**Virginia Biology Technical Note –**
**Aquatic Systems #1**

# "Wetland Management"

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## INTRODUCTION

Wetlands are among the most biologically productive ecosystems in the world, and are vital to the survival of many animals and plants. Wetlands provide breeding, nesting, feeding, and resting habitat for waterfowl, wading birds, and other wildlife such as frogs, turtles, salamanders, muskrats, and aquatic insects. Wetlands can also provide important winter cover for upland wildlife.

Wetlands help improve water quality by intercepting surface runoff, trapping sediment, and processing nutrients and organic wastes before they reach open water. Many wetlands also store water temporarily, allowing the water to percolate slowly into the ground, evaporate, or be absorbed by the roots of wetland plants. This temporary storage reduces the peak water flows after a storm and decreases flood damages downstream.

Plants that grow in wetlands (usually referred to "hydrophytic plants") provide food and cover for many species of wildlife. Seeds, stems and rootstocks of these plants are important waterfowl foods. Their germination, growth, and availability for food are dependent on the water regime of the wetland.
Plants also serve as a food source for many smaller members of the animal community. When plants and plant debris are flooded and begin to deteriorate, they provide nutrients for many small aquatic animals.

These small animals, such as snails, insects (especially caddisflies, beetles, true flies, and midges/ bloodworms), crustaceans (fairy shrimp, clam shrimp, water fleas, scuds), and earthworms, provide a major food source for waterfowl and wading birds. They are an especially important food during protein-demanding periods such as egg-laying or molting.

Wetlands that are intended to provide wildlife habitat should be designed to provide water regimes that are suitable for the desired wildlife species. Wildlife utilize a wetland based on how deep the water is, when and how long the water remains on the site, and the food and cover that is available.

Flooded wetland plants provide excellent resting and feeding areas for "puddle ducks" that "tip" to feed, such as mallard, widgeon, pintail, and teal. The optimum feeding depth for most of these ducks is 3 to 8 inches of water. In the spring, wetlands with shallow water areas (mud flats to 3 inches deep) are especially beneficial for shorebirds, such as plovers and sandpipers, on their northward migration. Canada geese will also feed in these shallow depths.

**VIRGINIA WETLAND PRACTICES**

The following list of Virginia Wetland practices is provided to assist with determining which practice to implement for a specific situation. Differences between the practices are detailed within the descriptions. Once the practices to be used are determined, management of the wetland is covered in proceeding topics.

**Wetland Wildlife Habitat Management** (644) is defined as retaining, developing or managing wetland habitat for wetland wildlife. Wetland wildlife management is typically centered around the timing and depths of water in the wetland, and its effects on the plant community. This practice cannot be used alone, but it must be included in a wetland plan in order to document and quantify habitat improvements for wetland wildlife. Other practices may include (but are not limited to)

- Wetland Restoration (657)
- Wetland Creation (658)
- Wetland Enhancement (659)
- Shallow Water Development and Management (646)
- Critical Area Planting (342)
- Tree and Shrub Establishment (612)
- Riparian Forest Buffer (391)
- Riparian Herbaceous Cover (390)
- Early Successional Habitat Development (647)
- Prescribed Burning (338)
- Pest Management (595)
- Brush Management (314)

**Shallow Water Development and Management** (646) is defined as the inundation of lands to provide habitat for fish and/or wildlife. The major differences between this practice and wetland creation (658) is the requirement for water depth to be maintained between 1 and 18 inches during periods of planned inundation and the sole purpose of providing habitat for wildlife species.

**Constructed Wetland** (656) is defined as an artificial ecosystem with hydrophytic vegetation for water treatment. Constructed wetlands are designed to treat wastewater and contaminated runoff from agricultural processing, livestock, and aquaculture facilities, or for improving the quality of storm water runoff or other water flows lacking specific water quality discharge criteria. This standard is for water quality only and does not have any primary wildlife considerations.

