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Managing Wetland Vegetation

Ann Berry Somers

Round-leafed sundew (Drosera rotundifolia).

Managing Wetland Vegetation

The purpose of this manual is to assist land managers in becoming successful wetland managers. A land manager can be any person or agency aware of the special needs and benefits of wetlands who has the power to make the needed changes. The intent is to stop the decline of wetland plants and animals by producing more and better wetland habitats. Habitats are environments used by species to grow, live, hibernate, bask, forage, and reproduce. The management options for specific wetlands vary, based on site character and the objectives and motivations of the management plan. Discussed below are some techniques used to manage wetland vegetation. While the primary consideration should be to improve the function of a target wetland, the adage "first, do no harm" is also worth remembering.

Over time, freshwater wetlands in the Southeast succeed toward a closed forest canopy; the sunny microhabitats gradually disappear as the interior surface becomes shady. The time this takes can be relatively short. For example, the Southeast experienced very dry conditions in the mid-1980s and during this time extensive woody growth emerged in many wetland sites. Although it is difficult to predict how global climate change will impact the wetland hydrology and biota of the Southeast, clearly the succession to shaded conditions is an important consideration in the conservation and management of small wetlands.

Many plants and animals require open sunny habitats and are not found in heavily shaded areas. Appropriate treatments may be needed to manipulate the wetland communities to the desired mix of woody and non-woody plants. For example, the ecology of the bog turtle seems to indicate a preference for patchy habitat of wet shrubby and woody areas interspersed with open, sunlit, boggy, wet meadows with various herbaceous vegetation types (Box 5.1). This habitat type might have developed and been maintained by natural disturbances (high winds, storms, floods) and the actions of animal herbivores such as beaver (Castor canadensis), elk (Cervus elaphus), or bison (Bison bison). Of the types of animals that might have played an important role, the beaver is the most likely since it not only feeds on woody plants, but is also an accomplished wetland builder. In many cases, our management strategy might be guided by comparison with the actions of beavers on the native landscape (see Wetland Management by Beavers, Chapter 6).

Several options for managing woody wetland vegetation include cutting, grazing, chemical methods (herbicides), and the use of fire. Each site will present prospects and challenges for the use of any or all of these techniques. Also, new technology and greater experience will likely produce new techniques applicable to specific problems. This basic discussion of vegetation management considers the dynamics of wetlands, the ecology of wetland species, and the larger picture of the watershed. With so many wetland functions and values at risk, it is helpful to know that options exist for their restoration and management.

Mechanical Woody Vegetation Removal Techniques

As used here the term mechanical means cutting, sawing, clipping, mowing, uprooting, and related physical techniques that can be used directly on plants. A variety of tools and mechanical equipment may be used to cut back or pull out wetland woody plants, depending on the job required. The size of the wetland and the amount of management

Box 5.1 Removal of Hardwood Canopy is Beneficial to the Bog Turtle

By Dennis W. Herman

The bog turtle's ultimate enemy may be a closed canopy. The turtle's basking sites and nesting areas are located in open, sunny sedge meadows with emergent vegetation and a subcanopy of shrubs. Later stages of succession produce a closed canopy that blocks sunlight and eliminates surface warming and herbs. Bog turtles are long-lived, reaching ages in excess of 40 years. Mating and egg-laying can occur over the life of a bog turtle. Reproductive success declines as adequate nesting sites disappear and individual turtles can live to a ripe old age persisting in sub-optimum sites. If areas open up in the wetland by man-made or natural reasons, then reproduction can once again occur in the population. This case study illustrates how an aged population of bog turtles benefited from the removal of canopy species and actually began reproducing again after nearly two decades.

Dennis W. Herman

This view of a meadow bog shows how livestock grazing maintains the open, shrubless wetlands preferred by bog turtles.

Dennis W. Herman

A view of the same meadow bog showing the rapid shrub succession two years after livestock were removed. Habitat becomes less suitable for bog turtles as shade increases.

The bog turtle was discovered along a second order stream in a north Georgia county in 1979. The habitat where the first turtles were found was atypical, comprised of a rocky meandering stream with small seepages irregularly located along the stream. Some typical wetland species were observed in the seepages including sedges (*Carex* sp.), bog rushes (*Scirpus* sp. and *Juncus* sp.), and small amounts of peat moss (*Sphagnum* sp.). A hardwood canopy of oaks (*Quercus* sp.), maples (*Acer* sp.), and tuliptree (*Liriodendron tulipifera*) dominated the area preventing sunlight from reaching the forest floor.

