9-2013

Plant Management Systems of British Columbia's First Peoples

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Citation Details

Turner, N. J., Lepofsky, D., & Deur, D. (2013). Plant Management Systems of British Columbia's First Peoples. BC Studies: The British Columbian Quarterly, (179), 107-133.

PLANT MANAGEMENT SYSTEMS OF BRITISH COLUMBIA'S FIRST PEOPLES

Nancy J. Turner, Douglas Deur, and Dana Lepofsky

INTRODUCTION

> But, see, … people didn't believe that we did this; they think that Nature just grows on its own. But our people felt, to get more harvest, and a bigger … berry, they did these things. Same thing … a farmer does. (Dr. Daisy Sewid-Smith, Mayanilth, Kwakwaka'wakw, interview with NT, 1 November 1996)

Anthropologists and archaeologists have traditionally categorized First Nations of British Columbia as "hunter-gatherers" who relied primarily on wild plant and animal foods and did not actively manage food species and their habitats (Duff 1997; Ames and Maschner 1999). However, in the last decade, as a result of research conducted by ethnobotanists and others working closely with Indigenous ecological knowledge holders, there is more widespread understanding that plant and animal use involved complex management traditions. In the case of plants, Indigenous peoples have been active participants in sustained plant resource production systems, influencing, through diverse and intentional methods, the quality and quantities of the foods and materials on which they have traditionally relied. This changed perspective has occurred within the context of a broader re-evaluation of Aboriginal resource management traditions worldwide (e.g., Anderson 1996; Berkes 2012; Minnis and Elisens 2000; Smith 2011). In British Columbia, as elsewhere in North America, both plants and environments are manipulated in Indigenous cultivation in an integrated process that has been referred to as "domesticating landscapes" (Deur and Turner 2005; Deur 2000).

This article provides an overview of the diverse plant resource management strategies of First Nations of British Columbia. Management practices range from relatively large-scale (geographically) and long-term activities – such as the use of fire to clear prairies and subalpine meadows – to very focused actions, such as the pruning of individual shrubs. We describe plant resource management practices and the diverse methods used to identify them, and focus on three case studies to augment this description. These case studies exemplify the range of plants and ecosystems that were managed as well as the combinations of strategies and outcomes encompassed within these systems. While we focus our review on coastal British Columbia, we recognize that these are practices that occurred throughout northwestern North America. We also recognize that plant management is nested within a larger continuum of management practices that encompassed terrestrial and aquatic animals and their ecosystems (Carpenter, Humchitt, and Eldridge 2000; Lepofsky and Caldwell in press; Thornton et al. 2010).

We end this summary with a discussion of how traditional and "new" management approaches introduced by European newcomers were integrated into "moditional management systems," and we identify some of the more recent trends in the study of Indigenous management systems. Finally, we focus on future prospects for traditional plant management as part of the contemporary movements towards ethnoecological restoration, cultural renewal, and enhanced food security for Indigenous peoples – a point explored more fully in the final section of this special issue.

RECOGNIZING AND DEFINING MANAGEMENT SYSTEMS

"Management" is a term that can be interpreted in many ways. Some feel that it connotes a degree of control and domination over other species that is not amenable to the kin-centric and reciprocal relationships that First Nations often have with the species upon which they rely. As an alternative, these researchers suggest that terms like "caretaking" and "stewardship" are more in keeping with this relationship (Berkes 2012; Fowler and Lepofsky 2011). We suggest, however, that "managing" is a versatile term that incorporates a continuum of practices, from light-handed caretaking to more intensive forms of resource manipulation.

Colonizers typically underestimated the tremendous quantitative and qualitative importance of plant foods within the Aboriginal diet. On closer inspection, however, we can see that traditional resource harvesting was not the meandering and opportunistic affair imagined

by colonialists (Deur et al. this volume; Deur 2002) but, rather, a patterned practice in which human populations regularly revisit and manage a finite and discrete range of plant-gathering sites. Many resource populations and resource sites were – and still are – traditionally "owned" by Native individuals, families, clans, or villages, with specific geographical and territorial associations. These associations are encoded in stories, songs, regalia, and many other common forms of cultural expression (Turner, Smith, and Jones 2005). The knowledge and protocols associated with management practices are built up over generations of observation, experience, practice, and monitoring, and some of them are embedded in age-old narratives and ceremonies, such as the First Foods ceremonies, which, in turn, reflect people's belief systems and world views (Turner and Berkes 2006). This is a form of "deep management," in which ancient lessons are embodied in world view, wisdom, and metaphor and are passed on in the form of taboos, stories, ceremonies, and arts. Such management systems may be difficult for those outside a culture to understand or interpret, but they are nonetheless effective with regard to informing management practices (Turner and Berkes 2006).

DOCUMENTING TRADITIONAL PLANT MANAGEMENT

A variety of approaches have been used to document different aspects of traditional management practices in British Columbia (Lepofsky and Lertzman 2008), encompassing a range of fields, including anthropology, archaeology, ethnography and ethnohistory, geography, botany, linguistics, and law and governance, to name a few. Most of our understanding comes from interviews with contemporary Indigenous experts, who, through their memories, experiences, and descriptions of practices like burning, pruning, selective harvesting, and ceremonial observances, have opened researchers' eyes to an entirely different view of traditional food production and resource use. Clear physical evidence of past plant management practices is sometimes elusive as many traditional practices had a "light footprint," leaving only fleeting impressions on plant distribution and genetics. However, using diverse lines of evidence, archaeologists have been able to extend the documentation of ancient plant management into the deeper past (e.g., Lepofsky et al. 2003; Lepofsky et al. 2005).

