Restoring Wetland Habitats with Cows and other Livestock

A prescribed grazing program to conserve bog turtle habitat in New Jersey

No chemicals, no chainsaws, no blowtorches—just an adequate fence, an occasional shelter, and the appropriate livestock, which, depending upon the habitat size and invasive plant species may be goats, sheep, or cattle . . .

At first glance this may not read like a recipe for bog turtle conservation. Yet, in the marshes, fens, and wet meadows of northwestern New Jersey, it has shown remarkable promise. The federally-threatened bog turtle *(Clemmys muhlenbergii)* is a tiny species, small enough to wade in the puddle of a cow's hoof print. A single turtle can bring as much as $1200 in the illegal pet trade. Although New Jersey still harbors a significant concentration of bog turtles, a suite of native and exotic plants is rapidly degrading the mucky fens and wet meadows where the turtles thrive. Once established, these plants can rapidly replace the native herbaceous communities that the turtle depends on for its survival with dense, shaded monocultures. Without intervention, New Jersey will likely lose 40 percent of its bog turtle populations in the next twenty years.

Most traditional vegetation management techniques employ herbicides, which are generally effective but not without negative effects. For example, using broadcast herbicide applications (such as glyphosate-based Rodeo) in bog turtle habitats kills desirable, non-target species. While glyphosate is EPA-approved for wetland use and considered safe for wildlife, its effects on ecosystems is unknown. Bog turtle habitats are rich in amphibian and insect species, many of which are rare. Spraying these spe-

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cies with a biocide that is labeled with the following precautionary statements: *"Harmful if Inhaled. Avoid breathing vapors or spray mist. Wash thoroughly with soap and water after handling,"* may well have a deleterious effect on some of these species. Even biological control (such as using beetles to control purple loosestrife) can take years, during which time the bog turtles may be extirpated.

Given these and other drawbacks of traditional techniques, coupled with the conservation urgency of the situation, my coworkers and I resolved to explore a new innovative approach to the problem—prescribed grazing.

Using Livestock to Control Invasive Species: The Empirical Evidence

The New Jersey Division of Fish and Wildlife's Endangered and Nongame Species Program (ENSP) first began experimenting with prescribed grazing to control succession and the invasion of exotic plants in bog turtle habitats in 1999. The idea first evolved from field observations and anecdotal evidence and later from research presented in the scientific literature. While conducting bog turtle surveys in northwestern New Jersey and southwestern New York, I was struck by the contrast between grazed wetland pastures and adjacent areas. In the wetland pastures, cows had pruned purple loosestrife and/or phragmites to knee-height, effectively eliminating it's canopy-closing ability and reducing its productivity. Neighboring non-grazed areas characteristically were choked with purple loosestrife. Moreover, the cows—simply by doing what cows do—had broken up the plants' dense rhizomes and had improved the burrowing quality of the soil for the bog turtle. The same was true in areas where goats had been given seasonal access to wetland pastures. In fact, in a survey of bog turtle habitat in over 200 emergent wetlands in the shale bedrock regions of Sussex County, New Jersey and Orange County, New York, I found that the majority of the wetlands composed of native floristic communities were actively grazed. The non-grazed wetlands, most of which were grazed several decades ago, were now densely colonized, primarily by purple loosestrife.

None of this should come as a surprise to those who graze livestock or to those who manage plants and wildlife. Controlling unwanted vegetation with livestock has been widely practiced in North America and Europe for some time. Livestock have been used to manage utility line rights-of-way, curtail the invasions of exotic species, control brush, and even create firebreaks.

Even the unintentional control of exotic/invasive plants by livestock in wetlands is well documented. In New York, for example, researchers have correlated grazing with high fen species richness. In Great Britain, scientists have shown that grazing maintains species diversity and prevents invasion of the tall-growing herb, *Epilobium hirtellum*. Even more specific to the case at hand, Dennis Herman, a renowned bog turtle expert from the North Carolina State Museum, witnessed a 64-percent decline in bog turtle captures at a North Carolina site after grazing had been stopped.

