

Purpose

For any assistance provided to cooperators by NRCS when the practice may affect listed species, informal or formal consultation, or use of a biological opinion are required. This document provides guidelines, based on an intra-service biological opinion (BO) and supporting documents, for *maintenance grazing* in bog turtle habitat. *Restoration grazing* is not covered in this document because it requires additional criteria and the support of a qualified monitoring biologist.

Introduction

The northern population of the bog turtle (*Clemmys muhlenbergii*), which ranges from Massachusetts to Maryland, was listed as a federally-threatened species in 1997, and its current state listing in Maryland as a threatened species was established in 1994. Primary threats to the bog turtle are loss, fragmentation, and degradation of its early successional wetland habitat, and collection for the wildlife trade. Based on documented losses, the northern population has declined by at least 50 percent over the past 20 years. Evidence suggests that grazing has been instrumental in maintaining bog turtle habitat, and that in the absence of grazers (or more intensive human management), bog turtle habitat will often decline to the point where it can no longer support viable populations.

Bog turtles are semi-aquatic, and are typically active from April to mid-October, hibernating below the surface of wetlands or near streams the rest of the year. Female bog turtles reach sexual maturity between 5 and 8 years of age, and mating occurs in May and June. Eggs are laid in sedge tussocks or sphagnum moss in May, June, or July, and the young emerge in August or early September. The relatively long life expectancy of bog turtles (40 years or more) can be misleading when attempting to assess population viability, because adults may survive in degraded habitat, but reproduction may not be successful.

Bog turtles typically inhabit spring-fed wetlands that are dominated by emergent plant species. Critical habitat elements include shallow water, soft mucky bottoms, relatively low grasses and sedges, and an open canopy. Soft mucky bottoms are important for anti-predator defense and hibernation. Open canopy and low grasses and sedges support nesting and basking requirements. *For more information on bog turtle life history and conservation, an overview can be found in Smith 2006.*

Definitions

Bog turtle sites – Any site identified by Maryland DNR as known sites, whether currently or historically occupied. Can also include additional previously unidentified sites that contain suitable habitat, and in which bog turtle surveys have revealed that the site is occupied.

Maintenance grazing – Objective is to maintain habitat quality using grazers in a prescribed manner that controls invasion of woody and undesirable plants and maintains desired plant heights, while avoiding adverse impacts to bog turtles and their nest sites. Maintenance grazing may be prescribed after habitat is restored, or on existing habitat that is in good condition.

Restoration grazing – Objective is to restore habitat in a way that utilizes appropriate livestock to remove undesirable species. This type of grazing may be prescribed over a period of 1 to 5 years, depending on the type of livestock, plant species targeted for removal, and existing habitat quality.

Grazing Regimes

Continuous Grazing. When livestock are continuously grazed, they are given access to an area for an extended period of time. Extended access to pasture allows livestock to be selective in their forage consumption in terms of both forage type and location. Livestock will typically graze cool season forage in upland areas during spring and fall, and move to lowland areas in summer when upland forage goes dormant and lowland vegetation remains lush. Continuous grazing is the most inefficient method of grazing with respect to livestock use of available forage. In practice, livestock may be obtaining minimal amounts of their nutritional requirements from grazing in a continuous regime, so a large proportion of their requirements are provided by supplemental feed.

Flash Grazing. Flash grazing methods provide livestock access to an area for relatively short periods (usually less than 4 days) on an infrequent basis. In typical practice, a flash grazing prescription requires a high herd density (e.g. 20 AU/ac on 1 paddock) to efficiently and quickly utilize available forage.

Rotational Grazing. In a rotational grazing regime, livestock are rotated amongst paddocks (3 or more) on a regular schedule (usually 1 week or less on a paddock) that is designed and adaptively managed to maintain vegetative cover and promote efficient use and regrowth of forage. Rotational grazing is the most commonly prescribed grazing regime, and is especially important in grass-fed dairy and beef operations.

