

# INTEGRATED MANAGEMENT GUIDELINES FOR AMERICAN WOODCOCK AND GOLDEN-WINGED WARBLER IN THE APPALACHIAN REGION



Appalachian  
Mountains  
Joint Venture



July 2012

# ACKNOWLEDGEMENTS

---

Development of these Management Guidelines was funded through a grant from the National Fish and Wildlife Foundation in cooperation with American Bird Conservancy and Appalachian Mountains Joint Venture. Contributors to this publication include Steve Capel, John Coleman, Tom Cooper, Katherine Greenwald, Tricia Miller, Amber Roth, Pat Ruble, and Andrew Vitz. We would like to thank Pennsylvania Department of Conservation and Natural Resources Bureau of Forestry, the Pennsylvania Game Commission, and Blooming Grove Hunting and Fishing Club for personnel, resources, and access to their lands, and Cathy and Warren Cooke for their financial contribution. Technical review of this publication was provided by: xxx and xxx.

Authors of this publication are Marja H. Bakermans and Jeffery Larkin, Indiana University of Pennsylvania; Brian Smith and Todd Fearer, Appalachian Mountains Joint Venture, American Bird Conservancy; Benjamin Jones, Pennsylvania Game Commission; and Scot. J. Williamson, Wildlife Management Institute.

Recommended citation. Bakermans, M. H., J. L. Larkin, B. W. Smith, T. M. Fearer, B. C. Jones, and S. J. Williamson. 2012. Integrated Management Guidelines for American Woodcock and Golden-winged Warbler in the Appalachian Region. American Bird Conservancy. The Plains, Virginia. 32 pp.

Design template by Debra Reynolds, U.S. Fish and Wildlife Service, modified by Marja Bakermans. Cover photos provided by Brian Smith (background), Jeff Larkin (Golden-winged Warbler) and Eric Dresser (woodcock).

*Golden-winged warbler, Christian Artuso*



# CONTENTS

Introduction.....	1
Disturbances.....	2
Then and Now.....	2
Wildlife and Young Forests.....	3
Wildlife Use of Young Forests.....	4
Food Resources.....	4
Cover.....	4
Purpose of This Document.....	5
Where Are They?.....	5
New England.....	7
Northern Appalachians.....	8
Southern Appalachians.....	9
Habitat Needs.....	11
Best Management Practices.....	11
Forest Cover in the Landscape.....	11
Young Forest in the Landscape.....	11
Management of Stands.....	12
Residual Trees.....	13
Saplings and Low-growing Woody Cover.....	15
Herbaceous Ground Cover.....	15
Management Tools.....	15
Tools to Maintain Young Forest.....	15
Mechanical Treatment.....	16
Prescribed Burns or Grazing.....	16
Herbicide Application.....	18
Tools to Create Young Forest.....	19
Timber Management.....	20
Even-aged Practices.....	20
Uneven-aged Practices.....	21
Reclaimed Minelands.....	22
Energy Development.....	23
Summary.....	24
References.....	25



*Regenerating forest stand. Scot J. Williamson*



*Woodcock feeding. Tim Flanigan*

# INTRODUCTION

Early successional or young forest habitats are dominated by shrubs and young trees less than 5m tall, and contain varying amounts of grasses and forbs. Often, this kind of habitat is referred to as scrub-shrub, brush, or thickets. Young forest habitat is created through either natural- or human-caused disturbances and starts the natural process of forest succession – a process of ecological change. Vegetation structure and species composition rapidly change in these stands and typically remain in an early successional state for fewer than 20 years. Consequently, wildlife that rely on young forest habitat may find them available for only short periods of time.

Young forest habitats can occur through a variety of processes like farmland abandonment, old field succession, and forest regeneration. Forms of young forest habitat include shrublands, woody wetlands, reclaimed minelands, regenerating timber harvests, utility rights-of-way, and barrens. It is important to provide a variety of these types of young forest habitats throughout the landscape to accommodate a suite of disturbance-dependent species.



*Reclaimed mineland. Jeff Larkin*



*Old field succession. Jeff Larkin*



*Scrub-oak barrens. Douglas Gross*



*Wetland. Douglas Gross*

# DISTURBANCES

---

**D**isturbances are major initiators of forest succession and stand development and play a large role in shaping forest structure. By killing existing plant species, disturbances create growing space and allow new plants to occupy the area. Natural disturbances may be caused by insects, mammals (e.g., beavers), fires, wind and storms, disease, and drought. Human disturbances include agriculture, timber harvesting, burning, and urbanization.

## Natural Disturbances



*Beaver meadow, John Confer*



*Tornado damage, Andrew Vitz*



*Insect damage, Jeff Larkin*

## Human-caused Disturbances



*Timber harvest, Robin Wildermuth*



*Abandoned farmland, Jeff Larkin*



*Utility right-of-way, Jeff Larkin*

# THEN AND NOW

The forested landscapes of the eastern United States have gone through tremendous changes since European settlement. Post-European settlement, forests were first cleared for new and growing settlements, and later for agriculture and timber. After about 1850, partial recovery of forests began with the abandonment of farms that converted back into forests.

Not surprisingly, the amount of young forest habitat on the landscape has varied tremendously as well. Once lands were abandoned in the 1850s – 1950s a high proportion of the forest was in young forest habitat. In 1953 and 1977, it has been estimated that 17% and 27% of all timberland in the northeast was 0 – 19 years of age. Today it is quite a different landscape. In 2010, the northeastern United States only had about 5.6% of the forested land in young forest habitat, and this has been consistently declining. The graph to the right illustrates the limited amount of young forest habitat in states throughout the Appalachian Mountains of the eastern United States (Figure 1).

Historically, it is estimated that about 10 – 15% of forests were in an early successional state, being naturally disturbed. But lower levels of young forest exists today because of loss of forest cover to development, forest management that does not consider natural processes, and a suite of conditions that are different from historical conditions, like fragmentation, loss of predators or plants in ecosystems, reduced disturbance regimes, public versus private land ownership, and public opposition to forest management practices.

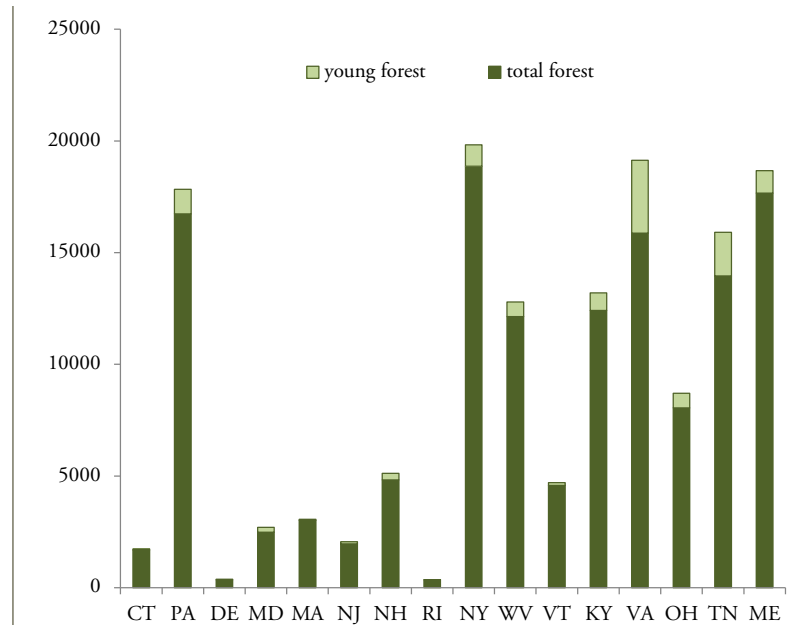


Figure 1. Acreage (in thousands of acres) of young forest (light green) and total forest (dark green) coverage in the Appalachian Mountains regions of eastern United States. Data accessed from the USDA Forestry Inventory Analysis (2006 - 2010).

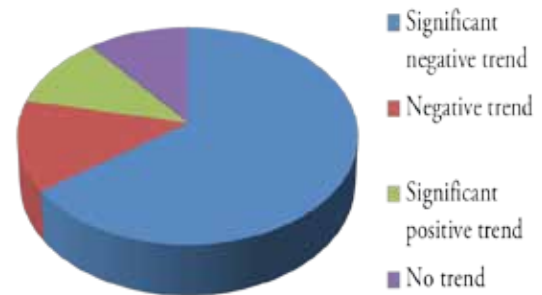


Figure 2. Trends for eastern bird species that use early successional habitats where 65% of species are significantly declining, 13% are declining, 11% are significantly increasing, and 11% show no trend (1966 - 2009; Sauer et al. 2011).

# WILDLIFE AND YOUNG FORESTS

A large number of species use or depend on young forest habitat for their daily, breeding, migratory, or non-breeding activities. The table to the right (Table 1) includes selected amphibian, reptile, mammal, and bird species that use young forest habitat with their preferred component of young forest habitat.

Because young forest habitat has been in decline in eastern North America, many of these species are experiencing population declines. It is estimated that in the northeast, approximately 200 vertebrate species occur in young forest habitat, and 65 of these species of birds, mammals, and reptiles are considered Species of Greatest Conservation Concern. According to Breeding Bird Survey results from 1966 - 2009, 79% of bird species that breed or use successional or scrub habitats in the eastern United States are experiencing population declines (Figure 2, previous page).