Analysis of how traditional management systems work and their outcomes demands yet more detailed examination and experimentation, and more integration of multiple lines of evidence (Lepofsky and Lertzman 2008). Most experiments aimed at the analysis of traditional

management outcomes relative to plant productivity have been carried out over a relatively short time frame – usually between one to five years – and at very limited sites, whereas longer-term experimental work across multiple sites informs us more definitively about traditional management's effects. Furthermore, the antiquity of different types of management needs more investigation. Even negative findings can be instructive, such as recent DNA studies of *Camassia quamash* populations (Tomimatsu, Kephart, and Vellend 2009) that did not reveal human transplanting of camas bulbs, despite some oral evidence of this practice (Turner and Efrat 1982). The disruptions from urbanization, clear-cut logging, intensive agriculture, and other activities make future discoveries relating to Aboriginal management less and less likely in many parts of the province.

COMMON PLANT MANAGEMENT PRACTICES

Researchers have documented a wide range of plant management practices and approaches, encompassing a wide variety of taxa and ecosystems, in British Columbia and neighbouring areas (Table 1). The plants managed are principally trees, shrubs, and herbaceous perennials that are readily propagated or regenerated by vegetative means and that are often amenable to continuous or cyclical harvesting from the same plant or genetic stock (Deur and Turner 2005).

The breadth of practices reflects how many management strategies are interdependent within particular food production traditions and cannot really be separated. For example, protocols of ownership and proprietorship are inseparable from the assessment of specific mechanical means of intensification. An individual or family who has ownership of a root garden or berry patch has the responsibility of ensuring that the resources are in good condition, for example, and that the resource site is properly tended and harvested. In the case of fire-managed landscapes, the owner of a resource is responsible for ensuring that burning is undertaken at the appropriate times and under the right conditions.

The social and philosophical aspects of Indigenous plant management may be less tangible or obvious but are no less important than are the physical aspects, and they often guide these more tangible practices. Traditional governance, world views, and cultural constraints (such as application of taboos or ceremonial approaches) are key components of a system. In the long run, these social controls may be the most significant in helping societies to transform attitudes and values into more conserving lifestyles. Because they govern values and modes of thought,

and affect people's overall behaviour, they are potentially integrative and holistic, instilling habits and attitudes of reciprocity and responsibility towards resource species.

TABLE 1

Plant management practices, strategies, and approaches used by Indigenous peoples of British Columbia and neighbouring areas

Practice, strategy, or approach	Examples from British Columbia
1. Ecological management strategies	
Landscape burning: prescribed, periodic burning of particular sites and habitats, usually undertaken as rotation over several years.	Camas prairies of southern Vancouver Island (Coast Salish) (Beckwith 2004); subalpine parkland of the Coast Mountains (Stl'atl'imx Salish) (Turner 1999); berry patches of Skeena River area (Gitxsan and others) (Trusler and Johnson 2008)
Clearing, weeding, "cleaning": manual pulling or digging out of brush or "weedy" growth; removing large rocks, etc.	Camas patches of southern Vancouver Island (Beckwith 2004); estuarine root gardens (case example here)
Habitat creation, extension, or alteration: creating new drainage, light, or nutrient regimes through berming, terracing, ditching, digging, cutting trees	Estuarine root gardens (case example here); orchard gardens of Kitsumkalum territory (case example here); Haida tobacco gardens (Turner 2004)
Bounding of resource areas: laying of plot boundaries or establishing borders	Estuarine root gardens (case example here); pegging Pacific crabapple trees (Turner et al. 2005); edible red laver seaweed-picking areas (Turner 2003)
Tilling soil (usually with digging stick): aerates soil; enhances moisture penetration; helps recycle nutrients, etc.	Camas prairies, estuarine root 'gardens' (case example here)
Dissemination: planting or scattering seeds, fruits, or other propagules	Tsilhqot'in mountain potatoes (Mellott 2010); "Indian celery" *q'ex̲mín* seeds, huckleberries and other berries (Turner 2005)
Transplanting: moving roots and other propagules from one location to another	Northern riceroot, stinging nettle, hazelnut transplanting (orchard gardens, case example here); estuarine root gardens (case example here); cattail (Turner and Efrat 1982)
Pruning or coppicing: cutting branches or entire upper growth of trees or shrubs to stimulate new growth	Saskatoonberry, hazelnut, salmonberry, huckleberry, soapberry (Peacock and Turner 2000; Turner and Peacock 2005)

Selective, partial, rotational, or non-damaging harvesting: taking only a portion of a plant or only some individuals from a population	Many examples; CMT case study here for western redcedar; birch bark and cherry bark (Peacock and Turner 2000); camas bulbs (Beckwith 2004)
Fertilizing, mulching: adding nutrients or moisture-retaining materials to soil	Berry gardens of Heiltsuk (Turner 2005); Tlingit strawberries (Thornton 1999); estuarine root gardens (case study here)
2. Social management strategies	
Ownership/proprietorship: individuals or cultural groups hold rights (usually inherited) to use particular resources or harvesting areas	Camas patches (Beckwith 2004; Suttles 2005); highbush cranberry and other berry patches, and crabapple stands (Turner et al. 2005); estuarine root gardens (case study here)
Monitoring: groups or individuals have the responsibility to watch over certain resources and harvesting areas	Edible red laver seaweed (Turner 2003); black tree lichen (Crawford 2007); various berry species, edible cambium, fibre plants (Turner et al. 2005)
Socially determined conservation: ceremonial promotion or protection of particular places, species, and populations	Sword fern fronds (Saanich) Turner and Hebda 2012); devil's club stalks for medicine (Turner and Thompson 2006); edible seaweed (Turner 2003)
Teamwork and division of labour: different task groups within a community specializing in different aspects of harvesting and processing plant resources	Widely practised by BC First Nations (e.g., Turner 2004)
Distributed seasonal access to resource areas: "seasonal rounds"	Widely practised by BC First Nations (e.g., spring harvesting of edible red laver seaweed [Turner 2003]); montane harvesting in summer (Turner et al. 2011)
Trade and exchange: kin-based trade networks; trading of surplus	Widely practised by BC First Nations (e.g., camas bulbs, wapato tubers, seaweed, crabapples [Turner and Loewen 1998])
Feasting and sharing: feasting, sharing, with elites and leaders taking on primary roles; a way of distributing plant resources	Widely practised by BC First Nations (e.g., Gitga'at [Turner and Hebda 2012])
Knowledge transmission: passing on knowledge and experiences relating to plant resource management and conservation through participatory and experiential learning, stories, ceremonies, art, discourse, and focused instruction	Widely practised by BC First Nations (e.g., Turner and Berkes 2006)

