Best Management Practices For Golden-winged Warbler Habitat in Deciduous Forests of the Appalachians

REVISED 2019

A publication of the Golden-winged Warbler Working Group, www.gwwa.org

This supplement for Deciduous Forests accompanies *Best Management Practices for Golden-winged Warbler Habitats in the Appalachian Region*, which includes general information that applies to all habitat types in this area. Users should refer to both documents to develop a comprehensive management strategy for Golden-winged Warblers. The following are guidelines and not absolute rules for the creation of nesting habitat, thus prescriptions that fall outside the numerical ranges presented can provide habitat, too. Consult a Golden-winged Warbler or young forest habitat expert for assistance in tailoring a management plan to your property, and, if available, follow forest management guidelines for your state.

Although the amount of forest cover has increased in the Appalachian Region recently, a lack of disturbance has limited the availability of young forest habitat. Natural disturbances in eastern forests that create young forest habitat used by Golden-winged Warblers may be caused by insects, mammals, fires, wind and storms, tree diseases, flooding, and drought. However, timber harvests will be an essential tool to supplement natural disturbance to meet the ambitious young forest goals established in the region.

Forest conditions created through timber harvesting are typically used by nesting Golden-winged Warblers for two to twelve years post-harvest until stem exclusion (~10–20 years). Because of the ephemeral nature of young forest habitat, stands must be re-harvested on short rotations or new young stands must be created regularly over time to provide continuous habitat. An astounding amount (85%) of our eastern forests is located on private lands (Figure 1) and conservation efforts will require a balanced approach between private and public land opportunities.

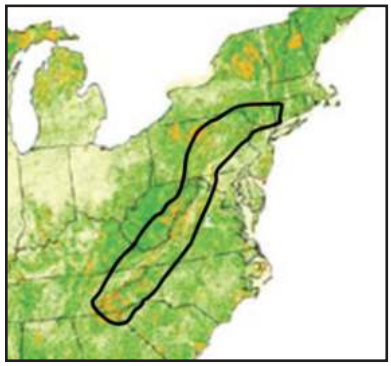

Figure 1. *Forest cover in private (green) and public (orange) ownership with the approximate Appalachian Mountain breeding range for Golden-winged Warbler (black polygon). Produced by U.S.F.S.*

Key Landscape and Stand Features

Habitat management should occur in areas that will most effectively boost Golden-winged Warbler populations. In general, these areas have a high degree of deciduous forest cover (Figure 2) and are at high elevations.

Some basic rules of thumb:

- Work within defined focal areas or < 5 miles (preferably < 1 mile) from known breeding populations and < 1 mile from other early successional patches.
- > 70% deciduous forest cover within 1.5 miles of site.
- Elevation generally > 1,000 ft in the northern Appalachians, lower in forested wetlands and heavily forested areas.
- Elevation > 1,800 ft in the central/southern Appalachians. Note: In some areas of this region, Golden-winged Warblers may only be found at elevations well above 1,800 ft and should be assessed for each site in consultation with a regional expert.

Harvest unit shape will be influenced by soils, slope, aspect, topography, and accessibility, but where possible:

- young forest patches intended to support nesting Golden-winged Warblers should be adjacent to mature forest to support the species full breeding cycle needs.
- increase the proportional amount of the young-mature forest edge by adjusting the harvest unit shape (i.e., linear shapes or meandering edges).
- create a feathered edge that promotes gradual transition from young to mature forest.

Figure 2. *A highly forested landscape with young forest clustered throughout.*

Figure 3. *Examples of Golden-winged Warbler habitat (left and center photos) with a mix of residual trees, saplings, shrubs, and herbaceous cover and a harvested stand (right photo) where sapling regeneration has advanced beyond what is used by breeding Golden-winged Warblers. Photos: Marja Bakermans, Brian Smith, Jeffery Larkin*

Key Within-stand Characteristics

- Golden-winged Warblers use deciduous trees for singing perches and foraging sites. Residual canopy trees play an important role in habitat guidelines. Retain 5–15 residual trees per acre (Figure 3), > 9 inches in diameter.
- Dispersed trees throughout the harvest is the best arrangement for retaining deciduous trees. However, another method is to create small groups of trees embedded within the harvest (Figure 4). In most cases, patchy conditions will occur inherently after a harvest. Underplanting is rarely necessary because tree seedling and shrub density from natural regeneration is adequate.
- Golden-winged Warblers use stands with 2,500 saplings per acre (1,300–3,000) and 100–300 shrubs or stump sprouts/acre.

Goldenrod (*Solidago* spp.) and other forbs are important to Golden-winged Warblers because they are used for nesting. The essential herbaceous component can be provided by properly retiring skid trails, haul roads, and landings using this minimal maintenance approach:

1. Treat invasive plants prior to other management.
2. Minimize invasive plant dispersal by cleaning machinery.
3. Grade roads and landings to minimize erosion.
4. Seed with plants that will establish quickly.
5. Avoid non-native perennial cool season grasses.
6. Use a mix of native annuals and perennials.
7. Mulch with wheat or oat straw as necessary.

JEFF LARKIN

Figure 4. *Retaining small groups of trees may reduce tree mortality from wind-throw.*

Before and after harvest there are additional considerations for the manager including assessing the adequacy of the regeneration and light conditions, retaining seed sources, and controlling excessive deer browsing and undesirable competitive plants. Prescribed fire, brush-hogging, and additional treatments may enhance and extend the suitability of stands for Golden-winged Warblers.

