FOREST RESOURCES ENHANCEMENT AND PROTECTION

PROTECT SPECIAL SITES AND SOCIAL CONSIDERATIONS

Special Sites

Gov. Dick's 1,105 acres of virtually unfragmented forestland is essential to maintaining the integrity of the Furnace Hills woodland corridor. The north-south width of the Furnace Hills corridor, which includes Gov. Dick, is approximately 2.8 miles. Gov. Dick's centralized location and size (more than 60% or 1.7 miles of the corridors width) make it an essential link for migrating woodland wildlife within the region.

A taste of the history surrounding Clarence Schock Memorial Park can be found by searching the internet. One particularly interesting site is http://governordick.tripod.com/history.html which describes an intriguing period of our history and an insight into Gov. Dick and the local community of Mount Gretna. Many references to iron and steel and "Furnace Hills" conjure images of the industrial revolution; a period in our history when conservation and natural resource management had little or no meaning.

Gov. Dick followed much the same path as nearly all the forestlands of Pennsylvania. Historical pictures and records describe a time around the turn of the 20th century where nearly all the timber resources in Pennsylvania were consumed by the "industrial furnaces" of that time. By the early 1900's all usable wood, large and small, was turned into energy, chemical, or other products. Entire landscapes lay devoid of sizable trees and brush land prevailed.

Charcoal hearths attest to this same fate at Gov. Dick. The telltale hearths can still be identified throughout the property. One need not travel far before coming across a flattened circular earth disturbance once used to produce charcoal. In fact, many of the existing trails intersect the "charred earthen circles" that are roughly 30 feet in diameter. The sites can often be recognized by blackened surface soil and the intrinsic nature of these circular flats to be wetter than surrounding soils. This is due to the soil's reduced permeability resulting from the baking and its compaction during the charcoal-making process.

Abandoned portions of an historic small gauge railroad grade are found at Gov. Dick. The unique 2-foot-gauge railroad connected the Cornwall & Lebanon R.R. (current location of rails-to-trails) north of Mount Gretna (via Lake Conewago) to the upper slopes of Gov. Dick Hill. After an accident in 1915, the rail-line was retired and dismantled. The 2-foot-gauge railroad is noted as the only operating rail-line of its type in United States history. The railroad grade enters onto Gov. Dick at the current location of the Pinch Road parking lot, cutting south and paralleling Pinch Road for a distance to gradually ascend the slope. At a point not too far upslope from the ***Environmental Center***, the grade switches back to continue its accent to the summit of Gov. Dick Hill. Most of the original grade has been maintained for continued use as hiking trails.

The Observation Tower located at the summit of Gov. Dick Hill provides a panoramic view of the horizon. Five counties are said to be visible from atop the Tower – Lebanon, Lancaster, Dauphin, York and Berks. The best view is perhaps towards the south to southwest horizon. Gretna Springs Retirement Community can be seen near the base of the hill. Manheim, Lititz, and Lancaster are somewhat visible further out on the horizon. An artist's rendition of the landscape could provide

interesting information such as the location and distance of Blue Mountain and Manheim. Several of these panoramic "maps" could be created and affixed atop podiums in appropriate locations in the Observation Tower.

The elevations along this ridge are the highest that can be found on this property and among the highest elevations found anywhere in the Furnace Hills region. The view of the Furnace Hills region and the farmlands that stretch beyond is spectacular.

Several scenic overlooks can be created to increase the enjoyment and appreciation felt by hikers, mountain bikers, and horseback riders. Numerous rock outcrops along the ridgeline of Gov. Dick Hill provide ample opportunities to overlook the woodlands below. Several possible vista locations have been marked on the map. Trails can be constructed to encourage use of the vistas.

The Horseshoe Trail traverses the property in an east-west direction along the northern boundaries of Mgmt. Units #2, #4, #6 and #7. This trail provides a continuous recreational corridor that extends across a multitude of land use types in southeastern Pennsylvania. This trail has historic and cultural significance worth preserving for future generation.

Rock, boulders, and "rubble land" comprise much of Mgmt. Unit #5. This management unit contains large areas of continuous rock outcroppings intermingled with areas of woodland that are less rocky. Some "islands of soil and trees" found in these rockscapes exhibit less amounts of deer browse damage. These areas often exhibit increased vertical structure and contain plants not found elsewhere on the property. Plant species noted during the survey include serviceberry, hawthorn, hornbeam, hophornbeam, witch hazel, rubus spp., dogwood, and various unidentified forbs and grasses, increased incidence of sapling regeneration including tulip-poplar, red maple, ash, and several oak and walnut pole-sized trees. These rubble lands also tend to have many downed trees of various sizes indicating that windthrow due to shallow rooting is common. Raccoon, rodent, and squirrel tracks were observed and grey fox were heard during the survey indicating that this environment greatly adds to species richness not found elsewhere on the property.

Several relatively large (1 to 2 acre) grapevine tangles were found during the survey. The larger tangles tend to be located on the mid- to upper-slopes of Mgmt. Units #3, #4 and #5 on the steep side slopes of rock outcroppings where shallow rooting of overstory trees is more likely. Groupings of several to many large trees were found wind thrown within the rock outcroppings, thereby creating favorable conditions for grapevine establishment and expansion. Deer, squirrels, and a grey fox were sighted in and around the grapevine tangles. Deer were using these tangles for winter cover, though considered marginal for this use at best.