Grazing Regimes and Bog Turtles. Historically, most occupied bog turtle sites have been grazed under a continuous grazing regime, suggesting that the inefficiencies of the method are at least partly responsible for maintaining the necessary habitat conditions. Seasonal selection of pasture by livestock when provided continuous access is also suggestive of similarities with flash grazing. Both continuous and flash grazing have been utilized to manage bog turtle habitat. Rotational grazing, although not well known to be used in bog turtle habitat management, can provide important benefits to bog turtle wetlands by reducing pollutants from upland pasture. Hence, all three types of grazing may be applied individually or in combination for the benefit of bog turtles. However, prescriptions for flash and rotational grazing for the purpose of bog turtle habitat maintenance differ from those for normal grazing, which emphasize efficient forage use and livestock production.

The grazing prescription criteria in the next section are variations on the typical methods (described above), provided specifically for the needs of the bog turtle. Major differences include herd densities and grazing efficiencies. The flash grazing regime is probably the best technique for utilization of grazing for bog turtle habitat management, because exposure to livestock is limited, and livestock are subject to a high level of management during the period of access to the wetland.¹

Criteria for Maintenance Grazing of Bog Turtle Habitat on Pasture

The following criteria can be applied to address grazing solely for management of a bog turtle site, or as part of a grazing plan for an operation that includes a bog turtle site. Utilize these criteria for the management units that contain bog turtle habitat and are accessible by livestock. Criteria for three types of grazing – continuous, flash, and rotational – are provided. *Criteria required by the biological opinion (BO) are noted.*

Criteria are based on available science, and are subject to change. Managers should pay careful attention to the effects on habitat, and make adjustments accordingly. Recommendations made by a qualified biologist supersede these criteria.

¹ Scientific validation of this statement has not been confirmed, nor is implied.

Criteria Applicable to All Grazing Methods

- Exclude livestock from known nesting sites during the bog turtle nesting season (June 1 to September 30). Usually, nesting sites are not known, so exclusion is not required. When nesting locations are known, the area of exclusion usually consists of a very small fraction of the management unit (< 0.1 ac). *Contact the Maryland Department of Natural Resources, Wildlife and Heritage Service for nest location information.* **REQUIRED BY BO**
- Remove livestock from the management unit when forage heights meet a minimum threshold, and return livestock only after a specified amount of forage regrowth is attained. The minimum forage heights for the wetland vegetation are different than for typical forages due to the requirements of the bog turtle. Ideally, a pastured bog turtle wetland will consist of a mosaic of vegetation ranging from 10 to 36 inches. The majority of the vegetation should not be grazed below 12 inches. As a rule of thumb, livestock should be removed when 50 percent of the vegetation has been grazed to a height of 12 to 16 inches. Vegetation should be allowed to reach a height of 24 inches before grazing. Ideally, undesirable vegetation, such as reed canarygrass, would be grazed much lower than 12 inches, but this is generally not practical where a matrix of desirable and undesirable vegetation exists.
- For the calculation of available forage in the wetland area, consider the proportion of the wetland that the grazers will utilize for foraging. (e.g. Only include areas of herbaceous vegetation for cows, even though the wetland contains a mixture of herbaceous and woody vegetation.)
- When possible, include an area of upland buffer around the wetland to protect it from pollution. The buffer may be part of the enclosure that is accessible to livestock during the grazing period, or part of a separate pasture or natural area. For natural buffers, maintenance of herbaceous vegetation on the south side of the wetland is encouraged to allow penetration of sunlight to the wetland surface. If part of a buffer is planned to be established with trees and/or shrubs, consider the potential for colonization of the wetland by highly competitive species (e.g. red maple). Plant native species that are not competitive in wetlands.
- When possible, exclude livestock from streams.
- Exclude livestock from known locations of rare, threatened and endangered plant species.
- Avoid use of heavy equipment in the wetland area. If required, only use heavy equipment in the wetland area between November 1 and March 31, and only use heavy equipment in the soft, boggy areas, if necessary, when the ground is frozen. **REQUIRED BY BO**
- If installing fence, site fence posts in uplands whenever possible. If installing fence posts in the wetland area, *contact a monitoring biologist at the Chesapeake Bay Field Office of the U.S. Fish and Wildlife Service prior to installation.* **REQUIRED BY BO**

Criteria Applicable to Continuous Grazing

- Limit grazing density on the management unit to 0.75 animal units (AU) per acre. **REQUIRED BY BO**
- During the bog turtle nesting season, provide livestock with access to upland pasture at a ratio of 2 acres of upland for every 1 acre of wetland. **REQUIRED BY BO**