Resources/References

- Golden-winged Warbler Status Review and Conservation Plan, **www.gwwa.org**
- For a more detailed version of this forestlands document see: 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. **www.amjv.org/appalachian-forests/**
- NRCS Working Lands for Wildlife provides technical and financial assistance to private landowners in the Appalachian region. **www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/?cid=stelprdb1046990**
- North American Bird Conservation Initiative, U.S. Committee, 2011. The State of the Birds 2011 Report on Public Lands and Waters. U.S. Department of Interior. Washington, DC. 48 pages; available at **www.stateofthebirds.org/2011/State%20of%20the%20Birds%202011.pdf**

Prepared by Marja Bakermans, Jeffery Larkin, and Sara Barker Swarthout with additional information from *Golden-winged Warbler Status Review and Conservation Plan*. **www.gwwa.org**

David Buehler

Best Management Practices For Golden-winged Warbler Habitat on Minelands in the Appalachians

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A publication of the Golden-winged Warbler Working Group, www.gwwa.org

This supplement for Minelands accompanies *Best Management Practices for Golden-winged Warbler Habitats in the Appalachian Region*, which includes general information that applies to all habitat types in the area. Users should refer to both documents to develop a comprehensive management strategy. The following are guidelines and not absolute rules for the creation of nesting habitat, thus prescriptions outside the numerical ranges presented can provide habitat, too.

Coal mining has an extensive footprint in the Appalachians with 30% of the Golden-winged Warbler range overlapping with coal reserves (Figure 1). Reclaimed minelands compose a significant portion of the total Golden-winged Warbler habitat available within the region. Because reclamation is required under the Surface Mining Control and Reclamation Act of 1977, reclaimed minelands provide an opportunity to create habitat in the future if designed with Golden-winged Warbler habitat requirements in mind.

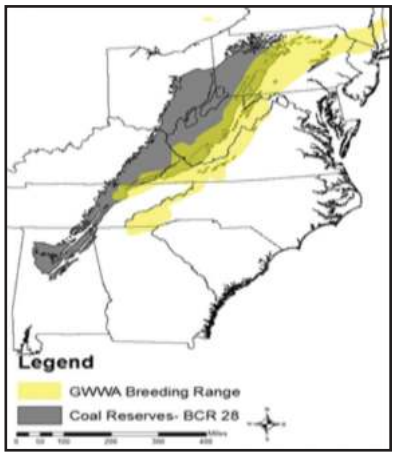

Figure 1. *Coal reserves and Golden-winged Warblers in the Appalachians.*

Reclaim and Restore Minelands in Landscapes:

- within defined focal areas or < 5 miles (preferably < 1 mile) from known breeding populations and < 1 mile from other early successional patches.
- with > 70% deciduous forest cover within a 1.5-mile radius of the site.
- at elevations > 1,800 ft in central/southern and > 1,000 ft in northern Appalachians. Note: In some areas of this region, Golden-winged Warblers may only be found at elevations well above 1,800 ft and should be assessed for each site in consultation with a regional expert.

How to Manage Nesting Habitat for New Reclamation Projects

The Appalachian Regional Reforestation Initiative recommends the five-step Forestry Reclamation Approach (see Resources):

1. Create a suitable rooting medium for trees no less than 4 ft deep and comprised of topsoil, weathered sandstone, or the best available material.
2. Loosely grade the topsoil to create non-compacted soil.
3. Use ground covers that are compatible with growing trees.
4. Plant two types of trees: a) early successional species for wildlife and soil stability and b) commercially valuable trees.
5. Use proper tree planting techniques.

Plant easily established, fast-growing native trees (e.g., tulip poplar and black locust), native shrubs (e.g., dogwood and viburnum), and commercially valuable trees (e.g., white oak). Incorporate patches of diverse native grasses and forbs along with reforestation. The spatial layout of the reclamation is very important (see Appalachian BMP guide). The individual species selected need to match site and soil characteristics (Table 1). For example, black locust, black and pin cherries, and oaks provide quality foraging habitat.

Table 1. *Plant species useful for reclamation for Golden-winged Warblers. Tree species with asterisks are typically early successional.*

Trees	Shrubs and Small Trees	Grasses
oaks (*Quercus* spp.)	hawthorn (*Crataegus* spp.)	broomsedge (*Andropogon virginicus*)
tulip poplar (*Liriodendron tulipifera*) *	elderberry (*Sambucus* spp.)	little bluestem (*Schizachyrium scoparium*)
black locust (*Robinia pseudoacacia*) *	beaked hazel (*Corylus cornuta*)	Virginia wildrye (*Elymus virginicus*)
American chestnut (*Castanea dentata*) *	viburnums (*Viburnum* spp.)	sideoats grama (*Bouteloua curtipendula*)
black cherry (*Prunus serontina*)	beautyberry (*Callicarpa americana*)	panicgrass (*Panicum* spp.)
pin cherry (*Prunus pensylvanica*) *	strawberry bush (*Euonymus americana*)	**Forbs**
flowering dogwood (*Cornus florida*) *	blackberry/raspberry (*Rubus* spp.)	partridge pea (*Chamaecrista fasciculata*)
white ash (*Fraxinus americana*)	dogwood shrubs (*Cornus* spp.)	goldenrod (*Solidago* spp.)
sugar maple (*Acer saccharum*)	smooth sumac (*Rhus glabra*)	perennial sunflowers (*Helianthus* spp.)
hickories (*Carya* spp.)	wild plum (*Prunus americana*)	tick-trefoils (*Desmodium* spp.)
American beech (*Fagus grandifolia*)	serviceberry (*Amelanchier* spp.)	Joe-pye weed (*Eupatorium fistulosum*)

Variable survival of individual trees and shrubs is expected and will contribute to the patchy habitat preferred by Golden-winged Warblers (Figure 2). The grass-forb ground cover is desirable because it will provide nesting sites. The mature forest edge of the site is also an important component, providing song perches, foraging habitat, and post-fledging brood habitat.