3. **Technological management strategies**	
Increasing access: finding more efficient ways to gain access to particular resources (e.g., building trails, camp shelters, better canoes)	Widely practised by BC First Nations (Lepofsky and Lertzman 2008)
Technical innovations: improvements in tools and approaches for harvesting, processing, and storing food and other plant materials (e.g., improved berry combs, digging sticks, baskets, mats, drying racks, smoking, pit-cooking)	Widely practised by BC First Nations (Lepofsky and Lertzman 2008)
4. **Integrated multi-resource management**	
Combined management strategies: effects and outcomes of two or more management strategies, applied to two or more species or entire habitats, over time and space	Estuarine root gardens, eelgrass beds, cedar groves, berry gardens of central coastal peoples (Deur and Turner 2005; case studies here)

Sources: Compiled from: Deur and Turner (2005); Fowler and Lepofsky (2011); Lepofsky and Lertzman (2008); Thornton (1999); Turner (2004, 2005); Turner and Hebda (2012); Turner and Peacock (2005); Turner et al. (2005). Based on knowledge shared by Indigenous plant experts, especially Dr. Arvid Charlie (Luschiim), Clan Chief Adam Dick (Kwaxsistalla), the late Christopher Paul, Dr. Daisy Sewid-Smith (Mayanilth), and the late Dr. Mary Thomas.

CASE STUDIES

Culturally Modified Trees as Plant Management

MORLEY ELDRIDGE[1]

Indigenous peoples of British Columbia had and have an intimate relationship with western redcedar and yellow cedar. This is reflected in the songs, prayers, and the abundant ways in which cedars were used in social, ritual, and economic contexts (Stewart 1984). Physical evidence of the deep time connections to cedars comes from waterlogged cedar artifacts (Lepofsky and Lyons, this volume) and in the widespread distribution of culturally modified trees (CMTs) (Mobley and Eldridge 1992; Stryd and Eldridge 1993) (Figure 1). CMTs provide clues as to how Indigenous peoples of the region managed cedar bark and wood extraction so as to ensure its ongoing availability.

[1] Morley Eldridge is founding president of Millennia Research Limited, an archaeological consulting company. He has conducted archaeological research in western Canada and abroad since 1969 and has been a pioneer in archaeological potential modelling, Culturally Modified Trees, wet site documentation, and resource and data management procedures.

Figure 1. Culturally modified tree, western redcedar (*Thuja plicata*), showing where a bark plank was removed, from Gitga'at (Ts'msyen) territory on the north coast. Photo by N. Turner.

Despite early ethnographic observations regarding the widespread abundance of giant cedars (e.g., Drucker 1955, 8; Drucker 1965, 5), cedars are in fact of limited distribution in British Columbia. This local scarcity may have been a motivating force both to adopt practices and principles of cedar management and to trade with neighbours who had greater access to cedar. Indeed, the uneven distribution of usable cedars is likely reflected in the high value of both the canoes carved from giant cedars and the large (two- to four-metre) sheets of cedar bark in Indigenous systems of trade (e.g., some of the references below). The risk taken to transport the bark sheets over sometimes dangerous waters further reflects their commodity value. The need to strip bark from many trees annually, combined with cedar longevity, meant that any accessible tree was likely to be harvested multiple times over the years. Any one of these harvests could kill the tree or make it unsuitable for canoe or large timber use. Thus, cedar would have been overharvested unless landscape-level management practices and ethics were in place. Such a social-ecological context is exemplified by the archaeological survey of groves of bark-stripped CMTs on the Skeena River, within Ts'msyen (Coast Tsimshian) traditional territory.

The archaeological surveys of three areas along the Skeena exemplify the extraordinarily high density of CMTs, and thus intensive Aboriginal

use and management of cedars, in many parts of coastal British Columbia. For instance, at Lakelse, close to the fishing village site of the prominent Ts'msyen chief Legaic, some 1,884 features (individual stripping or logging events) on 1,480 trees were recorded with density up to forty-five CMTs per hectare (Eldridge 2002; Owens et al. 2002). Almost one thousand were recorded on a small part of Kennedy Island at the mouth of the Skeena. In one group of surveyed logging cutblocks on the lower Skeena (the Telegraph blocks, Figure 2), over sixteen hundred CMT-features trees were recorded. The CMT density ranges from twenty-seven to forty-six CMT features per hectare – a high but by no means unprecedented value in British Columbia (e.g., Arcas Consulting Archaeologists Ltd. 1991).

The distribution of stripped cedar trees in the Telegraph block suggests regular revisiting, multiple sequential harvesting, and forest management. In this individual block, 384 taper and rectangular stripped trees had 577 strips – an average of 1.5 visible strips per tree. CMTs with two, three, and four stripping events cluster, and they may represent sequential harvesters using the same paths or strategies (Figure 2). Each harvesting event may have targeted a number of nearby trees. Care was taken to leave a strip of live bark on all these bark-stripped trees, through which the trees could pass nutrients and compounds up and down between needles and roots. In some cases, over 90 percent of the bark circumference was removed; yet these remarkable trees survived and often were re-harvested just a few years later.