A bog turtle survey began in 1979 by a US Forest Service biologist ended in 1982. Only one old adult female was found during this initial survey. Dr. Ken Fahey found additional adult bog turtles from 1983 to 1986, all of them very old. No evidence of reproduction was ever found at this site, and it was assumed that it was an old population, expected to persist only until the last turtle died out.

The upper slope above the site was logged in 1986, but provided no direct benefits to the population. The survey was discontinued from 1987 through 1990. In 1990, Dr. Fahey and the US Forest Service joined forces, renewed searches, and began a trapping campaign to locate new turtles. The survey was moderately successful, with the capture of additional specimens, yet reproduction and recruitment were not observed. The Forest Service, at the urging of Dr. Fahey, began to selectively remove some vegetation and girdled some large trees in 1993. Girdling of trees has continued from 1994 to the present. A bog turtle nest containing three eggs was found in the top of a rotting hardwood stump in July 1997 in one of the open areas created by tree and vegetation removal. This was the first reported case of bog turtles reproducing at the site and in Georgia.

required to implement the plan often determine the most effective and efficient method to use. Small wetlands, like the most common ephemeral pools, seeps, and bogs are amenable to skillful management by people using hand tools without the aid of large, heavy machines. On the other hand, large areas like floodplain forests may require large equipment like trucks, tractors, and earthmoving equipment to achieve the management goals. If heavy equipment was used to drain or otherwise alter the wetland, then it is likely that similar equipment will be required for restoration.

The amount of time required for different techniques also needs consideration. Can organized work crews of volunteers be used at the site? Is there sufficient skilled labor available from the landowner or other local groups to do the job? Can someone subcontract this work? Who has the knowledge and skills? The timing of the treatments and the frequency of repeated or subsequent treatments must be considered. Does the management plan outline any alternative treatment options as conditions change? How will the treatments and subse-quent responses be evaluated for effectiveness? A wetland management project where the goal is to keep conditions sunny will require more intensive management practices. Consideration must be given to the fact that management might also continue far into the future and plans should be made now to ensure that the best possible arrangements have been made for this commitment.

Choice of technique may depend on the season in which the work will take place. If a wetland has deep, soft mud, as required by bog turtles, this condition will limit the machinery used and may make it difficult to walk around the site even in high boots. The impact of entering a wetland, with either machinery or people intent on drastically modifying the vegetation, should not be considered a trivial part of the management project. In some cases the trampling, crushing, and breaking of the surface and the hummock forming vegetation can cause direct destruction of plants, eggs, nests, or animals who hide in these niches.

Matt Flint

*Turk's-cap lily (*Lilium superbum*) is found in moist conditions in the Mountains.*

This damage can affect reptiles, amphibians, mammals, and invertebrates that live and nest in the low vegetation at the open margins of wetlands. Excessive trampling may also harm the hydrology of the wetland by penetrating impervious soil layers.

Careful cutting of wetland woody trees and shrubs can be effective in opening a closed canopy to the point of producing a response in the plant community. Often it might be helpful to experiment on a small part of the wetland to determine both the logistics of the site and to gauge the response of the treatment before it is widely applied. Cutting with hand tools or hand-held power equipment is the most accurate method of trimming or removing woody plants. Removing individual plants to open the canopy and allow more light to reach the surface can benefit surface basking reptiles, amphibians, and insects. These openings in the canopy may also benefit wetland herbs requiring sunlight at the surface to germinate and grow.

There can also be drawbacks to sudden new openings in the canopy. In experiments to study the effects of canopy openings on populations of mountain sweet pitcher plant (Sarracenia rubra ssp. jonesii), it has been observed that grasses and even red maple seedlings aggres-sively colonize some new openings. In some cases the new plants

Box 5.2 A DOT Wetland Mitigation Site

By Kenneth A. Bridle, Ph.D. and Ann Berry Somers

Mitigation is a term used to describe actions to compensate for environmental damage. This essay describes the case of a small wetland restoration and preservation that resulted as part of a mitigation agreement. This site was chosen because it is considered to be a freshwater biodiversity site of local significance. The wetland is located in a larger floodplain and was purchased by the North Carolina Department of Transportation (NCDOT) as mitigation for wetland damage during the construction of a highway bypass. The construction project and this wetland are in the same USGS hydrologic unit.

This wetland, called a "marsh" by locals, consists of a rich and diverse biological community in the midst of an historic farming and grazing bottomland. Horses and cows have grazed the site as recently as 6-7 years ago. Historic photographs confirm that this wetland has been exposed to row crops and other agricultural activity since at least 1940.