Species	Grasses and Forbs	Shrubs and Saplings	Pole Stage
<b>Amphibians</b>			
American toad ( <i>Bufo americanus</i> )	X	X	X
Gray tree frog ( <i>Hyla versicolor</i> )		X	X
<b>Reptiles</b>			
Rough green snake ( <i>Opheodrys aestivus</i> )	X	X	X
Smooth green snake ( <i>Opheodrys vernalis</i> )	X		
Timber rattlesnake ( <i>Crotalus horridus</i> )	X	X	
Bog turtle ( <i>Glyptemys muhlenbergii</i> )	X	X	X
Shorthead garter snake ( <i>Thamnophis brachystoma</i> )		X	
<b>Mammals</b>			
Golden mouse ( <i>Ochrotomys nuttalli</i> )	X	X	
Allegheny woodrat ( <i>Neotoma magister</i> )	X	X	
New England cottontail ( <i>Sylvilagus transitionalis</i> )	X	X	
Appalachian cottontail ( <i>Sylvilagus obscurus</i> )	X	X	
Snowshoe hare ( <i>Lepus americanus</i> )	X	X	
Indiana bat ( <i>Myotis sodalis</i> )	X	X	
Bobcat ( <i>Lynx rufus</i> )		X	
Red fox ( <i>Vulpes vulpes</i> )	X		
Elk ( <i>Cervus elaphus</i> )	X	X	
<b>Birds</b>			
Northern bobwhite ( <i>Colinus virginianus</i> )	X	X	
Ruffed grouse ( <i>Bonasa umbellus</i> )	X	X	X
American woodcock ( <i>Scolopax minor</i> )	X	X	X
Eastern whip-poor-will ( <i>Camprimulgus vociferus</i> )	X	X	
Northern flicker ( <i>Colaptes auratus</i> )	X		
Willow flycatcher ( <i>Empidonax traillii</i> )		X	
White-eyed vireo ( <i>Vireo griseus</i> )		X	
Eastern bluebird ( <i>Sialia sialis</i> )	X	X	
Gray catbird ( <i>Dumetella carolinensis</i> )		X	
Brown thrasher ( <i>Toxostoma rufum</i> )		X	
Golden-winged warbler ( <i>Vermivora chrysoptera</i> )	X	X	
Blue-winged warbler ( <i>Vermivora cyanoptera</i> )	X	X	
Prairie warbler ( <i>Setophaga discolor</i> )	X	X	
Yellow-breasted chat ( <i>Icteria virens</i> )	X	X	
Eastern towhee ( <i>Pipilo erythrophthalmus</i> )	X	X	
Field sparrow ( <i>Spizella pusilla</i> )	X		
Indigo bunting ( <i>Passerina cyanea</i> )	X	X	

Table 1. Selected wildlife species and their preferred component of young forest habitat.

# WILDLIFE USE OF YOUNG FOREST

Widespread use of early successional habitats by wildlife, and especially young animals, are likely due to abundant food resources and dense cover. Both of these components promote survival because young wildlife lack extensive experience in foraging and detecting and evading predators.

## FOOD RESOURCES

Regenerating forests provide especially rich arthropod resources because there is a high volume of vegetation concentrated within a few feet from the ground. In young forest habitats, numbers of arthropods increase with saplings and shrubs being present and are more abundant than in adjacent, mature forest habitat. Arthropods likely prefer vegetation within regenerating forests due to leaves being more palatable and containing fewer secondary compounds compared to older plants. During the breeding season, arthropods are the primary food source for nearly all North American passerine birds and their nestlings, and arthropod abundance is known to be linked to selection of breeding territories, reproductive success, and distribution of birds in habitats.



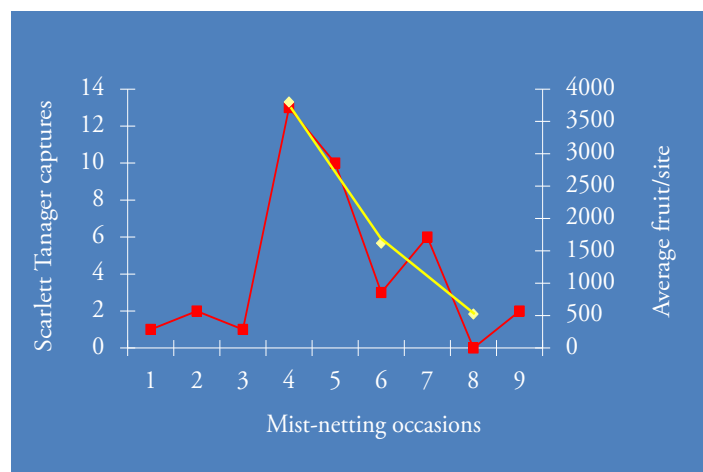
*Sumac (above) and blackberry (below) fruits are just a few of the fruits produced in young forest habitats. Andrew Vitz*



Some species also may use early successional habitat to gain access to the fruit resources. Fruit-bearing shrubs and trees, like blackberry (*Rubus* spp.), pokeberry (*Phytolacca americana*), blueberry (*Vaccinium* spp.), viburnum (*Viburnum* spp.), dogwood (*Cornus* spp.), sumac (*Rhus* spp.) and hawthorn (*Crataegus* spp.) provide ample resources for wildlife. Young forests produce fruit resources during mid-summer and before they are available in mature forests. It has even been shown that some species of birds track fruit resources and move into young forest habitats when fruits are most abundant (Figure 3).

## COVER

Young forest habitats provide thick vegetation cover that many species seek for nesting and brood-rearing (or post-breeding protection). Nesting or denning cover is important to conceal females and young from predators and bad weather during the breeding season. But even if wildlife do not breed in young forest habitats, they may seek out dense vegetation commonly found in regenerating forests for protection during the post-breeding season. Differences in habitat use between breeding and post-fledging periods are well documented for Ruffed Grouse, which frequently move their broods into areas of dense vegetation including young aspen stands and alder thickets. Using areas with dense vegetation may be a response to mitigate high risk of predation faced by juveniles.



*Figure 3. Many species of wildlife track food resources, especially fruits, in young forest habitats. Here you can see that the number of Scarlet Tanagers captured (red line) in regenerating forests closely matched the amount of fruit (yellow line) available at the site. Vitz 2006*

# A TALE OF TWO SPECIES

---

Two species in particular, the American woodcock and the golden-winged warbler, have become focal species for several efforts to create young forest habitat because of the drastic population declines they have been experiencing. Woodcock and golden-winged warbler populations have declined at a rate of 1.2% and 8.4%, in the eastern United States and the Appalachian Mountains, respectively. Population declines of both species have been linked to loss of young forest habitat.

## AMERICAN WOODCOCK

In the eastern United States, breeding woodcock inhabit mixed forest-agricultural areas from Maine to eastern Ohio and south to northern Virginia, western North Carolina, Kentucky and northern Tennessee (Figure 4). Current populations are estimated at approximately 350,000 individuals for the eastern region. Distribution of American woodcock is influenced by poorly drained soils, forest cover, and a mix of hardwood forest age classes on the landscape.

## GOLDEN-WINGED WARBLER

The golden-winged warbler has been experiencing steep population declines and now breeds in two disjunct populations – known as the Appalachian and Great Lakes populations (Figure 5, next page). The golden-winged warbler population has been estimated at 22,000 individuals in the Appalachian population. In this population, distribution of breeding birds is influenced by the interplay of elevation, landscape-scale forest cover, and the presence of blue-winged warblers.

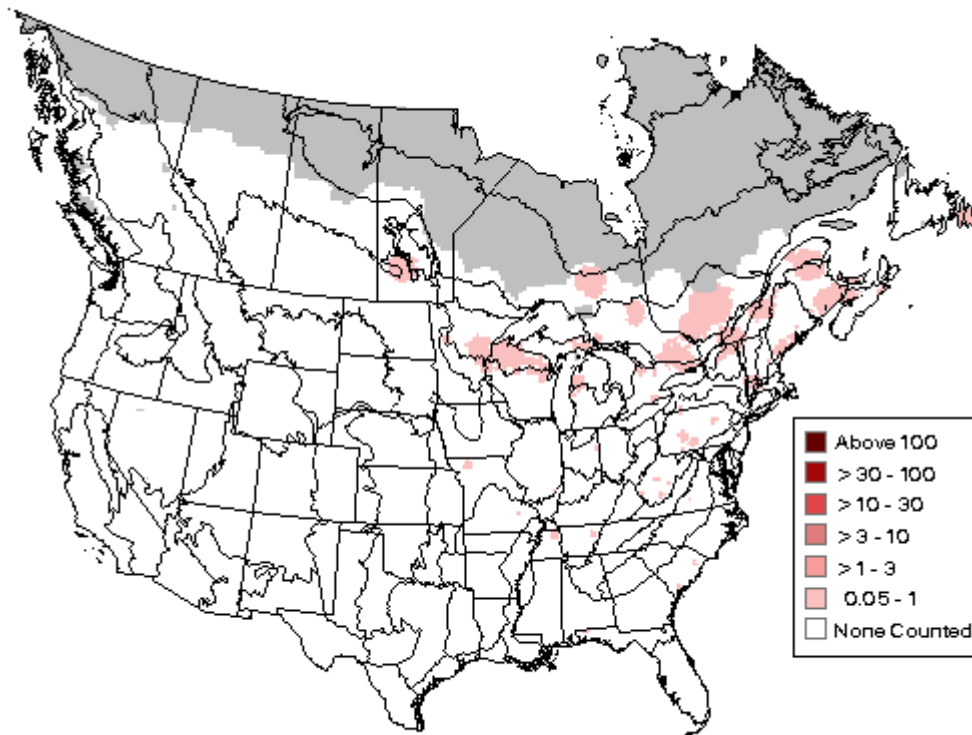


Figure 4. American woodcock Breeding Bird Survey distribution map (2006 – 2010, Sauer et al. 2011).