The Aboriginal harvesters selected trees with specific attributes, depending on the intended use. Rectangular bark strips (of both red and yellow cedar) tended to be a little larger, often around fifty centimetres in diameter when harvested; taper bark strips were usually taken when trees were relatively small, about ten to thirty centimetres in diameter. Aboriginal logging (reflected by stumps and standing plank-stripped trees) was not dense, perhaps not surprising given the intensity of the bark-strip and bark-sheet harvest. To gain access to appropriate trees for house posts or beams, carved poles, large planks, or canoes, these harvesters were willing to climb far up the mountainside, returning with their heavy products down some very steep hillsides. Finally, not every cedar was scarred, suggesting that those trees with multiple strip scars may have been intentionally targeted, perhaps for a desired characteristic of their inner bark. Alternatively, they may have been chosen in order to leave other trees intact as that was the only way to provide clear-grained wood for future generations to make canoes or to take large planks.

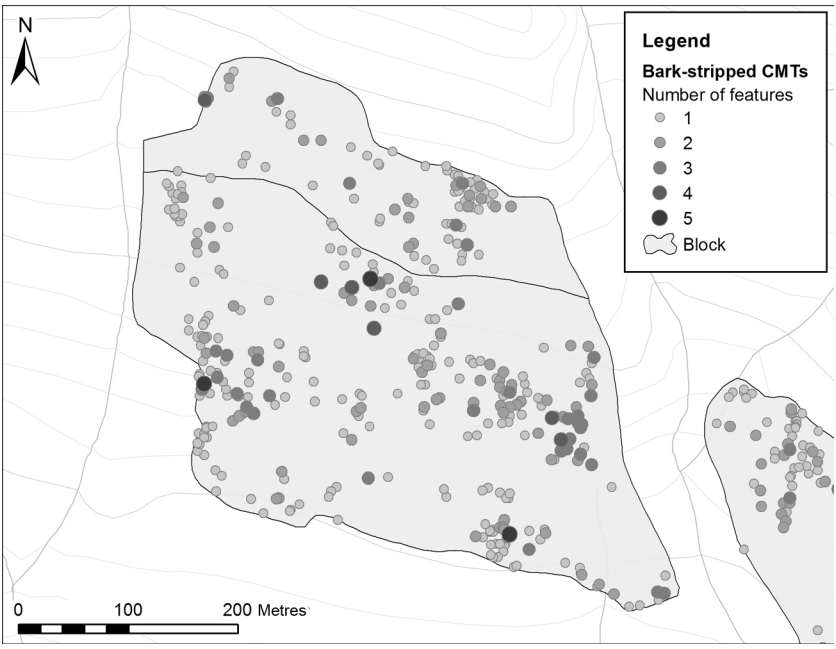

Figure 2. Bark-stripping events per tree, in one forestry block on the lower Skeena (lightest = 1, darkest = 5). Note the number of trees that have scars from multiple stripping events.

Estuarine Root Gardens

Some of the most compelling evidence of Northwest Coast "cultivation" may be found in the traditional management of native plants with edible "root vegetables" (including true roots, rhizomes, tubers, bulbs, and corms). A striking example is the estuarine plots of springbank clover (*Trifolium wormskioldii*) and Pacific silverweed (*Potentilla egedii*) developed by Nuu-chah-nulth, Kwakwa̲ka̲'wakw, and other First Nations from along the BC Coast. Plots of these plants were often modified or created anew to become what were termed "gardens" by early writers, among whom anthropologist Franz Boas (1921) was prominent. These gardens of native clover and silverweed were situated on estuarine salt marshes and gravel beds where the mouths of rivers and streams meet saltwater. These two "root vegetables," ordinarily grown together, possess edible, starchy roots ranging from three to ten millimetres across and ten centimetres or more long. Often, they were grown alongside other estuarine root vegetables, including northern riceroot lily (*Fritillaria camschatcensis*) and Nootka lupine (*Lupinus nootkatensis*). Specialized digging tools were constructed for root vegetable cultivation, and spe-

cialized "digging houses" were built alongside some garden sites (Boas 1921; Deur 2000, 2005; Lloyd 2011).

Clover and silverweed roots were of tremendous significance to pre-contact and early postcontact peoples of the Northwest Coast (Kuhnlein et al. 1982; Turner 1995; Turner and Kuhnlein 1982, 1983). The roots were among the foremost dietary sources of carbohydrates for central and northern coastal peoples prior to the introduction of the potato, augmenting a diet rich in marine protein. Multiple boxes of these estuarine root vegetables were served and used as gifts at potlatches and winter dances, and they were sometimes the focus of elaborate ceremonial feasts (e.g., Boas 1921; Drucker 1951). An intricate etiquette surrounded their preparation and consumption. They were exchanged for other foodstuffs and high-status ceremonial goods, and long-distance trading expeditions were sometimes made to acquire them. Among the Kwakwa̲ka̲'wakw, large roots were reserved for "chiefs," and the generic Kwak'wala term for such roots was one of the metaphorical expressions for a "chief," who was called the "long [root] of the tribe" (Boas 1921). Special storage pits for these roots were created in some houses, in the floor within the "chief's" sitting area. Edwards (1979) reports storage of living roots in boxes of soil within these recessed spaces by the Nuxalk of Bella Coola. The roots are also commonly depicted as foods of ancestral and supernatural beings within Northwest Coast oral traditions. For example, the origins of the first orcas, Canada geese, and mallard ducks often pivot on the harvesting of estuarine roots on owned plots. Indeed, hunters of ducks and geese knew well the preferences of these birds for the roots, which they sometimes used as bait.

