00067	3	3	2	3	2	3	2	2	3	3	3	3	3	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
PET-00067	3	3	2	3	2	3	2	2	3	3	3	3	3	3
PET-00067	3	3	2	3	2	3	2	2	3	3	3	3	3	3
PET-00067	3	3	2	3	2	3	2	2	3	3	3	3	3	3
PET-00067	3	3	2	3	2	3	2	2	3	3	3	3	3	3
PET-00067	3	3	2	3	2	3	2	2	3	3	3	3	3	3
PET-00067	3	3	2	3	2	3	2	2	3	3	3	3	3	3
PET-00067	3	3	2	3	2	3	2	2	3	3	3	3	3	3
PET-00067	3	3	2	3	2	3	2	2	3	3	3	3	3	3
PET-00067	3	3	2	3	2	3	2	2	3	3	3	3	3	3
PET-00122	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00470	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00472														3
KET-00097	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00467	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00468	3	3	2	3	3	3	2	2	3	3	3	3	3	3
PET-00556	3	3	3	3	3	3	3	3	3	3	4	3	3	3
KET-00305	2	2	1	2	1	1	1	2	2	2	3	2	2	2
KET-00096	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00541														3
PET-00541														3
XBC-00057	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00473	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00219	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00219	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00217	3	2	2	2	2	3	2	3	2	2	3	3	3	2
XBC-00044	3	3	3	3	3	3	3	3	4	4	4	3	3	3
PET-00170														3
XBC-00053	3	3	3	3	3	3	3	3	2	2	3	3	3	3
PET-00026	2	2	2	2	2	2	1	2	2	2	2	2	2	3
XBC-00054	3	4	3	3	3	3	4	4	3	3	4	4	4	3
PET-00144														2
PET-00208	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00583	2	2	2	2	2	2	2	2	2	2	3	2	2	3
PET-00531	3	3	3	3	3	3	3	3	4	4	4	3	3	3
PET-00530	4	3	3	3	4	4	3	3	3	3	4	3	3	3
PET-00480	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00558	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00209	3	3	3	3	3	3	3	3	2	3	3	3	3	3
PET-00225	2	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00016	4	4	4	4	4	4	4	4	4	4	4	4	4	4
PET-00142	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
PET-00029	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00141														3
PET-00175	4	3	3	3	4	4	3	4	3	3	4	4	3	3
PET-00321	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00176	4	4	4	4	4	4	4	4	4	4	4	4	4	3
PET-00222	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00174	3	3	3	3	3	3	4	4	3	3	4	4	3	3
PET-00206	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00206	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00206	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00206	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00206	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00147														4
PET-00071	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00178	2	2	2	2	2	2	2	2	2	2	3	2	3	2
PET-00324	4	3	3	3	3	3	3	3	3	3	4	4	3	3
PET-00466	3	3	3	3	3	3	2	2	3	3	3	3	3	3
PET-00072	3	3	3	3	3	4	3	3	3	3	4	4	3	3
PET-00107	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00121														3
PET-00270	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00070	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00269	4	4	3	4	4	4	4	4	4	4	4	4	4	3
XPA-00085	2	2	2	2	2	2	2	2	2	2	3	2	3	2
PET-00581	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00112	3	3	3	3	3	3	3	3	2	2	3	3	3	3
PET-00017	4	3	3	3	4	4	3	4	3	3	4	4	3	3
PET-00106	3	2	2	2	2	2	2	3	2	2	3	3	3	3
PET-00030	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00138	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00066	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00317	3	3	3	3	4	4	4	4	3	3	4	4	4	4
PET-00189	3	3	3	3	3	3	3	3	2	3	3	3	3	3
PET-00189	3	3	3	3	3	3	3	3	2	3	3	3	3	3
PET-00574														3
XBC-00043	3	3	2	3	3	3	3	3	2	2	3	3	3	3
XPA-00048	3	3	2	3	3	3	2	2	3	3	3	3	3	2
PET-00258	2	3	2	2	2	2	3	3	2	2	3	3	3	3
PET-00323	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00210	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00391	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
PET-00319	3	3	3	3	4	4	3	3	3	3	4	3	3	3
PET-00319	3	3	3	3	4	4	3	3	3	3	4	3	3	3
PET-00056	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00261	3	3	3	3	3	3	3	3	2	2	4	3	3	3
PET-00479														2
PET-00251	3	3	3	3	2	3	3	3	2	2	3	3	3	3
PET-00180	2	2	2	2	3	3	2	2	2	3	3	2	2	2
XBC-00005	2	2	2	2	2	2	1	2	2	2	2	2	2	3
PET-00215	3	2	2	2	2	3	2	2	3	3	3	2	3	2
PET-00215	3	2	2	2	2	3	2	2	3	3	3	2	3	2
PET-00589	2	3	2	2	2	2	3	3	2	2	3	3	3	3
PET-00094	3	2	2	2	2	2	2	3	2	2	3	3	3	3
XBC-00004	3	3	2	3	3	3	2	2	3	3	3	3	3	3
PET-00093	3	3	2	3	2	3	2	3	3	3	3	3	3	3
PET-00191	2	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00191	2	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00191	2	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00191	2	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00216	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00024	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XBC-00030	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XBC-00045	3	3	2	3	3	3	2	2	3	3	3	3	3	3
PET-00134	3	3	3	3	3	3	3	3	2	2	3	3	3	3
PET-00134	3	3	3	3	3	3	3	3	2	2	3	3	3	3
PET-00134	3	3	3	3	3	3	3	3	2	2	3	3	3	3
PET-00134	3	3	3	3	3	3	3	3	2	2	3	3	3	3
PET-00179	3	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00240														3
PET-00135	4	3	3	3	3	3	3	3	3	3	4	4	3	3
XBC-00039	2	2	2	3	3	3	2	2	3	3	3	3	3	3
XBC-00042	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00062	2	3	2	2	2	2	3	3	2	2	3	3	3	3
XBC-00041	3	3	3	4	4	4	4	4	4	4	4	4	4	4
PET-00051	3	3	2	3	2	3	3	3	2	3	3	3	3	3
PET-00006	3	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00573	3	3	2	3	3	3	2	3	3	3	3	3	3	3
PET-00557	2	2	2	2	2	2	2	2	2	2	3	2	2	2
XBC-00029														3
XBC-00006	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XBC-00015														2
PET-00048	2	2	2	2	2	2	2	2	2	2	3	2	2	2