The overstory of white pine found in Mgmt. Unit #2 provides a valuable change to structure of the surrounding habitat types. This high evergreen cover provides roosting sites for crows, owls, hawks and possibly turkey (if present).

Rocky outcrops along the ridge tops of Mgmt. Units #5 and #6 are important nesting and denning sites for birds, mammals, and reptiles. Turkey vultures were sited using these rock outcrops for nests.

Adjacent Stand or Ownership Concerns

Gov. Dick is located immediately east of Mount Gretna and Mount Gretna Heights. State Game Lands #145 (located to the west) enhance the recreational opportunities of this woodland community by providing an additional 2,793 acres of public land. The nearby quaint artisans' community of Mount Gretna is nestled in a conifer-dominated woodland setting. The public is drawn to the area in large numbers to enjoy social and cultural activities in Mount Gretna, as well as outdoor recreational activities like hiking, biking, horseback riding, and swimming, as well as the additional opportunities of fishing and hunting on SGL #145. More than 2.9 miles of the historic Horseshoe Trail lies within the boundaries of Gov. Dick with many additional miles of hiking trails available for public use, including the Lebanon Rails-to-Trails system.

Recreation

This property is located immediately east of Mount Gretna and Mount Gretna Heights. State Game Lands #145 (located west of Gov. Dick) enhance the recreational opportunities of this woodland community by providing an additional 2,793 acres of public land. The nearby quaint artisans' community of Mount Gretna is nestled in a conifer-dominated woodland setting. The public is drawn to the area in large numbers to enjoy social and cultural activities in Mount Gretna, as well as outdoor recreational activities like hiking, biking, horseback riding, and swimming, as well as the additional opportunities of fishing and hunting on State Game Lands #145. More than 2.9 miles of the historic Horseshoe Trail lay within the boundaries of Gov. Dick and traverses the property in an east-west direction. The trail is marked with yellow blazes as it follows or parallels much of the ridgeline inclusive of Gov. Dick Hill. This trail provides a continuous recreational corridor that extends across a multitude of land use types in southeastern Pennsylvania. An additional 11.7 miles of hiking trails are available for public use.

An Observation Tower stands at the summit of Governor Dick Hill. This 60+ foot tall structure affords visitors a wonderful panoramic view of the surrounding countryside from a unique perspective. The Tower is a very popular destination during all seasons of the year. The view offered during the fall foliage season is particularly attractive and peak use probably occurs at this time of year. Bird watchers can also view migratory birds from atop the Tower in the spring and fall seasons. However, a protective safety "cage" affixed to the top of the observation deck creates an obstructed landscape when viewing through binoculars or camera lens. The trails leading to the Tower provides a brisk uphill walk from the well-used parking lot on Pinch Road (located east-southeast of the Tower). The shortest route (from parking lot to Tower) is about 2,400 feet in length and rises 262 feet in elevation along its course; average grade is 12% slope.

"Bouldering" has become a nationally renowned recreational activity at Gov. Dick. Several competitions/events are hosted each year that draw hundreds of participants from throughout the United States. The ***Environmental Center*** at Gov. is located off Pinch Road and affords many opportunities to learn about and enjoy the outdoors. Planned leisure and informative self-guided trails are sure to please those looking for a casual stroll near the ***Environmental Center***.

Access – Boundary Markings

The boundaries of the property are well marked with red signs and yellow bands of paint (on trees) through most of the wooded areas. Route 117, Route 72 and Pinch Road form much of the perimeter elsewhere on the property and are also posted with red signs.

Access is afforded to the public via approximately 14 points of entry. Most of these accesses are primitive and consist of foot/bike/horse trails. Parking facilities are generally *inadequate* relative to the volume of users in all areas except the recently established ***Environmental Center*** located on Pinch Road. All areas of the property can be accessed via the extensive dirt road/trail system.

AIR, WATER AND SOIL PROTECTION

Access Roads

Trail maintenance is an ongoing project at Gov. Dick due to the high amount of use by patrons of the park. Many storm water run-off issues were addressed in 2014 by constructing water bars with the assistance of NRCS funding. It is recommended that proper drainage structures be maintained throughout the entire trail system of Gov. Dick. Proper trail location, proper drainage, and proper levels of impact (i.e. foot travel, bike, and/or horse) are key factors to the successful maintenance of existing trails. Therefore, install water-bars with turnouts, box culverts or similar devices to divert water run-off from trail surfaces at standard intervals.

Streams, Wetlands, Ponds, and Lakeshore

Water resources are very limited. Therefore, explore possibilities to enhance existing water resources via establishment of water "puddles" and vernal ponds near spring seeps and hydric soils. Thoroughly research possible locations as well as benefit and risk factors associated with microsite biota before proceeding. See websites www.fs.fed.us/r8/boone/vernal.pdf and www.vernalpool.org.

Water resources include the headwaters of Chickies Creek (also known as Chiques Creek) located in Mgmt. Unit #5 near the northeast boundary of the property. The stream originates at Gov. Dick and reaches little more than three feet in width further downstream on the property. Donegal Springs and Shearers Creek join the confluence of Chickies Creek Basin further downstream. The DER Bureau of Water Quality rates these streams as high quality cold-water fisheries (HQ-CWF).