Dennis W. Herman

Marsh prior to restoration. Note woody growth in background resulting from elimination of cattle and horses that once grazed the area.

Possibly the most significant natural area in the county, this wetland has been noted by local naturalists, birders, and herpetologists for over 30 years. An informal group of biologists has been studying the site with occasional visits since about 1971. An array of wildlife studies have been conducted and information about birds, reptiles, and plants all indicate the special biological nature of this wetland. Vegetational analysis and soil surveys were used to delineate the wetland, and site hydrology was monitored for a year prior to construction.

The marsh is composed of at least four separate wetland zones including different assemblages of plant species. There is some uncertainty about classification of these communities, given their long history of human and agricultural disturbance and natural dynamics. Among the names applied to the existing plant assemblages by those who have been there, are Piedmont Fen or Meadow Bog, Wet Meadow, Marsh Hibiscus Pool and a Boggy Alder Thicket. There is also a willow and birch lined ditch and a large, tree-covered clay pan which functions like an extended ephemeral pool. Each aspect of these areas offers a variety of wildlife habitat based on the diversity of plant species and water quality.

Present are zones of shrubs such as buttonbush (*Cephalanthus occidentalis*), swamp rose mallow (*Hibiscus moscheutos*) and tag alder (*Alnus serrulata*). Woody plants scattered throughout include silky dogwood (*Cornus amomum*), swamp rose (*Rosa palustris*), and the non-native multiflora rose (*Rosa multiflora*). Herb-dominated zones include sedges (*Carex* spp.) and grasses, American bur-reed (*Sparganium americanum*), and cattail (*Typha latifolia*). Other herbs scattered throughout include monkeyflower (*Mimulus ringens*), lamp rush (*Juncus effusus*), arrowleaf tearthumb (*Polygonum saggitatum*), swamp milkweed (*Asclepias incarnata*), orange touch-me-not (*Impatiens capensis*), white vervain (*Verbena urticifolia*), and a hedge hyssop (*Gratiola* sp.). Drier areas support ironweed (*Veronia noveboracensis*),

tick trefoil (*Desmodium* sp.), and grasses such as redtop (*Agrostis stolonifera*), fescue (*Festuca* sp.), and timothy (*Phleum pratense*).

The mitigation plan included a 40 acre buffer of old fields around the wetland site. Key to the project success may be these enhancements, which restored additional parts of this floodplain to a wetland condition, increasing its value as a functional and biodiverse wetland. Ditches were filled, two more pools were excavated, and raised berms and a freeboard dam were constructed to control water levels in the area. Continued monitoring of the plant community development and hydrology are taking place in restored areas now that the construction phase is completed.

On-going threats to the site are primarily a result of the nearby human population. The major threat to water quality is fertilizer runoff from nearby develop-ments, and buffers have been constructed to help absorb some of the excess. The primary animal threats to wildlife are from free-ranging domestic cats and an apparent over-abundance of raccoons. Cats hunt wildlife even if they are well fed at home. Raccoons proliferate as a result of free food offered by humans in the form of garbage, compost piles, and pet food left on porches. These predators endanger the eggs, young, and adults of most reptiles found in the site; the eggs and chicks of ground nesting birds; and almost all other small animals. Biologists' recommendations for the site include management for these pest species. They menace many conservation initiatives throughout eastern North America.

SITE SIGNIFICANCE: Regionally significant due to the size of the wetland, the complexity of its natural communities, and the presence of at least one species listed as threatened and several uncommon species.

PROTECTION STATUS: Easements, management plan, and transfer of the land to a qualified conservation organization after the NCDOT mitigation requirements are fulfilled, will accomplish long-term protection.

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Beavers kill large trees by girdling them, eliminating patches of canopy. This technique also works well when used by humans to limit shading.

colonize so thickly that other plants are excluded, including the rare pitcher plant.

Plants can be topped, limbed, or cut back to the ground in order to make openings. However, this treatment often may cause a bushy regrowth. Felling of large trees can also have a literal impact, depending on what they hit when they fall. Another method, bark girdling, removes the bark cutting off nutrient supplies to the roots, resulting in the death of the tree while leaving it standing as a snag. Standing dead snags can provide additional habitat for many species for many years. Eventually the tree will fall and provide important habitat and cover for animals and other species. Girdling is an easy, effective, and selective technique that can cheaply kill woody species using simple tools.

