DRAFT –Upland Pools and Depressions

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Ecosystem Description

These communities occur in shallow depressions which hold water in wetter parts of the year. They generally dry up by the end of summer, but are flooded long enough into the growing season to contain wetland vegetation that contrasts with the surrounding uplands. Most occur in the Piedmont, where they are associated with mafic rocks or shale, but a couple of upland pools are known from the Mountain region, where they occur on quartzite. There are two community types: upland depression swamp forests and upland pools.

Upland depression swamp forests occur in shallower depressions than upland pools, and are flooded for shorter periods. They have a closed canopy of wetland trees. Understory, shrubs, and ground cover are usually sparse.

Upland pools occur in wetter sites, where the water is deep enough or long-standing enough to prevent development of a closed tree canopy. The vegetation varies widely, and it is likely that this type could be split into several community types. Trees of the Upland Depression Swamp Forest community type may occur around the edges.

Both of these community types often have abundant amphibians. Because the pools do not support fish, which eat amphibian eggs and larvae, they are excellent amphibian breeding sites. Other important amphibian breeding sites in the Piedmont are pools located on higher, infrequently flooded riparian terraces. In most years, these pools are also fish-free and support good amphibian breeding success. During heavy storm events, however, fish can be swept in by overbank flooding, reducing the suitability of these pools for amphibian breeding until they dry out again.

The 2005 Wildlife Action Plan describes Piedmont Small Wetland Communities, which includes upland pools and depression swamp forests, as a priority habitat (see Chapter 5A) (NCWRC 2005).

Table 1 at the end of this report provides of summary of expected climate change impacts to these natural communities.

Predicted Effects to Wildlife Species

Tables 2 through 4 at the end of this report identify the species of conservation concern and priority species that use habitats in this ecosystem.

Members of this community all make use of upland pools for breeding, but make use of floodplain pools as well, at least where they are fairly well isolated from frequent overbank flooding. Wind throw pits may also be used and *Hemidactylium scutatum*, in particular, makes

frequent use of seepage habitats. All Piedmont wetland habitats are especially important as breeding sites for amphibian species. Small wetlands can also be important breeding habitat for crayfishes. Wading birds, waterfowl, and songbirds, too, may also use small wetland communities for nesting and feeding areas. (NCWRC 2005).

While often small in size, cumulatively these habitats provide critical breeding habitat for many amphibian species. Ephemeral and isolated wetlands are very valuable to amphibians because they typically do not support fish and other predators of amphibian eggs. The loss of ephemeral wetland communities in the Piedmont has strong ramifications for future amphibian populations. Amphibians in these communities depend on the surrounding uplands, and populations are lost or much reduced if the surrounding habitat is destroyed or altered. Pool-breeding amphibians that make use of these pools may potentially be as adversely affected by these changes as those associated with upland pools are by increased frequency of drought.

Increased road densities are correlated with declines in amphibian diversity and abundance (Vos and Chardon 1998, Findlay *et al*. 2001, Fahrig *et al*. 1995). Roads can cause heavy mortality for reptiles and amphibians and can effectively isolate breeding populations, or separate wetland habitats from upland habitats that are used during non-breeding portions of amphibian and reptile life cycles. Increases in impervious surfaces causes excess stormwater runoff and pollution from point and non-point sources, which degrades water quality. Most amphibians are highly sensitive to changes in water quality (NCWRC 2005).

Beaver ponds are a natural community, but result from modification of other community types and often result in an increase in wetland habitat. Beaver dams and impoundments can change local hydrology and caused damage to private property (*e.g.*, flooding in agricultural areas, tree girdling and removal). With stable populations, beaver ponds can be maintained for decades. A reduction of beaver ponds will place more importance on man-made ponds as the primary habitat for many lentic aquatic species. Dead trees in beaver ponds are important foraging and nesting habitat for woodpeckers, such as the red-headed woodpecker, and for wood duck nesting (NCWRC 2005). Research by Hood and Bayley (2008) and Wild (2011) suggests the presence of beaver dams can mitigate the effects of drought by retaining hydrology that allows wetlands and aquatic habitats to persist despite lack of rainfall.