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This association between grazers and turtles also makes sense from a historical perspective. David Lee and Arnold Norden have theorized that the interplay between beaver and wild herbivores (such as bison and elk, and even the now-extinct mastodon) created and maintained open fen habitats long before humans entered the picture. During the course of colonial settlement, bison and elk were extirpated and domestic livestock, including cattle, sheep, and horses, filled the niche of these herbivores. Today, as farming communities give way to suburbia, livestock no longer help to impede the encroachment of invasive vegetation in bog turtle habitats. The result, in conservation terms, has been disastrous.

Prescribed Grazing in Wetlands

The above evidence notwithstanding, grazing in wetlands often has been disparaged because it is associated with degraded water quality from manure and soil compaction. Yet, our experience with bog turtles dispels the belief that all grazing is deleterious to wetlands. The key is density. By using low densities of livestock and minimizing the use of feed subsidies, which can lead to eutrophication, livestock can become a conservation tool for threatened bog turtles—without harming sensitive wetland ecosystems.

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This was the rationale for the experimental prescribed grazing project initiated by the ENSP. To test the idea that prescribed grazing could help restore and maintain bog turtle habitat, we set up four sites: two phragmites control projects using goats and goats/sheep, one reed canary grass control project using cattle, and one purple loosestrife/woody vegetation control project using cattle. We chose livestock for each site based on habitat size and plant community structure. To avoid over-grazing and excessive trampling, we used cattle on sites larger than one-acre and goats and sheep on the smaller sites. Goats and sheep also were paired with sites that were densely colonized by phragmites, shrubs, and briars. Unlike cows that tend to avoid thicket-like habitats, goats seem to have no problem penetrating deep into the core of dense patches of vegetation for forage and refuge. At present, the prescribed grazing project is still young. Nevertheless, we can report some extremely encouraging preliminary results.

Site 1. Horned Goats and Phragmites

In May 1999, we released two 80-pound male, horned "pygora" (pygmy x angora) goats in a 0.2-acre portion of site one that was blanketed with a dense mat of phragmites. The phragmites had been there for over a decade, and the only clue that the site had once been suitable for bog turtles was a small spring-fed rivulet. Even this was choked with litter and dead tussock sedges.

Two seasons later, the changes were dramatic. In our two sample plots, phragmites cover had decreased by 60 and 50 percent, respectively. Coincidentally, clearweed *(Pilea pumila)* and horsetail (*Equisetum fluvitale)*, both native species, increased by 75 percent. We also witnessed increases in low-growing herbs and newly established sedges—all positive (albeit early) signs of bog turtle habitat restoration. We are hoping that a few successive seasons of grazing will eradicate the phragmites. The structure of this scourge of a grass—tall, individual culms with large, sparsely placed leaves—makes it very vulnerable to grazing. Continuously browsing of its leaves, its primary photosynthetic part, forces the plant to deplete its stored energy reserves, ultimately starving it to death.

Also noteworthy was the added value of the goat's horns. The woody vegetation in the enclosure, which consisted mostly of low-growing dogwoods and willows, was nearly obliterated by the goats girdling of the woody stems with their horns. Sites in which we used polled goats had substantially lower tree and shrub mortality.

Site 2. Goats, Sheep, Phragmites, and Japanese Stilt Grass

Our second experiment focused on a formerly grazed 0.5-acre wet meadow in southwestern New Jersey. Phragmites was well established in a drier portion of the meadow and was rapidly advancing toward the core bog turtle habitat. In July 1999, we released four juvenile, 50-pound horned goats to graze on the entire site. The goats, however, had other ideas and repeatedly escaped the enclosures. So, we traded some of the goats for sheep, and in spring 2000, we released three female sheep and two less wily juvenile goats.

After two growing seasons, the result was similar to that of site one. Phragmites cover was reduced by 85 percent. We also made a new discovery on site two. Sheep, although they are

lumped with goats by familiar association, are much different ecologically. While goats prefer woody browse, sheep prefer grasses and will browse on woody vegetation only occasionally or when grassy forage becomes limited. In restoration terms this is significant. Japanese stiltgrass *(Microstegium vimineum)*, a notorious ecologically noxious species, was distributed in patches throughout the moist meadows adjacent to the bog turtle habitat. When we were only grazing goats, the stilt grass grew, flowered, and set seed. With sheep in the meadows, it never reached more than three inches in height and never reproduced.

