Core Habitat, Not Buffer Zone

While the terms "buffer zone" and "riparian buffer" are commonly understood, areas surrounding wetlands and streams are more than just zones to protect aquatic resources. Two conservation biologists describe these areas as core habitat for semi-aquatic species and call for new criteria to evaluate, protect, and manage these critical areas.

by Raymond D. Semlitsch and John B. Jensen

The terrestrial habitats adjacent to and surrounding wetlands are critical for the management of natural resources. Most conservationists and land managers understand that this land and water interface protects adjoining aquatic resources by filtering chemical pollutants, moderating temperature, and ameliorating siltation and other pollution caused by human activities such as timber harvesting, road building, agriculture, and urbanization. Furthermore, scientists and others generally agree that patches or strips of terrestrial habitat ranging from 30 to 60 meters wide can function as essential barriers around core aquatic habitats to protect them from surrounding land-use practices.[1] These upland "buffer zones" (also called "buffer strips" and "riparian buffers") receive much attention for their value in protecting aquatic resources. For example, the Natural Resources Conservation Service introduced its National Conservation Buffer Initiative in 1997 to help farmers and ranchers to improve aquatic resources, and it instituted a national goal of installing two million miles of buffers by 2002.

But what about the upland itself? These terrestrial zones of upland habitat surrounding wetlands serve another critical but often overlooked function. Rather than simply a buffer, they are core habitat for many semi-aquatic and terrestrial "ecotone" species. They are therefore essential for the survival of a number of species and for the preservation of biological diversity.

Use of Adjacent Uplands by Semi-Aquatic Species

Biologists who study semi-aquatic species have long understood the importance of uplands adjacent to wetlands to numerous species of turtles, salamanders, dragonflies, plants, and other organisms for their survival. But the regulations to protect these areas and management strategies to maintain them lag far behind. Although these areas should be regulated for both water resource protection and biodiversity conservation, only the aquatic portion of the resource receives federal oversight (unless threatened or endangered species are present). Biodiversity criteria have minimal, if any, regulatory oversight, especially for areas associated with isolated wetlands.[2] At the state and local level, natural resource managers who strive to protect biodiversity face further challenges in regulations or ordinances skewed toward protecting water resources rather than protecting biodiversity or the inhabitants of these core areas.

Criteria for maintaining biodiversity are different from criteria for maintaining water resources. For example, water resource protection criteria primarily are based on water temperature, siltation rates, and contaminant levels within aquatic habitats. Biodiversity protection criteria are based on use by target species for life history functions such as feeding, mating, nesting, and over-wintering. Numerous studies over the past decade document the use of terrestrial habitat adjacent to streams and wetlands by a broad range of taxa, including mammals, birds, reptiles, and amphibians. Of these studies, two examine uplands associated with wetlands to reveal the close dependence of semi-aquatic species on both habitats. They also illustrate the criteria needed to define the size of core habitats.

The first study demonstrates the use of terrestrial habitats surrounding a natural wetland for nesting and hibernation by freshwater turtles.[3] Nesting and hibernation are crucial for the reproduction and survival of turtles, and hence for maintaining viable populations. Scientists used radio-telemetry to monitor the nesting, egg deposition, and hibernation of three species of turtles (mud turtle, *Kinosternon subrubrum;* Florida cooter, *Pseudemys floridana;* and yellow-belly slider, *Trachemys scripta*). By plotting each nest and hibernation site location onto an aerial photograph of the upland habitats surrounding the wetland, the scientists

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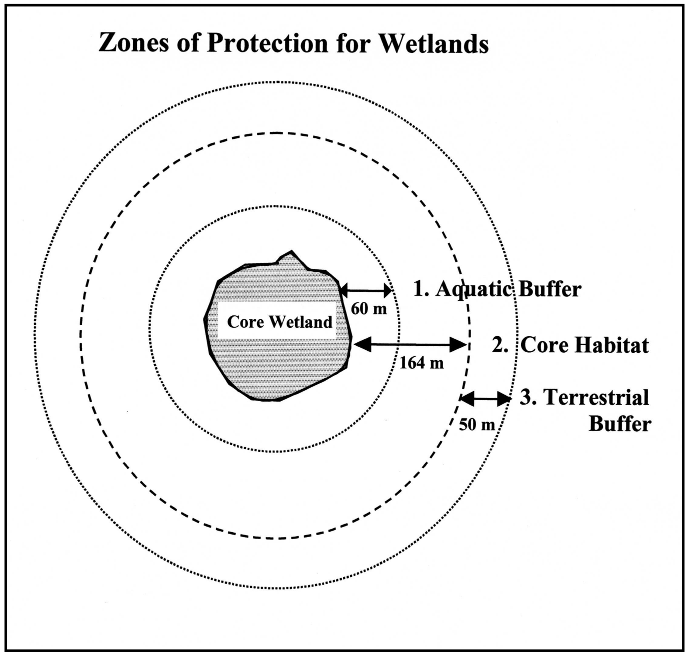
generated a distribution of locations and established the size of the core terrestrial habitat used by the turtles. All three species in the study nested and hibernated in the upland within a 275-meter radius of the associated wetland (calculated from the outer edge of the wetland at the high-water mark). To fully protect 100 percent of the turtles' nesting and hibernation sites and to ensure the integrity of this turtle community, an upland zone of protection measuring 275 meters would be needed around the wetland. On a more conservative note, the authors of the study found that exclusion of the most distant 10 percent of the nest and hibernation sites would reduce the size of this core terrestrial habitat to a 73-meter zone around the wetland.