All are likely to be strongly affected, particularly upland populations, by increases in prolonged droughts associated with climate change. Increased drawdown of groundwater levels, also the result of prolonged drought as well as increased human utilization, particularly in times of surface water scarcity, is another major threat for populations associated with floodplain pools or seeps. Floodplain pool populations are additionally likely to be adversely affected by increases in overbank floods that carry fish into their breeding sites. These impacts may be offset to some extent, however, by increases in the number of wind throw pits resulting from heavier storm damage.

Climate Change Compared to Other Threats

The greatest threats to these systems come from land use changes and ongoing exploitation. . With respect to climate change, however, upland pools and their associated species are likely to respond differently from the surrounding forests.

Table 5 compares climate change with other existing threats.

Table 5. Comparison Of Climate Change With Other Threats

Threat	Rank Order	Comments
Logging/Exploitation	1	Shallower examples may be destroyed by development or heavily altered by logging. Logging when the ground is wet creates permanent ruts as well as altering canopy structure and composition. Clearcutting near ephemeral wetlands causes higher solar radiation and an increase in probability of wetlands drying out; also, timber harvest may introduce weedy plant invasions of wetlands (NCWRC 2005).
Development	1	Piedmont wetland habitats are heavily impacted, and have been greatly reduced, by development, roads and drainage throughout the region. Wetter examples are degraded by development of surrounding areas.
Climate Change	2	Some models predict that rainfall will be concentrated during the fall, and there will be increased droughts in the spring and summer. This may reflect an expectation of increased hurricane activity rather than well-distributed rainfall. There is also a general expectation that both droughts and extreme rainfall events will become more common.
Flood Regime Alteration	3	Drainage ditches have affected some examples, and alteration of drainage by roads has altered some other examples. Includes artificial drainage and beaver impoundment effects. Beaver ponds can be a nuisance to landowners when they flood farm fields or commercial timber. Pools located in floodplain terraces that now rarely flood may experience greater flooding in the future due to more frequent severe storms.
Invasive Species	3	Invasive species are not a significant problem in these systems at present. Increased canopy opening and shortened hydroperiod will make them more susceptible to invasion by Japanese honeysuckle (Lonicera japonica), Japanese stilt grass (Microstegium vimineum), and possibly Asian dayflower (Murdannia keisak). Fire ants, which are not abundant in the Piedmont at present, are likely to increase with warmer temperatures. They represent a threat to these communities, and may represent an additional indirect threat if they harm amphibians in the uplands. The introduction of fish, bullfrogs, and other predatory species can devastate the breeding effort of amphibians in small wetlands (NCWRC 2005).

Summary and Recommendations

These communities are isolated and contrast strongly with the surrounding uplands. They will be unable to migrate. The most important actions needed for these communities are to protect unprotected examples and to protect or restore the surrounding uplands for as many as possible. As more examples are lost, the remaining ones will become increasingly important for the survival of amphibian populations.

Seasonal wetlands must have sufficient surrounding habitat in order to support the life history requirements of amphibian and reptile populations. It is particularly important to protect the larger and wetter examples, which are more likely to persist in drier conditions. With more extreme weather, species populations in individual basins may become less stable and more dependent on metapopulation dynamics for their long-term survival. Where they can be protected or established, connections between examples will become even more important than at present.

Recommended Actions

Surveys

- Gather better information about the status and distribution of more common species associated with Piedmont wetland habitats (*e.g.*, three-lined salamander, common ribbonsnake) (NCWRC 2005).
- Initiate distribution surveys for all amphibian species associated with small wetland communities, but especially the mole salamander, eastern tiger salamander, dwarf salamander, and four-toed salamander (NCWRC 2005).