Managing Woody Debris

Cutting techniques generate lots of debris, which may also need to be managed. In some cases this accumulation must be removed from the wet region, and may be used to create nearby brush piles for animal habitat. Another use for this material may be within the wet

core area —by placing it as a beaver might to make low dams perpendicular to the slope of the valley. These structures slow down the flow of water and spread the flows into sheets across the ground surface. They also increase the ability of the wetland to filter and trap sediments, capturing material to increase the organic material retention. They can be used in conjunction with other methods to increase retention of water in the site (see Chapter 6). If these structures are effective in altering the surface hydrology, this modification may increase the wetness of the site and might also help modify surrounding vegetation for the benefit of wetland species like pitcher plants. Excessive flooding may occur during springtime or other wet periods and should be avoided, as it may drown eggs or otherwise harm some wetland species.

Mowing and Using Heavy Equipment

On those sites where it is deemed appropriate to use heavy equipment to fell and remove trees or mow down herbs and brush, care must be taken to minimize the adverse impacts of this type of work. Not only the physical impact of the equipment, intentional and incidental, but also the probability of fuel and oil spills, and other contamination must be expected and planned for. It is important that the equipment operator be aware of management goals or work under close supervision.

Box 5.3 Woody Vegetation Cutting Suggestions

- With the help of a professional, assess what to cut based on the desired outcome.
- Use the least impact method possible.
- Limit canopy removal to 25-50 percent per year.
- Plan to use or manage the cuttings.
- Avoid stepping on hummocks and other areas where hatchlings or eggs could be disturbed.
- Disturb only one patch of the site at a time. Assess the impact before continuing.

In many cases a skilled equipment operator can use experience and finesse to augment the plan and make necessary corrections once work has started. Do not leave an operator unsupervised as most equipment can make a dramatic impact quickly, and some mistakes are uncorrectable.

Many agricultural techniques like mowing and haying can also be used to manage vegetation in and around wetland sites. The timing of any vegetation management operation should be such that no harm is done to native species of plants and animals encouraged by the wetland management plan. Care should be taken to avoid cutting pastures too low, which can damage nests, kill small animals, and scalp tufting, clumping, and climbing vegetation. Consultations with local biologists and wildlife managers can be used to plan the best time and frequency of cutting, mowing, or haying operations. Slight alterations in typical farm activities can profoundly impact a wetland and its native communities. Delaying mowing just a few weeks or leaving an unmowed area as a buffer and refuge, may only slightly affect farm operations, but may be critical to a flowering or nesting species' reproductive success for the year.

Horse logging, a technology of a past era, is regaining favor for use in conditions where environmental impact from standard equipment is a concern. Horses can get into tighter areas with less surface stability than wheeled equipment. Horses can also disturb the surface less during log skidding. Horse hoof prints also do not channel water flow in the same way as tire ruts which can dramatically change the way surface water flows.

Grazing and Browsing Animals as a Means of Vegetation Control

Many types of animals make their homes in native wetland communities, living off the productivity of the plant communities in a particular area. Commonly, large animals like deer and beaver can crop woody vegetation enough to have a dramatic impact. Other

Box 5.4 Mowing and Heavy Equipment Use Suggestions

- Use the least impact method possible.
- When mowing, don't cut close.
- Don't mow more than once a year, less often if possible. Unmowed grassy and weedy areas provide important refuges and foraging areas for many forms of wildlife, including various game species, songbirds, and butterflies.
- Minimize ruts and compaction of soils and vegetation.
- Plan to minimize and mitigate fuel, oil, and grease contamination in the site.
- Avoid working during known breeding times and in suspected breeding places.
- Limit canopy removal to 25-50 percent per year.
- If using heavy equipment, disturb only one patch of the site at a time. Assess the impact before continuing.

animals like small mammals, insects, and birds can have an equally impressive impact on native plant communities by eating vegetation, pollination, seed dispersal, and other activities. As the biodiversity of the wetland restoration increases, many more levels of structure and interaction become evident.

Animals can be one of the most effective and important means of controlling unwanted vegetation by their grazing, browsing, bark stripping, root eating, and other woody vegetation manipulations. While some animals graze fresh succulent new growth, others gnaw at bark and, in the case of beavers, even fell sizable trees. Common large animals, like cows, horses, goats, and sheep, can keep vegetation well trimmed in any paddock. These and other agriculturally important farm animals have been used as vegetation management tools for centuries.

