PennState College of Agricultural Sciences
Wildland Weed Management

Natural Resource Management Factsheet

The Benefits of

Young Forest Habitat

1

What is Habitat?

Our purpose is to make the case for adoption of early successional, or 'young forest' habitat as an important element of natural resource management in state parks (Figure 1). Young forest has been decreasing in the northeast U.S. in the past 50 years, and this has resulted in alarming declines in the populations of many game and non-game animals that depend on this habitat. Young forest is a missing link in a larger effort to maintain a landscape of diverse forest ecosystems with a range of tree age classes.

Any location that is supporting life is 'habitat', but our objective is to provide the best living conditions for the species that feature in the natural history of the site, and provide refuge for species that are conservation priorities. As the American landscape has become less rural in the last 100 years, specific habitat types important to many species have become fragmented and degraded by development and invasive species. This is why it is important to actively manage, when practical, for rare and threatened habitat on public lands.

Components of Habitat

The basic elements of habitat are familiar to us – water, food, shelter, and space. 'Shelter' describes the space animals use to nest, rest, and hide from their predators, while 'space' describes the area they need to forage for food and seek their mates. What 'food' is depends where you are in the food chain. However, whether you're a caterpillar or an apex predator, the quality of the habitat depends on having the right plants.

The 'right plants' has two elements - structure and species. Structure of the plant community addresses wildlife shelter and space needs. Plant *species* is critical when considering the food value of habitat.

Figure 1. Young forest habitat is a mix of native shrubs, sapling trees, and native herbaceous vegetation near intact forest and residual mature trees. The height and density of the vegetation is varied and patchy. Young forest habitat has been in steady decline due to changes in land use and an increase of exotic species.

Which Plants Make Good Food?

The element of habitat that we can most influence to make improvements is the plant community. This is true whether we are creating habitat for threatened or endangered butterflies that seek particular flowers for nectar, or a migratory songbird that is going to feed primarily on insects. The plants in an ecosystem are the base of the food web – they capture the energy of sunlight and convert it to food. Organisms that eat plants become food for the predators higher in the food chain. A key element of habitat management is to understand that not all plants are created equal in their food value.

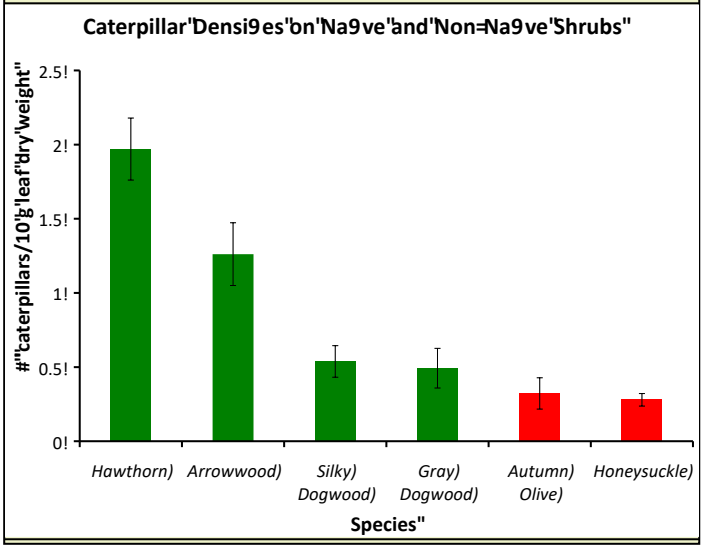
Native plants make the best food. The fundamental reason for this is that animals and plants native to an ecosystem have evolved together over thousands of years. They have come to a delicate balance in the struggle for survival between animals needing to eat and plants needing not to be eaten.

A visible example of an ecosystem out of balance is when white-tailed deer populations increase beyond a sustainable level and overbrowse the species they prefer. The population of remaining plants shifts to exotic species and a few highly unpalatable native plants such as hayscented fern and white snakeroot.

A less visible, but equally important impact is on insect populations. Insects and other invertebrates are by far the most important part of the diet of migratory songbirds and small mammals. The majority of herbivorous (plant eating) insects are *specialist* feeders – eating only a few closely related plant species. When exotic plants displace native plants in the landscape, many of the insects that feed on the native plants are lost as well because they no longer have anything to eat.