Jennifer Franklin

Figure 2. *This site will be suitable within the next 2–5 years.*

Reforestation of Non-forested (Legacy) Minelands

Coal mines reclaimed in the past 30 years (legacy mines) can provide habitat when plant succession reaches the stage where trees and shrubs have colonized the site and reached appropriate height and densities (10–30% cover in mature trees, 20–30% cover in saplings and shrubs). Thousands of acres of legacy mines are currently providing Golden-winged Warbler habitat. In some cases, reclamation for pasture/hayland land use has been so successful in establishing stable grass/forb plant communities, colonization by trees and shrubs hasn't occurred (Figure 3). These sites may not become suitable for decades. Management intervention in the form of ripping the substrate and planting trees and shrubs is recommended to speed up succession. When plant succession closes the tree canopy, habitat suitability declines and Golden-winged Warblers abandon the site. In this case, management intervention can restore suitable conditions (Table 2). Prescribed burning has been used successfully to restore habitat in Tennessee (Figure 4), while bush-hogging in irregular patches has worked in Pennsylvania.


Katie Percy

Figure 3. *Pasture/hayland reclamation will not undergo succession for many years and will not be suitable unless there is management intervention.*

Table 2. *Management options to restore Golden-winged Warbler habitat on legacy minelands.*

Management Techniques						
Symptom	**Timber Harvest**	**Mechanical Treament**	**Prescribed Burning**	**Grazing**	**Herbicide Use**	**Tree/shrub plantings**
Maturing trees, canopy closing	Irregular patch cutting	Irregular brush-hogging	X		X	
Too much herbaceous cover, too little woody cover, soil compaction		Ripping, disking		X	X	X
Limited edge	Irregular patch cutting	Irregular brush-hogging	X	X	X	X


Kelly Caruso

Figure 4. *Prescribed burning on one Tennessee site has led to a five-fold increase in Golden-winged Warbler territories.*

Four Key Steps for Successful Reforestation of Legacy Mines (Burger and Zipper 2011, Figures 5 and 6)

1. Site assessment and planning—vegetation and soil conditions are inventoried and treatments are prescribed.
2. Site preparation to be addressed—soil chemical properties (lime and fertilizer), soil physical properties (deep tillage), and undesirable vegetation removal (mechanical or herbicide treatment).
3. Native trees, shrubs, grasses, and forbs are planted.
4. Follow-up—additional management actions may be required to ensure the long-term success of the restoration.


David Ledford (2)

Figures 5 and 6. *(Left) A site that has been ripped is ready for planting of native trees, shrubs, grasses, and forbs. (Right) A reforested site might grow into Golden-winged Warbler habitat within 4–5 years.*

Resources/References

- Golden-winged Warbler Conservation Plan, **www.gwwa.org**. Working Group members are available for assistance in each state.
- The Appalachian Regional Reforestation Initiative (ARRI) – techniques for reclaiming minelands into forest. **http://arri.osmre.gov/**
- NRCS Working Lands for Wildlife provides technical and financial assistance to landowners interested in managing for Golden-winged Warblers **www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/?cid=stelprdb1046990**
- Angel, P.N., J.A. Burger, V.M. Davis, C.D. Barton, M. Bower, S.D. Eggerud, and P. Rothman. 2009. The forestry reclamation approach and the measure of its success in Appalachia. Proceedings of the National Meeting of the American Society of Mining and Reclamation 26:18-36. **http://arri.osmre.gov/FRA/Advisories/FRA_No.1.7-18-07.Revised.pdf**
- Burger, J., D. Graves, P. Angel, V. Davis, and C. Zipper. 2005. The forestry reclamation approach. The Appalachian Reforestation Reclamation Initiative, U.S. Office of Surface Mining, Forest Reclamation Advisory No. 2. 4 pp. **http://arri.osmre.gov/Publications/Publications.shtm**
- Burger, J.A. and C.E. Zipper. 2011. Reforestation guidelines for unused surface mined lands in the eastern United States. Virginia Cooperative Extension Publication 460-144. **http://pubs.ext.vt.edu/460/460-144/460-144.html**

Prepared by David Buehler, Katie Percy, Patrick Angel, and Sara Barker Swarthout with additional information from the *Golden-winged Warbler Status Review and Conservation Plan*. **www.gwwa.org**

LESLEY BULLUCK

Best Management Practices For

Golden-winged Warbler Habitat on Abandoned Farmlands in the Appalachians

REVISED 2019

A publication of the Golden-winged Warbler Working Group, www.gwwa.org

This supplement for Abandoned Farmlands accompanies *Best Management Practices for Golden-winged Warbler Habitats in the Appalachian Region*, which includes general information that applies to all habitat types in this area. Users should refer to both documents to develop a comprehensive management strategy for Golden-winged Warblers. The following are guidelines and not absolute rules for the creation of nesting habitat, thus prescriptions that fall outside the numerical ranges presented can provide habitat, too. Consult a Golden-winged Warbler or young forest habitat expert for assistance in tailoring a management plan to your property.

CURTIS SMALLING

Figure 1. *Typical early successional abandoned field in Appalachian region.*

Since the early 20th century, abandoned farmland has become an important component of the Appalachian landscape. When crop and pasture lands become inactive, they immediately begin succeeding into their pre-agriculture state, which is often deciduous forest. The span of time from field to forest takes decades, during which there is a period of years where the ratio of herbaceous vegetation, shrubs, and young trees on a given site can potentially create habitat for breeding Golden-winged Warblers (Figure 1). Without active management, this is a temporary condition that typically persists for less than a decade.

Throughout the region there is an excellent opportunity, especially on private lands, to create habitat for Golden-winged Warblers on abandoned farmlands. Perhaps the best opportunities exist on high elevation "balds" and poorly drained soils that are too wet for pasture or crops.

Key Landscape Scale Requirements

Abandoned farmland is found throughout the region, but much of it is not suitable for Golden-winged Warblers because it lacks a primarily forested habitat matrix and adequate elevation.