The riparian zone is totally protected by forest. Small to medium-sized sawtimber dominates the surrounding overstory vegetation and primarily consists of white ash, tulip-poplar, white oak, hickory, black birch, and American beech. Understory plants include spicebush, witch-hazel, Japanese barberry, hornbeam, hophornbeam, greenbrier, grasses, forbs, and legumes. This vegetation extends more than one hundred feet from the stream's edge. Forest trees shade most of the stream from sunlight at mid-day.

The riparian zone surrounding Chickies Creek is underlain with Watchung extremely stony loam (map symbols WbB). The soil contains major hydric components. This soil is nearly level, deep and poorly drained. The water table is high. Large stones cover 15 to 50 percent of the surface area.

Several small spring seeps originate on the north side of Mgmt. Unit #2 along Route 117. The surrounding overstory vegetation is dominated by tulip-poplar, beech, black birch, and black oak.

Water quality is excellent as indicated by the crystal-clear spring flow. This vegetation extends more than 100 feet from the springs' edge. Aquatic life is mostly limited to invertebrates due to the size and origination points of these springs.

Other springs, similar to those discussed above, originate elsewhere on the property. They share similar characteristics to those described above. Management activities should include provisions to substantially limit or totally exclude overstory removal from all riparian corridors. Equipment should not enter within 100 feet of the riparian corridor. Trails should be located outside the riparian corridors whenever possible.

Fish, Wildlife and Biodiversity

Complex stand structures are highly resilient to adverse natural or manmade disturbances. Managing for complex stand structures will go far to satisfy many of the goals set forth by the Board of Directors at Gov. Dick.

A species of bird known as the Cerulean Warbler requires certain stand structural elements that lead to a desirable degree of complexity within the stand. "The Cerulean Warbler (*Setophaga cerulea*) is a migratory songbird that breeds in mature deciduous forests of eastern North America. Cerulean Warblers (hereafter, ceruleans) require heavily forested landscapes for nesting and, within Appalachian forests, primarily occur on ridge tops and steep, upper slopes. They are generally associated with oak dominated (*Quercus* spp.) stands that contain gaps in the forest canopy, that have large diameter trees (>16 inches diameter breast height (dbh)), and that have well-developed understory and upper-canopy layers. Ceruleans primarily use the mid- and upper-canopy where they glean insects from the surface of leaves and conceal their open cup nests. Because they are severely declining across much of their range, habitat management is a high priority. Management for this species can also improve conditions for a number of other wildlife species that depend on the same structure." *Cerulean Warbler Management Guidelines for Enhancing Breeding Habitat in Appalachian Hardwood Forests*, **www.amjv.org**.

Governor Dick is located just 12 air miles south of known populations of ceruleans. Therefore, consider modeling and hosting one or more demonstration sites for this species. Hosting and possible verification of resident cerulean populations may ultimately lead to additional governmental funding opportunities for planned projects at Gov. Dick, while jointly creating habitat for a severely declining species in this region.

Contact the local Cerulean Warbler biologist to find out more about habitat Cerulean Warbler habitat requirements appear to be in line with the desired composition and structure of several management units in this plans requirements and determine the suitability for Gov. Dick Park to host a demonstration site for this species.

Below is a publication outlining the requirements of this species:

Forest Management Recommendations

Foresters can use silviculture to develop stands that are favorable for Cerulean Warblers while consistent with sustainable forest management goals of promoting oak regeneration. Recommendations include:

- Harvest in forested regions with greater than 70 percent forest cover at the six mile scale and in Cerulean Warbler focal areas.
- Shelterwood harvests with RBA levels of 40-90ft^2 (50-60ft^2 optimal) per acre of dominant/co-dominant crown classes generally result in increased Cerulean Warbler density and intermediate levels of nest success (Figure 1). Complete overstory removal during the final stage of a shelterwood harvest will reduce numbers of mature forest bird species. Retain residual canopy until adjacent habitat has been enhanced with shelterwood or other harvest types and colonized by Cerulean Warblers.
- Where feasible, favor white oak, chestnut oak, hickories, sugar maple, and cucumber magnolia (preferred nest and forage trees) in the residual stand and do not retain red maple or oak of the red oak group. Retain the largest diameter individuals of the preferred species as residual trees. Retain some grape vines when possible, as they provide nest material and additional cover from predators.
- Creation canopy openings using crown thinning or shelterwood seed cut methods to provide favorable canopy structure.
- Plan a series of adjacent shelterwood cuts so that Cerulean Warbler habitat is available nearby when one stand is ready for an overstory removal. Presence of favorable regeneration conditions in each stand should drive timing of treatments for that stand. Maintaining white and chestnut oak dominance in the residual stand is a primary consideration; presence of sufficient advance regeneration of white and chestnut oaks are important considerations in management. Presence of Cerulean Warblers should drive timing and location of treatments on the landscape.

Figure 1: Shelterwood harvest (4 yrs post harvest) with approximately 45 sq. feet RBA; Jim Sheehan.

Figure 2: Modified even-age regeneration stand with approximately 20 sq. feet RBA; Than Boves.