Livestock Grazing

Benefits derived from limited grazing include retardation of woody vegetation and shrubs, and prevention of channel formation. Hooves break up the rootstocks of shrubs and allow sheet flow to be restored. When livestock are removed from wetlands, water no longer pools in hoof prints, channels appear, and water flowing out of the site is increased. This enhanced flow in channels can cut deep grooves into the soil, increasing the detrimental effects of water lost to the system. Besides inhibiting channel formation, hoof prints also provide hiding areas for bog turtles and other wetland animals and exposes mineral soil for seed germination. However, excessive numbers of livestock can create problems by denuding vegetation and increasing nutrient input from fecal droppings.

At one time many conservationists thought that removing grazers was important for many rare wetland species populations to persist. In light of recent studies however, cattle and other livestock are now considered vital in maintaining site suitability for bog turtles and other rare species. The benefits derived from grazing can far outweigh negative impacts such as accidental trampling of plants and animals, compaction of soil, and additional nutrient enrichment.

A flexible system with the capacity to move animals into and out of the wetland, or provide grazer access only at specified times of the year will be the most useful and potentially the most agriculturally productive. Paddock management, fencing, alternative watering sources, heavy use areas, and controlled wallows have proved to be positive investments in many streamside and wetland sites—benefiting both the farmer's business and the environment of the watershed. These are practices where the strength of conservation agencies can help landowners with new technical information and financial assistance (see Chapter 7).

The best grazers for promotion of bog turtle habitat appear to be beef cattle; goats or sheep may have similar or perhaps greater benefits, but these have not been studied. Limiting grazing density to no more than one animal unit (= one mature beef cow, also see Glossary) per acre will optimize the situation for both pasture health and turtle success.

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Managing wetlands may include seasonal exclusion of livestock.

Adjustments can be made when other types of grazers, such as dairy cattle, horses, or sheep, are involved. Once a grazing regime is in place it can be fine-tuned by removing or adding livestock to the site.

The use of excluder fencing and seasonal grazing (winter grazing) are important conservation tools for the management and protection of bog turtle and other wetland species habitats. Seasonal exclusion of cattle has been proven to be an effective management tool in regulating soil and vegetation impact: denuded areas become reestablished with vegetation, sensitive plants can grow, and safer conditions exist for wetland nesting animals. Cattle can be permitted free access to the wetland during late fall and winter, permitting the benefits described above. Researchers studying a dangerously small population of bog turtles in North Carolina recorded a population increase of 85% within a 5-year period after seasonally restricting cattle. Other strategies include allowing grazers access to the sites year-round, but drastically limiting their numbers. Protection of nesting areas is paramount to the success of turtle populations.

Although bog turtles and some other rare species do indeed coexist with wild and domestic grazers, some plants cannot tolerate interaction with livestock. The size and type of wetland community have to be correctly matched with the amount and type of grazing in order to limit negative impacts on the wetland natural communities.

Box 5.5 Wetland Grazing Suggestions

- Allow only light to moderate grazing.
- Beef cattle are the preferred grazer; but horses are also highly effective. Goats and sheep may also have important beneficial effects.
- A ratio of 1 animal unit per acre is preferred.
- Grazing on a seasonal (winter only) rotation basis is acceptable. Construct a fence around the site allowing a buffer of native vegetation to filter polluted runoff.
- Use fertilizer and lime sparingly when applying to lawns and fields surrounding any wetland.
- Use excluder fencing around known or suspected turtle nesting areas, sensitive plants or plant colonies.

Chemical Controls of Vegetation

The modern tools of vegetation control include herbicide chemicals. In any vegetation management project, questions will always arise regarding the advisability of chemical herbicides for the control or elimination of undesirable plants. Chemical herbicides are complex formulations mixed to meet specific goals in specific situations. Because of the complexity of testing, labeling, and use, most herbicides are targeted for major markets, like agriculture, lawn care, or terrestrial weed control.

Using Chemicals with Caution

Each year chemicals are released into the environment in many forms ranging from raw petroleum products to refined pharmaceuticals. These chemicals amount to billions of pounds each year. The fates of these chemicals and the life cycle of their products in the environment are largely unknown. The release into the environment of chemicals commonly known

as pesticides can be especially risky as they are designed to be toxic. When deciding to use pesticides, one must consider the balance between benefit and risk. Herbicides are a type of pesticide used to kill plants.