The gardens allowed the peoples of the BC Coast to produce root vegetables in the quantities described in some ethnographic accounts. The earliest explorers to the Coast observed them, although most assumed the sites were natural features (e.g., Archibald Menzies in Newcombe 1923, 116). Over the last century, First Nations consultants have consistently asserted that their ancestors developed and maintained root gardens through: weeding out grasses and sedges, transplanting and replanting of propagules with desired properties, selective harvesting of optimal sized roots, and enhancing soils via tilling and removal of rocks and debris (Deur 2005; Lloyd 2011). Estuarine garden sites in Kwakwa̲ka̲'wakw territory were called *təkkillak*^{w}, which roughly translates as "place of manufactured soil," as described by Kwaxsistalla (Clan Chief Adam Dick), and the Nuu-Chah-Nulth have root grounds named *ts'isakis* "[place with] soil" (Deur 2000). Sometimes, estuarine plots were delineated with logs or cedar marking posts (Figure 3). In

Figure 3. Kingcome estuary, showing posts set generations ago to mark the family-owned root garden plots (fall, 2008). Photo by N. Turner.

rocky or high-gradient shorelines, soil might be mounded (Boas 1921, 1934). Archaeological remnants of such rock features can still be found at some ethnographically documented root garden sites, but they have often been confused with stone fishtraps (Deur 2000, 2005).

In some locations, mounding and reinforcing the soils around estuarine gardens appears to have served to elevate lower portions of the salt marsh habitat on a backfill surface. Importantly, this allowed the seaward expansion of the very narrow band of the high salt marsh in which silverweed and springbank clover can grow optimally (Figures 4 and 5). Rockworks, log alignments, and mounded soils appear to have served to dramatically expand this restricted portion of the intertidal zone. Here, in one of the world's most productive terrestrial ecosystems, Northwest Coast peoples have been able to bring large and predictable concentrations of nutritious root vegetables within their territories and, conveniently, adjacent to villages.

Gardens were owned through various lineage-based systems of tenure, and efforts were made to assert and maintain these rights (see Deur et al. this volume). Some Nuu-chah-nulth elders have explained that owners of estuarine gardens were possessive of their holdings as the plants were replanted and tended there, adding value to the site. Traditionally, harvesting a chief's root plot without permission would have been a grave offence. Chief Charlie Jones of the Pacheedaht First

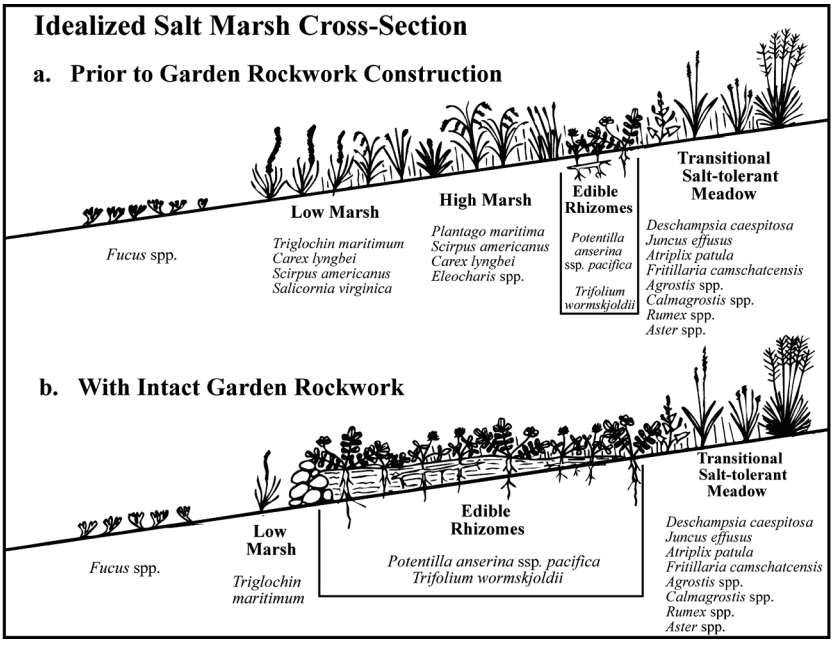

Figure 4. Schematic drawing showing the effect of building up soil in the root garden to create a broader expanse of suitable habitat for edible roots, springbank clover, and Pacific silverweed. Drawing by D. Deur. Note: *Potentilla anserina* ssp. *pacifica* is a synonym for *Argentina egedii*.

Figure 5. Bundles of springbank clover rhizomes harvested from Kwaxsistalla's family root plot at Kingcome River estuary, prepared for steaming for a feast hosted by Kwaxsistalla in fall, 2008. Photo by N. Turner.

Nation recalled that his ancestor, who owned *Argentina* plots near Port Renfrew, used to have his slaves guard the plots to prevent intrusion by others. When the roots were ready to be dug in the fall, he had his slaves harvest them (Turner et al. 1983).

Taken together, the cultivation and use of estuarine root foods reflects how plant management practices cross-cut social and economic aspects of Northwest Coast societies. Indigenous consultants, past and present, have asserted that these cultivation methods were practised before European contact. Indeed, all evidence – archaeological, ethnographic, and linguistic – points to this being true. The wide consistency in descriptions of the techniques and socio-economic aspects of root cultivation on the Coast, as well as the abundant place names associated with cultivated soils, likely reflects that the cultivation of root foods has deep time depth.