Monitoring

- Determine population trends and persistence of small wetland breeding amphibian populations, particularly mole salamander, eastern tiger salamander, dwarf salamander, and four-toed salamander (NCWRC 2005).
- Monitor amphibian populations to detect incidence of fungal and viral infections (*e.g.*, iridoviruses, chytridiomycosis).

Research

- Determine minimum upland buffers required to sustain at-risk amphibian populations (NCWRC 2005).
- Explore management strategies to eradicate undesirable species, such as bullfrogs, from wetlands (NCWRC 2005).
- Study the efficacy and practicality of “toad tunnels” and other wildlife crossings that allow passage under roadways and help maintain connectivity between wetland metapopulations (NCWRC 2005).
- Investigate minimum hydroperiods needed by priority amphibian species that utilize ephemeral pools and wetlands. Results can be used to determine when supplemental measures or intervention is needed to support breeding periods and metamorphosis during drought periods.

Management Practices

- Where ditches are affecting the hydrology of the pools, plugging the ditches or other hydrological restoration methods should be employed.
- Promote the adoption of agricultural and forestry best management practices that reduce run-off, erosion, and pollution. The federal Farm Bill and other cost share programs provide incentives for land stewards to adopt these practices. (NCWRC 2005).
- Work with U.S. Department of Agriculture Wildlife Services Beaver Management Assistance Program to develop landowners incentives to retain beaver ponds and to develop strategies to promote techniques for managing beaver damage that minimize the loss of quantity and quality of beaver ponds (NCWRC 2005).

Land Protection

- Every effort should made to maintain continuous gradients between wetland and upland sites; roads, agriculture, or forestry operations between complimentary sites may render them ineffective at supporting amphibian and reptile populations (Bailey *et al*. 2004, NCWRC 2005).
- Provide for habitat connectivity between nearby upland pools and other wetlands or surface waters.
- A high priority should be placed on protecting wetlands and adjacent uplands through acquisition or easement (NCWRC 2005)
- Wetland restoration efforts should focus on restoring the natural hydrology, water quality, and plant communities of degraded wetlands, and on creating new ephemeral wetlands in suitable locations (NCWRC 2005).

References

Bailey, M. A., J. N. Holmes, and K. A. Buhlmann. 2004. Habitat management guidelines for amphibians and reptiles of the southeastern United States (DRAFT). Partners in Amphibian and Reptile Conservation.

DeWan, A., N. Dubois, K. Theoharides, and J. Boshoven. 2010. Understanding the impacts of climate change on fish and wildlife in North Carolina. Defenders of Wildlife, Washington, DC.

Fahrig, L., J. H. Pedlar, S. E. Pope, P. D. Taylor, and J. F. Wegner. 1995. Effect of road traffic on amphibian density. Biological Conservation 73:177-182.

Findlay, C. S., J. Lenton, and L. G. Zheng. 2001. Land-use correlates of anuran community richness and composition in southeastern Ontario wetlands. Ecoscience 8:336-343.

Gaff, H., DeAngelis, D.L., Gross, L.J., Salinas, R., and M. Shorrash. 2000. Ecological Modeling 127:3352.

Hood, G. A. and S. E. Bayley. 2008. Beaver (*Castor canadensis*) mitigate the effects of climate on the area of open water in boreal wetlands in western Canada. Biological Conservation 141: 556-567.

Maurer, E.P, L.Brekke, T.Pruitt, and P.B. Duffy. 2007. Fine-resolution climate projections enhance regional climate change impact studies. Eos Trans. AGU, 88(47), 504.

NC Natural Heritage Program (NCNHP). 2001. Descriptions of the biological themes of North Carolina, 2nd edition. N.C. Department of Environment and Natural Resources, Natural Heritage Program, Raleigh, NC.

NC Wildlife Resources Commission (NCWRC). 2005. North Carolina Wildlife Action Plan. Raleigh, NC.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina, third approximation. N.C. Department of Environment and Natural Resources, Natural Heritage Program, Raleigh, NC.