Criteria Applicable to Flash Grazing

- Limit grazing density on the management unit to 1 animal unit (AU) per acre. **REQUIRED BY BO**
- Limit use of the pasture to periods during the growing season when upland pasture is typically stressed or dormant (i.e., July – September).
- Limit the number of rotations on any one management unit to 2 times during the growing season.
- Provide livestock with access to an upland area of a minimum size equal to 10 percent of the wetland area.
- Provide a minimum of 30 days rest for wetland vegetation regrowth between rotations.
- Use the *Bog Turtle Habitat Maintenance Rotational Grazing Worksheet* (Attachment 1) to determine the number of animals and days per rotation for the livestock type. Typically, a rotation will be about 2 weeks.

Criteria Applicable to Rotational Grazing

- Limit grazing density on the management unit to 0.75 animal units (AU) per acre. **REQUIRED BY BO**
- Provide livestock with access to an upland area of a minimum size equal to 10 percent of the wetland area.
- Provide a minimum of 30 days rest for wetland vegetation regrowth between rotations.
- Use the *Bog Turtle Habitat Maintenance Rotational Grazing Worksheet* (Attachment 1) to determine the number of animals and days per rotation for the livestock type. Typically, a rotation will be about 2 weeks.

Prepared by Steve Strano, NRCS, Maryland State Biologist. This guidance document was developed for use by NRCS – Maryland and its partners. Legal authority by NRCS for *Clemmys muhlenbergii* is neither intended nor should be inferred. The status of *Clemmys muhlenbergii* as a threatened species under the Endangered Species Act and Maryland state law extends legal responsibility for protection of the species to the U.S. Fish and Wildlife Service and the Maryland Department of Natural Resources.

References

- Herman, D.W. 2004. *Bog turtle site management: Using selective cutting of native and alien plants and grazing as conservation strategies in the southeastern United States*. In: Lee, D.S., C.W. Swarth and K.A. Buhlmann (eds.), *Proceedings: Bog Turtle Conservation in Maryland: Use of the Public and Private Sectors in Protection and Management of Small Isolated Wetlands*, pp. 24-26. Jug Bay Wetlands Sanctuary, February 2001. 60 pp.
- Somers, A.B., K.A. Bridle, D.W. Herman and A.B. Nelson. 2000. *The Restoration & Management of Small Wetlands of the Mountains & Piedmont in the Southeast: A Manual Emphasizing Endangered & Threatened Species Habitat with a Focus on Bog Turtles*. A Joint Publication of the Watershed Science & Wetland Science Institutes of the Natural Resources Conservation Service, The University of North Carolina at Greensboro, and Pilot View Resource Conservation & Development, Inc.
- Smith, E.T. 2006. *Bog Turtle (Clemmys muhlenbergii) Fish and Wildlife Habitat Management Leaflet, No. 44*. USDA – Natural Resources Conservation Service, Washington, DC, and the Wildlife Habitat Council, Silver Spring, MD. 13 pp.
- Tesauro, J. 2001. *Restoring wetland habitats with cows and other livestock*. *Conservation Biology in Practice* 2:26-30.
- Tesauro, J. 2006. *Guidelines for grazing in bog turtle habitats*. Report prepared for the U.S. Fish and Wildlife Service, New Jersey Field Office, Pleasantville, NJ. 16 pp.
- Tesauro, J. 2007. *Personal communication*. Ecologist. Ecological Consulting. Livingston Manor, NY.
- U.S. Fish and Wildlife Service. 1997. *Final rule to list the northern population of the bog turtle as threatened and the southern population as threatened due to similarity of appearance*. *Federal Register* 62:59605-59623.
- USDA – Natural Resources Conservation Service. 2005. *Prescribed Grazing Plan Design Worksheet 2-A*. In: USDA – Natural Resources Conservation Service, *Maryland Grazing Handbook*, Annapolis, MD.
- U.S. Fish and Wildlife Service. 2001. *Bog Turtle (Clemmys muhlenbergii), Northern Population, Recovery Plan*. Hadley, MA. 103 pp.
- U.S. Fish and Wildlife Service. 2006. *Biological opinion: Effects of the implementation of habitat restoration projects on the northern population of the bog turtle*. Hadley, MA. 39 pp.