# PURPOSE OF THIS DOCUMENT

---

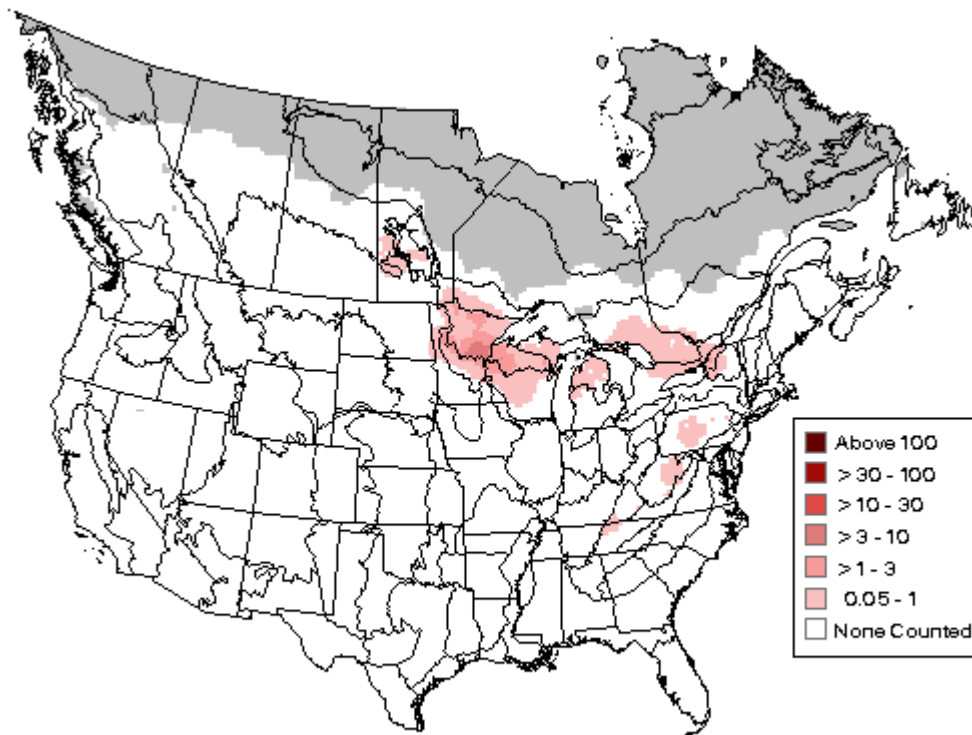
Before reading further in this BMP, we encourage you to read the documents *American Woodcock Habitat Best Management Practices for the Central Appalachian Mountains Region* (available at: [www.timberdoodle.org](http://www.timberdoodle.org)) and *Golden-winged Warbler Habitat Best Management Practices for Forestlands in Maryland and Pennsylvania* (available at: [www.gwwa.org](http://www.gwwa.org)). Both sources provide excellent, detailed information on the breeding biology, habitat needs, and management recommendations for each species.

## How is this BMP Different?

This document aims to help land managers and natural resource professionals determine 1) if there are woodcock, golden-winged warbler, or both on their land, and 2) in those areas of range overlap how they can manage for both species at the same time.



*Female golden-winged warbler on nest. Keith Watson*



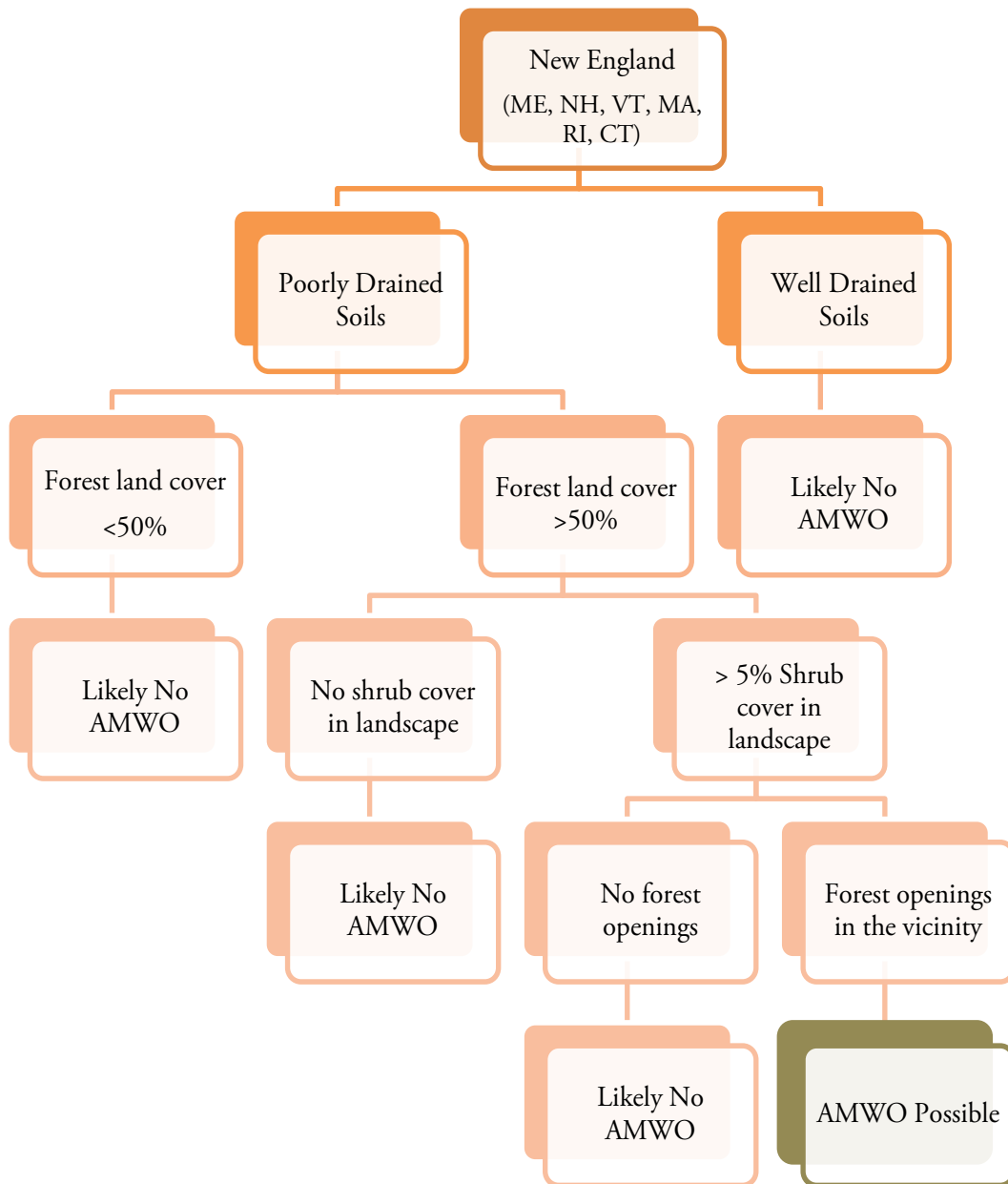
*Figure 5: Golden-winged warbler Breeding Bird Survey distribution map (2006 – 2010; Sauer et al. 2011).*

# WHERE ARE THEY?

American woodcock and golden-winged warblers can use the **SAME** young forest stands where their ranges overlap if the conditions are right for both species. We have created decision trees to help managers determine if woodcock, golden-winged warblers, or both species may be in your area. These decision trees are broken out by region: New England (ME, NH, VT, MA, RI, CT; see below), northern Appalachian Mountains (NY, NJ, PA, MD, WV; page 9), and southern Appalachians (VA, TN, NC, KY, GA; page 10).

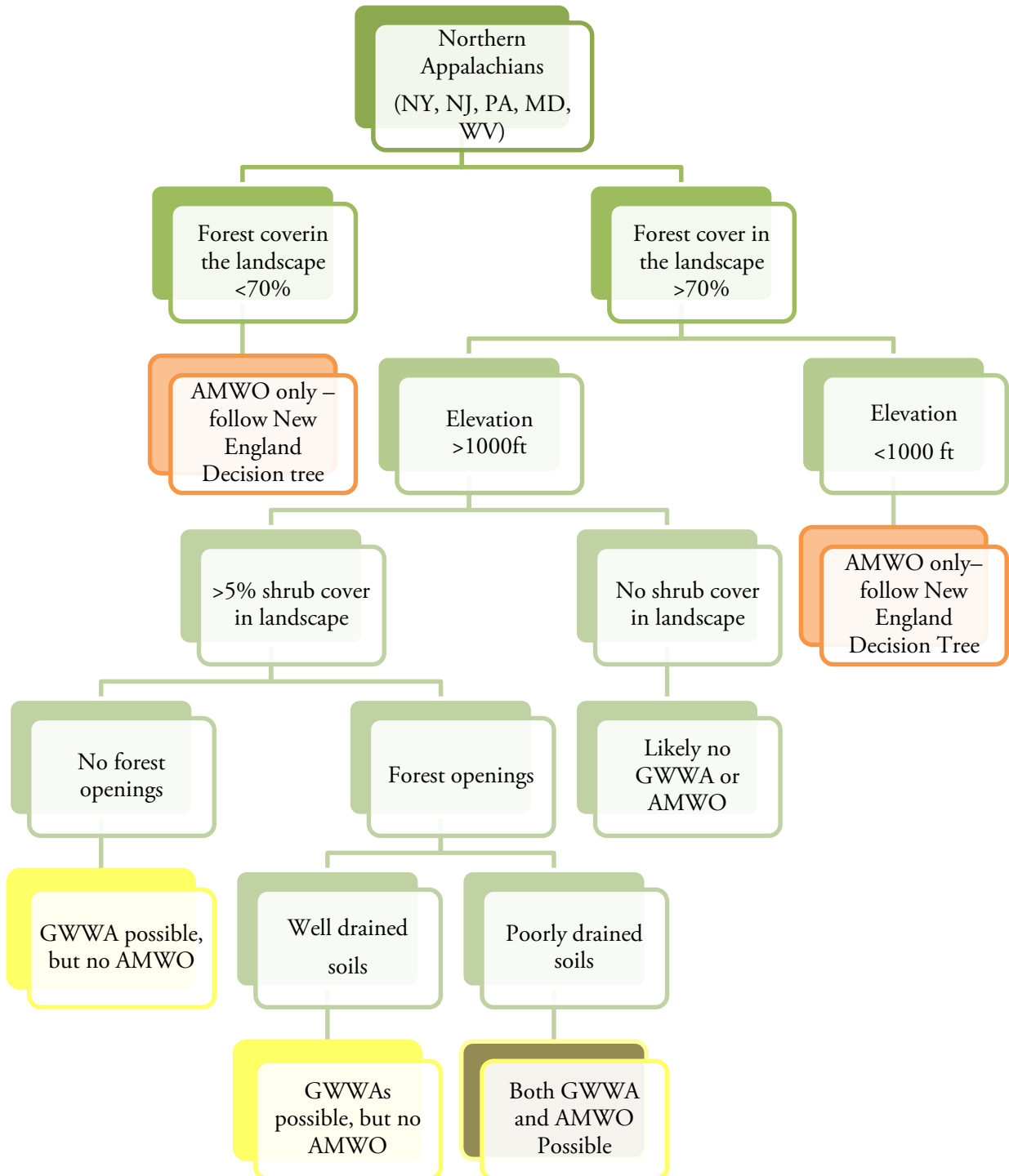
## NEW ENGLAND

Golden-winged warblers have been nearly extirpated from the New England region, so this decision tree only applies to woodcock. If you are working in an area that **ONLY** has woodcock, you can follow the guidelines set forth in the *American Woodcock Habitat Best Management Practices for the Central Appalachian Mountains Region*.