**Wetland Restoration** (657) is defined as the rehabilitation of a degraded wetland or the re-establishment of a wetland so that soils, hydrology, vegetative community and habitat are a close approximation of the original natural condition that existed prior to modification to the extent practicable. In this definition, rehabilitation is restoring an existing, but degraded wetland, back to its original condition. Re-establishment is the process of restoring a lost wetland back to its original condition. The critical determinant is whether there are hydric soils on the site, indicating the historical presence of a wetland. Wetland restoration may be used in manipulated, drained, and/or degraded wetlands or areas of hydric soils. Examples of these type areas are "prior converted" cropland, "farmed wetland pasture", and other agricultural lands and woodland where the hydrology has been altered by drainage or the native vegetation has been removed and replaced with non-native species. Restoration often includes plugging ditches and closing tile lines to reestablish hydrology in the area. In some cases, the original hydrologic factors that created the wetland's timing, duration, and depth of water no longer exist. If other sources of water can be supplied in a manner which provides self-sustaining hydrologic conditions over the long term, the effort can be considered a restoration.

**Wetland Creation** (658) is defined as the creation of a wetland on a site that was historically non-wetland (no hydric soils present). The creation will provide wetland hydrology on a geomorphic setting that was not originally wetland. Wetland creations usually have the highest cost and management requirements. They are usually done for only one function such as providing wildlife habitat, educational opportunities, wetland mitigation or improving the quality of water from nonpoint source runoff. A created wetland is not the same as a constructed wetland, which is built to treat point and non-point sources of pollution.

**Wetland Enhancement** (659) is defined as the rehabilitation or re-establishment of a degraded wetland, and/or the modification of an existing wetland, which augments specific site conditions for specific species or purposes; possibly at the expense of other functions and other species. An enhancement project is still in the original wetland geomorphic setting, but its functions have been altered to add additional benefit for particular species or purposes. For example, an increase in water depth, duration of water presence, or a change in plant community from the one originally supported by the natural wetland is considered to be an enhancement. An enhancement usually requires more management and is more expensive to construct. It augments specific functions, often at the expense of other functions. Possible enhancements include (but are NOT limited to)

- replace failing water control structure or install where none existed
- modify existing drainage system or water source
- exclude deleterious livestock/human activity
- manage water depth, flooding frequency, timing, and duration
- enhance micro-topography
- control nuisance wildlife
- establish wetland plants
- manage desired vegetation
- control of invasive/noxious plant species

**WETLAND PLANT MANAGEMENT**

Wetlands support trees, shrubs, sedges, rushes, or other native plant species. The different plant communities that grow in wetlands are dependent on the depth, duration, and seasonality of the water regime. One option in wetland restoration is to restore the natural plant community that originally occurred on the site, or at least a much younger version of the original community.

Another option is to restore the wetland to some other natural wetland plant community. For example, if you are primarily interested in providing habitat for waterfowl and wading birds, you will probably want a

wetland that consists mostly of herbaceous plants that grow in shallow water. Along with the herbaceous vegetation, you may want to add small areas of shrubs and/or trees on parts of the site. Mowing or burning may be used if needed to reduce encroachment of woody vegetation into herbaceous wetlands. This maintenance should not occur more often than once every two to three years. Do not mow between April 15 and August 15 to avoid disturbing resident wildlife.

For wetland areas that are intended to support trees and/or shrubs, mowing is generally not permitted after the desired woody plants are well established. Maintenance plans may allow selective thinning of less desirable woody species (e.g. sweetgum, red maple) to improve growing conditions for more desirable species such as oaks. Natural wetland plants have low nutrient requirements, and do not need additional fertilizer. Avoid harming wetland wildlife by restricting pesticide/herbicide use.

Plants that are considered "undesirable" are those that tend to tend to "take over" a site, to the exclusion of other plants. Undesirable plants in Virginia include cocklebur, reed canarygrass, phragmites (common reed), cattails, and all noxious weeds. These plants should be controlled by spot treatment, using mechanical methods or approved herbicides. The best approach for dealing with undesirable plants is to inspect your site periodically during the growing season and control undesirable invaders before they colonize a large area. Be especially alert if you have undesirable plants nearby that can readily seed into your wetland.