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
XBC-00012														3
XBC-00008														3
PET-00098	4	4	4	4	4	4	4	4	4	4	4	4	4	3
PET-00098	4	4	4	4	4	4	4	4	4	4	4	4	4	3
XBC-00010														3
XBC-00027														3
PET-00172	3	2	2	2	2	3	2	3	2	2	3	3	3	3
PET-00340	3	3	2	2	2	2	2	3	2	2	3	3	3	3
PET-00341	3	2	2	2	2	2	2	3	2	2	3	3	3	2
XBC-00034	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00128	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00173	3	2	2	2	2	2	2	2	2	3	3	3	3	2
PET-00329	3	2	2	3	3	3	2	2	3	3	3	3	3	3
PET-00214	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00127														3
PET-00213	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00126														3
PET-00126														3
PET-00187	3	3	3	3	3	3	2	2	3	3	3	3	3	3
PET-00187	3	3	3	3	3	3	2	2	3	3	3	3	3	3
PET-00187	3	3	3	3	3	3	2	2	3	3	3	3	3	3
PET-00187	3	3	3	3	3	3	2	2	3	3	3	3	3	3
PET-00554	3	3	3	3	3	3	2	3	3	3	3	3	3	2
PET-00182	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00246														3
PET-00184	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00032	3	4	3	3	3	3	4	4	3	3	4	4	4	3
PET-00201	3	2	2	2	2	2	2	3	2	2	3	3	3	2
PET-00266	3	3	3	3	4	4	3	3	3	3	4	3	3	3
PET-00202	2	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00202	2	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00185														3
PET-00186														3
PET-00125	2	2	2	2	2	2	2	2	2	2	3	2	2	3
PET-00125	2	2	2	2	2	2	2	2	2	2	3	2	2	3
PET-00333	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00207	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00334	3	3	2	3	2	3	3	3	2	3	3	3	3	3
PET-00332	2	2	2	2	2	3	2	3	3	3	3	3	3	2
PET-00332	2	2	2	2	2	3	2	3	3	3	3	3	3	2
PET-00035	3	2	2	2	2	2	2	2	2	2	3	3	3	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
PET-00203	3	2	2	2	2	2	3	3	2	2	3	3	2	3
PET-00235	3	3	3	3	3	3	3	3	3	3	3	3	3	2
PET-00553														3
PET-00408	3	2	2	2	2	2	2	2	1	2	3	2	2	2
PET-00408	3	2	2	2	2	2	2	2	1	2	3	2	2	2
PET-00408	3	2	2	2	2	2	2	2	1	2	3	2	2	2
PET-00408	3	2	2	2	2	2	2	2	1	2	3	2	2	2
PET-00408	3	2	2	2	2	2	2	2	1	2	3	2	2	2
PET-00408	3	2	2	2	2	2	2	2	1	2	3	2	2	2
PET-00408	3	2	2	2	2	2	2	2	1	2	3	2	2	2
PET-00408	3	2	2	2	2	2	2	2	1	2	3	2	2	2
PET-00408	3	2	2	2	2	2	2	2	1	2	3	2	2	2
PET-00408	3	2	2	2	2	2	2	2	1	2	3	2	2	2
PET-00408	3	2	2	2	2	2	2	2	1	2	3	2	2	2
PET-00344														3
PET-00205	3	2	2	3	3	3	2	2	3	3	3	3	3	2
PET-00205	3	2	2	3	3	3	2	2	3	3	3	3	3	2
PET-00399	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00399	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00389	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00389	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00400	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00343	3	3	2	3	3	3	2	2	3	3	3	3	3	2
XPA-00216	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00398	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00217	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00347	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00347	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00018	2	1	1	1	1	1	1	1	1	2	2	2	2	2
PET-00415	3	3	3	3	3	3	3	3	2	2	3	3	3	3
PET-00412	3	2	2	2	2	2	2	3	2	2	3	3	3	3
XPA-00210														3
XPA-00209	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00211	3	3	3	3	3	3	2	3	3	3	3	3	3	3
XPA-00164	3	3	3	3	4	4	3	3	3	3	4	3	3	3
PET-00015	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00208	3	3	3	3	3	3	2	3	3	3	3	3	3	3
XPA-00191	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00212	3	3	3	3	3	3	3	3	3	3	4	3	3	2
XPA-00218														3
XPA-00195														3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
PET-00079	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00207	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00159	3	3	2	3	3	3	2	3	3	3	3	3	3	3
XPA-00206	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00213	3	3	3	3	3	3	2	2	3	3	3	3	3	2
XPA-00192														3
XPA-00193	3	3	3	3	3	3	2	3	3	3	3	3	3	3
XPA-00205	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00234	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00158	3	3	3	3	3	3	3	3	2	3	3	3	3	3
PET-00057	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00204														3
XPA-00215	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00233	3	3	3	3	4	4	4	4	3	4	4	4	4	3
XPA-00214	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00230	4	4	3	4	4	4	4	4	3	3	4	4	4	3
XPA-00228	3	3	2	3	3	3	2	3	3	3	3	3	3	3
PET-00482	3	3	3	3	4	4	4	4	3	3	4	4	3	3
XPA-00231	3	3	3	3	3	3	2	3	3	3	3	3	3	2
XPA-00163	3	3	2	3	3	3	2	3	3	3	3	3	3	2
XPA-00186	4	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00414	4	3	3	3	4	4	4	4	3	4	4	4	4	3
PET-00462	3	3	3	3	4	4	3	3	3	3	4	3	3	3
PET-00462	3	3	3	3	4	4	3	3	3	3	4	3	3	3
XPA-00245	3	2	2	2	3	3	2	2	2	2	3	3	3	3
XPA-00244	3	3	2	3	3	3	2	3	2	3	3	3	3	3
XPA-00168	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00242														3
XPA-00169														3
XPA-00243														3
PET-00231	3	3	3	3	3	3	3	3	4	4	4	3	3	3
XPA-00202	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00034	3	3	3	3	3	3	3	3	4	4	4	3	3	3
XPA-00152	2	2	2	2	2	2	2	2	2	2	3	2	2	2
XPA-00151	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00157														3
XPA-00038														3
XPA-00185														2
XPA-00194	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00230	3	3	2	3	3	3	2	3	3	3	3	3	3	3
XPA-00190	2	2	2	2	2	2	2	2	2	3	3	2	2	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
XPA-00156														3
XPA-00154														3
XPA-00149														2
XPA-00155														3
PET-00212	3	3	3	3	4	4	4	4	3	4	4	4	4	3
XPA-00150	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00069														2
XPA-00158	3	3	3	3	3	4	3	3	3	3	4	4	3	3
XPA-00184	3	2	2	2	2	3	2	3	2	2	3	3	3	2
PET-00360														2
XPA-00147														2
XPA-00183														3
PET-00498														3
XPA-00171														3
XPA-00159	4	4	3	4	4	4	4	4	3	3	4	4	4	3
PET-00544	2	2	2	2	2	2	2	2	2	2	3	2	2	3
XPA-00148														2
XPA-00173														2
XPA-00172														3
XPA-00039														2
XPA-00039														2
XPA-00174	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00166														3
XPA-00178														3
XPA-00251	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00175														3
XPA-00176														3
XPA-00234	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00177														3
XPA-00252	3	3	3	3	3	3	2	3	3	3	3	3	3	3
XPA-00179														3
XPA-00030	3	3	3	3	3	3	2	3	3	3	3	3	3	3
XPA-00182														3
XPA-00250	2	2	2	2	2	2	2	2	2	2	3	2	2	2
XPA-00181														3
XPA-00161	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00180														3
XPA-00122	2	3	2	3	3	3	2	3	3	3	3	3	3	3
XPA-00249														2
XPA-00232														3
XPA-00233														3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
PET-00404	3	2	2	3	3	3	2	2	3	3	3	3	3	2
XPA-00248														2
PET-00078	4	3	3	3	4	4	4	4	3	4	4	4	4	3
PET-00535	3	3	2	2	2	2	3	3	2	2	3	3	3	3
XPA-00167	3	3	2	3	2	3	3	3	2	3	3	3	3	2
PET-00405	2	2	2	2	2	2	2	2	2	2	3	2	2	3
PET-00406	2	2	2	2	2	2	2	2	2	2	3	2	2	2
XPA-00123	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00351	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00370	2	2	2	2	2	2	2	2	2	3	3	2	2	2
PET-00376	2	2	2	2	2	2	2	2	2	2	3	2	3	3
XPA-00029	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00033	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00371	2	2	2	2	2	2	2	2	2	2	3	2	2	2
XPA-00108														2
PET-00380	3	2	2	2	2	2	2	3	2	2	3	3	3	3
PET-00379	3	2	2	2	2	2	2	3	2	2	3	3	3	3
PET-00381	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00028														3
PET-00382	3	2	2	2	2	2	2	2	2	3	3	3	3	2
PET-00375	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00364	2	2	2	2	2	2	2	2	2	2	3	2	3	2
PET-00409	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00401	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00107														3
PET-00372	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00369	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00023	3	3	3	3	4	4	3	3	3	3	4	3	3	3
XPA-00226														3
XPA-00196														2
PET-00104	3	3	2	2	2	2	2	3	2	2	3	3	3	3
XPA-00146	2	2	2	3	3	3	2	3	3	3	3	3	3	3
XPA-00145	3	3	2	3	3	3	2	3	3	3	3	3	3	3
XPA-00188	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00227														2
XPA-00106														3
XPA-00106														3
PET-00074	3	3	2	3	2	3	2	3	3	3	3	3	3	3
XPA-00111														3
XPA-00189	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00138														3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
PET-00378	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00139														3
XPA-00110	3	3	3	3	4	4	4	4	3	3	4	4	3	3
PET-00384	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00141	3	3	2	3	3	3	3	3	2	3	3	3	3	3
XPA-00141	3	3	2	3	3	3	3	3	2	3	3	3	3	3
PET-00377	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00118	2	2	2	3	3	3	2	2	3	3	3	3	3	3
PET-00084	2	2	2	2	2	2	2	2	1	2	3	2	2	3
XPA-00113	2	2	2	3	3	3	2	2	3	3	3	3	3	3
XPA-00116	2	2	2	2	3	3	2	2	3	3	3	2	2	3
XPA-00132	3	3	3	4	4	4	4	4	4	4	4	4	4	4
XPA-00142	2	2	2	2	2	2	2	2	2	2	3	2	2	2
XPA-00109	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00143	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00115	2	2	2	2	3	3	2	2	3	3	3	2	3	3
XPA-00140	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00114	3	2	2	3	3	3	2	2	3	3	3	3	3	3
XPA-00131	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00367	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00229	3	3	3	3	4	4	4	4	3	3	4	4	3	3
PET-00368	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00112	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00112	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00197	3	3	2	2	3	3	3	3	2	2	3	3	3	3
PET-00521	4	4	4	4	4	4	3	4	4	4	4	4	4	3
XPA-00200														2
XPA-00144	3	3	3	3	4	4	3	3	3	3	4	3	3	3
XPA-00239	2	2	2	2	2	2	2	2	2	2	3	2	2	2
XPA-00130	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00224	4	4	4	4	4	4	4	4	4	4	4	4	4	4
XPA-00050	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00009	2	2	2	2	2	2	1	2	2	2	3	2	2	3
XPA-00240	2	2	2	2	2	2	2	2	2	2	3	2	2	2
XPA-00198	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00241														2
PET-00411	3	3	2	3	2	2	3	3	2	2	3	3	3	3
PET-00411	3	3	2	3	2	2	3	3	2	2	3	3	3	3
PET-00032	2	2	2	2	2	2	2	2	2	2	3	2	2	3
XPA-00117	3	3	3	3	3	3	3	3	2	3	3	3	3	3
XPA-00199	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
PET-00365	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00500	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00366														3
PET-00551	3	2	2	3	3	3	2	2	3	3	3	3	3	3
XPA-00126	2	2	2	3	3	3	2	2	3	3	3	3	3	3
XPA-00129	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00374														2
XPA-00127	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00125	3	3	3	3	4	4	3	3	3	3	4	3	3	3
PET-00013	3	2	2	3	3	3	3	3	2	3	3	3	3	3
PET-00245	3	2	2	3	3	3	3	3	2	3	3	3	3	3
XPA-00128	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00344	3	3	3	3	3	3	3	3	2	2	4	3	3	3
XPA-00223	3	3	2	2	3	3	3	3	2	2	3	3	3	3
PET-00361	4	3	3	3	3	4	4	4	3	3	4	4	4	3
PET-00486	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00362	3	4	3	3	4	4	4	4	3	4	4	4	4	3
XPA-00222	2	3	2	3	3	3	2	3	3	3	3	3	3	3
XPA-00137	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00237														2
PET-00349	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00221	2	2	2	2	2	2	2	2	2	2	3	2	2	2
XPA-00246	3	3	2	3	3	3	2	2	3	3	3	3	3	2
XPA-00007	3	2	2	2	3	3	2	2	3	3	3	3	3	3
XPA-00238	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00014														3
XPA-00235	3	3	2	3	3	3	2	3	2	2	3	3	3	3
XPA-00236	2	2	2	2	2	2	2	2	2	2	3	2	2	2
XPA-00134	2	2	2	3	3	3	2	2	3	3	3	3	3	3
XPA-00135	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00133	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00165	3	3	3	3	3	3	3	3	3	3	4	3	3	3
XPA-00120	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00359	3	3	3	3	3	3	2	3	3	3	3	3	3	3
XPA-00119	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00119	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00119	3	3	3	3	3	3	3	3	3	3	3	3	3	3
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XPA-00119	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00119	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
XPA-00119	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00119	3	3	3	3	3	3	3	3	3	3	3	3	3	3
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XPA-00121	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00353	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00348	3	3	3	3	3	3	2	3	3	3	3	3	3	3
PET-00358	3	3	3	3	3	3	2	2	3	3	3	3	3	3
PET-00457	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00456	3	3	3	3	3	3	2	3	3	3	3	3	3	3
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PET-00458	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00549	2	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00559	3	2	2	2	2	3	2	2	3	3	3	2	3	2
PET-00021	3	3	2	2	3	3	2	2	2	2	3	3	3	3
PET-00102	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00354	3	3	2	3	3	3	2	3	3	3	3	3	3	2
PET-00355	2	2	2	2	2	3	2	3	3	3	3	3	3	2
PET-00356	3	3	2	3	2	3	3	3	2	3	3	3	3	2
PET-00357	2	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00455	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00249	3	3	3	3	3	3	3	3	3	3	3	3	3	3
XPA-00100	3	2	2	2	2	2	2	2	2	2	3	2	2	2
XPA-00041	3	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00460	2	2	2	2	1	2	1	2	2	2	3	2	2	3
PET-00418	3	3	2	3	3	3	2	2	3	3	3	3	3	3
PET-00419	3	3	3	3	3	3	3	3	3	3	4	3	3	3
PET-00087	3	3	3	3	3	3	2	3	3	3	3	3	3	2
PET-00256	3	3	3	3	3	3	3	3	3	3	3	3	3	2
PET-00420	4	4	4	4	4	4	3	4	4	4	4	4	4	3

Site Number	w1	w1a	w2	w2a	w3	w3a	w4	w4a	w5	w5a	w6	w7	w8	w8 deep
XPA-00026	2	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00417	3	2	2	3	3	3	2	2	3	3	3	3	3	2
XPA-00027	2	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00031	3	2	2	2	2	2	2	2	2	2	3	3	2	2
PET-00550	2	2	2	2	2	2	2	2	2	2	3	2	2	2
PET-00073	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PET-00045	2	1	1	1	1	1	1	1	1	1	2	1	1	2
XPA-00024	2	3	2	2	2	2	3	3	2	2	3	3	3	3
XPA-00051	2	2	2	2	2	2	2	2	2	2	3	2	2	2
XPA-00023	2	2	2	2	2	2	2	2	2	2	3	2	2	2
XPA-00093	2	2	2	2	2	2	2	2	2	2	3	2	3	3
XPA-00062	2	2	2	2	2	2	2	2	2	2	3	2	2	2
XPA-00043	3	3	3	3	3	3	4	4	3	3	4	4	3	3

10. Bibliography

Ackerman, Robert E.

1968. *The Archaeology of the Glacier Bay Region, Southeastern Alaska*. Washington State University Report of Investigations No. 44, Pullman

Ackerman, Robert E.