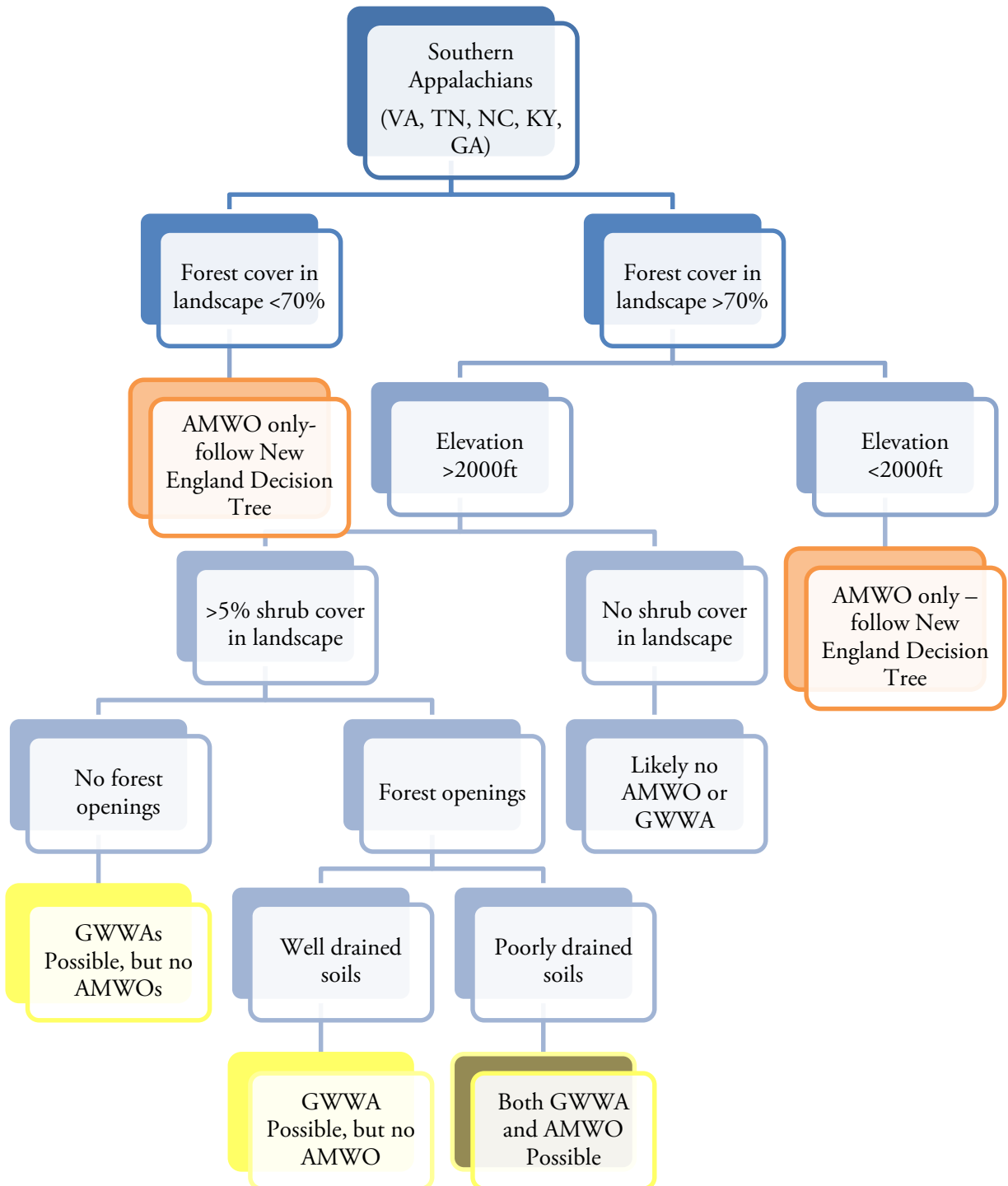


## NORTHERN AND SOUTHERN APPALACHIANS

The Appalachian Mountains region has the potential to have woodcock, golden-winged warbler, or both occupying an area even though abundance of each species declines as you travel further south. If in your path through the decision tree you determine that the area is potentially suitable for only woodcock, then refer back to the New England decision tree (page 8) and follow through the steps.



If you determine a site only has potential for golden-winged warblers you can follow the guidelines set forth in the *Golden-winged Warbler Habitat Best Management Practices for Forestlands in Maryland and Pennsylvania*. One caveat to these decision trees is that in **hardwood swamp forests** with a 30 – 70% open canopy (like within the Hudson Highlands in New York) presence of golden-winged warbler does not seem to be linked to elevation, and management may occur as low as 450 feet in elevation. Also remember that high elevations do not necessarily exclude woodcock and opportunities for management still exist near wetlands, beaver ponds, bogs, and seeps.



# HABITAT NEEDS

American woodcock require several stages of succession (often referred to as a mosaic of habitats) within close proximity to one another to meet their habitat needs. These needs are typically broken down into four categories: courtship, feeding, nesting, and roosting. For example, woodcock require small, forest clearings for courtship, pole forest for diurnal foraging of earthworms, and young forest for nesting, brooding, and roosting. Courtship areas are used for singing grounds where males display to females early in the breeding season. Courtship activities occur in clearings in timber harvests, natural openings, meadows, bogs, pastures, and reverting fields where males have enough space to fly out and into an area to perform his aerial display. The main diet of woodcock is earthworms so feeding areas must have moist, rich soils abundant in earthworms and cover to provide protection from predators. Woodcock nest on the ground in young, second-growth hardwood stands that may also serve as feeding areas. Roosting fields are where woodcock spend the night after the breeding season (i.e., about July until migration). Openings in timber harvests, pastures, and agricultural fields may be used as roosting areas. In order for the area to be suitable for woodcock, all of these habitat needs must be present in the landscape and within close proximity to one another.



*A diverse landscape that provides different habitats for woodcock. Scot Williamson*



*A woodcock nest in a young forest stand about 14 years post-harvest. Andrew Vitz*



*American woodcock. Eric Dresser*



*A stand with a mix of grasses, forbs, saplings, and retained trees that attracted breeding golden-winged warblers. Marja Bakermans*



*Eastern whip-poor-will and adult male golden-winged warbler. Jeff Larkin and Marja Bakermans*



*Swamp forest. John Confer*

Golden-winged warblers require a diverse vegetation structure of young forest habitats which may include forest created by timber harvests, wind or wildfire, abandoned farmlands, scrub barrens, managed shrublands, utility rights-of-ways, edges of reclaimed strip mines, and swamp forests with partially open canopies. We cannot emphasize enough the importance of swamp forests and landscapes with high proportions of wetlands in the Appalachians Mountains region. These forested wetlands have persisted as source habitats with genetically pure golden-winged warblers and high nest success. Of course, these wetland forests also provide feeding areas for woodcock.

Golden-winged warblers use **ALL** vertical layers of vegetation: they nest on the ground, forage on insects from shrub up to canopy trees, and males sing from canopy trees to delineate their territories. In general, young forest habitats that contain a patchy, heterogeneous environment that promotes both horizontal and vertical structure are preferred by golden-winged warblers. These habitats have varying amounts of shrubs, saplings, herbaceous plants, and bare ground with scattered trees and snags.