Registration of herbicides follows a complex set of rules that seek to allow the sale and use of chemicals judged to produce more benefit than harm. However, out of all theoretical possibilities, it is only possible to research the likely and obvious uses of chemicals. Therefore the labels of herbicides are specific about how they can and should be used. Use of any herbicide in a manner not intended on the label is illegal and both personally and environmentally risky. Because of the relatively small amount of applications of herbicides in and around water and the complexity of adding chemicals to aquatic solutions, few herbicides are labeled for use in aquatic or wetland conditions.

Testing for labeling includes herbicide toxicity in several types of models: breakdown products, persistence in the environment, potential to accumulate in the food chain, and hazards to non-target species. This complex assessment allows chemical manufacturers to claim benefits as weighed against potential and documented risks. Few chemicals have been tested with rigor for their impact on the environment, including unintentional consequences to non-target organisms and humans. Many chemicals can and do react to form complexes of products, most of which have not been well-studied. The interactions and accumulation of these products and their unintended consequences have, however, been documented with a few now famous case studies of DDT and 2,4 D effects on wildlife. Caution in the use of herbicides is always recommended. It is therefore crucial to apply herbicides according to label recommendations.

There may be conditions in wetlands where concerns for the effectiveness and efficiency of plant growth control offset unintended impacts of chemical herbicides. In these situations the selection of the proper chemical, application, timing, and technique can reduce negative impacts as well as enhance effectiveness.

At the time of development of your management plan, a review of the available labeled herbicides should be undertaken. Labels and chemical formulations change as older compounds are replaced with newer formulations for new uses. It is often best to check with the local cooperative extension agent to get an update on what might be available to achieve the intended goals for chemical vegetation control. Names and product descriptions given in Appendix G are for discussion and are not intended as endorsements.

Application Techniques

Herbicides are typically applied as sprays, liquid paints, injections, granular formulations, or fumigants. There are no granular formulated products or fumigants appropriate or labeled for wetland conditions. Some of these might be used in adjacent crops and these measures should be researched relative to the management plan.

The use of spray equipment allows for many combinations of nozzle type, orientation, and pressure to achieve correct delivery and contact of the herbicide with the target plant while minimizing drift. Label recommendations are given regarding equipment and acceptable weather conditions approved for use. It is worth emphasizing that the use of spray equipment, while perhaps the easiest strategy, produces the most non-target damage and drift. See Appendix G for more details of herbicide use in wetland restoration.

Simple tools can be used to stem inject using the cut and frill technique. A sharp knife or hatchet is used to make cuts down into the cambium, leaving the bark attached. The bark stays attached and forms a cup for application of the herbicide. These cuts, called frills, should be arranged to encircle the stem or trunk. The number of cuts is proportional to the diameter of the stem. Each of these cuts is then filled with herbicide using a squirt bottle or brush.

A treatment called stem injection uses a hatchet equipped with herbicide to inject herbicide with each cut. Cut and frill and

stem injection techniques are good methods to deliver the active ingredient only to the target plant, thus minimizing unintended impacts on other vegetation. The number of cuts or injections made in the stem controls delivery of the active ingredient. Larger stems require a larger number of cuts or injections, usually one per inch of stem diameter. Stem injection and cut and frill may not be useful on stems less than a few inches in diameter.

When using the cut and frill, or stem and stump painting techniques, the likelihood of an herbicide spill is high and must be considered likely. The results of dripping or splashing herbicide onto the ground, water, or non-target plants might be risky in habitat containing rich biodiversity or rare species. Extreme care should be taken when using these techniques.

In the specific case of the bog turtle and some wetland herbaceous species, woody vegetation forms a closed canopy over the wetland target of the vegetation management. With the removal or opening of the canopy vegetation, an equally important colonization of the surface by herbs will most likely be promoted. These herbs are not only important cover and root mass to hold the deep mud in place, but also the basis for the food chain. As plants are the foundation of the food chain, animals that depend on them will ultimately be affected by their loss. If herbicides can be confined to the canopy or inside the body of woody stems, the chance of negative impact on the herbaceous feeders on the ground is diminished.

Care must be taken whenever manipulations of wetland vegetation might have impacts broader than the target goals. There should always be concern for the sensitivity of non-target species to herbicide chemicals or their by-products in the wetland ecosystem.

Timing and Application Variables

Given a choice of a particular herbicide and its labeled uses, a wide range of treatment variables will affect the outcome. The amount of active ingredient needed for the desired effect will vary, depending on the seasonal and daily timing of the herbicide treatment, the species of plant and its stage of growth, the weather, temperature, and the thoroughness and consistency of the application technique. An effective result may be hard to duplicate if these parameters are not well documented. This difficulty is the reason why most manufacturers recommend a small test area before large-scale use of herbicides. This recommendation is especially useful if there is concern about effectiveness and other impacts in a situation where there is little experience.