The displaced native insects are typically not replaced with exotic insects. Most introduced plants come to their new home without their competition – the plants, insects, and microbes they evolved with in their own native ranges that kept them in check. Therefore, habitat quality is very much determined by which plants are present in an

Figure 2. Research conducted in Pennsylvania state parks demonstrates that native shrubs host more caterpillars than exotic shrubs. In the chart below, green bars represent native species and red bars are exotic species. Each bar indicates the average number of caterpillars found per unit of leaf dry weight (S. Moon, Indiana University of PA).



ecosystem – even for animal species that do not eat these plants directly (Figure 2).

What is Young Forest Habitat?

Change is always occurring in a habitat. In the early stages of the progression between 'no trees' and 'big, old trees', is young forest habitat. It is a transitional, or *successional* phase between disturbance and the maturation of a forest community to a point where change occurs more slowly.

Succession is the process where a plant community changes over time. The textbook example is an abandoned agricultural field – an area where disturbance has created bare soil with no plants. The first species to appear are seedlings adapted to quickly colonize this open ground. Over time, the vegetation transitions from short-lived opportunists to more persistent perennial plants, then finally to woody species that grow above the initial colonizers. Eventually the canopy closes, and change in the plant community slows – but it does not stop. Maturing forests continue to change. The changes can be discrete or cataclysmic, such as small canopy gaps due to individual tree mortality, or severe fire or loss of a dominant species to disease (e.g. chestnut blight).

Habitat Types

Broken down to very basic categories, terrestrial habitat can be described as grassland, early successional, and forest. This is an oversimplification, but it describes most of the landscape of the northeastern United States.

Grassland

Grassland habitat is almost exclusively herbaceous, with a very low level of shrub or sapling cover. The largest areas of grassland habitat in Pennsylvania are agricultural areas and reclaimed surface mines. Higher quality grasslands will feature native grasses and forbs, and likely need periodic maintenance such as prescribed fire to discourage woody species encroachment.

Mature Forest

We use the term 'Mature Forest' to describe tracts of closed canopy of varying heights and density that do not feature *non-forest* edges. Transitional, or 'soft' edges between forest age classes within a tract of mature forest are desirable. Abrupt, or 'hard' edges with fields and developed areas lead to predation by edge species such as opossum and raccoons, and nest parasitism by cowbirds.

Early Successional, or Young Forest

Grassland and mature forest can be thought of as the early and late ends of the continuum of terrestrial habitat types. This leaves the term 'early successional forest' to describe a great range of forms in between, and leads to a number of variants –old field, shrub-scrub, shrubland, or the term we will use – 'young forest'. This term conveys the critical elements – a significant population of young or small-statured native woody species, a native herbaceous community, and a transitional, changing plant community.

Young Forest Composition

Young forest provides a mix of plant species, sizes, and densities. The young forest composition we desire is a mix of woody and herbaceous species, with the woody component providing about 15 to 70 percent cover. The woody species should be native brambles, shrubs, vines, and sapling trees that vary in height and are patchy in distribution. In addition, scattered mature trees, and bordering tracts of intact forest are desirable.

Native forbs (e.g. goldenrods, asters) are the most important herbaceous component, and are complemented by native grasses that provide vertical structure, ground-level space for small mammals and birds, and fuel for sites managed with prescribed fire. Commonly planted native grasses include big bluestem, little bluestem, Indiangrass, and switchgrass. Exotic, cool-season agronomic grasses such as tall fescue, reed canarygrass, or smooth brome should be discouraged. These grasses are tremendously competitive, essentially stall succession by suppressing establishment of desirable forbs and shrubs, and provide little habitat value themselves.

Benefits of Young Forest

Establishing or enhancing young forest habitat provides benefits for many wildlife species that have suffered decline in the last several decades, and also serves as a model

approach to improve the natural resource and conservation value of state parks.