- Presence of dense understory vegetation is beneficial to Cerulean Warblers; understory condition should be considered during pre-harvest inventories, especially in areas of high deer density.
- Modified even-age regeneration that leave some large-diameter residual stems (10-30 sq ft/acre of dominate/co-dominate crown classes) in a harvest unit may in time lead to the development of multi-aged stands (Figure 2) favored by Cerulean Warblers. Such stands achieve more complex canopy structure earlier in their development than similar single-aged stands and will provide productive habitat for Golden-winged Warblers in areas where the two species overlap.
- Crop-tree release can accelerate development of crop-trees on higher quality sites. The practice is typically applied in 15 to 20 year-old stands. It can allow for earlier canopy differentiation by accelerating growth of dominant stems.

Associated Species

Other species will benefit from habitat management for Cerulean Warblers. Heavy (20-30 sq. ft. RBA of dominate/co-dominate crown classes) and medium intensity harvests (50-60 sq. ft. RBA of dominate/co-dominate crown classes) increased abundance and diversity of shrub-nesting species including Hooded Warbler, Indigo Bunting, Yellow-breasted Chat, Kentucky Warbler, and Eastern Towhee. Certain canopy-nesting species such as Bluegray Gnatcatcher generally increased in abundance at medium levels of canopy removal. Such harvesting can enhance habitat for Golden-winged Warblers, Chestnut-sided Warblers, Field Sparrow, and many species of forest-dwelling bats.

For More Information

Cerulean Warbler Management Guidelines for Enhancing Breeding Habitat in Appalachian Hardwood Forests, **www.amjv.org**

Contact:
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Coordinator, Appalachian Mountains Joint Venture
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Jeff Larkin - Wildlife Biologist & Forest Habitat Coordinator
American Bird Conservancy & Indiana University of Pennsylvania
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State and Federal Threatened or Endangered Species -Plants or Animals.

The Pennsylvania Natural Heritage Program (PNHP) is a partnership between The Department of Conservation and Natural Resources, The Nature Conservancy, and The Western Pennsylvania Conservancy. It conducts inventories and collects data regarding Pennsylvania's native biological diversity. The information is stored in an integrated data management system consisting of maps, manuals, and computer files, and is known as the Pennsylvania Natural Diversity Inventory (PNDI). "Biota of Special Concern" in Pennsylvania are those classified as Endangered, Threatened, or Rare as listed by the Department of Conservation and Natural Resources, PA Game Commission, PA Fish and Boat Commission, U.S. Fish and Wildlife Service and species recommended by the PA Biological Survey.[1]

A search of the PNDI database was conducted and potential conflicts that may impact the natural resource recommendations described in this plan are pending and will be added in Appendix G.

The Project Search Identification Number is: PNDI-620775

NOTE: Prior to implementing many of the projects recommended herein, specific information, including the PNDI search results, must be forwarded to certain government officials. Allow 30 days for completion of the project review request.

MANAGEMENT OF FOREST RESOURCES

Protection from Pests

- **Deer:** Hunting is not permitted at Gov. Dick and cannot be permitted due to legal restrictions imposed by Clarence Schock's original trust documents. The lack of hunting coupled with hunting pressures from neighboring State Game Lands and protectionism from adjacent communities has created an unusually large deer herd to persist on the property. Excessive deer populations and the accompanying severity of browsing have caused native flora to be drastically altered. The natural regenerative capabilities of the forest have been suppressed for many decades. Native plant communities can no longer restore themselves to a natural balance when under sustained influence of excessive deer browsing. Desirable tree regeneration is virtually absent from this property even though stocking levels favor seedling establishment in several stands. Attempts to regenerate the forest to oaks, poplar, sugar maple or other high-risk trees (i.e., tree species favored by deer for food) should be protected by deer exclosure fencing or individual tree shelters.
- **Interfering Understory Vegetation and Low Shade:** In recent years, opportunistic native plant "invaders" such as spicebush, black birch and pawpaw (three species not favored as browse by deer) have expanded dramatically throughout Gov. Dick. Spicebush is present in moderate to heavy densities over more than 70% of the total forestland area. Black birch, ranging in size from saplings (10 to 30 feet tall) to poletimber (4 to 11 inch dbh) is also present in substantial quantities throughout many areas of the property and especially in Mgmt. Unit #2. The "low shade" created by mid-story trees reduces the amount of sunlight reaching the forest floor. More desirable species such as oaks, poplar, and white pine have little chance to germinate and grow in these conditions. Ground cover, including spicebush, pawpaw, and hay-scented fern, have

[1] *The PNHP website homepage at http://www.dcnr.state.pa.us/forestry/pndi/index.aspx*

the ability to quickly expand after a disturbance that increases light on the forest floor. Regeneration efforts (even within deer exclosure fences) will likely result in an understory dominated by spicebush and black birch unless these species are removed from the site prior to harvest. Therefore, herbicide applications should be performed on all sites where a regeneration harvest is planned AND where significant quantities (i.e. greater than 30%) of low shade and interfering understory vegetation exist.