Bog Turtle Habitat Maintenance Rotational Grazing Worksheet

Calculation: Determine days per rotation.

1. Determine available acres for grazing in bog turtle management unit. Mgmt Unit Size = _____ ac (including associated upland area in the management unit)
2. Calculate equivalent number of animals that can be grazed on management unit:
 - a. From the grazing criteria, select the number of animal units per acre. AU/ac = _____ (1 AU/ac for flash grazing; 0.75 AU/ac for rotational grazing)
 - b. From table 2, select the animal unit equivalent for the type of livestock. AUE = _____
 - c. Calculate number of animals: No. of Animals = (Mgmt Unit Size x AU/ac) / AUE = _____
 - d. Round number of animals to nearest integer. No. of Animals = _____ (integer)
3. Convert number of animals (rounded to nearest integer) to animal units:
Total AU's = No. of Animals x AUE = _____ AU's
4. From table 3, determine forage availability per rotation. Available Forage = _____ lb/ac/rotation
5. Using table 1, determine daily forage intake rate. Forage Intake Rate = _____ lb/AU/day
6. Assume a grazing efficiency of 0.30. This efficiency rate has been adjusted down from typical rates (0.35 – 0.55) to maintain necessary habitat elements and vegetative structure.
7. Calculate days per rotation using the following equation:

$\text{Days per Rotation} = \frac{\text{Available Forage (lb/ac/rotation)} \times \text{Mgmt Unit Size (ac)} \times \frac{0.30}{\text{Grazing Efficiency}}}{\text{Forage Intake Rate (lb/AU/day)} \times \text{Total AU's}} = \text{_____ days}$
--

Example Calculation

Livestock type = dairy heifers, average annual hay yield = 3.0 tons/ac/yr, grazing regime = rotational

1. Mgmt Unit Size = **5 ac** (includes 10% upland)
2. Number of animals that can be grazed:
 - a. For rotational grazing, use 0.75 AU/ac
 - b. AUE = 0.92
 - c. No. of Animals = (5 ac x 0.75 AU/ac) / 0.92 AUE = 4.07 animals
 - d. Rounded(4.07) = **4 animals**
3. Total AU's = 4 animals x 0.92 AUE = **3.7 AU's**

4. Available Forage = **1,200 lb/ac/rotation**
5. Forage Intake Rate = **30 lb/AU**
6. Grazing Efficiency = **0.30** (assumed)
7. Calculation:

$$\text{Days per Rotation} = \frac{\frac{1,200 \text{ lb/ac/rotation} \times 5.0 \text{ ac} \times 0.30}{\text{Available Forage}}}{\frac{30 \text{ lb/AU/day} \times 3.7 \text{ AU}}{\text{Forage Intake Rate} \times \text{Total AU's}}} = \underline{16.2 \text{ days}}$$

Table 1. Average Daily Forage Intake for Typical Livestock

Livestock Type	Forage Intake Rate (lb/AU/day)
Lactating Dairy Cow	35
Stocker Cattle, Dairy Heifers	30
Beef Cow/Calf, Swine, Horses	26
Sheep, Goats	37

Table 2. Average Animal Unit Equivalent (1 AU = 1000 lb)

Animal Type	AUE	Animal Type	AUE
Heifer/Dry Cow	0.92	Sheep, mature	0.20
Lactating Holstein	1.50	Lamb, 1-yr old	0.15
Lactating Jersey	0.90	Goat, mature	0.15
Beef Cow/Calf	1.00	Kid, 1-yr old	0.10
Bull, Mature	1.35	Deer	0.15
Cattle, 1-yr old	0.60	Elk, mature	0.60
Cattle, 2-yr old	0.80	Bison, mature	1.00
Horse, Mature	1.25		

Table 3. Estimated Forage Production per Rotation.

Based on average annual hay yield. For wetland vegetation, can assume 3.0 tons/ac/yr, if not otherwise known.

Hay Yield (tons/ac/yr)	Forage (lb/ac/rotation)
4.0	1600
3.5	1400
3.0	1200
2.5	1000
2.0	800