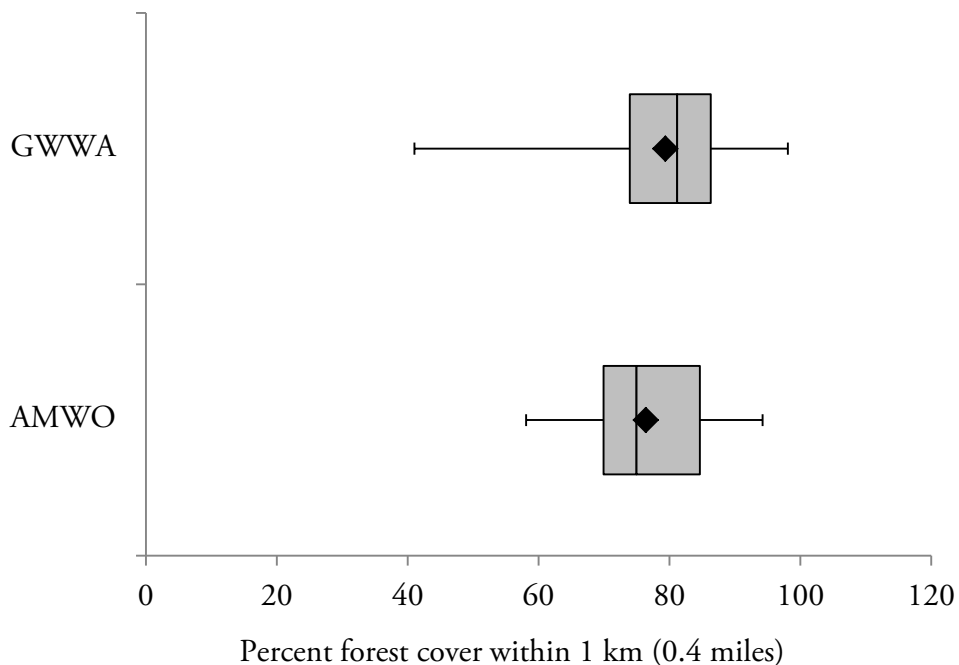


*High elevation site in the southern Appalachians. Katie Percy*

# MANAGEMENT GUIDELINES

---

Next, we provide management guidelines for selected habitat characteristics for each species. In these recommendations we include box-and-whisker plots of habitat variables from young forest stands (2 - 12 years post-disturbance) in Pennsylvania where American woodcock, golden-winged warblers or both were present. Data were collected during singing ground surveys in 2011 (for American woodcock) and point count surveys in 2010 – 2011 (for golden-winged warblers). Box-and-whisker plots provide six summaries for each group of data: the sample minimum (the smallest observation; where the line on the left ends), lower quantile (25% percentile that splits the lowest 25% of the data; the left side of the box), median (the middle value of all the data; the line in the box), upper quantile (75 percentile; the right line on the box), the sample maximum (the largest observation; where the line on the right ends), and the mean (the average of all data; the diamond). These boxplots illustrate that in landscapes where woodcock and golden-winged warblers both occur they can use stands with similar habitat characteristics.



*Above are box-and-whisker plots that illustrate the range, lower quantile, mean, median, and upper quantile of forest cover in the landscape surrounding stands of young forest habitat where Golden-winged Warblers and American Woodcock were present. Golden-winged Warblers were detected in stands with slightly higher mean forest cover (79%) compared to woodcock (76%).*

## **FOREST COVER in the landscape**

Forest cover on the landscape refers to all land that is forested within 0.5 miles of the proposed management site. For the purposes of this document, this should be predominantly hardwood forests and can be of multiple age classes (young to pole to mature to old-growth).

*How woodcock benefit:* Although woodcock use forest habitat for portions of its habitat needs (e.g., nesting areas), they are more flexible and can tolerate lower amounts of the forest landscape than golden-winged warblers. Woodcock can be found in landscapes that are mixed with agricultural fields and orchards. Many of these agricultural areas can be used for courtship, roosting and even foraging areas.

*How GWWA benefit:* Golden-winged warbler is a forest bird that breeds in young forest and uses mature forest during resting and post-breeding periods. Distribution of the eastern population of golden-winged warbler is influenced by an interplay of forest cover and elevation (>1000 ft in the northern Appalachians and >2000 ft in the southern Appalachians). Decreased forest cover in the landscape favors the settlement of the blue-winged warbler, a closely related species that will hybridize with and likely extirpate golden-winged warblers.



*A management site for both woodcock and Golden-winged Warblers in a highly forested landscape in north-central Pennsylvania. Jeff Larkin*

*Other species that benefit:* Many wildlife that are known as forest-interior species also will benefit from high levels of forest cover on the landscape. Many forest-interior mammals (e.g., fishers, *Martes pennanti*, and black bear, *Ursus americanus*) have large home ranges that require high amounts of forested land. Other forest-interior species (e.g., scarlet tanager, *Piranga olivacea*, worm-eating warbler, (*Helminthos vermivorum*) will benefit from high forest cover because it reduces the effects of forest fragmentation, like high rates of brood parasitism and nest predation.

*Management recommendations:* If managing habitat for golden-winged warblers, there should be >70% forest cover within 0.5 miles. This threshold is less stringent for managing for only woodcock (>50%) when the landscape includes a mix of farmland and hardwood forests.



*A highly forested landscape with different age classes of forest, including young forest, interspersed throughout. Andrew Vitz*

# MANAGEMENT GUIDELINES

---

## ***YOUNG FOREST COVER in the landscape***

Young forest cover on the landscape refers to all land that represents early successional or shrub-scrub habitat within 0.5 miles of the proposed management site. Appropriate land uses might include regenerating forest, abandoned farmland, woody wetlands, thickets, rights-of-way, barrens, managed shrublands, and reclaimed minelands.

**How woodcock benefit:** Woodcock require young forest habitat for their singing grounds and roosting fields. Early in the season, woodcock require open areas for courtship displays and use roosting fields late in the season during the post-breeding period (July – until migration) where they seek protection from predators at night. Without these components in the landscape, the area will not support populations of woodcock.



*A log landing can serve as a roosting field for woodcock and provide substrates for nesting golden-winged warblers. Scot J. Williamson*

**How GWWA benefit:** Young forest habitat, whether it is a timber harvest, abandoned farmland, or wooded wetland, is what golden-winged warblers require for breeding. All breeding activities, like courtship, territory defense, and nesting occur within the young forest stand. Too little young forest cover on the landscape causes patches to be isolated and decreases the likelihood that golden-winged warblers will settle and breed in that patch.

**Other wildlife that will benefit:** A suite of species that depend on young, shrubby forests will benefit from management of this habitat because they also are experiencing population declines, like eastern whip-poor-will, indigo bunting, prairie warbler, field sparrow, eastern towhee, brown thrasher, and Appalachian and New England cottontail. Other species commonly found in young forest habitats include common yellowthroat (*Geothlypis trichas*), chestnut-sided warbler (*Setophaga pensylvanica*), song sparrow (*Melospiza melodia*), least shrew (*Cryptotis parva*), meadow vole (*Microtus pennsylvanicus*), bobcat, and black bear.

**Management recommendation:** For both woodcock and golden-winged warblers it is advised that there is at least 5% shrub cover in the landscape. However, it is recommended that about 10 - 15% of a management area have young forest habitat and should be in close proximity to nesting and brood-rearing habitat. This will provide areas large enough for suitable singing grounds or roosting fields for woodcock. Young forest habitat cover on the landscape should not exceed 15- 20%. Once there is >20% in shrub cover on the landscape, then other consequences, such as an increase in edge-related habitat and loss of overall forest cover may result. These conditions would be unfavorable to golden-winged warblers and potentially favorable to blue-winged warblers. Indeed, blue-winged warbler expansion has been observed to move more quickly through river valleys than uplands, likely due to the differences in amount of forest cover. Shrub cover in the landscape can come in many forms: from other managed lands (e.g., timber harvests, shrublands, abandoned farmlands or orchards) or from other disturbances on the landscape (e.g., tornadoes, insect damage, fires). Managers should take advantage of other disturbances on the landscape by planning future harvests, prescribed fires, or other mechanical disturbances nearby. That is, patches of young forest habitat should not be isolated on the landscape but be placed near other patches of young forest (for GWWA) and areas for feeding and nesting (for woodcock).

---

### ***MANAGEMENT OF STANDS***

To support woodcock or golden-winged warbler populations, managers need to plan for and provide different age classes of forest habitat throughout time. Golden-winged warblers require young forest habitat (i.e., 3 – 15 years post disturbance) for breeding and mature forest for post-breeding activities. Woodcock require young forest, pole forest, and often mature forest (if the understory is dense) for courtship, feeding, nesting, and roosting fields. If just one age class (e.g., young forest) is missing for several years (e.g., 10 years) this could cause a bottleneck for the population where no habitat exists to suit the needs of the species and the species can become locally extirpated. Refer to the *American Woodcock Habitat Best Management Practices for the Central Appalachian Mountains Region* (Pages 9 – 10) and the *Golden-winged Warbler Habitat Best Management Practices for Forestlands in Maryland and Pennsylvania* (Pages 13 – 14) for a cutting cycle sequence to create a mosaic of habitats. Both models provide a general approach to interspersing forest age classes over time that would accommodate both species.



*Habitat mosaic implemented for woodcock management. Ethan Allen Firing Range, Jericho, VT*

# MANAGEMENT GUIDELINES

---



*A y. Robin Wildermuth*



*A mini island of trees retained to reduce tree mortality. Marja Bakermans*



*A shrubland managed for woodcock where the retained residuals remain in pockets or patches throughout the habitat to increase patchiness in structure and composition. Jeff Larkin*



*A regenerating timber harvest with interspersed residual trees. Marja Bakermans*

## **RESIDUAL TREES**

Residual trees are trees (>4 inches dbh) that remain or are retained during a management operation, like a regeneration harvest.

*How woodcock benefit:* Although there has been conjecture in the past that woodcock would benefit from removal of all residual trees to reduce perches for aerial predators, there is no evidence to support this claim. Instead, it has been demonstrated that woodcock use both managed shrublands and timber harvests with retained residual trees.

*How GWWA benefit:* Golden-winged warblers are insectivorous birds that will forage for insects throughout the vertical structure of young forest habitat, including residual trees. In addition, the male golden-winged warbler has a relatively quiet song, and their song can be best broadcast from a residual tree. Retaining an appropriate amount of residual trees in a timber harvest has been shown as an effective management tool to increase densities and mating success of golden-winged warblers because it allows golden-winged warblers to establish territories within a regenerating harvest or shrubland and does not restrict them only to the edge of the harvest along a mature forest edge.



*Scattered residuals, like along a feathered forest edge in this forest opening, makes excellent golden-winged warbler breeding habitat and the herbaceous opening can be used as a singing ground for woodcock. Scot J. Williamson*

*Other wildlife that benefit:* Mature forest breeding bird species, like red-eyed vireo (*Vireo olivaceus*), black-and-white warbler (*Mniotilta varia*), and ovenbird (*Seiurus aurocappilus*), are more likely to use and breed in regenerating harvests and managed shrublands with residual trees. If retained trees have existing cavities these may be used as nesting or denning locations for woodpeckers (e.g., red-headed woodpecker, *Melanerpes erythrocephalus*, bluebirds, chickadees, nuthatches, squirrels, raccoons, opossums, and fisher. Residual trees may also serve as important winter refugia for deer, owls, songbirds (e.g., golden-crowned kinglet, *Regulus satrapa*), and fisher.