Select sites:

- within defined focal areas or < 5 miles (preferably < 1 mile) from known breeding populations and < 1 mile from other early successional patches.
- with > 70% deciduous forest cover within 1.5 miles of the site (Figure 2).
- at elevations > 1,800 ft in central/southern and > 1,000 ft in northern Appalachians. Note: In some areas of this region, Golden-winged Warblers may only be found at elevations well above 1,800 ft and should be assessed for each site in consultation with a regional expert.
- with multiple, manageable patches each ≥ 10 acres in size that lack adjacent active agriculture, such as row cropping.

Figure 2. Management sites should be surrounded by mostly deciduous forest and other idle farmland.

Key Site Scale Requirements

Much Golden-winged Warbler habitat is intentionally created from existing forest by setting back ecological succession through specific timber harvesting practices. In the case of abandoned farmland, agriculture has already "reset succession" to an earlier state so the first goal in managing abandoned farmland is to evaluate that state relative to the habitat needs of breeding Golden-winged Warblers.

Characteristics of patches within management sites (Figure 3):

- 30–70% tall shrubs and saplings (3–13 ft) unevenly distributed as clumps.
- Shrub and sapling clumps interspersed with small herbaceous openings dominated by forbs, with both clumps and openings no larger than 30 ft in diameter.
- Overstory deciduous trees (5–15/acre) resulting in 10–30% canopy cover.

Advancing or retarding succession to achieve an appropriate successional stage can be difficult, and, in some cases, impractical. If a given patch is still in a primarily herbaceous state or has become a closed canopy forest, then the location might be better managed as grassland or forest (see Deciduous Forests Appalachian supplement).

Kyle Aldinger

Figure 3. *Good quality nesting habitat with clumped shrubs, herbaceous openings, and primary forest edge.*

How to Manage for Nesting Habitat

The three most common problems in abandoned farmlands are **1)** lack of a prominent forest edge, **2)** habitat elements (often shrubs or trees) too dense or evenly distributed, and **3)** too few overstory trees within the site (Table 1). When possible, on large sites, select abandoned fields adjacent to mature forest as opposed to those surrounded only by other fields. If this is not possible, develop an "interior feathered forest edge" by planting fast-growing, native trees and shrubs on each side of existing fencerows. Another way to increase edge habitat is to harvest trees in an irregular, feathered buffer along the existing forest edge. Mowing and brush-hogging in serpentine-like rows or small patches can be used to create a pattern of clumped shrub cover interspersed with herbaceous openings. A selective herbicide application might be necessary to reduce re-sprouting of woody plants and eliminate undesired invasive plant species. Habitat can be improved on sites with too few overstory trees by planting fast growing native trees in clumps or scattered throughout the plot.

Table 1. *Suggested management techniques to manipulate habitat conditions for Golden-winged Warblers.*

Symptom	Management Technique	Description of Technique
Lack of prominent forest edge	Timber Management	Harvest selected canopy trees along existing edge to promote shrub growth and extend habitat into forest.
	Plant Desired Species	Plant fast growing native trees and shrubs in large clumps or adjacent to existing fencerows.
Shrubs too evenly distributed or too many exotic shrubs	Mechanical Treatment	Mow within larger patches to create clumps with herbaceous openings; target exotic shrubs.
	Prescribed Burning or Grazing	Use micro-burns to selectively remove shrubs; graze cattle to reduce shrub density.
	Herbicide Spot Treatments	Treat individual or groups of shrubs to create smaller clumps, target exotic species when present.
	Restore Natural Disturbances	Restore hydrology on wetland sites to kill shrubs and retard re-growth.
Too few canopy trees	Timber Management	Create feathered edge through thinning; retain select saplings and poles as future trees.
	Plant Desired Species	Plant fast growing native trees in clumps or throughout the patch.
Too much herbaceous cover, too little shrub cover	Mechanical Treatment	Ripping, disking; reduce frequency and/or intensity of mowing.
	Prescribed Burning or Grazing	Reduce frequency and/or intensity of burning/grazing.
	Plant Desired Species	Plant fast growing native shrubs in clumps; best to use multiple species that vary in height when mature.

Resources/References

- Golden-winged Warbler Status Review and Conservation Plan, **www.gwwa.org**
- NRCS Working Lands for Wildlife provides technical and financial assistance to private landowners in the Appalachian region, **www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/?cid=stelprdb1046990**
- Golden-winged Warbler Habitat Best Management Practices for Forestlands in Maryland and Pennsylvania. American Bird Conservancy. The Plains, VA, 26 pp. **www.amjv.org/appalachian-forests/**

Prepared by Ron Rohrbaugh, Kyle Aldinger, Amber Roth, Curtis Smalling, Petra Wood, and Sara Barker Swarthout with additional information from the *Golden-winged Warbler Status Review and Conservation Plan*. **www.gwwa.org**

Curtis Smalling

Best Management Practices For
Golden-winged Warbler Habitat on Grazed Forestland and Montane Pastures in the Appalachians

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A publication of the Golden-winged Warbler Working Group, www.gwwa.org

This supplement for Grazed Forestland and Montane Pastures accompanies *Best Management Practices for Golden-winged Warbler Habitats in the Appalachian Region*, which includes general information that applies to all habitat types in this area. In this insert we discuss grazing practices that help meet Golden-winged Warbler habitat requirements and management strategies for maintenance or restoration of habitat where the stage of plant succession is unsuitable for nesting. Users should refer to both documents to develop a comprehensive management strategy for Golden-winged Warbler. The following are guidelines and not absolute rules for the creation of nesting habitat, thus prescriptions that fall outside the numerical ranges presented can provide habitat, too. Consult a Golden-winged Warbler or young forest habitat expert for assistance in tailoring a management plan to your property.