Young Forest Wildlife Species

Creating young forest provides habitat to species that specifically require these sites, *and* provides desirable habitat to species with broader habitat adaptations. Table 1 lists examples of wildlife species from a number of taxa that benefit from increased availability of young forest habitat, including migratory songbirds, game species, small mammals, and reptiles. In addition, native shrubs and forbs will benefit insects that feed on leaves and nectar.

Why Young Forest is Right for State Parks

Many state parks are positioned in a varied landscape including forest, agricultural fields, open water and streams, as well as man-made infrastructure such as roads and buildings. In a diverse landscape with relatively small patches of any particular landscape feature, young forest habitat will often provide the greatest benefit because relatively small areas still provide useful habitat, and it is a habitat that is by nature patchy and diverse.

When you consider the patch size for wildlife species that *require* mature forest, grassland, or young forest, the area needed for an obligate species to nest in young forest is generally smaller in than these other habitat types. In a patchy landscape, an area of high quality young forest will likely benefit more species and provide more conservation value per unit of management effort expended, and provide more value to park visitors.

Table 1. These are some species that benefit from an increase in young forest habitat. The benefits can be due to a reliance on young forest for all or some phases of their life cycle, occasional use of young forest as part of their larger habitat mosaic, or benefitting through an increase in prey.

Common Name	Common Name
Migratory Songbirds	Golden-winged Warbler
	Eastern Towhee
	Chestnut-sided Warbler
	Common Yellowthroat
	Black-and-white Warbler
	Red-eyed Vireo
	American Redstart
Game Birds	Ruffed Grouse
	American Woodcock
	Wild Turkey
Mammals	White-tailed Deer
	Appalachian Cottontail
	Bobcat
Reptiles	Eastern Box Turtle
	Northern Racer
	Smooth Green Snake
Insect	Monarch Butterfly

Young Forest Management

Young forest habitat is diverse, and will vary from one site to the next. Young forest management is an ongoing combination of techniques to remove undesirable plants, release or add desired plants, and adjust the size and density of existing plant populations.

Mechanical Clearing

Mechanical clearing describes operations including targeted tree removal and the use of specialized machines (forestry mowers) capable of mowing large shrubs and small trees (Figure 4).

Used judiciously, mechanical clearing is a key tool in young forest management, particularly in the process of reclaiming or 'resetting' areas where the woody growth has become too large or dense. Targeted cutting or logging can be used to create a feathered transition between existing forest and adjacent successional areas and 'creating' residual trees. Clearing operations provide a useful step prior to follow-up herbicide applications targeting exotic plant species.

In contrast to mechanical clearing, conventional mowing relies on equipment designed to cut herbaceous and small-diameter woody vegetation (i.e. 'brush hog'), and provides limited benefits as an ongoing maintenance tool. Routine mowing is highly disruptive because it temporarily eliminates the cover element of habitat, suppression of undesirable woody species is short-term, and the mowed residue accumulates at ground level, eliminating an important space for small ground-dwelling and foraging species.

Herbicides

Herbicides are useful for establishing and maintaining habitat. Herbicides can eliminate exotic species to facilitate release, planting, or seeding of desirable species. In contrast to mowing, herbicides can actually kill target plants, rather than setting them back temporarily. Additionally, herbicides are better suited for implementing a low-impact, highly selective spot-treatment regimen – for 'hand crafting' habitat.

Planting and Seeding

It may be necessary to supplement the existing vegetation through seeding or planting. The preferred approach is to manipulate the existing vegetation to release desired species that are present or in the seedbank, but conditions such as high deer density may prevent regeneration of native species without some intervention. This intervention can include introducing plants and excluding deer temporarily through exclosure fencing or tree shelters. Native plants can be introduced through

seeding of herbaceous or woody species, as well as planting live stakes and seedlings of woody plants.

Tillage

Soil disturbance may be necessary to release desired species, particularly in situations where herbaceous vegetation, such as goldenrods or previously planted warm-season grasses, has become too dense. A device such as a tractor-mounted disk harrow is often sufficient to thin established stands and disturb the soil to increase species and spatial diversity.