1996. Ground Hog Bay, Site 2. In *American Beginnings: The Prehistory and Paleoecology of Beringia*, ed. F.H. West. University of Chicago Press, Chicago: pg. 424-430

Ackerman, Robert E., Kenneth C. Reid, James D. Gallison, and Mark E. Roe

1985. *Archaeology of Heceta Island: A Survey of 16 Timber Harvest Units in the Tongass National Forest, Southeastern Alaska*. Center for Northwest Anthropology, Washington State University, Pullman

Ackerman, Robert E., T.D. Hamilton, and R. Stuckenrath

1979. Early Culture Complexes on the Northern Northwest Coast. *Canadian Journal of Archaeology*, 3: pg. 195-208

Ager, Thomas A. and Joseph G. Rosenbaum

2007. *Late Glacial-Holocene Pollen-Based Vegetation History from Pass Lake, Prince of Wales Island, Southeastern Alaska*. Studies by the US Geological Survey in Alaska, Professional Paper 1760-G

Ager, Thomas A., Paul E. Carrara, Jane L. Smith, Victoria Anne, and Joni Johnson

2010. Postglacial vegetation history of Mitkof Island, Alexander Archipelago, southeastern Alaska. *Quaternary Research*, 73(2): pg. 259-268

Altschul, Jeffrey A.

1988. Models and the Modeling Process. In *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling*, edited by W. James Judge and Lynne Sebastian. US Department of the Interior, Bureau of Land Management, Denver: pg. 61-96

Altschul, Jeffrey A. and Christopher L. Nagle

1988. Collecting new data for the purpose of model development. In *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling*, edited by W. James Judge and Lynne Sebastian. US Department of the Interior, Bureau of Land Management, Denver: pg. 257-299

Altschul, Jeffrey A., L. Sebastian, and K. Heidelberg

2004. *Predictive modeling in the military. Similar goals, divergent paths*. SRI Foundation, Rio Rancho

Ames, Christopher J.H., Andre Costopoulos, and Colin D. Wren

2010. 8,000 Years of Technological Change in the Gulf of Georgia: Is there a Major Transition at 4850 cal BP?. *Canadian Journal of Archaeology*, 34 (1): pg. 32-63

Ames, Kenneth M and Herbert D. G. Maschner

1999. *Peoples of the Northwest Coast: Their Archaeology and Prehistory*. Thames and Hudson, New York

Ames, Kenneth M.

1981. The evolution of social ranking on the Northwest Coast of North America. *American Antiquity*, 46(4): pg. 789-805

Anderson, R.G.

1991. Contributions to the geology and geophysics of northwestern British Columbia and southeastern Alaska. *Canadian Journal of Earth Sciences*, 28: pg. 835-839

Anschuetz, K.F., R.H. Wilshusen and C.L. Scheick

2001. An archaeology of landscapes: Perspectives and directions. *Journal of Archaeological Research*, 9: pg. 157-211

Antevs, Ernst

1929. *Maps of the Pleistocene Glaciations*. Bulletin of the Geological Society of America, vol 40: pg. 631-720

2012. ArcGIS 10.0 help. http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//009z000000s1000000.htm

Arnold, Thomas G.

2006. *The Ice-Free Corridor: Biogeographical highway or Environmental Cul-de-Sac*. Unpublished PhD dissertation, Department of Anthropology, Simon Fraser University

Baichtal, J.F. and R. J. Carlson

2010. Development of a Model to Predict the Location of Early Holocene Habitation Sites along the Western Coast of Prince of Wales Island and the Outer Islands, Southeast Alaska. *Paper Presented at the Alaskan Anthropology Association 37th Annual Meeting*, Anchorage: pg. 30

Baichtal, J.F., G. Streveler, and T.E. Fifield

1997. The geological, glacial, and cultural history of southern southeast. *Alaska Geographic*, 24: pg. 6-31

Bailey, Geoffrey N., and Nicholas C. Flemming

2008. Archaeology of the continental shelf: Marine resources, submerged landscapes and underwater archaeology. *Quaternary Science Reviews*, 27: pg. 2153-2165

Ballard, Robert D.
2008. Introduction. In *Archaeological Oceanography*, edited by Robert D. Ballard. Princeton University Press, Princeton: pg. ix-x

Barbar, Russel and Michael E. Roberts
1979. *Archaeology and Paleontology. A Summary and Analysis of Cultural Resource Information on the Continental Shelf from the Bay of Fundy to Cape Hatteras, Final Report, vol. II*. Institute for Conservation Archeology Report 88. Peabody Museum, Harvard University, Cambridge

Barrie, J. Vaughn, Kim W. Conway, Heiner Josenhans, John J. Clauge, Rolf W. Mathewes, and Daryl W. Fedje
2005. Late Quaternary Geology of Haida Gwaii and Surrounding Marine Areas. In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*, edited by Daryl W. Fedje and Rolf W. Mathewes. University of British Columbia Press, Vancouver: pg. 7-20

Barron, John A. David Burky, Walter E. Dean, Jason A. Addison, and Bruce Finney
2009. Paleoceanography of the Gulf of Alaska during the past 15,000 years: Results from diatoms, silicoflagellates, and geochemistry. *Marine Micropaleontology*, 72: pg. 176-195

Baucaire, Rene
1964. The Fos Underwater Excavation (translated by Thomas A. Babits - reprinted in *Maritime Archaeology: A Reader of Substantive and Theoretical Contributions*, 1998, edited by Babits, and Tilburg, Plenum Press, New York, pg 9-15). Bulletin de la Societe des Amis du Vielis Istres. Tome Quatorzieme, La Pensee Universitaire, Aix-En-Provence

Bell, James A.

1994. *Reconstructing Prehistory: Scientific Method in Archaeology*. Temple University Press, Philadeplphia

Bender, B.

2002. Time and Landscape. *Current Anthropology*, 43 (S4): pg. S103-S112

Benjamin, Jonathan

2010. Submerged Prehistoric Landscapes and Underwater Site Discovery: Reevaluating the 'Danish Model' for International Practice. *Journal of Island and Coastal Archaeology*, 5 (2): pg. 254-270

Bevan, A. and J. Conolly

2005. Multiscalar approaches to settlement pattern analysis. In *Confronting Scale in Archaeology: Issues of Theory and Practice*, edited by G. Lock and B. Molyneaux. Kluwer, New York: pg. 217-234

Binford, Lewis R.

1977. Introduction. In *For Theory Building in Archaeology*, edited by L.R. Binford. Academic Press, New York: pg. 1-10

1980. Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity*, 45 (1): pg. 4-20

1981. Relics to artifacts and monuments to assemblages: Changing conceptual frameworks. In *Bones: Ancient Men and Modern Myths*, edited by L.R. Binford. Academic Press, New York: pg. 3-20

Bird, Douglas and Brian Codding

2008. Human Behavioral Ecology and the Use of Ancient Landscapes. In *Handbook of Landscape Archaeology*, edited by Bruno David, and Julian Thomas. Left Coast Press Inc, Walmut Creek: pg. 396-408

Bird, Douglas W. and James F. O'Connell

2006. Behavioral ecology and archaeology. *Journal of Archaeological Research*, 14: pg. 143-188

Bjerck, Hein B.

2009. Colonizing Seascapes: Comparative Perspectives on the Development of Maritime Relations in Scandinavia and Patagonia. *Arctic Anthropology*, 43 (1-2): pg. 118-131

Blackman, Margaret B.

1990. Haida: Traditional Culture. In *Handbook of North American Indians, Volume 7: Northwest Coast*, edited by Wayne Shuttles (volume) and William C. Sturtevant (general). pulisher/journal. Smithsonian Institution Press, Washington: pg. 240 - 260

Blaise, Bertrand, John J. Clague, and Rolf W. Mathewes

1990. Time of Maximum Late Wisconsin Glaciation, West Coast of Canada. *Quaternary Research*, 34: pg. 282-295

Boas, Franz

1935. *Kwakiutl Culture: As reflected in Mythology*. American Folk-Lore Society, New York

1982a. [1940]. The social organization of the tribes of the North Pacific Coast. In *Race Language and Culture*. The University of Chicago Press, Chicago: pg. 370 - 378

1982b. [1940]. The growth of Indian mythologies. In *Race Language and Culture*. The University of Chicago Press, Chicago: pg. 425 – 436

Boaz, Joel, and Espen Uleberg

2000. Quantifying the non-quantifiable: studying hunter-gather landscapes. In *Beyond the Map: Archaeology and Spatial Technologies*, edited by Gary Lock. IOS Press, Washington, DC

Borden, Charles E.

1950. Preliminary Report on Archaeological Investigations in the Fraser Delta Region. *Anthropology in British Columbia*, 1: pg. 13-26

1951. Facts and Problems of Northwest Coast Prehistory. *Anthropology in British Columbia*, 2: pg. 35-57

1975. *Origins and Development of Early Northwest Culture to about 3000 BC*. National Museum of Man, Mercury Series, Archaeological Survey of Canada Paper 45, Ottawa: pg.

Bowens, Amanda (edited)

2009. *Underwater Archaeology: the NAS guide to principles and practice*. Blackwell Publishing, Oxford

Breen, Colin, and Paul J. Lane

2003. Archaeological approaches to East Africa's changing seascapes. *World Archaeology: Seascapes*, 35 (3): pg. 469-489

Brew, David A., Susan M. Karl, David F. Barnes, Robert C. jachens, Arthur B. Ford, and Robert Horner

1991. A northern Cordilleran ocean-continent transect: Sitka Sound, Alaska, to Atlin Lake, British Columbia. *Canadian Journal of Earth Sciences*, 28: pg. 840-853

Brown, James H.

1995. *Macroecology*. The University of Chicago Press, Chicago

Bryn, Petter, Marek E. Jasinski and Fredrik Soreide

2007. *Ormen Lange: Pipelines and Shipwrecks*. Universitetsforiaget, Oslo

Burley, David V.

1980. *Marpole: Anthropological Reconstruction of a Prehistoric Northwest Coast Culture type*. Department of Archaeology, Simon Fraser University, Publication Number 8, Burnaby

Cannon, Aubrey

1998. Contingency and Agency in the Growth of Northwest Coast Maritime Economies. *Arctic Anthropology*, 35 (1): pg. 57-67

Cannon, Aubrey and Dongya Y. Yang

2011. Pushing Limits and Finding Interpretive Balance: A reply to Monks and Orchard. *American Antiquity*, 76 (3): pg. 585-595

Cannon, Michael D. and Jack M. Broughton

2010. Evolutionary Ecology and Archaeology. In *Evolutionary Ecology and Archaeology: Applications to Problems in Human Evolution and Prehistory*, edited by Jack M. Brought and Michael D. Cannon. University of Utah Press, Salt Lake City: pg. 1-12

Capps, S.R.

1931. *Glaciation in Alaska*. U.S. Geological Survey Proffesional Paper, 170: pg. 1-8

Carleton, W. Chris, James Conolly, and Gyles Ianonne

2012. A locally-adaptive model of archaeological potential (LAMAP). *Journal of Archaeological Science*, 39: pg. 3371-3385

Carlson, Risa

2007. *Current Models for the Human Colonization of the Americas: the Evidence from Southeast Alaska*. Unpublished Master's Thesis, Department of Archaeology, Cambridge University

Carlson, Roy L.