Once well-established, most undesirable plants are difficult to control. Cutting, burning, and herbicide applications can work, but you risk damaging desirable wetland plants. Removal by hand is a possible solution if the undesirable plants occupy only a small portion of the site. However, plants such as phragmites and cattails have extensive root systems, so digging out more than a few of these plants is difficult.

Water management techniques can sometimes be used to reduce problems with nuisance plants. Seeds of reed canarygrass, phragmites, and cattails germinate best on moist soils, but not under several inches of water. Maintaining high water levels in the spring will help to discourage seed germination of these undesirable plants.

**WETLAND WATER MANAGEMENT**

Wetlands that have a variety of shallow water depths and soil moisture levels will support a diverse natural plant and wildlife community. During the growing season, water depths ranging from surface saturation to no more than 6 inches of water are usually best for plant growth. A few plant species will also grow in deeper water.

Providing permanently or semi-permanently wet "frog holes" on at least 20% of the site will especially benefit resident wildlife such as ducks, geese, herons, frogs, toads, salamanders, and turtles that need a long-term water supply. Most amphibians, for example, need semi-permanent water (at least until July) for egg-laying and tadpole development, while some need water year-round. Depending on the species, adult amphibians may spend most of their lives in shallow water or in adjacent upland forests and wet meadows. Naturally filling pools should be encouraged within the wetland system. Most aquatic wildlife need to spend some time resting, preening, or basking out of the water. Consider placing a few large tree branches and logs in the restored wetland to provide this type of habitat.

If you do not want to actively manage water levels or plants on a regular basis, then nature will do it for you. The wetland will have a natural water regime in which water levels rise and fall seasonally in response to varying natural conditions, such as rainfall, groundwater levels, evaporation rates, etc. The water level may be managed occasionally if needed to control noxious weeds or invasive species, or to make structural repairs. Plants on less managed herbaceous sites will tend to be perennials such as sedges, rushes, and many of the grasses. Perennial plants usually produce fewer seeds than annuals, but they can provide good year-round wildlife resting, nesting, and brood rearing cover. In addition to seeds, the foliage and rootstocks of these plants can be eaten by waterfowl, wading birds, marsh birds, beavers, and muskrats.

Water level manipulations are one of the most effective tools in wetland management, provided these fluctuations are well timed and controlled. Manipulations are most effective on sites with a dependable water supply; an elevation gradient that permits complete water coverage at desired depths over a majority of the site; and the proper type of water control structures that enable water to be supplied, distributed, and discharged effectively at desired rates. The size and location of structures are important, but timing, speed, and duration of drawdowns and flooding also have important effects on plant composition, plant production, and avian use. When optimum conditions are not present, effective moist-soil management is still possible, but limitations must be recognized.