Many herbicides achieve maximum effectiveness during the period of maximal growth of the target plant, a situation which in this case may also coincide with the maximum activity of the bog turtle and other wetland species. If convergence is deemed a problem, adjustments in treatment time might still prove effective. For example, avoiding herbicide application during the turtle breeding and nesting period may lower herbicide effectiveness. However, there are obvious benefits of not bothering the turtles during this important part of their life which may justify this action. Perhaps just avoiding the known nesting habitat during the active season might be another solution.

Target Species

Target plant species that need to be managed in freshwater wetlands include the native woody species that dominate later stages of succession into a wetland forest community. The climax woody species of canopy size include Canada hemlock (Tsuga canadensis), red maple (Acer rubrum), black gum (Nyssa sylvatica), tuliptree (Liriodendron tulipifera), sweet gum (Liquidambar styraciflua), black willow (Salix nigra), green ash (Fraxinus pennsylvanica), and sycamore (Platanus occidentalis). Shrubs may include great laurel (Rhododendron maximum), mountain laurel (Kalmia latifolia), silky willow (Salix sericea), tag alder (Alnus serrulata), silky dogwood (Cornus amomum), southern wild raisin (Viburnum nudum), poison sumac (Toxicodendron vernix), and spicebush (Lindera benzoin).

Many freshwater wetlands in the Piedmont and Mountain regions have been invaded by introduced alien species like multiflora rose (Rosa multiflora) and Chinese privet (Ligustrum sinense), often specifically mentioned as labeled species controllable by herbicides. Poison ivy (Toxicodendron radicans) may pose a problem in some wetlands as it can become dominant in disturbed wet areas along the edges of farm pastures. Any opening of the canopy may become an area colonized by poison ivy. This danger may actually be more of a deterrent for human visitors than resident species. Poison ivy is, however, a target species for many herbicides, which in fact have proved successful in management of this potentially aggressive vine.

When a chemical treatment is considered for wetland vegetation control, it should be integrated into a management plan that outlines ultimate goals and timelines of steps used to achieve these goals. These chemical techniques can and should be used in conjunction with other methods of woody vegetation management. It would be unlikely that a single herbicide treatment would achieve all the management goals in the typical wetland.

When used with care, a single herbicide treatment, correctly and environmentally applied, can be an effective tool. However, the use of herbicides brings with it many documented problems and unknown effects that may endanger long-term success of wetland management. In areas where rare species are found, all recommendations from the EPA and chemical manufacturers suggest that chemicals be considered only as an option of last resort.

Box 5.6 Chemical Use Suggestions

- Use chemicals only as a last resort.
- Use chemicals with the least impact.
- Minimize non-target vegetation impact.
- Plan to minimize and mitigate chemical contamination of the site.
- Leave refuges for wildlife.
- Avoid treating during known breeding times and in suspected breeding places.
- Limit vegetation removal to 25-50 percent per year.
- Use chemicals only on one patch of the site at a time. Evaluate the impact before continuing.
- Use an application technique that is targeted and appropriate.

Fire as a Management Tool

The influence of fire on the natural communities of the Mountains and Piedmont has not been fully appreciated. Studies suggest that naturally ignited fires burned regularly in the native plant communities of North America. More frequent and larger fires on the Coastal Plain grade to less frequent and smaller fires in the Mountains and Piedmont. The topography and variability of habitats make for barriers, limiting the spread of fire through the major communities. The impact of fires on formation of wetland communities is not definitively known. Indeed, no publications about fire ecology in these small, freshwater, Mountain and Piedmont wetlands were found. Likewise, the use of fire as a management tool in these sites is only vaguely covered in the literature. However, it would be reasonable to assume that wetlands are not immune from fire when conditions are right. Some parts of a wetland, like the fringe communities and the canopy, could burn without the most sensitive core of the wetland surface experiencing a hot fire situation. As more is learned about the dynamics and development of natural communities, we will understand the essential role that fire can, (and in some cases must) have on natural systems.

Fire is a useful tool, common in the tool kit of many landowners and land managers. Many people and agencies have experience with using prescribed fires for maintenance of fire dependent natural communities. Forest management went through a period of fire suppression and prevention which has proved both damaging to natural communities and dangerous when excess combustible fuel accum- ulates. Foresters have begun to re-introduce fire as a part of the natural and healthy ecology of many managed areas.

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A hand-held torch can be used to spot burn individual woody plants.