1979. The Early Period on the Central Coast of British Columbia. *Canadian Journal of Archaeology*, 3: pg. 211-228

1990. History of Research in Archeology. In *Handbook of North American Indians, Volume 7: Northwest Coast*, edited by Wayne Shuttles (volume) and William C. Sturtevant (general). Smithsonian Institution Press, Washington: pg. 107-115

1993. Soil Science and a Northwest Coast Shell Middle (Review of Stein ed.). *The Review of Archaeology*, 14: pg. 15-21

1996. Introduction to Early Human Occupation in British Columbia. In *Early Human Occupation in British Columbia* edited by Roy L. Carlson and Luke Dalla Bona. University of British Columbia Press, Burnaby: pg. 3-10

1998. Coastal British Columbia in the Light of North Pacific Maritime Adaptations. *Arctic Anthropology*, 35 (1): pg. 23-35

Carrara, P.E., T.A. Ager, and J.F. Baichtal

2007. Possible refugee in the Alexander Archipelago of southeastern Alaska during the late Wisconsin glaciation. *Canadian Journal of Earth Sciences*, 44: pg. 229-244

Carrara, P.E., T.A. Ager, J.F. Baichtal, and D. Paco Van Sistine

2003. *Map of Glacial Limits and Possible Refugia in the Southern Alexander Archipelago, Alaska, During the Late Wisconsin Glaciation*. United States Geologic Survey, Denver

Casey, Edward S.

2008. Place in landscape archaeology: A philosophical prelude. In *Handbook of Landscape Archaeology*, edited by David and Thomas. Left Coast Press Inc, Walnut Creek: pg. 44-50

Chapman, Henry P. and Philip R. Chapman

2005. Seascapes and landscapes – the siting of the Ferriby Boats find in the context of Prehistoric Pilotage. *International Journal of Nautical and Underwater Archaeology*, 34 (1): pg. 43-50

Christensen, Arne Emil

1997. Review of Archaeology underwater: Research and reports on underwater archaeology in German and Swiss lake dwellings and the North Sea - German - Schlichtherle, H. *The International Journal of Nautical Archaeology*, 26 (3): pg. 268-269

Clague, Jon H., Rolf W. Mathewes, and Thomas A. Ager

2004. Environments of Northwestern North America before the Last Glacial Maximum. In *Entering America: Northeast Asia and Beringia before the Last Glacial Maximum*, edited by D. B. Madsen. The University of Utah Press, Salt Lake City: pg. 63-94

Clark, David L.

1968. *Analytical Archaeology*. Methuen, London

Cliquet, Dominique, Sylvie Coutard, Martine Clet, Jean Allix, Bernadette Tessier, Frank Lelong, Anges Baltzer, Yann Mear, Emmanuel Poizot, Patrick Auguste, Philippe Alix, Jean Olive, and Joe Guesnon

2011. The Middle Paleolithic Underwater Site of La Mondree, Normandy, France. In *Submerged Prehistory*, edited by Johnathan Benjamin, Clive Bonsall, Catriona Pickard, and Anders Fischer. Oxbow Books, Oxford: pg. 111-128

Coastal Environments, Inc. (CEI)

1977. *Cultural resources evaluation of the northern Gulf of Mexico Continental Shelf, volume II Historical Cultural Resources*. Prepared for Interagency Archaeological Services, Office of Arhcaeology and Historic Preservation, National Park Services, US Department of the Interiror, Washington, D.C.

Coleman, Dwight F.

2008. Archaeological and Geological Oceanography of Unundated Coastal Landscapes: An Introduction. In *Archaeological Oceanography*, edited by Robert D. Ballard. Princeton University Press, Princeton: pg. 177-199

Coleman, Dwight F. and Kevin McBride

2008. Underwater Preshistoric Archaeological Potential of the Southern New England Continental Shelf off Block Island. In *Archaeological Oceanography*, edited by Robert D. Ballard. Princeton University Press, Princeton: pg. 200-223

Coleman, Dwight F. and Robert D. Ballard

2008. Oceanographic Methods for Underwater Archaeological Surveys. In *Archaeological Oceanography*, edited by Robert D. Ballard. Princeton University Press, Princeton: pg. 3-14

Coles, Bryony

1998. *Doggerland: a Speculative Survey*. Proceedings of the Prehistoric Society, 64: pg. 45-81

2000. Doggerland: the cultural dynamics of a shifting coastline. *Coastal and estuarian environments: sedimentary, geomorphology, and geoarchaeology*, pg. 393-401

2004. The development of wetland archaeology in Britain. In *Living on the Lake in Prehistoric Europe: 150 years of lake-dwelling research,* edited by Francesco Menotti. Routledge, New York: pg. 98-114

Coupland, G.

1998. Maritime adaptation and evolution of the developed Northwest Coast pattern on the central Northwest Coast. *Arctic Anthropology*, 35 (1): pg. 36-56

Croes, Dale R. and Steven Hackenberger

1988. Hoko River Archaeological Complex: Modeling prehistoric northwest Coast economic evolution. In *Prehistoric Economies of the Pacific Northwest Coast*, edited by B.L. Isaac. Research in Economic Anthropology Supplement 3. JAI Press, Inc., Greenwich, Connecticut: pg. 19-85

Croome, Angela

2004. Thoughts on thirty years as reviews editor. *International Journal of Nautical and Underwater Archaeology*, 33 (2): pg. 352-353

Dalla Bona, Luke

1994. *Cultural Heritage Resource Predictive Modelling Project: vol 4: A Predictive Model of prehistoric activity location for Thunder Bay District, Ontario*. Report Prepared for the Ontario Ministry of Natural Resources, Lakehead University, Thunder Bay

2003. Predictive Maps and Archaeological Conservation in Ontario. In *The Archaeology of Landscapes and Geographic Information Systems: Predictive Maps, Settlement Dynamics and Space and Territory in Prehistory*, edited by Jurgen Kunow and Johannes Muller. Wunsdorf, Germany: pg. 99-105

Dalla Bona, Luke and Linda Larcombe

1996. Modeling Prehistoric Land use in Northern Ontario. In *New Methods, Old Problems: Geographic Information Systems in Modern Archaeological Research*, edited by H.D.G. Maschner. Occasional Paper No 23, Center for Archaeological Investigations, Southern Illinois University, Carbondale: pg. 252-271

Daly, P.T. and G.R. Lock

1999. Timing is everything: commentary on managing temporal variables in geographic information systems. In *New techniques for old times: CAA 98 computer applications and quantitative methods in archaeology*, edited by Barcelo, JA, Briz, I and Vila A. BAR International Series, S757 (Oxford: Archaeopress): pg. 287-293

Darvill, Timothy

2008. Pathways to a Panoramic Past: A Brief History of Landscape Archaeology in Europe. In *Handbook of Landscape Archaeology*, edited by Bruno David, and Julian Thomas. Left Coast Press Inc, Walmut Creek: pg. 60-76

David, Bruno and Julian Thomas

2008. Landscape Archaeology: Introduction. In *Handbook of Landscape Archaeology*, edited by Bruno David, and Julian Thomas. Left Coast Press Inc, Walmut Creek: pg. 27-43

Davidson-Arnott, Robin

2010. Introduction to Coastal Processes and Geomorphology. *Cambridge University Press*, Cambridge

Davis, Stanley D.

1989. Project History. In *The Hidden Falls Site, Baranof Island, Alaska*, edited by Stanley D. Davis. Aurora, Alaska Anthropological Association Monograph Series V, Anchorage: pg. 23-29

Davis, Stanley D.

1990. Prehistory of Southeastern Alaska. In *Handbook of North American Indians, vol 7: Northwest Coast*, edited by Wayne Suttles. Smithsonian Institution Press, Washington: pg. 197-202

1996. Hidden Falls. In *American Beginnings: The Prehistory and Paleoecology of Beringia*, ed. F.H. West. University of Chicago Press, Chicago: pg. 413-424

Dawson, Sir William

1893. *The Canadian Ice Age*. Montreal

de Laguna, Frederica

1960. *The Story of a Tlingit Community: A Problem in the Relationship between Archaeological, Ethnological, and Historical Methods*. Bureau of American Ethnology Bulletin 172, Washington, DB

1990. Tlingit. In *Handbook of North American Indians, Volume 7: Northwest Coast*, edited by Wayne Shuttles (volume) and William C. Sturtevant (general). Smithsonian Institution Press, Washington: pg. 203-228

Dean, M. Ferrari, Ian Oxley, M. Redknap, K Watson (ed.)

1992. *Archaeology underwater: the NAS Guide to Principle and Practice*. Nautical Archaeology Society, London

Deeben, J., D. Hallewas, J. Kolen, and R. Wiemer

1997. Beyond the crystal ball; Predictive modeling as a tool in archaeological heritage management and occupation history. In *Archaeological heritage management in the Netherlands: Fifty years of State Service for Archaeological*, edited by W.J.H Willems, H. Van Gorcum, Amersfoort: pg. 76-118

Descartes, Rene

1991. [1647] *Principles of Philosophy*, translated by Valentine Rodger Miller. Kluwer Academic Publishers, Netherlands

Dincauze, Dena F.

2000. *Environmental Archaeology: Principles and Practice*. Cambridge University Press, Cambridge

Dixon, E. James

1979. *A predictive model for the distribution of archaeological sites on the Bering Continental Shelf*. Unpublished PhD dissertation, Department of Anthropology, Brown University

1983. Pleistocene Proboscidean Fossils from the Alaska Outer Continental Shelf. *Quaternary Research*, 20: pg. 113-119

1989. Reassessing the Occurrence and Survival of Submerged Terrestrial Archeological Sites on the Bering Continental Shelf. *Underwater Archeological Proceedings from the Society of Historic Archeology Conference*, edited by J. Barto Arnold, III, Baltimore, Maryland

1993. *Quest for the Origins of the First Americans*. University of New Mexico Press, Albuquerque

1999. *Bones, Boats, and Bison: Archaeology and the First Colonization of Western North America*. University of New Mexico Press, Albuquerque

2002. How and When did People First come to North America?. *Athena Review*, 3 (2): pg. 23-27

2007. *Progress Report: Gateway to the Americas CU Innovative Seed Grant Program*. Reported submitted to Dr. Moore, Colorado University

2011a. The Pleistocene/Holocene Transition along the Northwest Coast. Paper *Presented at the 38th Annual meetinging of the Alaska Anthorpology Association*, Fairbanks

2011b. Arrows, Atlatls, and Cultural-Historical Conundrums. In *From Yenisei to the Yukon*, edited by T. Geobel and I. Buvit. Texas A& M University Press, College Station: pg. 362-269

2013. Late Pleistocene colonization of North America from Northeast Asia: New Insights from large-scale paleogeographic reconstructions. *Quaternary International*, 285: pg. 57-67

Dixon, E. James and Kelly Monteleone

2011. *Final Report for Gateway to the Americas (2010-02).* Report on file with Alaska SHPO Office, Anchorage in press. Submerged Beringia. In *Submerged Prehistoric Archaeology: How Climate Change and Technology Are Rewriting History*, edited by Joe Flatman, Amanda Evans, and Nic Flemming. Springer, New York

Dixon, E. James, Timothy H. Heaton, Terence E. Fifield, Thomas D. Hamilton, David E. Putnam, and Frederick Grady

1997. Late Quaternary Regional Geoarchaeology of Southeast Alaska Karst: A Progress Report. *Geoarchaeology: An International Journal*, 12 (6): pg. 689-712

Drucker, Philip

1955. Indians of the Northwest Coast. In *Issue 10 of Anthropological Handbook, American Museum of Natural History American Museum Science Books*. McGraw-Hill for the American Museum of Natural History, New York

Dunbar, J.S., S.D. Webb, and M. Faught

1992. Inundated Prehistoric sties in Apalachee Bay, Florida, and the Search for the Clovis Shoreline. In *Paleoshorelines and Prehistory: An Investigation of Method*, edited by Johnson and Stright. CRC Press, Ann Arbor: pg. 117-146

Dunn, John A. and Arnold Booth

1990. Tsimshian of Metlakatla, Alaska. In *Handbook of North American Indians, Volume 7: Northwest Coast*, edited by Wayne Shuttles (volume) and William C. Sturtevant (general). Smithsonian Institution Press, Washington: pg. 294-297

Dunnell, R.C.