Orchard Gardens of Dałk Gyilakyaw, or Robintown

In many places in British Columbia, generations of management and use of plants have transformed entire landscapes into cultivated ecosystems (Johnson and Hunn 2010). Robintown in the Skeena region is one such place. This now-vacated settlement was occupied by the Kitsumkalum Ts'msyen until the mid- to late-1800s. Archaeological evidence (terraces, fishing stations, pathways, and CMTs) and oral history suggest multiple generations of occupancy. Evidence of an ancient connection to the landscape and management of important plants is reflected today in the distribution, form, and immense range of culturally important plant species. Prominent among them are Pacific crabapple (*Malus fusca*) and hazelnut (*Corylus cornuta*) as well as dense patches of northern riceroot (*Fritillaria camschatcensis*), stinging nettle (*Urtica dioica*), and a multitude of berry species.

On 20 May 2008, a group of us, including Jim McDonald and Kitsumkalum elected chief Don Roberts,[2] visited Robintown. We traversed a remarkable series of several broad terraces down to the river. These terraces, now overgrown, supported the houses and were still covered by remnants of what we have called "orchard gardens" because of their distinctive combination of culturally important plants, with evidence of past tending and management. Dozens of mature Pacific crabapple trees, spaced out along the terraces, still showed the effects of pruning and cutting at the tops, causing them to partially fall over and then regrow closer to the ground for easier access to the fruit (Figure 6). As well as

[2] Others who participated in this expedition were: Stephanie Forsyth, Clint Marshall, Judy Thompson, Nancy Mackin, and Ken Downs.

Figure 6. Crabapple (*Malus fusca*) of the Robintown orchard garden, showing how the top was partially lopped many years ago, presumably to make the fruit easier to harvest (fall 2008). Photo by N. Turner.

their edible fruits, which were harvested in quantity, stored for winter in boxes with water or grease, and highly regarded as a prestige, trade, and feast food, crabapple trees produce tough wood, which is used for implements, and crabapple bark is commonly used in medicine.

Hazelnut (*Corylus cornuta*) was also prominent in the orchard gardens. The nuts were formerly eaten in large quantities, and it is this species after which the town of Hazelton is named. Hazel branches are also sometimes used for cordage. Hazelnut may have originally been transplanted to Robintown as saplings, as these were known to have been distributed from Kitselas Canyon to other sites, including the townsite at the mouth of the Kitsumkalum River. As McDonald (2003, 57) notes: "People now consider the presence of [hazel]nut trees and crabapple trees to be a sure sign of an old residential community or camp site."

Other key fruiting species growing at Robintown included: saskatoonberry, gray currant, wild raspberry, thimbleberry, salmonberry, black huckleberry, and four other *Vaccinium*s, as well as highbush cranberry, among a total of about twenty. The green shoots of thimbleberry and salmonberry were eaten in spring as green vegetables, and many of these species were also used in various ways as materials and medicines (Turner 1995, 1998).

A range of other woody plants (totalling around fifteen) were growing on the site, each with known cultural applications, including: Rocky Mountain maple (bark for basketry, medicine; wood for snowshoes and implements); red alder (wood for carving, fuel for smoking fish; bark for red dye, medicine); devil's club (branches and inner bark an important medicine); western redcedar (wood for construction; inner bark for basketry, cordage, hats, clothing; bark sheets for roofing; roots, branches for cordage, basketry); and western hemlock (edible inner bark; boughs for bedding; wood for fuel; bark for medicine).

Growing among these woody plants were many culturally important herbaceous species. Northern riceroot, an important root vegetable all along the Northwest Coast, was said to have been introduced to Robintown from Port Essington on the Coast many generations ago (Chief Don Roberts, personal communication, 2008) (Figure 7) and shows evidence of intensive gardening, with possible terracing and rock borders around extensive riceroot patches (Downs 2006). Stinging nettle is well known as a source of fibre for cordage and fishnets, a use that is widely recognized in traditional origin stories (Cove and MacDonald 1987). It is commonly found in ancient village sites, and people were said to have routinely transplanted good-quality plants from one village to another (Turner and Peacock 2005). Other prominent herbaceous species of the Robintown orchard gardens (totalling around fifteen) included: fireweed (edible green shoots; stem fibre used for cordage, fishing line, nets); spiny wood fern (rootstocks pit-cooked and eaten); cow-parsnip (young shoots peeled and eaten as greens; possible medicinal use); and skunk-cabbage (large leaves used for pit-cooking, wrapping food, drying berries; also used medicinally).

In all, approximately fifty plant species, named in the Sm'algyax (Ts'msyen/Tsimshian) language and having specific cultural roles, were identified from Robintown, over an area of about 0.3 hectares, with potentially twenty or more species that were conceivably managed at a population level. From oral and physical evidence, management practices included cultural modification of trees, pruning and partial cutting of the tops, planting and transplanting, selective harvesting, terracing and water management, ownership of patches, and possibly clearing (Downs 2006; McDonald 2003). Few sites anywhere could compare with regard to the number of important plant resource species within a limited area. Although much more work needs to be done to better characterize the complex management system represented by the orchard gardens of Robintown, it remains a good example of significant human interaction with plant production and enhancement.

Figure 7. Riceroot (*Fritillaria camschatcensis*) at Robintown, said to have been intentionally transplanted to this site from the Coast, growing together with stinging nettle (*Urtica dioica*), another commonly managed plant (fall 2008). Photo by N. Turner.

DISCUSSION

Traditional Aboriginal land and resource management is often enacted at multiple, intertwined spatial and temporal scales. Landscape-level management is usually associated with the use of fire (e.g., Johnson 1999; Lepofsky et al. 2005; Turner 1999). As the case studies exemplify, other activities (such as building terraces and extensive rock structures, and cutting down trees and shrubs to create clearings [as is done around many villages]) could also be considered as creating broad-scale ecosystem change that influences entire suites of species over wide areas. In the case of burning, the management cycle is often five to ten or more years, allowing for the development of several successional stages, from early to sub-climax ecosystems, before the cycle is repeated. However, given the longevity of western redcedar (*Thuja plicata*) and some of the other trees – still standing as CMTs after several centuries – the effects of broad-scale stand management can be seen with repeated harvests over generations.