Many sites currently supporting Golden-winged Warbler in the Appalachian region are used as grazing areas for cattle (Figure 1), horses, and other livestock species. With a more than two hundred year history of these practices in many areas of the region, these mid-to-high elevation, often steep slope areas can support a diverse mix of plant species like grasses, hawthorne (*Crataegus* spp.), blackberry (*Rubus* spp.), goldenrod (*Solidago* spp.), and pioneering tree species like locust (*Robinia* spp.), wild cherry (*Prunus* spp.), and maple (*Acer* spp.). This diversity coupled with varying densities and timing of grazing creates the "clumpiness" preferred by Golden-winged Warbler and other shrubland specialists. Simple changes in grazing intensity, timing, or additional practices can significantly enhance habitat suitability.

Kyle Aldinger

Figure 1. *Cattle or other grazers can be an efficient way to maintain or create habitat.*

Key Landscape Scale Requirements

Select sites:

- within defined focal areas or < 5 miles from known breeding populations and < 1 mile from other early successional patches (e.g., timber harvests, old fields).
- with > 70% deciduous forest cover within a 1.5-mile radius of the site.
- at > 1,800 ft elevation in GA, TN, NC, KY, VA, WV, MD and > 1,000 ft in PA. Note: In some areas of this region, Golden-winged Warblers may only be found at elevations well above 1,800 ft and should be assessed for each site in consultation with a regional expert.

How to Manage for Nesting Habitat

Specific management prescriptions for Golden-winged Warbler should strive to create a complex, patchy mosaic of grasses, forbs, shrubs, saplings, a few canopy trees, and a forested edge (Figure 2). Transitional areas between dense vegetation and open areas are important for nesting and can be managed with grazing, mowing, or prescribed fire (Aldinger 2018). At the patch level, maintain less than 30% tree canopy coverage and up to 30–70% of area in shrubs and saplings clumps, with extensive forb and grass coverage (more than 80% of ground surface). See Appalachian BMP guide for more details.

Laura Patton

Figure 2. *Excellent Golden-winged Warbler nesting habitat with clumped shrub distribution and a prominent forest edge.*

Grazing for Habitat Maintenance

Maintaining early successional habitat with grazing is a balancing act of not overgrazing, versus not enough grazing intensity to curb the natural encroachment of canopy producing tree species. In general, if habitat has become too woody (> 30% tree canopy cover or too high stem density [see Appalachian BMP guide]), increasing grazing intensity coupled with mechanical treatments or other means is a preferred option. If the lack of woody stems and structural complexity is the issue, decreasing grazing pressure for varying periods is a simple solution.

Table 1. *Common plants associated with Golden-winged Warbler habitat. Tree species with asterisks are typically early successional.*

Trees	Shrubs and Small Trees	Grasses
oaks (*Quercus* spp.)	hawthorn (*Crataegus* spp.)	broomsedge (*Andropogon virginicus*)
tulip poplar (*Liriodendron tulipifera*) *	elderberry (*Sambucus* spp.)	little bluestem (*Schizachyrium scoparium*)
black locust (*Robinia pseudoacacia*) *	beaked hazel (*Corylus cornuta*)	Virginia wildrye (*Elymus virginicus*)
American chestnut (*Castanea dentate*) *	viburnums (*Viburnum* spp.)	sideoats grama (*Bouteloua curtipendula*)
black cherry (*Prunus serontina*)	beautyberry (*Callicarpa americana*)	panicgrass (*Panicum* spp.)
pin cherry (*Prunus pensylvanica*) *	strawberry bush (*Euonymus americana*)	**Forbs**
flowering dogwood (*Cornus florida*) *	blackberry/raspberry (*Rubus* spp.)	partridge pea (*Chamaecrista fasciculata*)
white ash (*Fraxinus americana*)	dogwood shrubs (*Cornus* spp.)	goldenrod (*Solidago* spp.)
sugar maple (*Acer saccharum*)	smooth sumac (*Rhus glabra*)	perennial sunflowers (*Helianthus* spp.)
hickories (*Carya* spp.)	wild plum (*Prunus americana*)	tick-trefoils (*Desmodium* spp.)
American beech (*Fagus grandifolia*)	serviceberry (*Amelanchier* spp.)	Joe-pye weed (*Eupatorium fistulosum*)

Depending on pasture quality, the recommended stocking level for maintenance of habitat is around one grazing unit (brood cow and calf) per 3–10 acres during the growing season. Avoid higher densities during May – July and increase if necessary during the non-breeding season. It is also important to avoid other management techniques during the breeding season.

When using grazing to manage early successional habitats, care must be taken to manage against invasives like autumn olive and multiflora rose, and manage for native plant species suitable for Golden-winged Warbler (Table 1). A simplified decision support matrix can be used for addressing specific habitat problems (Table 2).

Table 2. *Management options to maintain and restore Golden-winged Warbler habitat on grazed lands.*

Symptom	Management Technique	Description of Technique
Excessive canopy cover	Grazing	Winter and early spring grazing (especially horses and goats) to encourage browsing or cribbing
	Timber Management	Harvest to remove canopy trees and promote shrub growth
	Prescribed Burning	Use fire to kill intolerant trees and reduce canopy cover
Shrubs too evenly distributed	Grazing	Increase density of cattle or use other species to encourage browsing
	Prescribed Burning	Conduct micro-burns to selectively remove shrubs
	Mechanical Treatment	Mow in patches to create large shrub clumps interspersed with herbaceous openings
Too little herbaceous cover	Grazing	Exclude grazers to allow for recovery of herbaceous cover
	Timber Management	Harvest canopy trees to create gaps and allow greater sun penetration
	Mechanical Treatment	Cut or mow woody cover; apply herbicide to prevent re-growth; light fall disking
	Prescribed Burning	Use late growing season burns to promote grass/forb growth and frequent (annual) burning to reduce shrub cover
Too little edge (when residual canopy trees not present)	Grazing	Exclude grazers from edge zone or site to allow shrub and edge development
	Timber Management	Create irregular patch margin through timber harvesting
	Mechanical Treatment	Mow some shrubs and small trees to create feathered edges
Too few canopy trees	Grazing	Reduce grazing intensity for extended periods of time
	Timber Management	Create feathered edge; retain select saplings and poles of desirable species as future residual trees
High herbaceous cover, but low woody cover	Grazing	Reduce grazing intensity
	Mechanical Treatment	Reduce frequency and/or intensity of mowing
	Prescribed Burning	Reduce frequency and/or intensity of burning
	Plant Desired Species	Plant woody shrubs or trees