1992. The notion site. In *Space, Time, and Archaeological Landscapes*, edited by J. Rossignol and L. Wandsnider. Plenum Press, New York: pg. 21-41

Dunnell, R.C., and W. Dancey

1983. The siteless survey: A regional scale data collection strategy. In *Advances in Archaeological Method and Theory, Vol 6*, edited by M.B. Schiffer. Academic Press, New York: pg. 267-288

Easton, Norman A.

1993. Underwater archaeology in Montague Harbour: interim report on the 1992 investigations. *Occasional Papers of the Northern Research Institute Report* 4, Whitehorse

Easton, Norman A. and C. Moore

1991. Test excavations of subtidal deposits at Montague Harbour, British Columbia. *International Journal of Nautical and Underwater Archaeology*, 20: pg. 269-280

Ebert, James I. and Timothy A. Kohler

1988. The Theoretical Basis for Archaeological predictive modeling and a consideration of appropriate data-collection methods. In *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling*, edited. US Department of the Interior, Bureau of Land Management, Denver: pg. 97-171

Ejstrud, Bo

2003. Indicative Models in Landscape Management: Testing the Methods. In *The Archaeology of Landscapes and Geographic Information Systems: Predictive Maps, Settlement Dynamics and Space and Territory in Prehistory*, edited by Jurgen Kunow and Johannes Muller. Wunsdorf, Germany: pg. 119-133

Erlandson, Jon M., Madonna Moss, and M. Des Lauriers

2008. Life on the edge: Early maritime cultures of the Pacific Coast of North America. *Quaternary Science Reviews*, 27 (23-24): pg. 2232-2245

ESRI

2001. *ArcGIS 9: What is ArcGIS?*. ESRI, USA

Faught, Michael K. and Amy E. Gusick

2011. Submerged Prehistory in the Americas. In *Submerged Prehistory*, edited by Johnathan Benjamin, Clive Bonsall, Catriona Pickard, and Anders Fischer. Oxbow Books, Oxford: pg. 145-157

Fedje, Daryl W.

1997. Early Holocene Archaeology and Paleoecology on the Northern Northwest Coast. *CRM,* 20 (4): pg. 45-47

2000. Millennial Tides and Archaeology in Gwaii Haanas. *Research Links: A Forum for Natural, Cultural and Social Studies*, 8 (1): pg. 1-7

2003. Ancient Landscapes and Archaeology in Haida Gwaii and Hecate Strait. In *Archaeology of Coastal British Columbia: Essays in Honor of Professor Philip M. Hobler*, edited by Roy L. Carlson. Archaeology Press, Simon Fraser University, Burnaby: pg. 29-38

Fedje, Daryl W. and Heiner Josenhans

2000. Drowned forests and archaeology on the continental shelf of British Columbia, Canada. *Geology*, 28 (2): pg. 99-102

Fedje, Daryl W. and Quentin Mackie

2005. Overview of Cultural History. In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*, edited by Daryl W. Fedje and Rolf W. Mathewes. University of British Columbia Press, Vancouver: pg. 154-162

Fedje, Daryl W. and Rolf W. Mathewes (ed)

2005. *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*. University of British Columbia Press, Vancouver

Fedje, Daryl W. and Tina Christensen

1999. Modeling paleoshorelines and locating early Holocene coastal sites in Haida Gwaii. *American Antiquity*, 64 (4): pg. 635-652

Fedje, Daryl W., A.P. Mackie, J.B. McSporran, and B. Wilson

1996a. Early Period Archaeology in Gwaii Haanas: Results of the 1993 Field Program. In *Early Human Occupation in British Columbia*, edited by Roy L. Carlson and Luke Dalla Bona. University of British Columbia Press, Vancouver: pg. 133-150

Fedje, Daryl W., Heiner Josenhans, John J. Clauge, J. Vaughn Barrie, David J. Archer and John R. Southon

2005a. Hecate Strait Paleoshorelines. In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*, edited by Daryl W. Fedje and Rolf W. Mathewes. University of British Columbia Press, Vancouver: pg. 21-37

Fedje, Daryl W., A.P. Mackie, R.J. Wigen, Q. Mackie, and C. Lake

2005b. Kilgii Gwaay: An early maritime site in the south of Haida Gwaii. In H*aida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*, edited by Fedje, D.W., Mathewes, R.W. University of British Columbia Press, Vancouver: pg. 187-203

Fedje, Daryl W., J. B. McSporran, and A.R. Mason

1996b. Early Holocene archaeology and paleoecology at the Arrow Creek sites in Gwaii Haanas. *Arctic Anthropology*, 33: pg. 116-142

Fedje, Daryl W., Martin P.R. Magne, and Tina Christensen

2005c. Test Excavations at Raised Beach Sites in Southern Haida Gwaii. In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the*

Iron People, edited by Daryl W. Fedje and Rolf W. Mathewes. University of British Columbia Press, Vancouver: pg. 204-244

Fedje, Daryl W., Q. Mackie, D. McLaren, and T. Christensen

2008. A projectile point sequence for Haida Gwaii. In *Projectile Point Sequences in Northwestern North America*, edited by Carlson and Magne. Simon Fraser University Archaeology Press Publication 35, Burnaby: pg. 19-40

Fedje, Daryl W., Quentin Mackie, E. James Dixon, and Timothy H. Heaton

2004. Late Wisconsin Environments and Archaeological Visibility on the Northern Northwest Coast. In *Entering America: Northeast Asia and Beringia before the Last Glacial Maximum*, edited by D. B. Madsen. The University of Utah Press, Salt Lake City: pg. 97-138

Fedje, Daryl W., Rebecca J. Wigen, Quentin Mackie Cynthia R. Lake, and Ian D. Sumpter

2001. Preliminary Results from Investigations at Kilgi Gwaay: An Early Holocene Archaeological Site on Ellen Island, Haida Gwaii, British Columbia. *Canadian Journal of Archaeology*, 25: pg. 98-120

Feinman, G.M.

1999. Defining a contemporary landscape approach: Concluding thoughts. *Antiquity*, 73 (281): pg. 684-685

Fischer, Anders (editor)

1995. *Man and sea in the Mesolithic: Coastal settlement above and below present sea level*. Oxbow Books, Oxford

2004. Submerged Stone Age - Danish examples and North Sea potential. In *Submarine prehistoric archaeology of the North Sea: Research Priorities and collaboration with industry*, edited by N.C. Flemming. CBA Research Report 141 English Heritage/Council for British Archaeology, Bootham: pg. 21-36

2011. Stone Age on the continental shelf: an eroding resource. In *Submerged Prehistory*, edited by Jonathan Benjamin, Clive Bonsall, Catriona Pickard, and Anders Fischer. Oxbow Books, Oxford: pg. 298-310

Fischer, C.T. and T.L. Thurston

1999. Dynamic landscapes and sociopolitical process: The topography of anthropogenic environments in global perspective (special issues). *Antiquity*, 73 (281): pg. 630

Fischer, George

1974. This history and nature of underwater archaeology in the national park service. In *Underwater archaeology in the National Park Service: a model for the management of submerged cultural resources*, edited by Daniel J. Leniham. Department of the Interior, National Park Service, pg. 3-8

Fitzhugh, William

1975. A Comparative Approach to Northern Maritime Adaptations. In *Prehistoric Maritime Adaptations of the Circumpolar Zone*, edited by William Fitzhugh. Mouton Publishers, Paris: pg. 339-386

Fladmark, Knut R.

1975. A Paleoecological model of Northwest Coast Prehistory. *National Museum of Man, Mercury Series, Archaeological Survey of Canada Paper* No. 43, Ottawa: pg.

1979. The Early Prehistory of the Queen Charlotte Islands. *Archaeology*, 32 (2): pg. 38-45

1982. An introduction to the Prehistory of British Columbia. *Canadian Journal of Archaeology*, 6: pg. 95-156

Flannery, Kent

1968. Archeological Systems Theory and Early Mesoamerica. In *Anthropological Archeology in the Americas*, edited by Betty J Meggers. Anthropological Society of Washington, Washington, DC: pg. 67-87

Flatman, Joe

2003. Cultural biographies, cognitive landscapes and dirty old bits of boat: ‘Theory’ in maritime archaeology. *International Journal of Nautical and Underwater Archaeology*, 32 (2): pg. 143-157

2011. Places of Special Meaning: Westerdahl's Comet, "Agency," and the Concept of the "Maritime Cultural Landscape" . In *The Archaeology of Maritime Landscapes*, edited by Ben Ford. Springer, New York: pg. 311-330

Fleming, Andrew

2006. Post-processual Landscape Archaeology: a Critique. *Cambridge Archaeological Journal*, 16(3): pg. 267-80

Fleming, Melissa A. and Joseph A. Cook

2002. Phylogeography of endemic ermine (Mustela erminea) in southeast Alaska. *Molecular Ecology*, 11 (4): pg. 795-807

Ford, Ben

2011a. Introduction. In *The Archaeology of Maritime Landscapes*, edited by Ben Ford. Springer, New York: pg. 1-9

2011b. The Shoreline as a Bridge, Not a Boundary: Cognitive Maritime Landscapes of Lake Ontario. In *The Archaeology of Maritime Landscapes*, edited by Ben Ford. Springer, New York: pg. 63-80

Ford, Ben and Jessi Halligan

2010. A North American Perspective: Comments on Jonathan Benjamin's 'Submerged Prehistoric Landscapes and Underwater Site Discovery: Reevaluating the 'Danish Model' for International Practice'. *Journal of Island and Coastal Archaeology*, 5 (2): pg. 277-279

Forrest, Craig J.S.

2002. Defining underwater cultural heritage. *International Journal of Nautical and Underwater Archaeology*, 31 (1): pg. 3-11

Gaffney, Vincent and Kenneth Thomson

2007. Mapping Doggerland. In *Mapping Doggerland: The Mesolithic Landscapes of the Southern North Sea*, edited by V. Gaffney, K. Thomson, and S. Fitch. Archaeopress, Oxford: pg. 1-10

Gehrels, G.E. and H.C. Berg

1992. Geology of southeast Alaska. *U.S. Geological Survey Miscellaneous Investigation Series* Map I-1867, scale 1:600,000: pg.

Gesch, D, M Oimoen, S Greenlee, C. Nelson, M. Steuck, and D. Tyler

2002. The National Elevation Dataset. *Photogrammetric Engineering and Remote Sensing*, pg. 68 (1)

Getis, Arthur and J.K. Ord

1992. The Analysis of Spatial Association by Use of Distance Statistics. *Geographical Analysis*, 24 (3): pg. 189-206

Gibson, James R.

1992. *Otter Skins, Boston Ships, and China Goods: The Maritime Fur Trade of the Northwest Coast, 1785-1841*. University of Washington Press, Seattle

Goggin, John M.

1960. Underwater Archaeology: Its Nature and Limitations. *American Antiquity*, 25 (3): pg. 348-354

Gormly, Mary

1971. Tlingits of Bucareli Bay, Alaska (1774-1792). *Northwest Anthropological Research Notes*, Universtiy of Idaho, 5 (2): pg. 157-180

Gould, Richard A.

2000. *Archaeology and the social history of the ship*. Cambridge University Press, Cambridge

GRASS Development Team

2012. *Geographic Resources Analysis Support System (GRASS) Software*, Version 6.4.1. Open Source Geospatial Foundation, http://grass.osgeo.org

Green, Ernestene L.

1973. Location Analysis of Prehistoric Maya Sites in Northern British Honduras. *American Antiquity*, 38 (3): pg. 279-293

Green, J.