The second study examined the use of upland habitats by pond-breeding salamanders.[4] This study summarized data from several other studies indicating that salamanders, after breeding in wetlands, emigrated to upland habitats and spent 86–99 percent of each year in rodent and shrew burrows and other subterranean refuges. Although the wetland is critical to these species for breeding, the surrounding terrestrial habitat is critical for feeding, growth, maturation, and maintenance of the entire juvenile and adult population. The study also documented the emigration of adults and post-metamorphic juveniles of six species of salamanders (Jefferson salamander, *Ambystoma jeffersonianum;* spotted salamander, *A. maculatum;* marbled salamander, *A. opacum;* mole salamander, *A. talpoideum;* small-mouthed salamander, *A. texanum;* and tiger salamander, *A. tigrinum*). Adult salamanders were found up to 625 meters from the edge of wetlands, and juveniles were found as far as 247 meters. The study reveals that on average, an upland zone 164 meters wide surrounding the wetland would encompass 95 percent of the sample population—constituting the salamanders' core terrestrial habitat.

Implications for Protection and Management

The terrestrial ecology of semi-aquatic species is often underappreciated or overlooked by managers and conservationists. Semi-aquatic reptiles make only brief visits to terrestrial habitats when nesting, and hibernation sites are very rarely seen by the untrained observer. Many pond-breeding amphibians spend the vast majority of their lives in uplands, but they live mostly underground and are therefore infrequently seen in uplands. Observations and studies of these animals are consequently concentrated in streams and wetlands, where they are found more easily (in the right season), rather than in terrestrial habitats where they elude detection, yet where much of their life plays out. In fact, semi-aquatic species can survive without water for extended periods, including between breeding seasons and during droughts. For example, in a study of a population of striped newts *(Notophthalmus perstriatus)* in northern Florida, a drought relegated the newts to predominantly terrestrial activity for five years.[5] Semi-aquatic organisms therefore depend on both wetland and associated upland habitats during their entire life cycle. Both constitute core habitat and should be regulated and managed together for biodiversity protection.

The chicken turtle depends on terrestrial habitats immediately surrounding isolated ponds for its core habitat needs.



In this diagram of zones of protection for wetlands, both core habitat and aquatic buffer requirements are met within a 164-meter zone. An additional 50-meter buffer is recommended to protect core habitat.

Can One Size Fit All?

Buffer zones—in the traditional sense of the term—continue to be a valuable concept, and they are still needed. Buffer zones should surround the upland portion of the core habitat to protect the terrestrial and aquatic habitats from surrounding land-use practices that could damage these areas. While core habitat for maintaining viable populations of species is not the same as a buffer zone for protecting water resources, some may ask whether core habitat for maintaining biodiversity also can be used to protect water resources.

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The answer is yes, but only if the criteria for the size and use of the terrestrial habitat fully satisfies the needs of both functions.

Ideally, one could develop a single universal size for core terrestrial habitat around wetlands and streams, which would simplify adoption of regulations and management strategies. We doubt, however, that one value can be used for all wetlands and streams, because of local differences in stream size, topography, climate, and surrounding land-use practices. Likewise, requirements of semi-aquatic species vary from species to species and region to region.

The species or group with the largest terrestrial core habitat needs could be the base for a universal terrestrial core habitat (for example, for the turtles and salamanders in the wetland studies, the 164-meter terrestrial core would protect both sets of species). Alternatively, scaled criteria could accommodate specific wetland attributes—such as diversity of fauna using the wetlands—and major factors impacting habitat quality, such as land-use practices in the surrounding areas. For example, a study of streams associated with timber harvesting called for criteria to be adjusted for attributes including stream width, intensity of logging, and slope adjacent to the stream.[6] The same study also recommends a two-tiered approach to regulating adjacent habitats, where the terrestrial habitat closest to the water enjoys full protection, while an outer area retains limited protection but allows certain minimal-impact land uses to take place. For more complete protection, a third "transition zone" would encircle the buffer zone.[7] The transition area would be used explicitly for compatible land-use practices. This set of protection zones follows the traditional reserve principle adopted by biosphere reserves and many other protected areas across the country and around the world.

By applying biologically relevant criteria and bolstering the biological value of core terrestrial habitats, land managers could develop stratified habitat zones that guide associated protection and management, resulting in more effective biodiversity conservation. We propose the use of stratified criteria that would include at least three terrestrial zones adjacent to core aquatic and wetland habitats:

(1) starting from the wetland edge, a first terrestrial zone would buffer the core aquatic habitat and protect water resources;

(2) starting again from the wetland edge and overlapping with the first zone, a second terrestrial zone would comprise the core terrestrial habitat defined by semi-aquatic focal species or species-group use; and

(3) starting from the outward edge of the second zone, a third terrestrial zone would buffer the core terrestrial habitat from edge effects and surrounding land-use practices.

It is not our intent to protect more habitat than is needed nor to exclude all activities from terrestrial areas around wetlands. It is our intent, however, to ensure managers and regulators recognize these upland habitats are absolutely essential for maintaining biodiversity and should be managed and regulated as such. We hope this discussion generates more research on the effect of land-use practices on plants and animals and that studies begin testing the effectiveness of various criteria for protecting the core habitats of species. A sustainable balance between continuing economic development and protecting natural resources absolutely depends on setting realistic criteria to attain the ultimate goal of conserving biodiversity. ■

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