The antiquity and antecedents of anthropogenic landscapes such as estuarine root gardens and berry gardens are still not known; however, given the complexity of ancient socio-economic systems, the size of

pre-contact populations, and the widespread documentation of these systems at contact, there is little doubt that people were managing plants and their habitats for millennia. Berkes (2012) suggests that different elements of management systems build up over time, starting with the accumulation of basic knowledge about a newly encountered environment and the potential utility of its plants and other species. Through careful observation and experience, these practical understandings of ecological relationships, life cycles, phenology, and habitats of species accrue.

Eventually, more complex social structures – specialized roles, division of labour, task groups, proprietary rights – are developed to ensure optimal accessibility to resources, at least for elites, who then had a responsibility to share their resources. Techniques for increasing the productivity of the resources through management of species and habitats – and ways of passing on this knowledge to others and to future generations – also develop. Over generations, as people's knowledge bases, social systems, and technologies mature, the plants and environments become embedded within complex belief systems, in which cultural control becomes encoded in stories, taboos, ceremonies, art, and ethics. The complexities of this last layer of culturally proscribed management, one could argue, are still little understood (Turner and Berkes 2006) but may well be the most significant component, and one that allows for the development and maintenance, over a long time period, of a truly sustainable anthropogenic landscape.

These different types and scales of management have indirect and cumulative effects on other landscapes and species, with many complexities and interactions that we are only now starting to recognize, let alone understand. For example, animals – through browsing, digging, and other means – participate in the manipulation of some species (like the estuarine root vegetables and berry patches), and they, in turn, become part of the human management systems (cf. Edwards 1979). There are linkages between these managed species and sites as well, both social and physical, in the form of trail and trade networks, camping and gathering places, kinship and knowledge mobilization networks, and overall systems of resource use for particular communities. These incorporate ecological and cultural "edges" (cf. Turner et al. 2003).

Working with natural processes such as vegetative regeneration, soil building, nutrient cycling, and ecological succession, traditional land and resource management is compatible with the maintenance of biological diversity and complex ecosystems. On a population and individual organism scale, taking advantage of the ability of many plant species to regenerate from meristematic tissues (the "meristem bank")

in their roots, underground stems, inner bark, branches, and buds, as well as the embryonic tissues in their seeds, is an important aspect of many management practices. If bark is removed, branches pruned, roots harvested, or leaves picked, the plant is able to regenerate these parts, sometimes very quickly and in predictable ways. This makes it possible for people to "create" long, slender withes for basketry and cordage from the first year's growth after pruning a shrub like saskatoonberry (*Amelanchier alnifolia*) and then, in successive years, to harvest large quantities of fruit produced by the renewed growth on the same plant.

There are many other characteristics of traditional plant management systems that ethnoecologists are just starting to explore. The language and vocabulary of traditional management needs much more attention, as do comparative linguistic studies that may point to human roles in the extension of plant ranges through localized transplanting or long-distance translocation. In the case of estuarine root gardening, for example, Kwaxsistalla and others have provided distinctive names in Kwak'wala for digging implements, ownership marking posts, inherited rights, and the gardens themselves – places where the soil is built up – and various other aspects of these practices. Also, these cultivation practices appear frequently in place names and oral traditions of many coastal peoples, as recorded by the region's earliest ethnographers. Examination of Indigenous narratives – such as the Nuxalk story of how Raven introduced soapberries (called "buffaloberries" in this story) to the Bella Coola Valley (McIlwraith 1948) – may also reveal hints or clues of ancient human intervention in plant distribution. Certainly, modern ethnographic accounts provide many examples of people having moved plants from place to place through transplanting or bringing seeds or other propagules (cf. Turner et al. 1990). There is also much more to be learned about the role of gendered knowledge, specialists in management techniques, children's roles, knowledge transmission, governance, and other social aspects of Indigenous management systems (cf. Turner 2003).

Another aspect of traditional plant management is spatial variation in the different practices. It seems, for example, that estuarine root gardens were most developed on the Central Coast of British Columbia, including the west coast of Vancouver Island (Deur 2000). Based on the differentiation of different named varieties of Pacific crabapple in the Sm'algyax and Haisla/Hanaksiala areas (Compton 1993; Turner and Thompson 2006; Wyllie-Echeverria 2013), with the added evidence of crabapple enhancement at Robintown, one could argue that crabapple management was most intensive in the Skeena, Douglas Channel, Kitimaat, and Kitlope regions of the province. Obviously, plant distri-

butions will determine where their use will be focused (e.g., camas cultivation is concentrated on southern Vancouver Island and the adjacent Gulf Islands, probably because that is where camas occurs), but there may be evidence of centres of innovation for some of the management techniques that can be discerned through careful comparisons across regions and over time. An extension of this would be evidence of transmission of techniques from one group to another and, possibly, adapting particular techniques to new and different species and environments. For example, the technique of replanting small propagules at the base of the northern riceroot bulb in the estuarine root gardens of the Tsawataineuk at Kingcome Inlet as described by Kwaxsistalla (see Turner and Peacock 2005) may be linked, from long ago, to the replanting of the "whiskers" of another edible lily bulb, *scwicw*, yellow glacier lily (*Erythronium grandiflorum*), by Mary Thomas and her mother and grandmother on the hillsides of Secwépemc territory around Shuswap Lake (Loewen 1998). Alternatively, this technique may have been developed independently. Obviously, more research, including linguistic comparisons, is needed to determine such relationships.