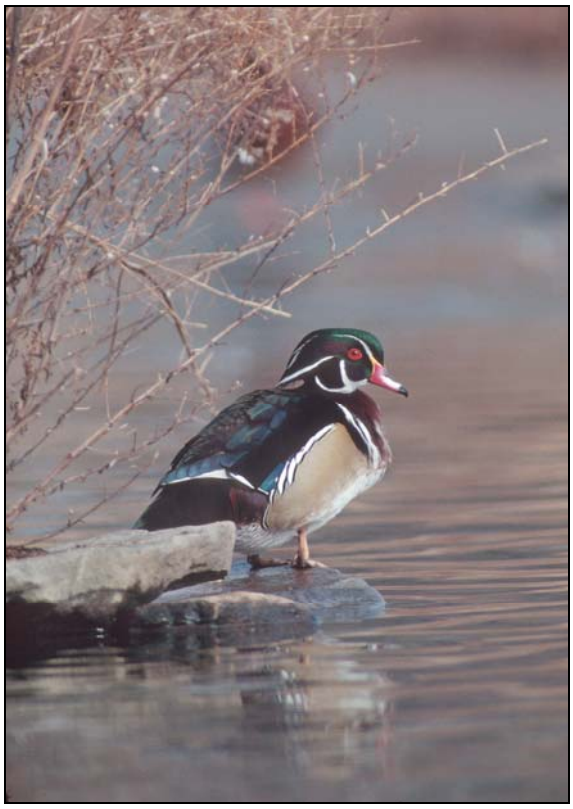
Wild millet, rice cutgrass, smartweeds, sedges, rushes, and many other desirable plants can be encouraged through water level manipulations to germinate from existing seed sources in the soil, and produce an abundant source of high quality food for waterfowl. Drawdown (de-watering) of the area is necessary for germination of moist-soil plants. Annual plants produce the most seeds and provide an abundance of waterfowl food. Therefore, to maintain an area in early successional species (mostly annuals), and to control unwanted species, it is best to de-water and lightly disk the area every 3 years.

Consider the plant seeds that are likely to exist in the soil when determining whether you can manage for the plants you want. What plants have you seen growing on the site in years when you didn't plant a grain crop? Seeds of those plants are probably still viable in the soil. The plant seeds available in the soil, and the timing and rate of the drawdown, will determine which plant species will grow in a restored wetland. Slow drawdowns, over a period of 2 to 3 weeks, are usually more desirable for plant establishment and wildlife use, and will reduce the amount of nutrients leaving the site (see Table 1). If you have a flashboard riser, pull one board and let the water drain down. After a few days, pull another board. Or, if you have a PVC standpipe with an elbow, tip it slightly to let just a few inches of water escape at a time. Slow drawdowns provide optimum conditions for germination of moist-soil plants, and result in the

greatest quantity of seeds produced by those plants in late summer. In general, early slow drawdowns during April result in germination of smartweeds and sedges, while midseason drawdowns during May produce millets and beggarticks.

Table 1. Effects of fast vs. slow drawdowns on selected resource concerns (adapted from the Waterfowl Management Handbook, Fish and Wildlife Leaflet 13.4.6, 1991).

| **Resource Concern** | **Duration of Drawdown** | |
|---|---|---|
| | **Less than 4 days (fast)** | **More than 2 weeks (short)** |
| Time available for seed germination of moist-soil plants | Short | Long |
| Growth and seed production by moist-soil plants after April drawdown | Good | Excellent |
| Growth and seed production by moist-soil plants after May or June drawdown | Poor | Excellent |
| Cocklebur problems | High potential | Lower potential |
| Availability of snails, soil insects, and earthworms for waterfowl food | Low | High |
| Waterfowl use of the site during April drawdown | Good | Excellent |
| Waterfowl use of the site during May or June drawdown | Poor | Good |
| Nutrients leaving the site | High | Low |



Shorebirds, such as plovers and sandpipers, feed on insects, small crustaceans, and earthworms in mud flats and in very shallow water (up to 3 inches) during the time of an early to midseason drawdown. Therefore, managed moist-soil areas can be a very important source of food for shorebirds during their spring migration.

After the moist-soil plants have produced seed in late summer or fall, re-flood the site slowly to coincide with the arrival of fall migrant waterfowl, usually September through November. Flooding the site slowly over a period of 2 to 3 weeks allows new areas of food to become available every day at the preferred water depth as the water is rising. Refer to Table 2 for the water depths preferred by various waterfowl and wading birds.

