DOES THE SOUTH CAROLINA UPSTATE HAVE 'ISOLATED WETLANDS' AND HOW DO THEY FUNCTION? A PRELIMINARY ANALYSIS

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Extended Abstract. Habitat degradation, loss, and fragmentation have been identified as primary contributors to the global extinction crisis that is affecting species from all taxonomic groups (Clark et al., 2007; Gagne and Fahrig, 2007; Hepinstall et al., 2008; Semlitsch & Skelly, 2008). Among the most imperiled of ecosystems are small, geographically isolated, temporally dynamic wetlands known as *isolated wetlands* (i.e., vernal pools, seasonal pools, ephemeral wetlands, woodland ponds, temporary ponds) (Calhoun & deMaynadier, 2008; Colburn, 2004). Isolated wetlands are important habitats for sensitive species in the United States and Canada (Colburn, 2004). They provide critical breeding habitat for mole (Ambystomatid) salamanders, wood frogs (*Lithobates* – formerly *Rana* - *sylvatica*), and eastern spadefoot toads (*Scaphiopus holbrookii*), alternative breeding habitats for many other amphibians, important foraging habitats for reptiles and larger anurans (Mitchell et al., 2008; Semlitsch & Skelly, 2008), and essential habitat for unique invertebrate species such as fairy shrimp (Anostraca) (Colburn, 2004; Colburn et al., 2008; Hunter, 2008). Additionally, these wetlands offer refugia and contribute to movement corridors for wetland dependent species traveling through woodlands and other terrestrial environments (Hunter, 2008). These pools support dynamic food webs within and between aquatic and terrestrial ecosystems (Hunter, 2008; Semlitsch & Skelly, 2008) and provide ecosystem services including flood water storage, ground water recharge (Leibowitz & Brooks, 2008), and maintenance of a broad spectrum of plant (Cutko & Rawinski, 2008) and wildlife species and communities (Colburn, 2004; Colburn et al., 2008; Hunter, 2008; Mitchell et al., 2008; Semlitsch & Skelly, 2008). Despite the importance of these wetlands, they remain highly imperiled ecosystems and their federal regulatory status is ill defined and generally lacking, and little state-level protective legislation exists in regard to these habitats (Colburn, 2004; Mahaney & Klemens, 2008). More troubling, few of these wetlands have been mapped, especially in the southeastern United States where the National Wetlands Inventory (NWI) has particularly high rates of omission (Burne & Lathrop, 2008) with the exception of well-known Carolina Bays. To help fill this void of information, we initiated a map inventory and assessment system for "geographically isolated" wetlands in the upper Piedmont and Blue Ridge region of South Carolina (i.e., "the Upstate"). In addition to mapping and creating an assessment system for these wetlands, we seek to identify what species are using these wetlands in the Upstate and develop an understanding of the ecological roles these wetlands play in this region. We discuss preliminary findings as to isolation characteristics in regards to spatially and temporally dynamic hydrological conditions. Specifically, we have found, mapped, and are collecting ecological data (amphibian presence, water chemistry, invertebrate community, depth, and hydroperiod) at 41 wetlands at the isolated end of a gradient that is heavily influenced by ephemeral stream systems, land use history, and anthropogenic land forms. In addition to collecting critical information for a wetland assessment system that can be implemented in other areas of the southeastern United States and beyond, we are examining spatial and temporal aspects of community structure in ephemeral wetland habitats in a particularly species-rich region. By integrating freely available digital resources from federal, state, and local agencies into ArcGIS 9.x (ESRI Laboratories), we identified potential wetlands for ground truthing. Results of ground truthing showed our techniques were successful for identifying larger isolated wetlands, but smaller wetlands were not identifiable using the available data. Our inability to identify the smallest

wetlands was a direct result of the resolution of the available free data. Most available digital resources had a resolution of 1 m and we believe a resolution of 0.33 m is required to find smaller wetlands remotely. We recommend that higher resolution (0.33 m vs. 1 m) digital resources be collected in the future so that smaller geographic features and ecosystems, especially isolated wetlands, can be remotely detected. As a result of the limitations associated with remote sensing techniques, we incorporated a "word of mouth" protocol into our research design. We employed a top-down technique for attaining local knowledge of the location of wetlands from a variety of sources, including state park personnel and non-profit conservation agencies. We also employed departmental connections and public record searches to find and contact private landowners who had large tracts of land within our region. Our efforts to locate isolated wetlands through "word of mouth" proved to be very successful, albeit labor intensive. When alternative means of locating small, cryptic geographic features and/or ecosystems are unavailable, we suggest using a "word of mouth" protocol to make use of regional ecological knowledge. After locating a variety of wetlands, we selected 41 sites to intensively study. These sites included roadside ditches, depressions in forest service roads, borrow pits, upland forested depressions within and above flood plains, beaver ponds, and manmade wetlands. Wetlands were classified according to the ecoregion in which they were located, the current and historical land use of the area, the processes affecting their formation, the NWI classification, hydrological status and isolation, area, depth, soil characteristics, water chemistry, and biotic communities. Thirty nine percent of the 41 wetlands intensively studied were associated with other water systems, either by being located within a floodplain or ephemeral stream or seep. Seventeen percent were created by beaver activity. Approximately 50% of the wetlands were of anthropogenic origin. Fish were confirmed in 17% of the wetlands but another 17% of the wetlands have the potential to contain fish at least temporarily due to their occasional connectivity with other aquatic systems. Fifty six percent of the wetlands contained species that rely on isolated wetlands for critical breeding habitat, including *L. sylvatica* and spotted salamanders, *Ambystoma maculatum*. Fifty two percent of the wetlands that contained species that rely on isolated wetlands for critical breeding habitat were associated with other water systems. Thirteen percent were created by beaver activity. Approximately 60% were of anthropogenic origin. Nine percent contained fish and another 26% had the potential to contain fish at least temporarily. Our preliminary ecological data suggest that isolated wetlands within the Upstate are physically and biologically diverse ecosystems. Species that rely on isolated wetlands for critical breeding habitat were found in wetlands that were at least temporarily hydrologically connected to other water systems and beavers appear to be important ecosystem engineers that can create temporally isolated wetlands from streams. Anthropogenic wetlands may also play an important role in sustaining populations of species that rely on isolated wetlands for critical breeding habitat in this region although more research is necessary to confirm or refute this conclusion. As our research progresses, we will be elucidating the physical and biological characteristics that allow various wetlands to function as isolated wetlands and sustain species dependent upon these ecosystems.

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