The adoption and integration of European gardening and agricultural practices is another area that bears more attention. Lutz (2008) proposes a term for the "blended" economic system of BC First Nations following the entry of Europeans to the region: the "moditional" ("modern" + "traditional") economy. A similar blending of management approaches – "moditional management" – occurred as well. European-style gardening and ranching were adopted by many First Nations (British Columbia 1987; Turner and Brown 2004) and combined with traditional methods, bringing new foods such as the potato, and new sources of income (trading Indigenous foods like wapato and cranberries, along with potatoes and turnips, to Europeans at trading posts) (Suttles 1951; Turner and von Aderkas 2012). By the late 1800s, many Indigenous people were supplementing their traditional food – and the food products (such as flour, sugar, rice, and tea) that they purchased – with produce that they were growing in European-style gardens: not only potatoes but also turnips, onions, carrots, peas, beans, rhubarb, and various berries (strawberries, currants, gooseberries, raspberries) and other fruits (apples, plums, cherries, pears). People continued to use – and manage – their estuarine root gardens, berry gardens, eelgrass beds, and other plant resources; however, due to a whole range of factors, from alienation of lands, to impacts of the residential school system, to Indigenous people's participation in the wage economy, the use of Indigenous plant foods

and the associated management practices tapered off considerably by the mid-1900s (Turner and Turner 2008).

For their part, as colonial peoples arrived in British Columbia they initially gravitated towards traditionally managed plant communities. With so few clearings in the dense forests of western British Columbia, they sought out burned prairie clearings for their first farms and townsites. With so few level areas along the coastline for livestock grazing and transshipment, they also sought out broad deltaic estuarine lands heretofore used for root gardens for settlement and industrial development, from farming to placement of log-sorting yards. Plant-gathering sites became contested spaces during the colonial period – a role that, in many respects, they have maintained today (Deur et al. this issue; Deur 2000, 2002; Turner et al. 2011).

CONCLUSIONS

The future of plant management by Indigenous peoples in British Columbia and elsewhere is an important consideration. There is tremendous potential for traditional management methods to be renewed and applied, probably incorporating some of the more recent tools and techniques to make them practical in a modern context. Experimental work such as that already undertaken in various research projects can inform ventures in reestablishing plant management systems. Just as there is a renewed interest in Indigenous peoples' food systems (Kuhnlein et al. 2009; Kuhnlein et al. this volume), language revitalization (Thompson 2012), and ceremonial practices such as the potlatch, restoring traditional plant management practices can have many advantages and can become part of the entire suite of cultural renewal initiatives. In ecological restoration, too, there is an important place for traditional plant management, including experimental reintroduction of landscape burning, re-creation of traditional berry gardens and root gardens, and reinstituting traditional harvesting regimes (Senos et al. 2006). These activities can become important tools in the education of children and youth (Gomes 2012; Joseph 2012; Turner and Lepofsky this volume) and in raising general awareness about the links between cultures and environments, and the meaning of ecocultural diversity.

There are many obstacles to renewing traditional management, not the least of which is the vast number of introduced species, many of them invasive, which are likely to colonize disturbed soils and perhaps dominate areas where indigenous species would otherwise flourish. Climate change is another factor to be taken into account, potentially

affecting which species and varieties of plant will thrive in a particular environment. Each complication and obstacle to ethnoecological restoration will need to be faced as it presents itself, and solutions, adaptations, and complications devised, in the very spirit of innovation in which the original management systems were developed.

Ultimately, the techniques and approaches of Indigenous plant management in British Columbia are a key part of peoples' overall environmental knowledge systems. They are a component of ecological wisdom that is as relevant today as it ever was in the past. Traditional plant management practices are already being evoked in legal cases involving Indigenous peoples' land rights and title, and they are likely to gain an even higher profile in the continuing treaty negotiations with the federal and provincial governments. In truth, they have been widely neglected by researchers until quite recently, and, because of the drastic and sweeping changes to many of British Columbia's landscapes and ecosystems over the past couple of centuries, it will be very difficult, if not impossible, to fully understand their extent and complexity. Nevertheless, within the past quarter century or so there have been some remarkable and highly significant "discoveries" relating to an entire range of plant resource management approaches (known all along, of course, to those peoples whose cultures developed these systems). The future promises to bring more insights as researchers start asking more questions and focusing their enquiries on the possibilities of human-enhanced ecosystems.

ACKNOWLEDGMENTS

We are so grateful to the many Indigenous experts whose knowledge and wisdom has informed this chapter, especially to Clan Chief Adam Dick (Kwaxsistalla), Dr. Daisy Sewid-Smith (Mayanilth), Kim Recalma-Clutesi (Oqwilogwa) (all of the Kwakwa̱ka̱'wakw Nation), Dr. Richard Atleo (Umeek) (Nuu-chah-nulth); Dr. Arvid Charlie (Luschiim) (Cowichan); Christopher Paul (Tsartlip; Saanich); Dr. Mary Thomas (Secwépemc); Helen Clifton (Gitga'at; Ts'msyen); Chief Don Roberts (Kitsumkalum; Ts'msyen); and Barbara Wilson (K̲ii'iljuus) (Haida).

We acknowledge our colleagues for their help and inspiration: Jennifer Carpenter, Ken Downs, Dr. Dick Ford, Dr. Kay Fowler, Dr. Barbara Lane, Dr. Ken Lertzman, Dr. Jim McDonald, Dr. Nancy Mackin, Dr. Paul Minnis, Dr. Sandra Peacock, and many other colleagues and graduate students cited in this chapter. We also acknowledge Dr. Eric Peterson and Christina Munck of the Tula Foundation for supporting Nancy Turner's work as well as research grants from the Social Sciences and Humanities Research Council. Finally, we thank Dr. Richard Mackie for making this special volume possible.

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