**Management recommendation:** Maintain residual trees that can be used by cavity-nesting birds or denning mammals. The majority of residual trees should be deciduous trees that have healthy crowns that provide foraging opportunities. A general recommendation is to include a minimum of 5 – 6 large (>16 inches dbh) residuals per acre. However, golden-winged warblers and woodcocks use stands with a range of sizes of residuals. One method to retain residuals is to evenly scatter them throughout the stand or create mini islands of residuals. Clumping residuals in mini islands may help reduce mortality of trees at a site due to sun or wind exposure. Important species of residual trees to retain include: oaks (*Quercus* spp.), hickories (*Carya* spp.), cherry (*Prunus* spp.), and black locust (*Robinia pseudoacacia*) based on their ability to provide food (insects and hard and soft mast) for wildlife and can serve as seed trees to ensure regeneration of desired tree species.

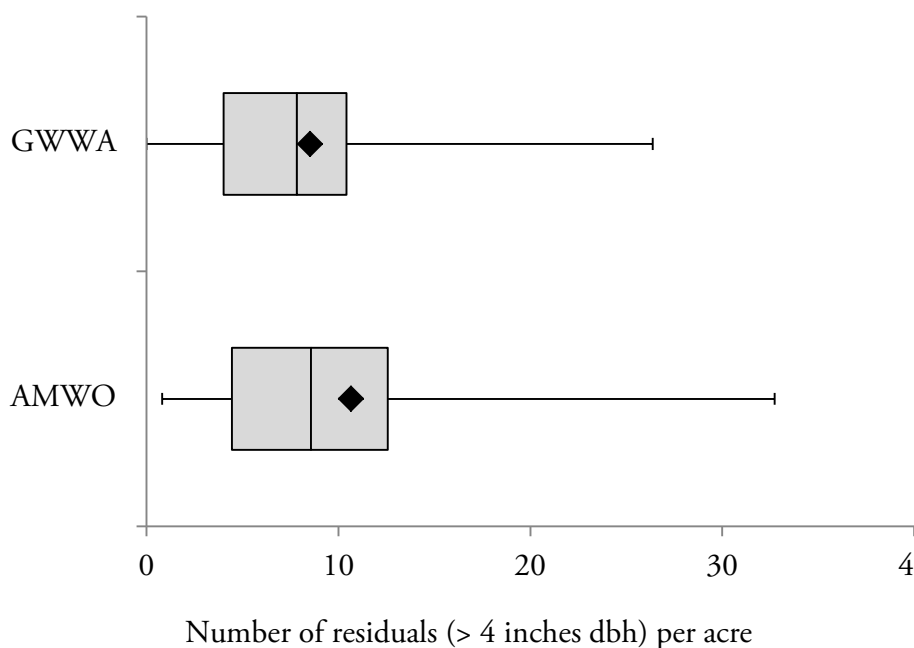
*Retaining an appropriate number of residual trees and snags has been proven to be an effective management tool to increase breeding densities of golden-winged warblers within a stand.*



*A female golden-winged warbler foraging in a chestnut oak (*Quercus montana*). Chad Wildermuth*



*Abandoned farmland, like orchards, provide residual trees and excellent habitat for both species. Scot J. Williamson*



# MANAGEMENT GUIDELINES



*Dense saplings are great cover for feeding and protection from predators for woodcock, but would not be used by golden-winged warblers (but it may be a small part of its territory). Scot J. Williamson*

## **SAPLINGS AND LOW-GROWING WOODY COVER**

Saplings are small trees between 2 - 4 inches dbh. Low growing woody cover refers to seedlings and stump sprouting hardwoods (trees <2 inches dbh), woody vines, and shrub species of plants, like blackberry and raspberry (*Rubus* spp.), blueberry (*Vaccinium* spp.), and sweetfern (*Comptonia peregrine*).

*How woodcock benefit:* Woodcock use dense stands of young, hardwood forests for nesting and feeding cover. These stands include small pole-sized hardwoods that can be anywhere from 5 – 25 years post-harvest depending on site quality. This thick cover provides protection from predators for foraging and incubating birds. These stands typically do not have much understory vegetation, which allows for easy foraging on earthworms in poorly drained soils.

*How GWWA benefit:* Patches of dense saplings and shrubs are an important component of golden-winged warbler breeding territories because golden-winged warblers will feed on the insects found on these plants (especially *Rubus*) and nests will be placed under shrubs for cover. However, once patches become too dense and reach the stem exclusion stage where there is little to no herbaceous understory, it is no longer used by breeding golden-winged warblers.



*An example of a stand approaching canopy closure where the herbaceous cover has been shaded out and understory saplings and shrubs are too dense for breeding golden-winged warblers. Jeff Larkin*



*A female American Woodcock on a nest in dense sapling cover in a timber harvest that has both American woodcock and golden-winged warblers breeding in close proximity. Andrew Vitz*



Golden-winged warbler fledgling. Katie Percy



A regenerating harvest that has patches of saplings and shrubs that are suitable for breeding golden-winged warblers. This same stand can be used as singing grounds or a roosting area for woodcock. Marja Bakermans



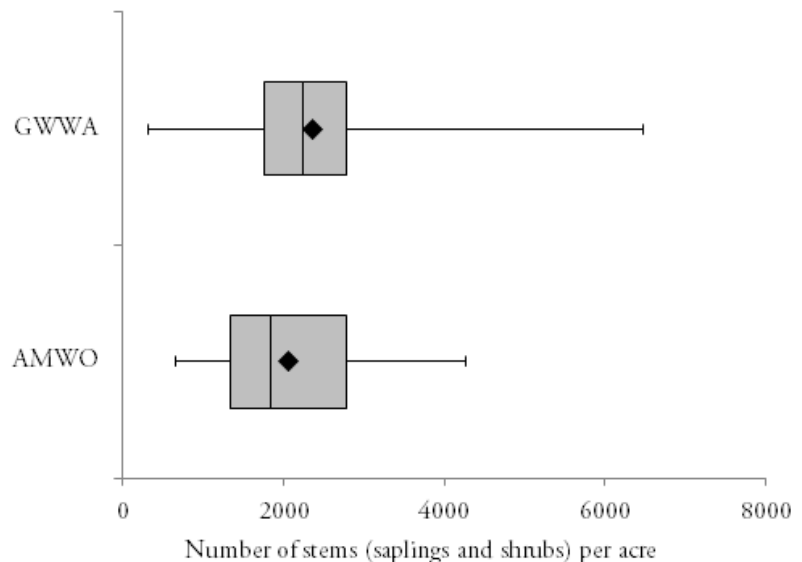
Dense stands of regenerating aspen are preferred feeding and nesting habitats for woodcock. Scot J. Williamson



Patches of saplings are incorporated into golden-winged warbler breeding territories. Marja Bakermans

*Other wildlife that benefit:* Dense cover of saplings and shrubs in young forest habitat will benefit both breeding wildlife that are habitat specialists and wildlife that will use the habitat during the post-breeding period (e.g., turkeys and grouse). For example, Appalachian and New England cottontail will use the dense vegetation as cover and browse and elk and white-tailed deer (*Odocoileus virginianus*) for calving and resting areas.

**Management recommendation:** Sapling and shrub cover for courtship and roosting areas for woodcock can overlap with those values for breeding golden-winged warblers (see boxplot) with 300 – 6,000 stems/acre. However, sapling and shrub cover for feeding and nesting woodcock should be higher (>6,000 stems/acre). Nesting areas are typically found on drier sites than the feeding areas. Areas with this amount of dense, nesting cover could be as small as 1 acre, but up to 5 acres is recommended. Species of saplings/trees that provide dense cover that woodcock prefer include birch (*Betula* spp.), aspen (*Populus* spp.), alder (*Alnus* spp.), hawthorne (*Crataegus* spp.), arrowwood (*Viburnum* spp.), and dogwood (*Cornus* spp.).



# MANAGEMENT GUIDELINES

## HERBACEOUS GROUND COVER

Herbaceous ground cover includes all non-woody plants like grasses, grass-like plants, and forbs. Examples of native plant species include goldenrod (*Solidago* spp.), bracken fern (*Pteridium* spp.), large-leaved aster (*Aster macrophyllus*), wild strawberry (*Fragaria virginiana*), Pennsylvania sedge (*Carex pennsylvanica*), wild rye (*Elymus* spp.), and switchgrass (*Panicum virgatum*).

*How woodcock benefit:* Open, herbaceous ground cover is found in courtship and roosting areas. These open areas allow woodcock to detect ground predators. On average, woodcock and golden-winged warblers will use timber harvests with the same amount of herbaceous cover, but woodcock are more tolerant of wider ranges (up to 45% herbaceous cover; see boxplot).

*How GWWA benefit:* Forbs, such as goldenrod, are used by golden-winged warblers as a nesting substrate. Nests are placed on the ground with the support of forbs, grasses, or a shrub stem. The cover of the herbaceous vegetation also will conceal the nest from predators.

*How other wildlife benefit:* Herbaceous cover provides excellent brooding habitat for ruffed grouse and wild turkey (*Meleagris gallapavo*), fawning cover and forage for white-tailed deer, soft mast for various wildlife, and ground cover for reptiles such as five-lined skink (*Eumeces fasciatus*), eastern hognose snake (*Heterodon platirhinos*), northern black racer (*Coluber constrictor*), eastern smooth green snake, eastern milk snake (*Lampropeltis triangulum*), and black rat snake (*Pantherophis obsoletus*).