Resources/References

- Golden-winged Warbler Status Review and Conservation Plan, **www.gwwa.org**. Each Appalachian state has working group members available for assistance.
- NRCS Working Lands for Wildlife provides technical and financial assistance to private landowners in the Appalachian region, **www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/?cid=stelprdb1046990**
- Aldinger, K. R. 2018. Ecology and management of Golden-winged Warblers (*Vermivora chrysoptera*) and associated avian species in the Allegheny Mountains of West Virginia. PhD Dissertation, West Virginia University, Morgantown, WV.

Prepared by Curtis Smalling, Kyle Aldinger, Ron Rohrbaugh, Petra Wood, and Sara Barker Swarthout with additional information from the *Golden-winged Warbler Status Review and Conservation Plan.* **www.gwwa.org**

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This supplement for Utility Rights-of-way (ROWs) accompanies *Best Management Practices for Golden-winged Warbler Habitats in the Appalachian Region*, which includes general information that applies to all habitat types in this area. Users should refer to both documents to develop a comprehensive management strategy for Golden-winged Warbler. The following are guidelines and not absolute rules for the creation of nesting habitat, thus prescriptions that fall outside the numerical ranges presented can provide habitat, too. Consult a Golden-winged Warbler or young forest habitat expert for assistance in tailoring a management plan for utility companies and landowners to manage ROWs using methods that create habitat for Golden-winged Warbler.

Utility ROWs consist of long, linear corridors that are often managed in a way that can provide habitat for Golden-winged Warbler and other shrubland birds. Many landscapes within the range of the species are traversed by extensive networks of electric transmission lines and gas pipelines, which are expanding in response to increased gas extraction in the northeastern United States (Figure 1). In some states, such as New Jersey, more than half of the nesting Golden-winged Warbler occur on ROWs. Only a small proportion of these utility ROWs are managed for Golden-winged Warbler; therefore, substantial opportunities exist to benefit this species while still meeting the vegetation management goals of utility companies and working within acceptable budgets.

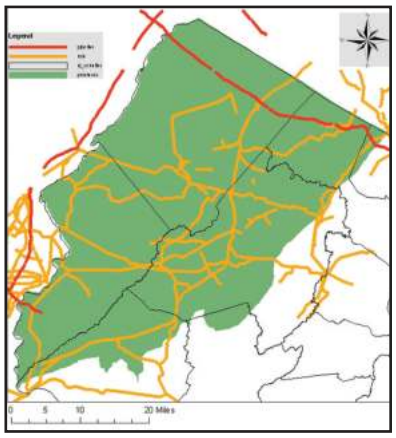

Figure 1. *ROWs in the Appalachian Region transecting New Jersey.*

Select and Manage ROWs in Landscapes:

- within defined focal areas or < 5 miles (preferably < 1 mile) from known breeding populations and < 1 mile from other early successional patches (e.g., timber harvests, old fields).
- with > 70% deciduous forest cover within 1.5 miles of the site.
- > 1 mile from residential areas and active croplands (to minimize disturbance by ATV operators, brown-headed cowbirds, and human-associated predators).
- > 165 ft wide unless they occur within or adjacent to larger areas of early successional habitat (Figure 2).
- with moist or unproductive soils, when possible, to help sustain nesting habitat with minimal maintenance.

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Figure 2. *Narrow ROW adjacent to early successional habitat.*

Other Issues to Consider

- Invasive plant species are often prevalent in utility ROWs, particularly *Phragmites* spp., reed canarygrass (*Phalaris arundinacea*), honeysuckles (*Lonicera* spp.), oleasters (*Elaeagnus* spp.), spotted knapweed (*Centaurea stoebe*) and common buckthorn (*Rhamnus cathartica*). Eradication of invasive plants is recommended when possible.
- Management of utility ROWs should be conducted in cooperation with the managing utility company and the owners of the properties within and bordering the ROW. Landowner incentive programs, such as those implemented by USDA Natural Resources Conservation Service, are available in many areas to encourage landowners to manage lands for conservation. These programs can be used to expand the area of appropriate habitat along the border of the ROW.

ROW Characteristics

- At least one side of the ROW must be bordered by intact deciduous forest that is ideally managed as Golden-winged Warbler habitat.
- Patches of woody-plant cover should be 30–70% of the total area within the ROW (Figures 3 and 4).
- Patches of grasses and forbs should be 30–60% cover, be fairly distinct from shrubby patches, and also contain several woody plant stems.

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Figure 3. *ROW with minimum shrub cover for Golden-winged Warbler.*

Tom Langen

Figure 4. *ROW with maximum shrub cover for Golden-winged Warbler.*

How to Manage for Nesting Habitat in ROWs

1. Allow for growth of low woody vegetation within the ROW (Table 1). Growth of dense shrub thickets slows the establishment of trees, thus reducing vegetation management costs. To minimize the risk of arcs in the wire zone of power lines, allow woody vegetation to grow < 330 ft from the towers where electrical wires are farthest from the ground (depending on topography), and maintain grasses/forbs under the wire zone where the lines sag.
2. Maintain taller woody vegetation along the ROW edges for a feathered effect. When practical, thin adjacent forest along the ROW edge(s) to help widen the corridor of open habitat.
3. The type of management, timing, and resulting slash can impact Golden-winged Warbler (Table 2). Strategic placement of slash piles from cuttings may protect woody vegetation from deer while allowing grasses to grow where slash is cleared.
4. Maximize diversity in habitat structure and species composition within the ROW (Table 3), and stagger maintenance activities in space and time. Please consult the Appalachian BMP guide for additional information.