2003. *Maritime Archaeology: A technical handbook*. Academic Press, London

Gruhn, Ruth

1994. The Pacific Coast Route of Initial Entry: An Overview. In *Method and Theory for Investigating the Peopling of the Americas*, edited by Robson Bonnichsen and D. Gentry Steele. Center for the Study of the first Americans, Oregon State University, Corvallis: pg.

Guisck, Amy E. and Michael K. Faught

2011. Prehistoric Archaeology Underwater: A Nascent Subdiscipline Critical to Understanding Early Coastal Occupations and Migration Routes. In *Trekking the Shore*, edited by Nuno F. Bicho, Jonathan Haws, and Loren G. Davis. Springer, Dordrecht: pg. 27-50

Halligan, Jessi

2011. Lake Ontario Paleoshorelines and Submerged Prehistoric Site potential in the Great Lakes. In *The Archaeology of Maritime Landscapes*, edited by Ben Ford. Springer, New York: pg. 45-62

Halpin, Marjorie M. and Margaret Seguin

1990. Tsimshian Peoples: Southern Tsimshian, Coast Tsimshian, Nishga, and Gitksan. In *Handbook of North American Indians, Volume 7: Northwest Coast*, edited by Wayne Shuttles (volume) and William C. Sturtevant (general). Smithsonian Institution Press, Washington: pg. 267-284

Hamilton, Scott and Linda Larcombe

1994. *Cultural Heritage Resource Predictive Modelling Project: vol 1: Introduction to the Research*. Report Prepared for the Ontario Ministry of Natural Resources, Lakehead University, Thunder Bay

Hamilton, Scott, Luke Dalla Bona and Linda Larcombe

1994. *Cultural Heritage Resource Predictive Modelling Project: vol 5: Summary and recommendations*. Report Prepared for the Ontario Ministry of Natural Resources, Lakehead University, Thunder Bay

Hansen, B.C.S. and Engstrom, D.R.

1996. Vegetation history of Pleasant Island, Southeastern Alaska, since 13,000 BP. *Quaternary Resarch*, 46: pg. 161-175

He, F.

2011. *Simulating Transient Climate Evolution of the Last Deglaciation with CCSM3*. Ph.d. Thesis, University of Wisconsin, Madison, Wisconsin, USA

Heaton, Timothy H. and Frederick Grady

2003. The Late Wisconsin Vertebrate History of Prince of Wales Island, Southeast Alaska. In *Ice Age Cave Faunas of North America*, edited by Blaine W. Schubert, Jim I Mead, and Russel Wm. Graham. Indiana University Press, Bloomington: pg. 17-53

Hetherington, Renee and Robert G.B. Reid

2003. Malacological insights into the marine ecology and changing climate of the late Pleistocene – early Holocene Queen Charlotte Islands archipelago, western Canada, and implications for early peoples. *Canadian Journal of Zoology*, 81: pg. 626-661

Hetherington, Renee, J. Vaughn Barrier, Robert G.B. Reid, Roger MacLeod, and Dan J. Smith

2004. Paleogeography, glacially induced crustal displacement, and Late Quaternary coastlines on the continental shelf of British Columbia, Canada. *Quaternary Science Reviews*, 23: pg. 295-318

Heusser, Calvin J.

1955. Pollen Profiles from the Queen Charlotte Islands, British Columbia. Canadian *Journal of Botany*, 33: pg. 429-449

1960. Late-Pleistocene Environments of North Pacific North America: An Elaboration of Late-Glacial and Postglacial Climatic, Physiographic, and Biotic changes. Special Publication 35, *American Geographic Society*, New York

Hobler, Phillip

1978. The relationship of archaeological sites to sea levels on Moresby Island, Queen Charlotte Islands. *Canadian Journal of Archaeology*, 2: pg. 1-14

Hodder, I.

1977. Some new directions in the spatial analysis of archaeological data at the regional scale (macro). In *Spatial Archaeology*, edited D.L. Clarke. Academic Press, New York: pg. 223-330

2011. *Imagenex Model 872 "Yellowfin" Sidescan Sonar*. Imagenex Technology Corp., www.imagenex.com: pg. 445-029, http://www.imagenex.com/YellowFin_manual_v2.pdf

Ingold, Tim

1993. The Temporality of the Landscape. *World Archaeology*, 25 (2): Concepts of Time in Ancient Society: pg. 152-174

Johnson, G.A.

1977. Aspects of regional analysis in archaeology. *Annual Review of Anthropology*, 6: pg. 479-508

Johnson, James A., Brad A. Andres, and John A. Brissonette

2008. *Birds of the Major Mainland Rivers of Southeast Alaska*. United States Deparment of Agriculture, General Technical Report PNW-GTR-739

Josenhans, Heiner, Daryl Fedje, Reinhard Pienitz, and John Southon

1997. Early Humans and Rapidly Changing Holocene Sea Levels in the Queen Charlotte Islands - Hecate Strait, British Columbia, Canada. *Science*, 277: pg. 71-74

Kantner, J.

2008. The Archaeology of Regions: From Discrete Analytical Toolkit to Ubiquitous Spatial Perspective. *Journal of Archaeological Research*, 16: pg. 37-81

Kari, James, and Ben A. Potter

2010. The Dene-Yeniseian Connection: Bridging Asia and North America. In *The Dene-Yeneiseian Connection: Bridging Asia and North America*, edited by James Kari and Ben A. Potter. Department of Anthropology, University of Alaska, New Series, Vol 5 (1-2), Fairbanks: pg. 1-24

Kemp, Brian M., Ripan S. Malhi, John McDonough, Deborah A. Bolnick, Jason A. Eshleman, Olga Rickards, Chistina Martiez-Labarga, John R. Johnson, Joseph G. Lorenz, E. James Dixon, Terence E. Fifield, Timothy H. Heaton, Rosita Worl, and David Glenn Smith

2007. Genetic Analysis of Early H Holocene Skeletal Remains from Alaska and its Implications for the Settlement of the Americas. *American Journal of Physical Anthropology,* 132: pg. 605-621

Kincaid, C.

1988. Predictive Modeling and its relationship to cultural resource management applications. In *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling*, edited by Judge and Sebastian. US Department of the Interior, Bureau of Land Management, Denver: pg. 549-580

King, A.

1950. Cattle Point, A Stratified Site on the Southern Northwest Coast. *Memoirs of the Society for American Archaeology,* 7: pg. Salt Lake City

Knapp, A. Bernard and Wendy Ashmore

1999. Archaeological Landscapes: Constructed, Conceptualized, Ideational. In *Archaeologies of Landscape: contemporary Perspectives*, edited by Wendy Ashmore and A. Bernard Knapp. Blackwell Publishers, Oxford: pg. 1-30

Kohler, Timothy A.

1988. Predictive Locational Modeling: History and Current Practice. In *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling*, edited by W. James Judge and Lynne Sebastian. US Department of the Interior, Bureau of Land Management, Denver: pg. 19-96

Kohler, Timothy A. and Sandra C. Parker

1986. Predictive Models for Archaeological Resource Location. In *Advances in Archaeological Method and Theory, Vol 9,* edited by M. Schiffer. Academic Press, New York: pg. 397 - 452

Kondo, Yasuhisa, Takayuki Omori, and Philip Verhagen

2011. *Developing predictive models for palaeoanthropological research: a preliminary discussion*. Department of Computer Science Tokyo Institute of Technology, pg. TR12-0001

Kondo, Yasusisa and Takashi Oguchi

2012. *How can we apply ecological niche models to paleoanthropological research?*. Center for Spatial Information Science, University of Tokyo, RNMH 2012 P-26

Kroeber, Alfred L.

1939. *Cultural and Natural Areas of North America*. University of California Publications in American Archaeology and Ethnology 38, Berkeley

Kvamme, Kenneth L.

1988a. Using Existing Data For Model Building. In *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling*, edited by W. James Judge and Lynne Sebastian. US Department of the Interior, Bureau of Land Management, Denver: pg. 301-323

1988b. Development and Testing of Quantitative Models. In *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling*, edited by W. James Judge and Lynne Sebastian. US Department of the Interior, Bureau of Land Management, Denver: pg. 325-428

2006. There and Back Again: Revisiting Archaeological Locational Modeling. In *GIS and Archaeological Site Location Modeling*, edited by Mark W. Mehrer and Konnie L. Wescott. Taylor and Francis, New York: pg. 2-34

Lacourse, Terri and Rolf W Mathewes

2005. Terrestrial Paleoecology of Haida Gwaii and the Continental Shelf: Vegetation, Climate, and Plant Resources of the Coastal Migration Route . In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*, ed Fedje and Mathewes. University of British Columbia Press, Vancouver: pg. 38-58

Langdon, Stephen John

1977. *Technology, Ecology and Economy: Fishing systems in Southeast Alaska*. PhD. Disseration, Stanford University, Stanford

Lee, Craig Michael

2007. *Origin and Function of Early Holocene Microblade Technology in Southeast Alaska, USA*. Unpublished PhD dissertation, Department of Anthropology, University of Colorado

Lewis, David

1972. *We, the Navigators: The ancient Art of Landfinding in the Pacific*. University of Hawaii Press, Honolulu

Liu, Z., B. L.Otto-Bliesner, F. He, E. C. Brady, R. Tomas, P.U. Clark, A.E. Carlson, J. Lynch-Stieglitz, W. Curry, E. Brook, D. Erickson, R. Jacob, J. Kutzbach, and J. Cheng

2009. Transient simulation of last deglaciation with a new mechanism for Bolling-Allerod warming. *Science*, 325 (5938): pg. 310-4

Lock, Gary

2004. Wetland archaeology and computers. In *Living on the Lake in Prehistoric Europe: 150 years of lake-dwelling research*, edited by Francesco Menotti. Routledge, New York: pg. 194-204

Lock, Gary and Trevor Harris

1992. Visulaizaing spatial data: the importance of Geographic Information Systems. In *Archaeology and the Information age: a global perspective*, edited by Reilly and Rahtz. Routledge, London: pg. 81-96

2006. Enhancing Predictive Archaeological Modeling: Integrating Location, Landscape, and Culture. In *GIS and Archaeological Site Location Modeling*, edited by Mark W. Mehrer and Konnie L. Wescott. Taylor and Francis, New York: pg. 36-55

Longley, Paul A., Michael F. Goodchild, David J. Maguire, and David W. Rhind

2005. *Geographic Information Systems and Science, Second Edition*. John Wiley & Sons, Ltd, Chichester

Lyman, R. Lee

1991. *Prehistory of the Oregon Coast: The effects of excavation strategies and assemblage size on archaeological inquiry*. Academic Press, San Diego

Lyons, C.P. and Bill Merilees

1995. *Trees, Shrubs & Flowers to Know in Washington and British Columbia*. Long Pine Publishing, Vancourver

MacDonald, S. O. and J. A. Cook

2009. *Recent Mammals of Alaska*. University of Alaska Press, Fairbanks

MacKenzie, J.D.

1916. Geology of Graham Island, British Columbia. *Geological Survey of Canada, Memoir 88*

Mackie, Alexander P. and Ian D. Sumpter

2005. Shoreline Settlement Patterns in Gwaii Haanas during the Early and Late Holocene. In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*, edited by Fedje, D.W., Mathewes, R.W. University of British Columbia Press, Vancouver: pg. 337-371

Mandryk, Carole A. S., Heiner Josenhans, Daryl W. Fedje, and Rolf W. Mathewes

2001. Late Quaternary paleoenvironments of Northwestern North America: Implications for inland versus coastal migration routes. *Quaternary Science Reviews*, 20: pg. 301-314

Mann, Daniel H.