- **Invasive Plants**: Even more troublesome perhaps is the introduction of exotic invasive (non-native) flora and fauna. Once inoculated into the woodland environment invasive plants proliferate. Ailanthus, mile-a-minute weed, garlic mustard, Japanese stiltgrass and Japanese barberry appear to be the most troublesome invasive species at this time. Most invasive plants are found within 50 feet of existing roads and trails. Few species of invasive plants (except those species with windborne seed) were found further than 400 feet from an existing trail (Japanese barberry is a notable exception). Therefore, it is likely that the primary mode of introduction into the interior of Gov. Dick is via the trail system. Horses, bikes, and foot traffic (to a lesser extent) are probable vectors for many species of invasive plants. Seeds are picked-up, carried to, and subsequently deposited along the trails of Gov. Dick. Exposed "bare-mineral-soil" and increased (if not abundant) levels of sunlight are often needed to germinate the seed. Once established, invasives tend to spread rapidly throughout the surrounding area. Many invasive plants are capable of overrunning and displacing native plant community's entirely. Continual public utilization of the trail system, natural seed dissemination via migratory avian and mammalian populations, and windborne seed from nearby invasive plant populations are likely to prevent invasives from being totally eradicated at Gov. Dick. Therefore, diligently suppress invasive plant populations when conditions warrant their attention. The establishment of a healthier, more resilient forest ecosystem will greatly minimize the damaging effects of invasive plants.
- **Insects:** Several hemlock trees were observed on the property and most were dead or nearly dead as a result of past hemlock wooly adelgid infestations. The few remnant Eastern hemlock trees are not likely to persist much longer. For more information go to the website www.fs.fed.us/na/morgantown/fhp/hwa/hwasite.html. The property currently has no other forest insect or disease problems except for the Emerald Ash Borer. However, outbreaks of fall cankerworm recently occurred within twenty miles of this property, and gypsy moths infested the property 10 or more years ago. Therefore, it is recommended that gypsy moth populations be monitored yearly. If a gypsy moth outbreak or other insect attack is suspected, contact your local service forester for further advice. Currently, other than the Emerald Ash Borer (EAB), insect pests appear to have no significant impact on proposed management activities for Gov. Dick.

Reforestation and Afforestation

The majority of stands are now mature. Efforts to establish natural regeneration are prudent at this time and will require deer exclosure fencing for protection. Fenced areas should be planted with tree species that are absent, scarce or otherwise deemed desirable for their ability to enrich forest stand biodiversity. The introduction of shade tolerant species such as sugar maple, basswood, beech and white spruce are particularly desirable. Conifers including white pine and white spruce should be

introduced anytime tree plantings are performed. All forest regeneration projects should address the factors that limit desirable regeneration. Specifically, each regeneration harvest should address competing plants, deer and light… also known under the acronym "CDL": The *"Penn State Forest Science Fact Sheets: Regenerating Hardwood Forests Managing Competing Plants, Deer, and Light"* is included below to explain this concept and stress its importance for all forest regeneration activities at Gov. Dick.

Forest Management Plan Implementation Constraints

Equipment limitations are severe in many portions of Mgmt. Unit #5 due to boulder fields and extensive surface rock.

Penn State **Extension**

FOREST SCIENCE FACT SHEET SERIES

Regenerating Hardwood Forests: Managing Competing Plants, Deer, and Light

Forest regeneration, or regrowth, requires sufficient numbers of desirable tree seedlings to replace today's forest following harvest. Under many circumstances, regeneration is not easy. Competing plants, deer, and insufficient light on the forest floor can interfere with regeneration and, in the long run, may threaten forest sustainability.

In this fact sheet we look at how an understanding of competing plants, deer, and light can lead to successful forest regeneration and the sustainability of hardwood forests. It is our hope that, after reading this fact sheet, you will view your forest management role in a new way. We hope you will use these key concepts to ensure a future for your forest.

How Do We Benefit from a Healthy Forest?

We all benefit from a healthy, productive, viable forest. To name a few of the benefits, forests:

- Clean our air by using carbon dioxide and providing oxygen
- Protect and filter our water supplies
- Provide a home for countless plants and animals
- Make up a vital part of the economy.
- Provide a major source of employment
- Supply the key ingredients for more than 5,000 products

Forests Are a Precious Natural Resource

We depend on forests for the quality of life we enjoy. We use them to sustain life as we know it. Wisdom tells us that future generations, your children and theirs, will also use forests for these same benefits. The science of forestry was developed to "sustain" our forests.

SUSTAINABLE FORESTRY
is defined as managing our forest resources to meet the needs of the present without compromising the ability of future generations to meet their own needs.

Howard Nuemberger

As forests mature and people begin to conduct harvests, potential regeneration problems need to be identified. This mature forest clearly lacks regeneration.

Currently, with a maturing forest and increased harvest levels, "sustainable forestry" has become a necessary label. While many claim to practice forestry, only about half do so in a sustainable manner. The problem lies not in forest science but in its rampant misuse in name and practice.

How Are We Doing?