There is now significant evidence that fire is an efficient and selective tool, worth using in the right situations. There are also specific techniques that use fire to control invasive weedy plant species, prepare seedbeds, promote seed germination, reduce combustible litter, and enhance soil fertility from the ash. Most of these forestry techniques rely on prescribed and controlled ground fires set with drip torches and wicks. These fires propagate along the surface and in the herb, shrub, and sub-canopy species, are generally controlled in such a way as to limit the impact on canopy trees. Fire roads, fire breaks, backfires, teamwork, preplanning, permitting, and a careful watch of the weather are all necessary parts of a successful burn. This type of burn is an integral part of most terrestrial landscapes; however, the use of these techniques might be inappropriate or impossible to use in wetlands. In some cases a limited ground fire might be the right tool for a wetland management job and therefore should be considered.

Other techniques that use fire as a management tool rely on torches to burn only the target species and are much more selective. Several versions of commercially available torches have been developed for use in special applications. These propane-based torches are usually small, light weight, and easy to use. Torches have been used on specific targets like weeds growing in cracks in sidewalks or at the base of metal fences. Some have been used for weed control in greenhouse, nursery, and tree farming situations. Smaller units have even been advertised for homeowner use in weeding flower and garden beds. The advantage of control and selectivity makes these torches promising in the control of wetland vegetation where burning the surface can be avoided. It is often on the surface that the most significant and least fire adapted wetland plants and animals are found.

The benefits of this technique on the target vegetation depends on the type of fire treatment and the sensitivity of the species involved. The frequency and seasonal timing of fire can dramatically influence effects on the target plants. In most cases hot and intense fire can kill plant tissues directly with the effects of the heat, desiccation, and direct combustion of leaves, stems, and seed. Plants with significant underground stems or tubers or fire protected stems and buds can survive and recover from fire. Plants without these adaptations may not be directly killed by the fire, but may be stressed to the point that they become susceptible to attack by insects or other pathogens, which can then kill the plant. A good source of information about the effects of fire as a management tool can be found in the Fire Effects Information System (FEIS). FEIS provides up-to-date information on fire effects on plants and animals. It was developed at the USDA Forest Service Intermountain Research Station's Fire Sciences Laboratory (IFSL) in Missoula, Montana. The National Wildfire Coordinating Group and the USDA Forest Service sponsor this national inter-agency information source. The FEIS Information Center is maintained by the Intermountain Region computer staff. The database is available on the Internet at: www.fs.fed.us / database / feis / welcome.htm.

Prescribed controlled burns have been used to try to eliminate reed canary grass (Phalaris arundinacea) in a bog turtle wetland in Pennsylvania. This strategy is based on a report from Illinois that burning five years in a row effectively controls this species. Three

years of early December burns have not proven effective at the Pennsylvania site. This same group is also using experimental light grazing (1 animal unit / acre) on a rotational basis to reduce cover, create water pockets, and control invasive species. They also girdle trees to control succession to forest and are considering some burning in the tussock sedge habitats of the bog. The results of this management study have not been published.

One technique of using a torch to eliminate woody vegetation depends on the promotion of systemic pathogen infections that subsequently causes plant death. In this method the target vegetation is cut 6-12 inches off the surface at some time early in the growing season. Several weeks later the plants resprout new succulent growth, when air and water temperatures have warmed. At this point a flame from a torch is used to singe or sere these new shoots, breaking the surface cuticle and damaging the outer cell wall defenses of the plant. This procedure leaves the plant susceptible to invasion by naturally occurring pathogens that can find their way into these open wounds. Experiments show that this treatment results in a higher probability of plant death than cutting alone. Several field tests of this technique in bog turtle habitat have documented some its effectiveness in the short term. The long-term effect of this treatment over several seasons is also being observed. There is need for both experiment and long-term follow-up on the effects of fires in freshwater wetlands. Also, the results of different variations and augmentations of the torch technique, along with more traditional ground fire, will undoubtedly improve our understanding of the critical aspects of the technique and improve its application to wetland vegetation management.

A related technique, using super-heated steam, has also proved effective in weed control. With water as the active ingredient and only by-product, this technique should be attractive for use in wetlands. Currently, the equipment is produced in New Zealand and is only recently becoming available in the United States.

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Additional Resource

Fire Effects Information System database is available on the Internet at:
www.fs.fed.us / database / feis / welcome.htm. An online resource with specific information on a broad list of plant species and their responses to fire. Examples, management case studies, and literature review for many species.