1986. Wisconsin and Holocene glaciation of southeast Alaska. In *Glaciation in Alaska—The Geologic Record*, edited by Thomas D. Hamilton, Katherine M. Reed, and Robert M. Thorson. Alaska Geological Society, Anchorage: pg. 237-265

Mann, Daniel H. and Gregory P. Streveler

2008. Post-glacial relative sea level, isostasy, and glacial history in Icy Strait, Southeast Alaska, USA. *Quaternary Research*, 69 (2): pg. 201-216

Mann, Daniel H. and Thomas D. Hamilton

1995. Late Pleistocene and Holocene Paleoenvironments of the North Pacific Coast. *Quaternary Science Reivews*, 14: pg. 449 - 471

Maschner, Herbert D.G.

1992. *The origins of hunter and gatherer sedentism and political complexity: A case study from northern Northwest Coast*. Unpublished PhD dissertation, Department of Anthropology, University of California, Santa Barbara

1996. Theory, Technology, and the Future of Geographic Information Systems in Archaeology. In *New Methods, Old Problems: Geographic Information Systems in Modern Archaeological Research*, edited by H.D.G. Maschner. Occasional Paper No 23, Center for Archaeological Investigations, Southern Illinois University, Carbondale: pg. 301-308

Maschner, Herbet D, and Jeffrey W. Stein

1995. Multivariate approaches to site location on the Northwest Coast of North America. *Antiquity*, 69: pg. 61-73

Masselink, Gerhard and Michael G. Hughes

2003. *Introduction to Coastal Processes and Geomorphology*. Oxford University Press Inc., New York

Masters, Patricia

1983. Detection and Assessment of Prehistoric Artifact Sites Off the Coast of Southern California. In *Quaternary Coastlines and Marine archaeology: Towards the prehistory of land bridges and continental shelves*, edited by P.M. Masters and N.C. Flemming. Academic Press, New York: pg. 189-214

Mathews, W.H.

1979. Late Quaternary Environmental History affecting Human Habitation of the Pacific Northwest. *Canadian Journal of Archaeology*, 3: pg. 145-156

Matson, R.G. and Gary Coupland

1995. *The Prehistory of the Northwest Coast*. Academic Press, San Diego

Mazurkevich, Andrey and Ekaterina Dolbounova

2011. Underwater Investigations in Northwest Russia: lacustrine archaeology of Neolithic pile dwellings. In *Submerged Prehistory*, edited by Johnathan Benjamin, Clive Bonsall, Catriona Pickard, and Anders Fischer. Oxbow Books, Oxford: pg. 158-172

McCartney, Allen P.

1974. Maritime Adaptations on the North Pacific Rim. *Arctic Anthropology*, 11 (supplement): pg. 153-162

McGrail, Sean

1981. *The Ship: Rafts, Boats and Ships*. Her Majesty's Staionery Office, London

McLaren, Duncan and Nicole Smith

2008. The Stratigraphy of Bifacial Implements at the Richardson Island Site, Haida Gwaii. In *Projectile Point Sequences in Northwestern North America*, edited by Carlson and Magne. Simon Fraser University Archaeology Press Publication 35, Burnaby: pg. 41-60

McNiven, Ian J.

2008. Sentient Sea: Seascapes as Spiritscapes. In *Handbook of Landscape Archaeology*, edited by Bruno David, and Julian Thomas. Left Coast Press Inc, Walmut Creek: pg. 149-157

Mears, John

1790. *Voyages made in the years 1788, and 1789 from China to the north west coast of America*. Logographic Press, London

Mehrer, Mark W.

2006. Preface. In *GIS and Archaeological Site Location Modeling*, edited by Mark W. Mehrer and Konnie L. Wescott. Taylor and Francis, New York: pg. ix- x

Metz, M., Mitasova, H., and Harmon, R. S.

2011. Efficient extraction of drainage networks from massive, radar-based elevation models with least cost path search. *Hydrology and Earth System Sciences*, 15 (2: February): pg. 667-678

Mink II, Philip B., B. Jo Stokes, and David Pollack

2006. Points vs. Polygons: A Test Case using a Statewide Geographic Information System. In *GIS and Archaeological Site Location Modeling*, edited by Mark W. Mehrer and Konnie L. Wescott. Taylor and Francis, New York: pg. 200-219

Momber, Garry

2000. Drowned and deserted: A submerged prehistoric landscape in the Solent, England. *International Journal of Nautical and Underwater Archaeology*, 34 (1): pg. 86-99

2011. Submerged Landscape Excavations in the Solent, Southern Britain: climate change and cultural development. In *Submerged Prehistory*, edited by Johnathan Benjamin, Clive Bonsall, Catriona Pickard, and Anders Fischer. Oxbow Books, Oxford: pg. 85-98

Moss, Madonna L.

1992. Relationships between maritime cultures of Southern Alaska: Rethinking culture area boundaries. *Arctic Anthropology*, 29 (2): pg. 5-17

1998. Northern Northwest Coast Regional Overview. *Arctic Anthropology*, 35 (1): pg. 88-111

2004. The status of archaeology and archaeological practice in southeast Alaska in relation to the larger Northwest Coast. *Arctic Anthropology*, 41 (2): pg. 177-196

2011. *Northwest Coast: Archaeology as Deep History*. Society of American Archaeology, Washington

Moss, Madonna L. and J. M. Erlandson

1992. Forts, Refuge Rocks, and Defensive sites: the Antiquity of Warfare along the North Pacific Coast of North America. *Arctic anthropology*, 29 (2): pg. 73-90

1998. A Comparative Chronology of Northwest Coast Fishing Features. In *Hidden Dimensions: The Cultural Significance of Wetland Archaeology*, edited by Kathryn Bernick. University of British Columbia Laboratory of Archaeology, Vancouver: pg. 180-198

Muche, James

1998 [1981]. Site Location Factors. In *In the Realms of Gold: The proceedings of the Tenth Conference on Underwater Archaeology*, edited by Wilburn A. Cockrell, pp 137-139. Fathom Eight, San Marino, California. (reprinted in *Maritime Archaeology: A Reader of Substantive and Theoretical Contributions*, 1998, edited by Babits, and Tilburg, Plenum Press, New York, pg 253-255)

Muckelroy, Keith

1978. *Maritime archaeology*. Cambridge University Press, Cambridge

2011. National Data Buoy Center (NOAA). http://www.ndbc.noaa.gov/station_page.php?station=46084 , Station 46084: Cape Edgecumbe

2010. NOAA National Geophysical Data Center: Multibeam Bathymetry. http://www.ngdc.noaa.gov/mgg/bathymetry/multibeam.html

2010. NOAA National Geophysical Data Center: NOS Hydrographic Survey Data. http://www.ngdc.noaa.gov/mgg/bathymetry/hydro.html

2011. NOAA Tides and Currents. http://tidesandcurrents.noaa.gov/

2011. NOAA National Geophysical Data Center: NOS Hydrographic Survey Data. http://www.ngdc.noaa.gov/mgg/bathymetry/hydro.html

Oberg, K.

1973. *The social economy of the Tlingit Indians*. University of Washington Press, Seattle

O'Claire, Rita M., Robert H. Armtsrong, and Richard Carstensen

1992. *The Nature of Southeast Alaska*. Alaska Northwest Books, Anchorage

Okada, Hiroaki and Atsuko Okada

1992. *Heceta Island, Southeastern Alaska: Anthropological Survey in 1989 & 1990*. Hokkaido University, Sapporo

Parker, A. J.

1999. A maritime cultural landscape: The port of Bristol in the Middle Ages. *International Journal of Nautical and Underwater Archaeology*, 28 (4): pg. 323-342

Patterson, Thomas C.

2008. The History of Landscape Archaeology in the Americas. In *Handbook of Landscape Archaeology*, edited by Bruno David, and Julian Thomas. Left Coast Press Inc, Walmut Creek: pg. 77-84

Pearson, Chales E. David B. Kelley, Richard A. Weinstein, and Sherwood M. Gagliano

1986. *Archaeological investigations on the outer continental shelf: A study within the Sabine River Valley, Offshore Louisiana and Texas*. OCS Study MMS 86-0119 manuscripted prepared for US Department of the Interior, Mineral Management Service, Reston, Virginia, by Coastal Environments Inc.

Peeters, Hans

2005. The Forager's Pendulum: Mesolithic-Neolithic landscape dynamics, land-use variability and the spatio-temporal resolution of predictive models in archaeological heritage management. In *Predictive modelling for archaeological heritage management*, Amersfoort, Colophon: pg. 149-168

Peltier, W.R.

2004. Global glacial isostasy and the surface of the ice age Earth: the ICE-5G (VM2) model and GRACE. *Annual Review of Earth and Planetary Sciences*, 32: pg. 111-149

Peltier, W.R. and R.G. Fairbanks

2006. Global glacial ice volume and Last Glacial Maximum duration from an extended Barbados sea level record. *Quaternary Science Reviews*, 25 (23-24): pg. 3322-3337

Peterson, Curtiss

1974. Data from underwater archaeological sites. In *Underwater archaeology in the National Park Service: a model for the management of submerged cultural resources*, edited by Daniel J. Leniham. Department of the Interior, National Park Service, pg. 62-65

Purdy, B.A.

1991. *The Art and Archaeology of Florida's Wetlands*. CRC Press, Boca Raton

Raab, Mark and Albert C. Goodyear

1984. Middle-Range Theory in Archaeology: a Critical Review of Origins and Applications. *American Antiquity*, 49 (2): pg. 255-268

Raab, Mark and Andrew Yatsko

2009. California Galapagos. In *California Maritime Archaeology: A San Clemet Island Perspective*, edited by L. Mark Raab, Jim Cassidy, Andrew Yatsko, and William J. Howard. Altamira Press, New York: pg. 3-22

Ramenofsky, A.F., and A. Steffan

1998. Units as tools of measurement. In *Unit Issues in Archaeology: Measuring Time, Space, and Material*, edited by A.F. Ramenofsky and A. Steffen. University of Utah Press, Salt Lake City: pg. 3-17

Ramsey, Carolyn L., Paul A. Griffiths, Daryl W. Fedje, Rebecca J. Wigen, and Quentin Mackie

2004. Preliminary investigation of a late Wisconsinan fauna from K1 cave, Queen Charlotte Islands (Haida Gwaii), Canada. *Quaternary Research*, 62: pg. 105-109

Reimchen, Tom and Ashley Byun

2005. The Evolution of Endemic Species in Haida Gwaii. *In Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*, edited by Daryl W. Fedje and Rolf W. Mathewes. University of British Columbia Press, Vancouver: pg. 77-95

Reimer, PJ, MGL Baillie, E Bard, A Bayliss, JW Beck, C Bertrand, PG Blackwell, CE Buck, G Burr, KB Cutler, PE Damon, RL Edwards, RG Fairbanks, M Friedrich, TP Guilderson, KA Hughen, B Kromer, FG McCormac, S Manning, C Bronk Ramsey, RW Reimer,…

2009. calib 6.0. *Radiocarbon*, 51 (xxx-yyy)

Ritter, Dale F., R. Craig Kochel, Jerry R. Miller

2006. *Process Geomorphology: Fourth Edition*. Waveland Press, Inc., Long Grove

Rossignol, J. and L. Wandsnider

1992. Concepts, methods, and theory building: A landscape approach. In *Space, Time, and Archaeological Landscape*, edited by J. Rossignol and L. Wandsnider. Plenum Press, New York: pg. 3-19

Ruppe, R. J.