Prescribed Fire

There may be situations where prescribed burns can be implemented to preserve the existing desirable woody species and suppress encroaching exotic species. Research is ongoing to determine if a combination of fire-tolerant woody and herbaceous species can be developed so that sites can simply be burned on a cycle to prevent encroachment of exotic shrub species while maintaining a desired maturity and density of the native species.

Getting Started

Improving habitat value of park areas will start with identifying the footprint of existing habitat types, and then prioritizing work among the available areas, starting with the higher quality sites.

Where is the Habitat?

When viewed simply as habitat/non-habitat, the park areas considered 'non-habitat' are heavily trafficked locales in day-use areas and affiliated parking, administrative, and utility areas. However, most of the park is suitable for supporting young forest habitat, including existing fields and natural areas, large tracts of undeveloped area, small patches of lawn and 'field' that are close to highly visited areas but not highly trafficked, as well as campground and tenting areas. This presents a range of opportunities for habitat creation and enhancement.

Smaller, highly visible areas are not insignificant. As long as they are contiguous with or in proximity to larger habitat areas, these smaller sites not only provide real habitat value, but also useful interpretive sites and opportunities to promote habitat management to park visitors.

Young forest habitat is heterogeneous by nature, so you can create larger tracts by combining various patches of forest and fields of varying quality and states of reforestation (Figure 5).

Prioritize the Work

The basic approach to habitat management is to 'protect the best' - improve better areas, then progressively address sites that require more work per unit area. The goal is to maximize the acres of high quality habitat created for each hour or dollar invested.

Figure 4. A forestry cutter is a specialized mower capable of clearing brush and woody stems several inches in diameter. Forestry cutters are useful for clearing woody vegetation that is becoming too dense. They also serve as good first step in eliminating exotic shrubs, as the resprouts can be selectively removed with a foliar herbicide application.

Young forest does not function alone – it augments existing forest. The highest priority sites are adjacent to existing forest areas, and feature at least some scattered, larger trees. To determine the most useful operations, evaluate the following sequence of questions:

1) Are there enough native shrubs and trees?

2) Are there too many exotic shrubs?

3) Are there enough native forbs?

4) Are there too many exotic grasses?

Figure 6 provides a decision tree approach to these questions, leading to a series of prescriptive actions to improve habitat quality.

Native Shrubs

Shrubs and sapling trees provide the structure of young forest habitat, as well as the foraging sites for insects and birds. Native shrubs are more valuable than exotic shrubs, so having a certain critical mass of native shrubs or sapling trees is the top management priority. With so many factors affecting the suitability of a site as habitat, only a rough guideline on how much is 'enough' can be provided. If the minimum desired total shrub/sapling cover is 15 percent, we can set a threshold that at least 2/3, or 10 percent of the total cover be from *native* shrubs and saplings.

Exotic Shrubs

Our long-term goal is minimizing exotic shrub cover. If we have sufficient native shrubs and trees, we can aggressively reduce exotic shrub content. However, if native woody species cover is low but exotic shrubs are present, we need to preserve a certain amount of these exotic shrubs until we can increase the cover from native

species. The structure provided by shrubs is important enough that our working model is that some exotic shrubs are better than no shrubs at all.

Native Forbs

Native forbs (wildflowers) are the most important herbaceous component because in addition to providing ground-level cover, the nectar and pollen of forbs attracts more insects than grasses. Forb presence is our indicator of the quality of the herbaceous community. If native forb presence is low we will suppress other components of the plant community to release or establish additional forbs. A minimum target level of native forb cover is 10 percent, assuming there is sufficient native shrub cover.

Exotic Grasses

Exotic, agronomic grasses such as tall fescue, smooth brome, and reed canarygrass are detrimental to habitat quality and should be actively suppressed. Alone, these grasses have little foraging value, their sod-like growth habit provides poor ground-level structure, and they are extremely competitive and essentially 'stall' succession so that desired native woody and herbaceous species cannot establish. For this reason, we set a low threshold of five percent cover as the point to actively suppress exotic grasses.

Summary

Quality young forest habitat is declining in the northeast United States due to development, invasive plant species, and young forest aging into pole stage and mature forest. As this habitat declines, so does the population of wildlife species that depend upon it.