Table 1. *Suggested low woody plant species for Golden-winged Warbler in ROWs.*

Shrubs and Small Trees
hawthorn (*Crataegus* spp.)
dogwood (*Cornus* spp.)
willow (*Salix* spp.)
viburnums (*Viburnum* spp.)
alders (*Alnus* spp.)
brambles (*Rubus* spp.)
elderberry (*Sambucus* spp.)
beaked hazel (*Corylus cornuta*)
American hazel (*C. americana*)
scrub oak (*Quercus ilicifolia*)
dwarf chinkapin oak (*Q. prinoides*)

Table 2. *Suggestions for ROW maintenance for Golden-winged Warbler.*

Management		Timing*	Suggestions
Herbicide	Basal	–	not recommended
	Radiarc	–	not recommended
	Selective Foliar	Aug 16–Apr 15	retain shrubs and small trees
	Stump Treatment	Aug 16–Apr 15	retain shrubs and small trees
Mowing	Grass	Aug 16–Apr 15	retain shrubs and small trees; stagger mowing of adjacent spans
	Brush	Aug 16–Apr 15	retain shrubs and small trees; stagger mowing of adjacent spans
Other	Hand Cutting	Aug 16–Apr 15	retain shrubs and small trees; stack slash; stagger cutting of adjacent spans
	Hazard Tree Removal	as needed	retain shrubs and small trees
	Tree Pruning	as needed	retain shrubs and small trees
	Light Grazing	as needed	retain some tall herbaceous ground cover

** avoid management during nesting and post-fledging periods*

Table 3. *Management options to restore Golden-winged Warbler habitat on ROWs.*

Symptom	Vegetation Management
Adjacent or wide ROWs > 820 ft with few trees	Change from mowing to hand cutting or selective herbicide to maintain larger, non-hazard trees.
	Plant appropriate fast-growing trees along the edge or between corridors.
Shrubs evenly distributed	Mow in patches to create clumps with herbaceous openings.
	Restore hydrology on wetland sites to kill shrubs and slow re-growth.
< 30% shrub cover	Reduce mowing/herbicide frequency, stagger cutting of adjacent spans.
	Plant patches of shrubs to initiate establishment of shrub cover.

Resources/References

- Golden-winged Warbler Status Review and Conservation Plan, **www.gwwa.org**
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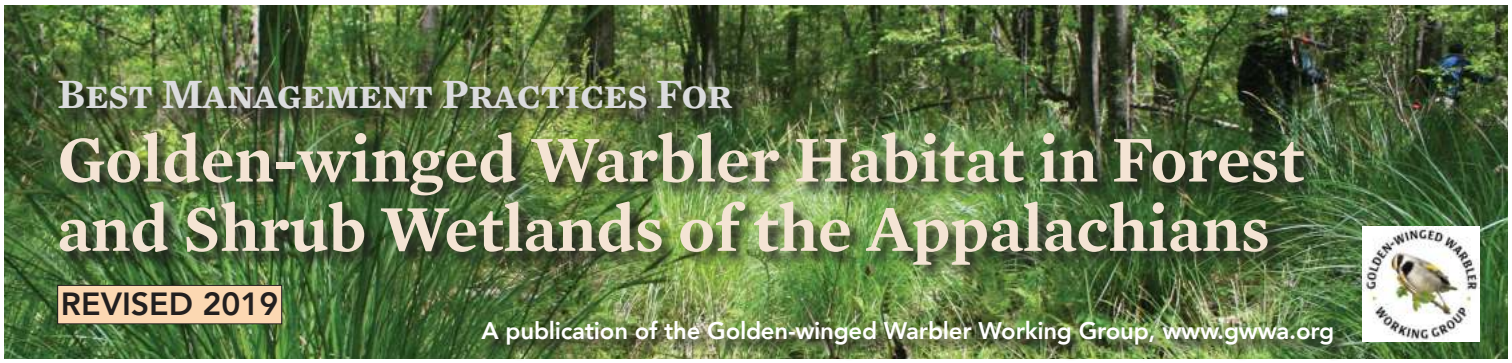
Prepared by Sharon Petzinger, Tom A. Langen, Jacob E. Kubel, Amber Roth, and Sara Barker Swarthout with additional information from the *Golden-winged Warbler Status Review and Conservation Plan*. **www.gwwa.org**



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BEST MANAGEMENT PRACTICES FOR
Golden-winged Warbler Habitat in Forest and Shrub Wetlands of the Appalachians

REVISED 2019

A publication of the Golden-winged Warbler Working Group, www.gwwa.org

This supplement for Forest and Shrub Wetlands accompanies *Best Management Practices for Golden-winged Warbler Habitats in the Appalachian Region*, which includes general information that applies to all habitat types in this area. Users should refer to both documents to develop a comprehensive management strategy for Golden-winged Warblers. The following are guidelines and not absolute rules for the creation of nesting habitat, thus prescriptions that fall outside the numerical ranges presented can provide habitat, too. Consult a Golden-winged Warbler or young forest habitat expert for assistance in tailoring a management plan to your property.