Table 2. Timing and depths of water needed by migrating birds (○ - fall/spring migrants and winter residents), summer resident birds (●), and resident amphibians and turtles (■).

| Wildlife Species | Preferred Surface Water Depths | Time of Year When Surface Water is Needed: | | | | | | | | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | |
| Shorebirds (Yellowlegs, Sandpipers, and Plovers) | 0* - 3 inches | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ ● | ● | ● | Shorebirds are late summer, fall and spring migrants; winter residents. Statewide during migration; wintering mostly on the Coastal Plain. |
| Marshbirds (Rails and Snipe) | 0* - 3 inches | | ○ | ○ | ○ | ○ | ○ | ○ | ○ ● | ● | ● | ● | ● | Marshbirds are fall & spring migrants; winter residents. Statewide during migration; wintering mostly on the Coastal Plain. |
| Geese | 0* - 3 inches | | ○ | ○ | ○ | ○ | ○ | ○ | ○ ● | ● | ● | ● | ● | Geese are fall & spring migrants; winter residents. Statewide during migration; wintering mostly on the Coastal Plain. Populations of permanent resident Canada geese also occur statewide. |
| Herons (Little Blue, Green, Great Blue, and Night Herons) | 1 - 4 inches | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ ● | ○ ● | ● | ● | Herons are fall & late spring migrants; some are winter residents. Statewide during migration; wintering mostly on the Coastal Plain. The Great Blue Heron can easily feed in water up to 12 inches deep. |
| Amphibians (Frogs, Toads, and Salamanders) | 1 - 8 inches | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Frogs and toads, and some salamanders, need areas of permanent shallow water for egg-laying and tadpole development, and to escape from predators. Eggs are usually laid in late winter to mid-summer. Tadpoles of most species develop into adults in less than 6 months (sometimes as little as one month), but other species need at least two years. Adults may live in the water or in adjacent upland buffers. |
| Turtles | 1 - 20 inches | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Aquatic turtles need areas of permanent shallow water for feeding and to escape from predators. Turtles lay their eggs in nearby uplands, and the young return to the water after hatching. |
| Dabbling Ducks (Wood Ducks, Mallards, Pintails, Gadwalls, Widgeon, Teal) | 3 - 8 inches | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ ● | ● | ● | ● | These ducks are fall & spring migrants; some are winter residents. Wood ducks and mallards are found statewide. Pintails, gadwalls, widgeon, and teal are found statewide during migration; wintering mostly on the Coastal Plain. |
| Diving Ducks (Mergansers and Ruddy Ducks) and Coots | 8 inches or more | | | ● | ● | ● | ● | ● | ● | ● | | | | These ducks and coots are fall & spring migrants; some are winter residents. Statewide during migration; wintering mostly on the Coastal Plain. |

Note: *When there is 0 inches of surface water, then the soil needs to be saturated to the surface (mudflat) to provide suitable feeding habitat.

Drawdowns are often described in general terms as early, midseason, or late. These drawdowns are considered within the context of the length of the local growing season. Early drawdowns are those that occur during the first 45 days of the growing season, whereas late drawdowns occur the latter 90 days of the growing season.

The timing of a drawdown has an important influence on the composition and production of moist-soil plants. An independent water supply for each management unit is required to optimize food production, maintain the potential to control problem vegetation, and make food resources available for wildlife. Stoplog water control structures or flashboard risers that permit water level manipulations as small as 2 inches provide a level of fine tuning that facilities control of problem vegetation or enhancement of desirable vegetation. During most years, early and midseason drawdowns result in the greatest quantity of seeds produced. However, there are exceptions, and in some cases, late drawdowns are very successful in stimulating seed production.

Slow drawdowns (2-3 weeks) usually are more desirable for plant establishment and wildlife uses. The prolonged period of soil saturation associated with slow drawdowns creates conditions favorable for moist-soil plant germination and establishment. For example, slow drawdowns late in the growing season can result in seed yields of 700 pounds per acre. Slow drawdowns also provide shallow water over a longer period, ensuring optimum foraging conditions for wildlife. When water is discharged slowly from a unit, invertebrates are trapped and become readily available to foraging birds along the soil-water interface or in shallow water zones. These invertebrates provide critical protein rich food resources required by pre-breeding and breeding female ducks, newly hatched waterfowl, and shorebirds. Shallow foraging is required by the vast majority of species. Slow drawdowns lengthen the period for optimum foraging and put a large portion of the invertebrates with the foraging ranges of many species.