A comprehensive study in 1995 examined 85 randomly selected timber harvest sites in Pennsylvania. The study sought to determine whether or not our current harvesting practices are affecting timber sustainability. *It found that 47 percent of the harvests were unsustainable.*

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Cooperative Extension
College of Agricultural Sciences
extension.psu.edu

What was wrong with these timber harvests? The concerns most often identified were:

- Failure to retain quality trees of desirable species
- Failure to establish adequate regeneration
- Failure to remove sufficient overstory to foster existing regeneration development
- Failure to control competing plants

Three of these concerns deal with problems in *regenerating* (or regrowing) our forests; harvests are occurring without adequate plans for tree replacement. Sustainable forestry requires that we focus on growing new trees, but we cannot practice sustainable forestry if we do not regenerate a healthy, young forest for future generations.

Recent U.S. Forest Service data from Pennsylvania's statewide forest inventory (2009) document regeneration problems. In forest stands where light conditions are adequate for regeneration development, just over 50 percent have adequate seedlings and saplings to regenerate the forest. This finding includes all tree species capable of growing into the forest canopy. When only commercially desirable species are considered, only 40 percent of these forest stands have adequate regeneration to replace the existing forest.

Many times, forest owners believe that by harvesting forests "selectively" they are addressing regeneration issues. This is not the case. The remaining trees often create too much shade, are of too low a quality, or are a less desirable species to warrant having been left for future harvests. Regenerating a forest is a process, not an event. That is, harvesting does not always lead to successful regeneration—it takes planning, care, and investment to ensure an adequately stocked forest for the future.

What Can You Do?

The challenge for each landowner is to continue using our forest resources without jeopardizing resource health or future. Landowners, loggers, and foresters all play key roles in achieving a successful timber harvest outcome. Each group has equal responsibility for creating healthy forests in the future.

For decades it has been obvious that there have been difficulties in achieving successful regeneration of fully stocked stands across Pennsylvania.

—Dr. James Finley, Penn State

David Jackson

This area has severe interfering fern cover. Desirable regeneration is not likely to develop until the ferns are controlled.

Combating the Regeneration Issue

Most regeneration of hardwood forests occurs naturally—that is, without planting trees—but many factors can affect forest regeneration. To regenerate naturally, the current forest must produce seedlings, stump sprouts, and root suckers that will become the next forest following a harvest or natural disturbance. The right conditions are necessary for forests to regenerate naturally. Unfortunately, the "right conditions" often are not met.

In this section we will look at three factors affecting forest regeneration and introduce practices to help make timber harvests sustainable. The three factors are *competing vegetation*, *deer impact*, and *light on the forest floor*. We abbreviate this "C-D-L." Following the practices outlined by this simple acronym will encourage healthy, new forests following timber harvests.

Competing Vegetation

Competing vegetation consists of plants that interfere with the germination and growth of desirable seedlings by casting dense shade across the forest floor. Some competing plants also provide cover for small mammals that feed on tree seeds and seedlings.

Several factors favor the development of competing vegetation. Many interfering plants tolerate shady understory conditions and are not typically browsed by deer. Some, such as Japanese barberry, are also *invasive*, meaning they spread rapidly and suppress native plant communities. Competing plants are similar to weeds in your garden—they interfere with the establishment and growth of your future crop. Undesirable trees and plants can take over a forest just as weeds can take over a garden.

The most common competing plants found in Pennsylvania include hayscented and New York ferns, some grasses, striped maple, American beech, mountain laurel, ironwood, and spicebush. Many other plants can also interfere with seedling growth and development. Only so much space, water, nutrient material, and sunlight are available for plant growth. Whether you are growing corn, grass, or trees, you must make choices about resource use.

The predominant challenge for sustainable forestry in Pennsylvania is prompt reforestation with desirable species.

—Dr. Susan Stout, USDA Forest Service

Mike Eckley

Hand application of herbicides is appropriate for small areas or when treating individual invasive or competing plants.

Howard Nuernberger

When competing plants cover extensive areas, herbicide treatments using track-mounted mist blowers are effective. Make applications prior to harvesting timber.

Competing vegetation can inhibit diverse and valuable forest regeneration as well as the establishment of desirable nonwoody plants, such as native wildflowers, forbs, and herbs. If competing plants are present and left untreated in an area you propose to harvest, they may become your next crop. Timber harvesting will increase light on the forest floor and magnify problems caused by competing plants. It is not uncommon in Pennsylvania to see forest understories covered with competing plants.

Often, successful forest regeneration depends on controlling competing vegetation. Extensive research and testing have provided low-risk and effective herbicide recommendations or "prescriptions" for controlling most competing vegetation. Public and private forestry organizations across the state have experience with herbicide use for this purpose. Consult them for detailed prescriptions for dealing with your specific competing vegetation problem. For additional resources, visit the Penn State Extension Forest Vegetation Management website at **fvm.cas.psu.edu**.

If you are reluctant to use herbicides, mechanical control of competing vegetation works in some cases. Typically, mechanical methods such as cutting or pulling are not as effective as herbicides and are ineffective at controlling nonwoody plants like fern and grass. Mechanical removal generally involves having the harvesting operator break off or cut competing seedlings and saplings. With this method, the competing plants will likely resprout; however, they may no longer have a height advantage over desirable seedlings.