Vos, C. C., and J. P. Chardon. 1998. Effects of habitat fragmentation and road densities on the distribution pattern of the moor frog (*Rana arvalis*). Journal of Applied Ecology 35:44-56.

Wild C. 2011. Beaver as a climate change adaptation tool: concepts and priority sites in New Mexico. Seventh Generation Institute. Santa Fe, New Mexico.

Table 1. Predicted Impacts of Climate Change	
Climate Change Factor	**Comments**
Wind Damage	An increase in wind throw may occur if severe storms become more frequent. Most of these systems are forested, and their trees are particularly susceptible to wind throw because of the wet soil and shallow rooting depth. These communities are already disproportionately affected by severe storms, but normally have supported closed canopies of large trees. More frequent storms will lead to more open canopies, possibly causing some upland depression swamps to more resemble the more open upland pools. Increased wind throws may benefit amphibians by creating deeper pools that hold water longer into the season or that offer at least some breeding opportunities when the rest of the pool is dry.
Increased Temperature	Most of their component species range well to the south, and the change in temperature is not expected to have a major effect on them. Warmer water temperatures may have uncertain effects on amphibian development as well. Higher temperatures will increase evaporation and will lead to somewhat shorter hydroperiods.
Drought	These systems are perched wetlands that are fed mostly by rainwater, with little surface input. All of them dry up in in the course of most growing seasons.
Structural Change	Where dominated by large trees, increased wind throw will affect structure and possibly composition.
Acreage Change	Shallower marginal depressions and edges of larger depressions may be dried enough that they are invaded by upland species and lose their identity. This will cause a loss of acreage, but this loss is not likely to be extreme.
Compositional Change	A more open canopy that results from wind damage impacts may allow less shade tolerant plants to establish, changing the composition of the communities in ways that would not be detrimental.

Table 2. Bird Species Utilizing Piedmont Upland Pools and Depressions							
Species	**Common Name**	**Element Rank**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
BIRDS							
Melanerpes erythrocephalus	Red-headed Woodpecker					/ /P	
Nyctanassa violacea	Yellow-crowned Night-heron					/ /P	

Table 3. Reptile Species Utilizing Piedmont Upland Pools and Depressions							
Species	**Common Name**	**Element Rank**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
REPTILES							
Clemmys guttata	Spotted Turtle					/ /P	
Thamnophis sauritus sauritus	Common Ribbonsnake					/ /P	

Table 4. Amphibian Species Utilizing Piedmont Upland Pools and Depressions							
Species	**Common Name**	**Element Rank:**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
AMPHIBIANS							
Ambystoma maculatum	Spotted Salamander	G5/S5				/ /P	
Ambystoma opacum	Marbled Salamander	G5/S5				/ /P	
Ambystoma talpoideum	Mole Salamander	G5/S2				/SC/P	
Ambystoma tigrinum	Eastern Tiger Salamander					/T/P	
Eurycea guttolineata	Three-lined Salamander					/ /P	
Eurycea quadridigitata	Dwarf Salamander					/SC/P	
Hemidactylium scutatum	Four-toed Salamander	G5/S3				/SC/P	
Hyla gratiosa	Barking Treefrog					/ /P	
Hyla versicolor	Northern Gray Treefrog					/SR/P	

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Species	**Common Name**	**Element Rank:**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
AMPHIBIANS							
Scaphiopus holbrookii	Eastern Spadefoot					/ /P	

*** US/ NC/ WAP Abbreviations (species are subject to reclassification by USFWS, NHP, or WRC).**

E	Endangered	SC	Special Concern	P	WAP Priority Species
T	Threatened	SR	Significantly Rare		
FSC	Federal Species of Concern	W	Watch Category		
T(S/A)	Threatened due to Similarity of Appearance				

NatureServe Element Rank: http://www.natureserve.org/explorer/ranking.htm

USFWS Endangered Species Listing Status: http://www.fws.gov/raleigh/es_tes.html

NC Natural Heritage Program Status:
http://www.ncnhp.org/Images/2010%20Rare%20Animal%20List.pdf

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