Fall flooding should coincide with the arrival times and population increase of fall migrants. When flooding is possible from sources other than rainfall, fall flooding should commence with shallow inundation on impoundments suited for blue-winged teal. Impoundments with mature but smaller seeds, such as panic grass and crabgrass, that can be flooded inexpensively are ideal for these early migrating species. Flooding should always be gradual and should maximize the area with water depths no greater than 4 inches. As fall progresses, additional units should be flooded to accommodate increasing waterfowl populations and other bird groups such as wading birds. A reasonable rule of thumb is to have 85% of the surface area of an impoundment flooded to an optimum depth at the peak of fall migration.

A typical moist-soil scenario can be used for many years once competing vegetation has been eliminated through mowing, disking, burning and water level manipulation; and a diverse community of natural waterfowl food plants has been established.

1. Drawdown during late February to early March to expose soil. Drawdowns should be gradual to concentrate invertebrates for waterfowl and shorebirds.
2. Maintain drawdown through April for germination of target plant species. Standing water should not cover the area during this period.
3. In late April to early May – saturate soil to the surface by replacing lower stoplogs in the flashboard riser. Maintain until mid-October.
4. Mid-October to early November – flood impoundment to an average depth of 9 to 12 inches. Delay flooding if standing vegetation is green. (Spot burns may be conducted prior to flooding, if conditions are conducive.)
5. Closely monitor water levels throughout the fall and winter to maintain an average depth of 9 to 12 inches over the majority of the area.

**WILDLIFE MANAGEMENT CONCERNS**

Wetlands are intended to support wildlife, but some wildlife are less welcome than others. Beavers can significantly change a site's water regime and vegetation, and can cause structural failure by raising water levels above the intended design. They are difficult to discourage, and may need to be removed in accordance with state hunting and trapping regulations.

Muskrats can be beneficial because they control cattails and help maintain open water areas. However, muskrats can also cause structural failures by burrowing into berms. Burying chain link material into the berm immediately above and below the waterline can help to discourage burrowing. Damage can also be minimized by designing berms with gentle slopes to the waterline (5:1), and with a shallow bench adjacent to the berm at the waterline. Muskrats seem to prefer steep banks to burrow in, with an approach that is safely under water. A few steep-bank islands in the water will provide habitat where muskrats can safely burrow. If necessary, muskrats may need to be removed from a site in accordance with state hunting and trapping regulations.

Geese can be discouraged by making the wetland and buffer less attractive to them. Geese generally prefer areas of open water and low vegetation for easy access into and out of the site. To discourage geese, design the site to minimize open water and favor the growth of tall, dense vegetation in the wetland. In the buffer, tall grasses, shrubs, and trees will be much less attractive to geese than a well-manicured area.

**REFERENCES**


Fredrickson, L. H. 1991. *Strategies for Water level Manipulations in Moist-soil Systems*. U. S Fish and Wildlife Service Leaflet 13.4.6. 8 pp.

Mitchell, J.C., A. R. Breisch, and K. A. Buhlmann. 2006. *Habitat Management Guidelines for Amphibians and Reptiles of the Northeastern United States*. Partners in Amphibian and Reptile Conservation, Technical Publication HMG-3, Montgomery, Alabama. 108 pp.

USDA, NRCS. Wetland Restoration, Enhancement or Creation. Engi*neering Field Handbook Chapter 13, Part 650*, pp. 3, 24, 77, 78.

USDA, NRCS, 2003. *ECS 190-15 Wetland Restoration, Enhancement, Management & Monitoring*. 425 pp.

Williams, R. K.,, R. D. Perry, M. B. Provost, and S. E. Adair. 1998. *Management of South Atlantic Coastal Wetlands for Waterfowl and Other Wildlife*. Ducks Unlimited. Memphis, TN. 29 pp.