To sustain our forests, competing vegetation problems need to be recognized and treated before harvesting timber. Dealing with competing vegetation before harvest is important because after harvest:

- Logging slash can impede access
- Increased light will cause competing plants to flourish
- Desirable species may be more easily harmed by herbicide treatments
- Costs for controlling competing plants are typically higher

Deer Impact

Through selective feeding, deer have the ability to broadly affect forest plant communities. Specifically, they can reduce tree seedling numbers, seed availability, species composition, and seedling height. They can also affect herbaceous plant composition as they browse on some species and ignore others.

In many areas, deer have reduced seedling numbers, shifted tree species composition to less desirable species, and slowed the growth of surviving seedlings. Research has shown that when the deer population density exceeds what the land can support, forest regeneration suffers. In regions of the state where decades of overbrowsing have severely depleted the habitat, even relatively few deer can have significant effects.

In many parts of Pennsylvania, deer numbers have adversely affected habitat. In fact, many state residents have never seen a healthy forest understory unaffected by deer. Habitat repeatedly damaged by overbrowsing continues to decline, losing its ability to support additional deer. In many areas, poor habitat conditions limit deer numbers more than hunting does. The only way to increase the number of deer land can support is to temporarily reduce deer numbers still further and allow the habitat to recover. When the habitat improves, deer managers can gradually allow deer numbers to increase until a balance is reached between desired habitat conditions and deer populations.

Deer have taste preferences; some plants are highly preferred while others are hardly touched. By selectively browsing

Attempting to raise more deer than the land can support has been the greatest mistake in the history of wildlife management in Pennsylvania.

—Dr. Gary Alt, Pennsylvania Game Commission (retired)

preferred species, deer have the ability to completely change the species found in forest understories. Selective browsing can greatly reduce or eliminate preferred species or those not resilient to browsing and favors less preferred, more resilient species. Deer food preferences vary by region and season, but, in general, deer prefer oak, maple, ash, and yellow poplar over species such as beech, birch, and cherry. Deer, on average, consume 4 to 8 pounds of browse per day for seven months of the year. Clearly, the state's deer herd has a tremendous potential to influence what grows (or doesn't grow) in the forest.

Landowners can use several indicators to assess whether deer impact in their forest is high or low. Indicators of high deer impact include severely browsed or hedged seedlings, obvious browse lines, and forest floors dominated by species that deer do not prefer or species that are resilient to browsing. Deer do not readily eat ferns, striped maple, beech, ironwood, mountain laurel, blueberry, or spicebush.

There is strong evidence that the expansion of understory fern in forests across Pennsylvania results from deer overbrowsing, which removes plants that would normally compete with ferns. Forests with a dense fern carpet are the result of high deer impact over many years. Research has shown that fern density increases as deer impact increases. Unfortunately, after fern cover dominates the understory, the forest's ability to support deer declines. A severely damaged forest may appear to have no deer at all. Likely, a few deer will continue to suppress desirable tree species. The cycle of browsing and poor habitat is difficult to break.

If you recognize that deer impact on your forest is high, you should take steps to reduce populations even if a timber harvest is not planned for the immediate future. Consider harvesting additional antlerless deer. The Pennsylvania Game Commission's Deer Management Assistance Program (DMAP) helps landowners meet their forest management goals. DMAP allows hunters to harvest additional antlerless deer from a property during the regular hunting seasons.

Although hunting is by far the most practical means of reducing deer impact, other tools include fencing, seedling protectors, and deer repellents. Areas with low deer impact will support healthy, diverse understories, preparing the forest for future replacement following planned timber harvests or natural disturbances.

Gary Alt

Forest regeneration inside versus outside a fence. Research demonstrates that high deer impact inhibits forest regeneration.

David Jackson

Note the "browse line," where deer have eaten the preferred palatable vegetation from ground level to a height of 5 feet. Browse lines are an indication of high deer impact.

In 85 percent of the problem areas, simply excluding deer made the difference.

—Dr. David Marquis, USDA Forest Service (retired)

Light on the Forest Floor

The amount of sunlight reaching the forest floor plays a key role in determining which tree seedling species will germinate and grow. Tree species have different requirements for sunlight, a factor referred to as *shade tolerance*. Shade tolerance describes the light level at which a species is best able to germinate and grow. Foresters generally separate trees into three shade-tolerance classes: intolerant, intermediate, and tolerant.

Examining the shade-tolerance classes of three valuable timber species, we find they fall into three different shade-tolerance classes: black cherry, intolerant; northern red oak, intermediate; and sugar maple, tolerant (see Table 1). Understanding the shade-tolerance characteristics of desirable species forms the basis for developing harvest prescriptions.

Table 1. Shade tolerance for common Pennsylvania trees.

SPECIES	SHADE TOLERANCE
Black cherry	Intolerant
White ash	Intolerant
Hickory	Intolerant
Yellow poplar	Intolerant
Northern red oak	Intermediate
White oak	Intermediate
Basswood	Tolerant
Red maple	Tolerant
Sugar maple	Very tolerant
American beech	Very tolerant

For example, if a forest is managed for shade intolerants and intermediates such as yellow poplar, white ash, black cherry, and oak, you have to increase the amount of light across the forest floor to stimulate seed germination and seedling growth. Harvesting activities *must* consider shade tolerances of the species for which you are managing.

Foresters have developed harvesting systems that create openings to mimic natural disturbances. These systems regenerate diverse, healthy forests. Harvesting systems used in Pennsylvania to create light conditions for shade-intolerant and intermediate species include group selection, shelterwood, and clearcutting.