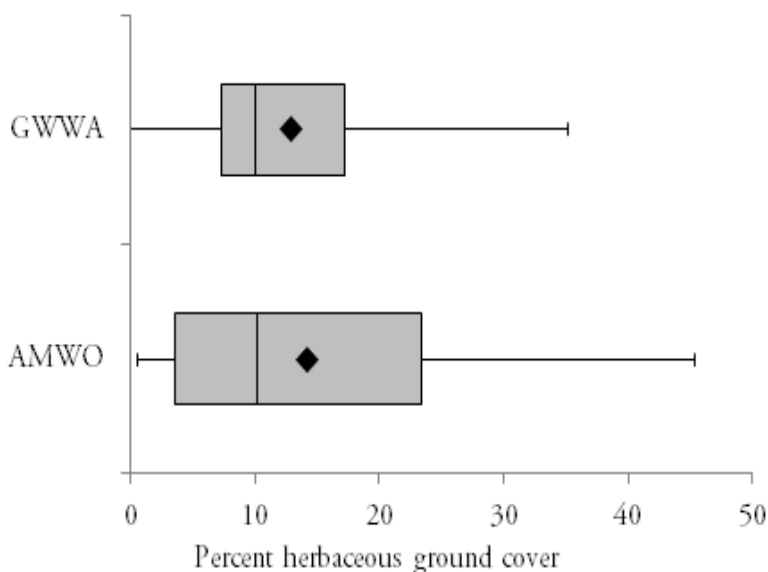
*A female golden-winged warbler sitting on her nest that is concealed by dense herbaceous cover. Chad Wildermuth*



*A roosting field for woodcock and potential breeding habitat for golden-winged warblers. Scot J. Williamson*

### Management recommendation:

Herbaceous cover can be provided by properly retiring skid trails, haul roads, and log landings. Because these areas have experienced the most soil compaction, they will provide herbaceous cover longer than other areas of a site. It is not necessary to use native seed because forbs used by nesting Golden-winged Warblers are wind disseminated and available in the seed bank, and will join planted seed in the future. Seed with plants that establish quickly to prevent erosion, but will not dominate permanently. **Avoid non-native, perennials cool-season grasses** such as reedtop (*Agrostis palustris*), fescue (*Festuca* spp.), smooth broome (*Bromus inermis*), and orchardgrass (*Dactylis glomerata*). An easy option would be to plant 50lbs of annual rye grass (*Lolium multiflorum*) per acre.



# MANAGEMENT TOOLS

---

## HOW TO CREATE or MAINTAIN YOUNG FOREST HABITAT

Because early successional habitat is an ephemeral resource, it must be created or maintained continuously across the landscape. Here we discuss several techniques that habitat managers can use to make young forest habitat. In general, management actions should aim to create patchy habitats that include clumps of shrubs and saplings interspersed with herbaceous cover and residual trees.

## TOOLS TO MAINTAIN YOUNG FOREST

### **Mechanical treatment of shrublands:**

Periodic mechanical treatment, using chainsaws up through big machines, like the Fecon shown below, is useful in maintaining young forest habitat. One example of a simple but effective technique is to use strip disking to maintain habitat. Strip disking can eliminate or reduce thick mats of exotic grasses or species and encourages the natural re-vegetation of native grasses and forbs. Again, this will help restore the herbaceous components of habitats that are critical to roosting woodcock and nesting golden-winged warblers.



*Before strip mowing at this site, both golden-winged warblers and woodcock used the habitat. However, due to the complete removal of shrubs, saplings, and trees only woodcock used this habitat the following years. Jeff Larkin*

It is important to remember when maintaining young forest habitat that some residual trees should remain (~5/acre) and the shrub layer should be reduced but not completely removed. This provides light and resources for an herbaceous layer to reestablish. The retained shrubs and saplings should remain in strips or pockets throughout the habitat to increase patchiness in structure and composition. If areas that are treated are too large (as in the strip method in the photo above), this will likely result in one or both species no longer using the habitat.



*Fecon equipment used at Bald Eagle State Park, Howard, PA (left photos) and skid-steer with a root rake used at Sproull State Forest, Renovo, PA (right photo). Jeff Larkin*

# MANAGEMENT TOOLS

---



*Examples of joint habitat management for woodcock and golden-winged warblers at Bald Eagle State Park (Howard, PA) and Sproul State Forest (Renovo, PA). Jeff Larkin*

---

*Managing for patchy habitat involves providing a mix of interspersed residual trees and snags, saplings, shrubs, forbs, grasses and bare ground.*

---



*Retained trees, saplings, and shrubs can be mowed or manipulated in strips (two right plots) or in a patchwork (plot in foreground), Sproul State Forest, Renovo, PA. John Long.*



*Moderate to light grazing in West Virginia can maintain habitat for Golden-winged Warblers. Kyle Aldinger*



*Burning of roosting fields maintains use by woodcock. Scot J. Williamson*



*Prescribed burn. Katie Percy*

### **Prescribed Burning or Grazing**

Prescribed or controlled burning is a technique used in habitat management to reduce fuel loads, promote regeneration of desirable tree species (e.g., oaks), setback succession, and remove woody vegetation. Stands used for roosting and breeding woodcock and breeding Golden-winged Warblers can be maintained in a young forest state by burning fields/shrublands every 3 – 5 years. Repeated burning will suppress invading woody species that would progress succession. Prescribed burning should occur early in the season (e.g., before mid-March) to avoid destruction of nests. Throughout the Appalachian Mountains, grazing from livestock (e.g., cattle, goats, etc.) can have similar effects of prescribed burning because animals reduce growth of woody vegetation. It is advised that graze one animal unit/5–10 acres during the growing season.



*Post-fire regeneration at a different site. Jeff Larkin*

# MANAGEMENT TOOLS

---

## Herbicide Application

In some cases, application of herbicides may be used to target woody plant growth, especially when controlling invasive species, like honeysuckles (*Lonicera* spp.) and multiflora rose (*Rosa multiflora*). If used correctly (i.e., applied by a certified applicator and if near a waterway/wetland to use only approved herbicides for aquatic systems), herbicides can be a safe and effective way to retard plant succession. An effective means is to use the cut-stem method where the tree or shrub is cut near the base of the trunk and herbicide is immediately applied to the stump. This method reduces the amount of herbicide and has a low chance of affecting non-target species and the environment. Please refer to Chapter 10B from *Habitat Management Tools: Herbiciding from Managing Grasslands, Shrublands, and Young Forests for Wildlife: A Guide for the Northeast* (available at: [http://www.wildlife.state.nh.us/Wildlife/Northeast\\_Hab\\_Mgt\\_Guide.htm](http://www.wildlife.state.nh.us/Wildlife/Northeast_Hab_Mgt_Guide.htm)) for more information on safety regulations, herbicide application techniques, and selecting the right herbicides for common invasive exotic plants.



*Cut-stem method. Art Grover*



*Stump treatment after herbicide application. Art Grover*



*Basal bark application, with oil-soluble triclopyr formulation in oil carrier. Art Grover*



*Low volume foliar spray. Art Grover*

---

## TOOLS TO CREATE YOUNG FOREST

### Timber management

Harvesting trees for timber can be accomplished in a way that creates excellent habitat and provides the necessary resources (e.g., food and vegetation structure and composition) for wildlife. In general, even-aged practices are the best means for creating young forest habitat used by woodcock, golden-winged warblers, and other wildlife.

*Even-aged management practices* open the forest canopy and allow light to reach the forest floor which will increase advanced regeneration of shade-intolerant (e.g., black cherry, aspen, tulip poplar) and shade intermediate (e.g., oaks, hickories, etc.) tree species and herbaceous growth. Even-aged management mimics large-scale disturbances (e.g., beaver impoundments, tornado, etc.) that are limited on today's landscapes.



*A seed tree (above) and shelterwood harvest (below). Marja Bakermans*



*A regeneration cut. Marja Bakermans*

*Regeneration cut* – This is a method of harvest where the removal of canopy trees is intended to assist regeneration that is already present or to make regeneration possible. Regeneration cut is similar to a clearcut with reserves where residual trees or snags are retained in the harvest process. Regenerating cuts make excellent breeding habitat for golden-winged warblers if an appropriate number of residual trees are maintained. Woodcock also will use these harvests for singing grounds and roosting fields.

*Seed tree* – A method of harvest where a small number of widely dispersed trees are retained for seed production. Both golden-winged warblers and woodcock may use a seed tree harvest shortly (e.g., 2 – 3 years) after harvest.

*Shelterwood* – A harvest method that removes all mature trees in an area in a series of two or more cuts. Gradual reduction of the canopy (i.e., removal of 40 – 50% of the canopy) provides a seed source and shade for stand regeneration while protecting understory trees. Shelterwood cuts are least likely of the three even-aged methods to provide habitat for BOTH species due to the higher retained canopy cover, but golden-winged warblers may breed in these habitats.

# MANAGEMENT TOOLS

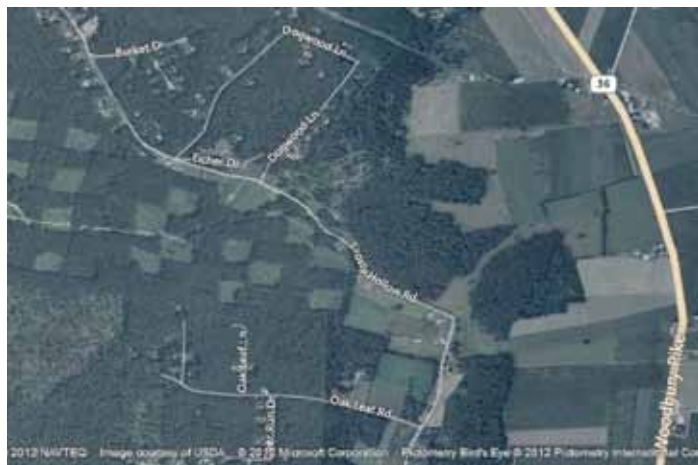
*Uneven-aged management practices*, like single tree or group tree selection, maintain mixed age classes within one stand while providing continuous canopy cover. This type of forest management favors tree species that are shade-tolerant. Usually brushy ground cover associated with young forest habitat are limited in uneven-aged systems and, thus, support few species that depend upon young forest conditions. However, this may be an appropriate management practice for wildlife species that benefit from continuous forest cover that is interspersed with canopy gaps, like forest interior birds like cerulean warblers (*Setophaga cerulea*), yellow-throated vireo (*Vireo flavifrons*), and scarlet tanager, and amphibians, like marbled salamander (*Ambystoma opacum*), northern redback salamander (*Plethodon serratus*), and northern slimy salamander (*Plethodon glutinosus*).