In the Appalachians, beaver wetlands (Figure 1), valley bottoms, and the perimeters of high elevation bogs can provide habitat for breeding Golden-winged Warblers. Perimeters of beaver meadows are often used shortly after a pond and its dam are abandoned, and water level drops promote a dense growth of both herbs and shrubs in the wet edges of the former pond. In high elevation wetlands of the Appalachians, Golden-winged Warblers occur in the forested perimeter around bogs, in forest wetlands dominated by red maple and sedges, and in scrub-shrub wetlands dominated by blueberry, willow, and sedges (Larkin pers. com.). See Table 1 for a list of common wetland plants of the Appalachians. Not all forest and shrub wetlands are occupied by Golden-winged Warblers for a variety of reasons, including high water levels, lack of vegetation patchiness, too few canopy trees, and a lack of surrounding forest. Reduced flooding and beaver activity may be partially responsible for these conditions and restoration of these natural disturbances can improve habitat quality. In other cases, mechanical treatments provide the mechanism for creating or restoring nesting habitat (Figure 2).

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Figure 1. *Golden-winged Warbler territory in a beaver wetland.*

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Figure 2. *Wetland in an extensively forested landscape after a mechanical treatment in Bald Eagle State Park, Pennsylvania. Note frozen lake in background.*

Key Landscape Scale Requirements

Select sites:

- within defined focal areas or < 5 miles (preferably < 1 mile) from known breeding populations and < 1 mile from other early successional patches.
- with > 70% deciduous forest cover within 1.5 miles of the site.
- with shrub wetlands ≥ 5 acres in size where rotational management can be applied so that at least 20% of the area is cut every 5 years.

Table 1. *Common plants associated with Golden-winged Warbler habitats in Appalachian wetland systems.*

Characteristic Canopy Species	Characteristic Shrub Species	Characteristic Herbs
red maple *(Acer rubrum)*	spicebush *(Lindera benzoin)*	sensitive fern *(Onoclea sensibilis)*
green ash *(Fraxinus pennsylvanica)*	alders *(Alnus* spp.*)*	cinnamon fern *(Osmunda cinnamomea)*
black ash *(Fraxinus nigra)*	viburnums *(Viburnum* spp.*)*	royal fern *(Osmunda regalis)*
elm *(Ulmus* spp.*)*	blueberry *(Vaccinium* spp.*)*	marsh fern *(Thelypteris palustris)*
willows *(Salix* spp.*)*	shrubby dogwoods *(Cornus* spp.*)*	tussock sedge *(Carex stricta)*
yellow buckeye *(Aesculus octandra)*	swamp azalea *(Rhododendron viscosum)*	iron weed *(Vernonia noveboracensis)*
	poison sumac *(Toxicodendron vernix)*	wing stem *(Verbesina* spp.*)*
	hawthorn *(Crataegus* spp.*)*	

Is Management Necessary?

Forest and shrub wetlands might not need management if they have **1)** many small open herbaceous patches with either dry ground or sedge tussocks for nest sites, **2)** scattered patches or clumps of woody shrubs that are not continuous in large blocks, **3)** scattered trees throughout, and **4)** periodic natural disturbances (e.g., flood, beaver) (Figure 3). The absence of any of these characteristics suggests that there is a current or future management opportunity to improve habitat. Certainly not all forest and shrub wetlands should be managed, particularly those that are not accessible with the necessary equipment, have rare plants or animals that may be harmed by the management activities, or where soils remain wet or are sensitive even in winter.

Figure 3. *Aerial photo taken during winter of an extensive wetland system supporting Golden-winged Warblers at 4,200 ft in North Carolina. Management consists of limited sporadic mowing in the upland borders and fire twice in the past five to six years.*

Forest and Shrub Wetland Management Guidelines

Treatment Practices:

Shrub management is needed when shrub cover is continuous in large blocks with few large patches of herbaceous vegetation (> 70% shrub cover). Use small machinery to shear, cut, or chip woody shrubs or individual trees to open patches of herbaceous vegetation, regenerate decadent patches of mature shrubs, and to create a more balanced mix of shrub and herbaceous patches. Hand-cutting woody vegetation (Figure 4) is an option for small areas and places sensitive to disturbance by large equipment. In most places, wetland shrub treatment will be noncommercial so material can be left scattered on-site. For private landowners, cost-share programs (e.g., Natural Resources Conservation Service) are available to reduce the expense of management.

Treatment Patterns:

Cut shrub wetlands as strips and blocks with irregular edges on a rotational schedule. Within treatment areas ≥ 5 acres, retain 50% of the shrubs in patches to create a patchwork of shrub and herbaceous vegetation throughout the managed area. Deciding which shrub patches to cut and which to retain is as much art as science. Follow the topography and retain trees and other features that increase vegetation structural diversity. Canopy trees are important for nesting habitat. For forested wetlands, manage for 30–70% canopy cover and for shrub wetlands, retain all trees up to 15 trees/acre.

Pennsylvania DCNR – Bureau of Forestry

Figure 4. *Winter wetland treatments at Delaware State Forest target removal of some canopy red maple trees to promote sedge growth, providing increased herbaceous habitat for Golden-winged Warblers.*

Other Management Considerations

Invasive Plants:

Prior to wetland shrub management, identify invasive plant species on-site or nearby. Pre-treatment of invasives may be necessary to prevent their spread or potential competition with desired regenerating species. Cut sites in winter and routinely clean machinery between sites to minimize the spread of invasive plants. Forested wetlands of the Hudson Highlands (New York and New Jersey) have recently experienced a major expansion of *Phragmites communis*. This non-native, invasive species forms dense, monotypic stands, which are rarely used by Golden-winged Warblers. Wherever possible, *Phragmites* should be aggressively controlled through flooding, herbicide treatments, or grazing by small ungulates such as goats.

Riparian Zone Management:

Wetland shrubs in riparian zones, especially where adjacent to or intermixed with deciduous forests can be managed for Golden-winged Warblers. Follow riparian zone management guidelines for your area.

Resources/References

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