Pennsylvania state parks represent an ideal setting to increase the availability of high quality, young forest habitat, particularly where there are existing tracts of forest or woodlot to complement the young forest. Young forest habitat is diverse, and the varied landscape of state parks creates a great setting to optimize resources by creating the most useful habitat practical with the resources at hand.

'Protect the best' is the basic premise of habitat management. Within a park, landscape patches are combined to create larger habitat areas. The high-quality areas are maintained, and areas that require more work are improved as resources allow. Over time, the original collection of variable-quality sites becomes a large, high-quality habitat area.

Prioritizing habitat management efforts will rely on identifying key patches of mature forest and residual trees to anchor the young forest enhancement. Then maximize native shrubs and sapling trees, as well as native forbs. At the same time, exotic shrubs and grasses need to be minimized. The process will be a combination of operations to suppress undesirable vegetation and release and introduce desirable vegetation.

Ideally, field operations will be integrated with environmental education and will result in not only enhanced conservation efforts, but also greater visitor use and appreciation of the improved habitat.

Further Reading

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. https://www.pgc.pa.gov/Wildlife/HabitatManagement/Pages/default.aspx

Jones, B. C., Miller, H.E. Undated. Habitat Management for American Woodcock in Pennsylvania. https://www.pgc.pa.gov/Wildlife/HabitatManagement/Pages/default.aspx

Tallamy, Douglas W. Bringing Nature Home: How You Can Sustain Wildlife with Native Plants. Portland, OR. Timber Press. 2009.

Williamson, S.J. 2008. American Woodcock Habitat Best Management Practices for the Central Appalachian Mountains Region. https://timberdoodle.org/resource/american-woodcock-habitat-best-management-practices-central-appalachian-mountains-region

Figure 5. When prioritizing young forest habitat management operations, identify tracts of mature forest to 'anchor' the habitat. The red border is the park boundary, the green-shaded area is mature forest, and the yellow-shaded areas are suitable for young forest operations. The polygons within the young forest area indicate existing field or woodland patches. The sequence of work on the young forest units would be prioritized based on the decision process described in Figure 6.

Figure 6. Operations on young forest areas can be prioritized based on the workflow described below. These conditions assume the site does not require reclamation with extensive mechanical clearance. Questions proceed from left to right, in order of priority, from native woody species cover, exotic woody species cover, native forb cover, and exotic grass cover. The operations, designated by the letters A through D, are described below the chart.

Native Shrub/Sapling (>10 % cover)	Exotic Woody Species (<5 % cover)	Native Forbs (>10 % cover)	Exotic Grasses (<5 % cover)	Operations
YES	YES	YES	YES	NO ACTION
			NO (C)	B
		NO (C, D)	YES	B, D
			NO (C)	B, D
	NO (B)	YES	YES	A
			NO (C)	A, B
		NO (C, D)	YES	A, B, D
			NO (C)	A, B, D
NO (A)	YES	YES	YES	B, C
			NO (C)	B, C
		NO (C, D)	YES	B, C, D
			NO (C)	B, C, D
	NO (B)	YES	YES	A, C
			NO (C)	A, B, C
		NO (C, D)	YES	A, B, C, D
			NO (C)	A, B, C, D

Code	Operation	Options
A	Introduce Woody Species	Plant and protect (shelters or exclosures), direct seed, or release from seedbank with herbicide and/or tillage.
B	Shrub Suppression	Herbicide application, or mechanical clearance plus herbicide application.
C	Herbaceous Suppression	Herbicide application, using a systemic, non-residual herbicide mix.
D	Introduce Herbaceous Species	Seed, or release from seedbank with tillage or herbicide application.

This work was sponsored by the Pennsylvania Department of Conservation and Natural Resources, Bureau of State Parks (PA DCNR). Penn State College of Agricultural Sciences research and extension programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.

Prepared by Art Gover, Penn State University, and Rachel Reese, PA DCNR, Bureau of State Parks. The authors wish to thank Jeff Larkin, Indiana University of PA, for critical review.

pennsylvania
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
www.dcnr.state.pa.us