Group selection cuts create small openings across a forest with the intent of establishing regeneration in each opening. This method harvests all trees larger than 2 inches in diameter in groups ranging in size from 1 to 4 acres scattered across a property. Openings less than one acre will not provide adequate sunlight for shade-intolerant tree species. By scheduling group selection harvests at 10- to 20-year intervals, landowners can produce periodic income and encourage habitat diversity. This harvesting system is desirable for aesthetic reasons since it retains areas of large, mature trees and the openings created are relatively small. The harvested groups are large enough to encourage the regeneration of shade-intolerant tree species in the center and more shade-tolerant tree species along the edges.

Shelterwood cuts occur in two stages. The first stage leaves a prescribed number of desirable trees per acre to drop seed and provide conditions (partial shade, cooler temperatures, and higher moisture) conducive for seedling development. The residual trees provide an environment best suited for intolerant and intermediate tree seedling growth and development. Once regeneration is well established, the remaining overstory trees are harvested and the new forest grows in full sunlight. The timing of the final harvest is critical. The regeneration should be tall enough (greater than 5 feet) to be above the deer's reach but not so large (greater than 10 feet) as to be significantly damaged during final harvest when remaining overstory trees are removed.

Clearcutting should be practiced only where adequate forest regeneration is already present on the forest floor. This is called advanced regeneration. The next forest is already in place and simply needs more light. In areas with high deer impact, adequate advanced regeneration is difficult to achieve. It is often necessary to have at least one desirable seedling per square foot (40,000 desirable seedlings per acre or more).

What Are the Costs?

Managing C-D-L certainly involves investments of thought, money, and time. However, it is necessary to *address all three components* when planning a sustainable harvest. In most cases, failing to make the necessary investment for managing the interactions of competing vegetation, deer, and light will lead to inadequate desirable regeneration after a timber harvest. Regeneration failures on a large scale would devastate our forests and threaten many of the benefits we depend on every day.

When we discuss the costs of C-D-L and other efforts that help sustain our forests, we have to consider the costs of not using sustainable methods. Treating competing vegetation, managing deer impacts, and meticulously controlling light can be costly, but how does that compare to the degradation or loss of our forests' vitality?

If you control competing vegetation, reduce deer impacts, and take into consideration the light requirements of the species you are trying to regenerate, you will be successful in establishing and sustaining new forests.

—Mr. David Jackson, Penn State Extension

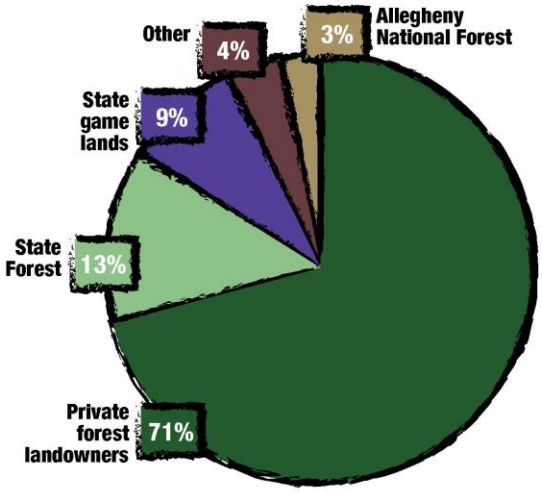
Putting It into Practice

C-D-L practices have become central to managing our public forests. Deer exclosures are common in state and national forests as well as state game lands. Herbicide treatments, clearcuts, shelterwoods, and other forest management practices that address C-D-L are also common. Unfortunately, the sustainable forest management practices used by public agencies are not occurring in many private forests. This is cause for concern.

Pennsylvania has vast forest resources—17 million acres. The amount of public forestland is actually small compared to the amount of forestland owned by private citizens (see Figure 1). Every day, private forest landowners make decisions that affect future forest values. Critical among these decisions is the need to ensure that we are regenerating hardwood forests. The 1995 Pennsylvania study revealing that 47 percent of private forest harvests are not sustainable is a benchmark for the future. If forest owners manage forest resources to meet today's needs without compromising the needs of future generations, all harvest sites will be sustainable. In this way, we will:

- Retain quality trees of desirable species
- Establish adequate regeneration
- Remove sufficient overstory to foster existing regeneration development

Figure 1. Pennsylvania forestland ownership chart.



Source: DCNR Bureau of Forestry

David Jackson

A sustainably managed forest. The competing vegetation on this site was treated with an herbicide before harvest. Immediately following harvest, the deer fence was erected. This shelterwood harvest left a good seed source and allowed the proper amount of light to reach the forest floor. Within a few years, a healthy, new forest will regenerate on this site and a subsequent harvest will remove the overstory trees.

Because of our dependence on forest products for the quality of life we enjoy, we will continue to use our forests and harvesting in Pennsylvania's private forests will likely continue. It is vital that every timber harvest proceed with the advice of a professional forester and be part of an overall forest management plan. The plan will provide custom guidelines to follow, guidelines that will certainly address C-D-L and other sustainable forestry considerations. Remember to plan! Remember to invest! Remember C-D-L! *Regenerate hardwood forests.*

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