*Single tree selection. Marja Bakermans*

*Single tree selection* – This harvest method is when individual trees of all size classes are removed throughout the stand to increase growth of remaining trees and provide space for regeneration. Single tree selection is not suggested when creating young forest habitat because the disturbance is not large enough to stimulate enough understory growth to support wildlife that rely on dense vegetation.

*Group tree selection* – A method that removes trees as a group and new age classes are established in small areas. The size of the group often is approximated as twice the height of the mature trees. If uneven-aged management practices are to be used, apply group selection to create openings 1 – 2 acres in size, which is similar to a small, even-aged stand. Both woodcock and golden-winged warblers have been detected using group selection cuts. Similar work is already in use by many state agencies for grouse management where harvests are implemented at 10-year intervals over a 40-year rotation (see photo below).



*On the left side of this photo are group selection cuts (~2.5 acres each) created for grouse management at State Game Lands 041 in Bedford County, PA.*



*Ripping the soil to create favorable soil conditions for planting. Jeff Larkin*



*Reclaimed mineland with adequate woody cover for nesting Golden-winged Warblers. Katie Percy*



*This site now has loosened soil and is ready for planting. Jeff Larkin*

### **Reclaimed Minelands:**

Throughout the Appalachian Mountains, reclaimed minelands provide habitat management opportunities for both species. Woodcock may use reclaimed minelands for feeding and courtship activities. A study in West Virginia found that reclaimed minelands that had a mix of old (>25 years) and new reclamation had the highest densities of woodcock. Feeding areas were in the older reclamation areas that had 50% canopy cover of shrubs and trees. Courtship areas, however, were more open and had short herbaceous cover.

Golden-winged warblers will use reclaimed minelands for breeding habitat when there is adequate shrub cover near a forested edge (see photo to left). Consult the Guidelines for Mine Reclamation for Golden-winged Warblers for further information (available at: [www.gwwa.org](http://www.gwwa.org)).

Reclamation of sites for both species should aim to provide sites with good soil and a mix of woody cover and open, grassy areas. Soils that have been compacted during the mining process may need to be loosened to promote growth of shrubs and trees. Trees and shrubs should be planted in clumps (1 - several acres in size) near the forest edge while leaving grassy openings in between. Remember that some tools can be used in conjunction. For example, prescribed burning on reclaimed minelands has been proven to restore habitat for golden-winged warblers in Tennessee. Consult the Appalachian Regional Reforestation Initiative to access their forest reclamation advisories that explain the reclamation process in further detail (available at: <http://arri.osmre.gov/FRA/Advisories/Advisories.shtm>).



*Ripping the soil will bring large boulders to the surface and increase the patchiness of a site. Jeff Larkin*

# MANAGEMENT TOOLS

## Energy development:

Habitat created through energy development (e.g., well pads, pipelines, and roads) will provide both challenges and opportunities for land managers, and may provide habitat for woodcock, golden-winged warblers, and other wildlife if reclaimed properly. After construction, it is recommended that reclamation efforts **AVOID** using non-native or invasive plant species, like fescue. Instead, follow the guidelines to use herbaceous cover that will stabilize the site but also allow plants from the seedbank to return (see Herbaceous Ground Cover Management Guidelines on page 21). In addition, operators should use soil, mulch, gravel, and seed that are weed-free to avoid introduction of undesirable plant species.

Similar to the mine reclamation, we suggest that clumps of shrubs and trees be planted or allowed to succeed to provide feeding cover for woodcock and nesting habitat for golden-winged warblers. Once a site becomes too dense, the shrubs and saplings can be mowed back every few years and allow for access to the site. Again, use native shrubs and trees and **DO NOT** plant or encourage exotic, invasive species such as honeysuckle or multiflora rose.

Review your state's guidelines and BMPs for oil and gas activities on state lands (e.g., for Pennsylvania, Ohio, etc.) for more information. An example from Pennsylvania is available at: [http://www.dcnr.state.pa.us/ucmprd1/groups/public/documents/document/dcnr\\_004055.pdf](http://www.dcnr.state.pa.us/ucmprd1/groups/public/documents/document/dcnr_004055.pdf).

*A gas pipeline that will not provide habitat if not reclaimed properly.*  
Jeff Larkin



*The space around a well pad (shaded yellow) can be reclaimed in a young forest state rather than planted with non-native grasses.* Richard Martin



*A shallow gas well pad that was not reclaimed properly (above) and one that has retained trees, shrubs, grasses and forbs adjacent to the well pad (below). This reclamation was successful in attracting Golden-winged Warblers.* Jeff Larkin



# SUMMARY

Habitat loss is a leading driver of population declines of many wildlife species, and especially for those wildlife that depend on or use young forest habitat. Loss of young forest habitat has occurred through loss of forest cover, forest maturation, reduced disturbances on the landscape, and opposition from the public for certain forest management practices.

American woodcock and golden-winged warbler are two such species that have been experiencing sharp population declines, yet respond well to habitat management efforts. Conservation plans for both species seek to reverse these declines and rebuild populations. The only way to accomplish this task is for biologists, land managers, and the public to work together to create and maintain young forest habitat. A critical step in this process will be to appropriately **manage for both species at the same time** where their ranges overlap and suitable habitats exist. And don't forget, management geared toward woodcock and golden-winged warblers is beneficial to a large group of wildlife as well.



*Mechanical (above) and hand-pulled (below) management of young forest habitat. Art Grover*



*Male golden-winged warbler. Christian Artuso*



*A managed shrubland that can meet the habitat needs of both woodcock and golden-winged warbler. John Confer*



*American woodcock. ©Bill Hubick at <http://billhubick.com/>*

# REFERENCES AND FOR MORE INFORMATION

---



*A timber stand with complex vertical and horizontal diversity. Marja Bakermans*



*Nesting cover for woodcock. Scot J. Williamson?*



*A woodcock chick. Eric Dresser?*

Information on Woodcock Best Management Practices, Demonstration Areas, Regional Initiatives, and Conservation Plans can be found at [www.timberdoodle.org](http://www.timberdoodle.org) and Golden-winged Warbler Fact Sheets, Conservation Initiatives, Best Management Practices, and Conservation Plan can be found at [www.gwwa.org](http://www.gwwa.org)

Bakermans, M. H., J. L. Larkin, B. W. Smith, T. M. Fearer, and B. C. Jones. 2011. Golden-winged Warbler habitat best management practices for forestlands in Maryland and Pennsylvania. American Bird Conservancy. The Plains, Virginia. 26 pp.

DeGraaf, R.M., and M. Yamasaki. 2003. Options for managing early-successional forest and shrubland bird habitats in the northeastern United States. *Forest Ecology and Management* 185: 179-191.

DeGraaf, R. M., M. Yamasaki, W. B. Leak, and A. M. Lester. 2006. Technical guide to forest wildlife habitat management in New England. University Press of New England, Hanover, VT. 305 pp.

Gilbart, M. 2012. Under cover: wildlife of shrublands and young forest. Wildlife Management Institute. Cabot, VT. 87 pp.

Gregg, I. D., J. G. Skousen, and D. E. Samuel. 1998. American woodcock use of reclaimed surface mines in West Virginia. *Green Lands Summer 1998*: 39-44.

Harper, C. A. 2007. Strategies for managing early succession habitat for wildlife. *Weed Technology* 21: 932-937.

Litvaitis, J. A. 2003. Are pre-Colombian conditions relevant baselines for managed forests in the northeastern United States? *Forest Ecology and Management* 185: 113-126.

Lorimer, C. G., and A. S. White. 2003. Scale and frequency of natural disturbances in the northeastern US: implications for early successional forest habitats and regional age distributions. *Forest Ecology and Management* 185: 41-64.

Oehler, J. D., D. F. Covell, S. Capel, and B. Long, editors. 2006. Managing grasslands, shrublands, and young forest habitats for wildlife - a guide for the northeast. Northeast Upland Habitat Technical Committee, Massachusetts Division of Fish and Wildlife. 104 pp.



*When reclaimed properly, log landings and haul roads can provide herbaceous cover used by both species. Mack Frantz*



Roth, A. M., R. W. Rohrbaugh, T. Will, and D. A. Buehler, editors. 2012. Golden-winged Warbler status assessment and conservation plan. <http://www.gwwa.org/plan>

Sauer, J.R., J.E. Hines, and J. Fallon. 2008. The North American Breeding Bird Survey, Results and Analysis 1966-2007, version 6.2.2006, U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Schlossberg, S., and D. I. King. 2007. Ecology and management of scrub-shrub birds in New England: a comprehensive review. Beltsville, Maryland: Report submitted to Natural Resources Conservation Service, Resource Inventory and Assessment Division.

Thogmartin, W. E., J. R. Sauer, and M. G. Knutson. 2007. Modeling and mapping abundance of American Woodcock across the Midwestern and Northeastern United States. *Journal of Wildlife Management* 71: 376-382.

Thompson, F. R. III, and D. R. Dessecker. 1997. Management of early-successional communities in central hardwood forests. USDA-Forest Service General Technical Report NC-195, St. Paul, MN.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2007. Early successional habitat. Natural Resources Conservation Service and Wildlife Habitat Council Fish and Wildlife Habitat Management Leaflet, Number 41.

Wildlife Management Institute. 2008. American Woodcock Habitat Best Management Practices for the Central Appalachian Mountains Region.



*A timber stand in northeast PA. Robin Wildermuth*



*A golden-winged warbler nest. Chad Wildermuth*