Site 3. Cows and Reed Canary Grass

By the time we began our third site experiment, we began to think a little bigger—in terms of cows, that is. Working with a local farmer, we fenced a 3-acre fen smothered by reed canary grass with triple-stranded barbed wire and cedar posts and prescriptively grazed three dairy cows. The canary grass had formed such a dense mat that an existing network of rivulets and burrowable ground could hardly be seen. The farmer, who had used this site as pasture in the early 1980s, recalled when the area was primarily covered with sedges (*Carex* sp.), several species of ferns, and skunk cabbage (*Symplocarpus foetidus*). Only after storm water from an uphill housing development was directed into the site did the grass take over.

All this changed after only one season of grazing. The unsuitable patch of reed canary grass completely transformed into superb bog turtle habitat. The cows trampled and compacted several years' worth of litter, broke up rhizomes, and created a perfect hollow-hummock topography. Rivulets and seeps that were completely masked by the mat of reed canary grass prior to the grazing were revealed.

The wholesale eradication of reed canary grass may be impossible, however. Despite, our best efforts—and those of the cows—the grass persisted, staying in 95-100 percent cover class. What we found, however, was that its inhospitability for bog turtles can be moderated by a continuous regimen of light cattle grazing. Unlike phragmites, reed canary grass responds to grazing by forming a lawn-like mat that is still capable of photosynthesizing. The key variable is height. If the canary grass is grazed from as much as 3-feet to 4.5-inches, other native species can get a glimpse of sunshine.

Site 4. Cows, Purple Loosestrife, and Shrubs in Larger Pastures

Our fourth experimental site was the largest, situated on 3 acres of limestone fen between a 32-acre upland cattle pasture and a lowland beaver marsh. By extending the barbed wire fence from the upland border to the edge of the beaver marsh, we effectively increased the total acreage of the pasture for the approximately 25 cattle to 35 acres, slightly below the recommended 1:1 ratio. In doing so, we—and the cows—were able to reduce the purple loosestrife cover by as much as 40 percent and the shrub cover by 33 percent.

Bog turtles, for their part, appear to be moving in once favorable habitat is created, although sometimes more slowly than the invasive plants are moving out. At site one, I found an adult male turtle basking along the bank of a rivulet that had been completely shaded prior to the goat release. Near the perimeter of the phragmites stand was a clutch of four eggs that had been deposited in the rotted stump of a black willow. Prior to the goats, the canopy surrounding the willow stump was at least 50-percent closed, which would have been too shaded to provide nesting habitat.

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Often, the place to look for bog turtles in cow pastures is in cow footprints. At site four, three adult bog turtles were found, two of which were wading in water-filled hoof prints and one that was basking atop a sedge hummock just above the hoof print hollows. Prior to the introduction of cows, only one bog turtle had

been documented from this site in over a dozen surveys. Thus it appears that these three turtles may have migrated into the fen in response to the presence of cattle. However, this would be an unwarranted assumption. It is more likely that these bog turtles were present in this wetland complex all throughout the project but decided to move into more preferred habitat once it was created. It is also possible that the reduction in vegetative cover made the turtles more visible to the observer. Nonetheless, the observation of the three bog turtles among cattle hoof prints in an area freshly browsed of woody cover indicates that just two seasons of light cattle grazing can benefit bog turtles by the creation of suitable microhabitats.

As we look forward, the question has shifted from, "Does prescribed grazing work for bog turtle habitat restoration?" to "How can we make it work better?" We are now working on developing a rigorous, empirically-based approach to managing bog turtle habitats through prescribed grazing. With future research we hope to answer to the following frequently asked questions: "What type of livestock are the most effective for controlling particular invasive plants?" "What is the most effective density of livestock per area of wetland?" "Can certain invasive species be eradicated or will livestock grazing have to be used indefinitely?" "Will the plant communities that regenerate once invasive species are controlled be suitable for bog turtles?" "Can purple loosestrife and phragmites be effectively controlled without overbrowsing the remainder of the plant community?"

The bog turtle is imperiled throughout its range by invasive and often exotic plants; and the situation is only worsening as livestock-based agriculture is becoming increasingly obsolete, and suburbia is rapidly encroaching upon the few remaining undeveloped landscapes where bog turtles occur. New Jersey's prescribed grazing project is an attempt to stem habitat degradation by invasive plants, and we are hopeful that the data generated through this project will be a major factor in the bog turtle's range-wide recovery.

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