1988. The location and assessment of underwater archaeological sites. In *Wet Site Archaeology*, edited by B.A. Prudy. Telford Press, Telford: pg. 55-68

Saile, Thomas and Carsten Lorz

2005. An Essay on Spatial Resolution in Predictive Modelling: Pitfalls and Challenges. In *Predictive modelling for archaeological heritage management : a research agenda*, edited by Hans Kamermans; Martijn van Leusen. Amersfoort, Colophon: pg. 139-147

Schalk, R.F.

1977. The structure of an anadronmous resource. In *For Theory Building in Archaeology*, edited by L.R. Binford. Academic Press, New York: pg. 207-249

Schiffer, Michael B.

1972. Archaeological Context and Systemic Context. *American Antiquity*, 37 (2): pg. 156-165

1988. The structure of archaeological theory. *American Antiquity*, 53 (3): pg. 461-485

Sebastian, Lynne and W. James Judge

1988. Predicting the Past: Correlation, explanation, and the use of archaeological models. In *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling*, edited by W. James Judge and Lynne Sebastian. US Department of the Interior, Bureau of Land Management, Denver: pg. 1-18

Shafer, Aaron B. A., Catherine I. Cullingham, Steeve D. Cote, and David W. Coltman

2010. Of glaciers and refugia: A decade of study sheds new light on the phylogeography of northwestern North America. *Molecular Ecology*, 19: pg. 4589-4621

Shafer, Aaron B. A., Kevin S. White, Steeve D. Cote, and David W. Coltman

2011. Deciphering tanslocations from relicts in Baranof Island mountain goats: is an endemic genetic lineage at risk?. *Conservation Genetics*, 12: pg. 1261-1268

Shennan, Stephen

2002. *Genes, Memes and Human History: Darwinian Archaeology and Cultural Evolution*. Thames & Hudson, London

Silverstein, Michael

1990. Chinookans of the Lower Columbia. In *Handbook of North American Indians, Volume 7: Northwest Coast*, edited by Wayne Shuttles (volume) and William C. Sturtevant (general). Smithsonian Institution Press, Washington: pg. 533-546

Smith, Jane L.

2011. An update of Intertidal fishing structures in Southeast Alaska. *Alaska Journal of Anthropology*, 9 (1): pg. 1-26

Stanford, Dennis J. and Bruce A. Bradley

2012. *Across Atlantic Ice: The origin of America's Clovis Culture*. University of California Press, Berkeley

Stein, J. (editor)

1992. *Deciphering a Shell Midden*. Academic Press, New York

Stern, Nicola

2008. Stratigraphy, depositional environments, and paleolandscape reconstruction in landscape archaeology. In *Handbook of Landscape Archaeology*, editted by Bruno David, and Julian Thomas. Left Coast Press, Walnut Creek, CA: pg. 365-378

Stewart, Hilary

1984. *Cedar: Tree of Life to the Northwest Coast Indians*. Douglas and McIntyre, Vancouver

Sullivan, Alan P. and Michael B. Schiffer

1978. A Critical Examination of SARG. In *Investigations of the Southwestern Anthropological Research Group: The Proceedings of the 1976 Conference*, edited by Rovert C. Euler and George J. Gumerman. Museum of Northern Arizona, Flagstaff: pg. 168-175

Surovell, Todd A.

2003. Simulating Coastal Migration in New World Colonization. *Current Anthropology*, 44 (4): pg. 580-591

Suttles, Wayne

1990a. Introduction. In *Handbook of North American Indians, Volume 7: Northwest Coast*, edited by Wayne Shuttles (volume) and William C. Sturtevant (general). Smithsonian Institution Press, Washington: pg. 1-15

1990b. Environment. In *Handbook of North American Indians, Volume 7: Northwest Coast*, edited by Wayne Shuttles (volume) and William C. Sturtevant (general). Smithsonian Institution Press, Washington: pg. 16-29

Swanton, John R.

1905. *Haida Texts and Myths, Skidegate Dialect*. Government Printing Office, Washington

Terraflow GRASS. http://grass.fbk.eu/gdp/html_grass64/r.terraflow.html

Thompson, Laurence C. and M. Dale Kinkade

1990. Languages. In *Handbook of North American Indians, Vol 7 Northwest Coast*, edited by Wayne Suttles. Smithsonian Institution Press, Washington: pg. 30-51

Tilley, Christopher

1994. *Phenomenology of Landscape: Place, Paths, and Monuments*. Berg, Oxford

2004. *The Materiality of Stone: Explorations in Landscape Phenomenology*. Berg, Oxford

2008. Phenomenological Approaches to Landscape Archaeology. In *Handbook of Landscape Archaeology*, edited by Bruno David, and Julian Thomas. Left Coast Press Inc, Walmut Creek: pg. 271-276

Trigger, Bruce

1971. Archaeology and Ecology. *World Archaeology*, 2 (3): pg. 321-336

Tschauner, Hartmut

1996. Middle-Range Theory, Behavioral Archaeology, and Postempiricist Philosophy of Science in Archaeology. *Journal of Archaeological Method and Theory*, 3 (1): pg. 1-30

2009. USGS Seamless Server. http://seamless.usgs.gov/

2009. USGS Earthexplorer Server. http://edcsns17.cr.usgs.gov/EarthExplorer/

U.S. Navy

1985. US Navy Diving Manual, Chapter 1. San Pedro, CA, Best Publishing Company. (reprinted in *Maritime Archaeology: A Reader of Substantive and Theoretical Contributions*, 1998, edited by Babits, and Tilburg, Plenum Press, New York, pg 343-354)

Van de Noort, Robert

2003. An ancient seascape: the social context of seafaring in the early Bronze Age. *World Archaeology*, 35 (3): pg. 404-415

van Leusen, Martijn, Jos Deeben, Daan Hallewas, Paul Zoetbrood, Hans Kamermans, and Philip Verhagen

2005. A Baseline for Predictive Modelling in the Netherlands. In *Predictive modelling for archaeological heritage management : a research agenda*, edited by Hans Kamermans; Martijn van Leusen. Amersfoort, Colophon: pg. 25-92

Verhagen, Philip

2008. Testing Archaeological Predictive Models: A Rough Guide. In *Layers of Perception: Proceedings of the 25th International conference on Computer Applications and Quantitative Methods in Archaeology (CAA) Berlin, Germany, April 2-6, 2007*, edited by. Romisch-Germanische Kommission des Deutschen Archaeolgischen Istituts, Frankfurt: pg. 285-291

Verhagen, Philip and Thomas G. Whitley

2012. Integrating Archaeological Theory and Predictive Modeling: A Live Report from the Scene. *Journal of Archaeological Method and Theory*, 10.1007/s10816-011-9102-7: pg. 1-52

Wandsnider, L.

1992a. The spatial dimension of time. In *Space, Time, and Archaeological Landscapes* edited by J. Rossingol and L. Wandsnider. Plenum Press, New York: pg. 257-284

1992b. Archaeological Landscape Studies. In *Space, Time, and Archaeological Landscapes*, edited by Jacqueline Rossignol and LuAnn Wandsnider. Plenum Press, New York: pg. 285-292

Warner, B.G.

1984. *Late Quaternary paleoecology of eastern Graham Island, Queen Charlotte Islands, British Columbia, Canada*. Unpublished PhD Dissertation, Department of Biological Sciences, Simon Fraser University, Burnaby

Watson, Patty Jo

1983. Method and Theory in Shipwreck Archaeology. In *Shipwreck Anthropology* edited by Richard A. Gould). University of New Mexico Press, Albuquerque: pg. 23 - 36

Watts, Jack, Brian Fulfrost, and Jon Erlandson

2011. Searching for Santarosea: Surveying Submerged Landscapes for Evidence of Paleocoastal Habitation off California's Northern Channel Islands. In *The Archaeology of Maritime Landscapes*, edited by Ben Ford. Springer, New York: pg. 11-26

Weckworth, Byron V., Natalie G. Dawson, Sandra L. Talbot, Melanie J. Flamme, and Joseph A. Cook

2011. Going Coastal: Shared Evolutionary History between Coastal British Columbia and Southeast Alaska Wolves (Canis lupus). *PLoS ONE*, 6 (5): pg. e19582

Westerdahl, Christer

1992. The maritime cultural landscape. *The International Journal of Nautical and Underwater Archaeology*, 21 (1): pg. 5-14

Westley, Kieran, Trevor Bell, Ruth Plets,a nd Rory Quinn

2011. Investigating Submerged Archaeological Landscapes: a research strategy illustrated with case studies from Ireland and Newfoundland, Canada. In S*ubmerged Prehistory*, edited by Johnathan Benjamin, Clive Bonsall, Catriona Pickard, and Anders Fischer. Oxbow Books, Oxford: pg. 129-144

Wheatley, David

1993. Going over old ground: GIS, archaeological theory and the act of perception. In *Computing the Past: Computer Applications and Quantitative Methods in Archaeology*, edited by Anderson, Madsen, and Scollar. Aarhus University Press, Arahus: pg. 133-138

Wheatley, David and Mark Gillings

2002. *Spatial technology and Archaeology: The Archaeological applications of GIS*. Taylor and Francis, London

Whitley, Thomas G. and Gwendolyn Burns

2008. Conditional GIS surfaces and their Potential for Archaeological Predictive Modelling. In *Layers of Perception: Proceedings of the 25th International conference on Computer Applications and Quantitative Methods in Archaeology*. Romisch-Germanische Kommission des Deutschen Archaeolgischen Istituts, Frankfurt: pg. 292-298

Wigen, Rebecca J.

2005. History of the Vertebrate Fauna in Haida Gwaii. In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*, edited by Daryl W. Fedje and Rolf W. Mathewes. University of British Columbia Press, Vancouver: pg. 96-115

Willey, Gordon R.

1953. Prehistoric settlement patterns in the Virú Valley, Perú. *Smithsonian Institution Bureau of American Ethnology Bulletin*; 155, Washington

Willey, Gordon R. and P. Phillips

1958. *Method and Theory in American Archaeology*. University of Chicago Press, Chicago

Wilson, I.R.

1996. Paleoindian Sites in the Vicinity of Pink Mountain. In *Early Human Occupation in British Columbia*, edited by Roy L. Carson and Luke Dalla Bona. University of British Columbia Press, Vancouver: pg. 29-34

Winterhalder, Bruce

1981. Optimal Foraging Strategies and Hunter-Gatherer Research in Anthropology: theories and Models. In *Hunter-Gather Foraging Strategies*, edited by B. Winterhalder and E. A. Smith. University of Chicago Press, Chicago: pg. 66-98

Winthrop, Robert H.

1991. *Dictionary of Concepts in Cultural Anthropology*. Greenwood Press, New York

Wissler, Clark

1914. Material Cultures of the North American Indians. *American Anthropologist*, 16: pg. 447-505

Worl, Rosita

1990. History of Southeastern Alaska Since 1867. In *Handbook of North American Indians, Volume 7: Northwest Coast*, edited by Wayne Shuttles (volume) and William C. Sturtevant (general). Smithsonian Institution Press, Washington: pg. 149-158

Wright, John, Angela Colling, and Dave Park (Open Univeristy Course Team)

2005. *Waves, Tides and Shallow-water Processes, second edition*. Butterwoth-Heinemann, Oxford

Yajima, Kunio

1992. Chuck Lake Site-Loc. 1S. In *Heceta Island, Southeast Alaska: Anthropological Survey in 1989 & 1990*, edited by Hiroaki Okada and Atsuko Okada. Hokkaido University, Sapporo: pg. 9-13