Conservation Action Plan
CAP 106
Forest Management Plan

Developed for: **CLARENCE SCHOCK MEMORIAL PARK AT GOVERNOR DICK**

Mailing Address: P.O. Box 161
Mt. Gretna, PA 17064

Property Location: 3283 Pinch Road
Lebanon, PA 17042

Developed by: **Barry S. Rose, Certified Forester #579, TSP 11-7334**
Forest Regeneration Services, Inc.
P.O. Box 1260
Gouldsboro, PA 18424
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Managed Acreage: 1,105 acres

Preparation Date: December 2016

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SIGNATURES AND APPROVALS

This Forest Management Plan (FMP) is provided as a guide to help landowners accomplish the objectives that they have for their forest. This FMP will act as a guide for landowners in achieving the sustainable benefits of managing their forest resources for the next 10 years. With this FMP, the landowner automatically complies with the standards and benefits of the US Forest Service's Forest Stewardship Program; the American Forest Foundation's American Tree Farm System and is eligible for NRCS Cost Share programs. This plan will need to be reviewed and approved by the local NRCS District Conservationist, DCNR Service Forester, Technical Service Provider, and Landowner.

The Forest Stewardship Program and American Tree Farm Program are designed to promote wise use and sustained benefits of forest resources. While participation in these programs can provide benefits of forest management information networks, national recognition, financial tax savings, and increased forest product income generation through select markets, by NRCS policy, the landowner is not required to participate in these programs. If the landowner wishes to participate in either of these programs, please check the appropriate boxes and proceed to the Landowners Pledge.

Forest Stewardship Program Participation	**Tree Farm Program Participation**
Yes: ☑ No: ☐	**Yes: ☐ No: ☑**

LANDOWNER'S PLEDGE FOR FOREST STEWARDSHIP/TREE FARM PROGRAM STATUS

Since timber harvesting has a significant impact on our forest resources, we agree to complete commercial timber harvests recommended in the plan with the assistance of a professional forester. We understand that the forester is to designate trees to be cut based on a written prescription derived through a careful stand analysis of the stands involved.

We understand that a DCNR Service Forester or forest consultant will periodically review the implementation of our FMP to assist us in properly following the plan for my objectives. To enable him/her to carry out this responsibility we will make available copies of plan amendments and/or timber harvesting prescriptions before carrying out a major activity. We understand that we are not obligated to obtain approval from the service forester but that he/she may advise me if prescriptions do not appear to serve the goals of my FMP or meet Forest Stewardship/Tree Farm standards.

If we choose to deviate from the guidelines in the FMP, we agree to return the applicable signs designating my property as a "Stewardship Forest" or "American Tree Farm" to the DCNR Service Forester.

_____ _____

Landowner Signature Date

_____ _____

Landowner Signature Date

FOREST STEWARDSHIP/AMERICAN TREE FARM/EQIP PROGRAM CERTIFICATIONS

We are satisfied with the content and recommendations contained in this FMP, and will make an honest effort to follow them for the ten-year period covered by the plan. We understand that the information within this plan may be used by NRCS and DCNR for conservation planning, and is not protected by legal privacy acts for either agency.

_____ _____

Landowner Signature Date

We certify that this FMP meets the requirements of the federal Forest Stewardship Program, American Tree Farm Program, and the USDA Environmental Quality Incentives (EQIP) Program and/or the Quality Criteria for Forest Management Plans in Section III of the USDA NRCS Field Office Technical Guide.

_____ _____

Technical Service Provider Date

_____ _____

DCNR Service Forester ATFS Inspector # Date

_____ _____

PA Unique ID Number Certified Tree Farm #

_____ _____

NRCS District Conservationist Date

PROPERTY OWNERSHIP

Lebanon County Commissioners (Trustees)

Room 207, Municipal Building
400 South 8th Street
Lebanon, PA 17042

Park Representatives:

Mr. Charles B. (Chuck) Allwein, Board Member
Telephone: (717) 926-5143
eMail:. callwein7@comcast.net

Mrs. Audrey Wells, Naturalist
Telephone: (717) 964-3808
eMail:. governordick@hotmail.com

GOVERNMENT OVERSIGHT

Lebanon County Service Forester

Mr. Gary L. Gilmore, CF
Woodland Stewardship Coordinator
PA DCNR Bureau of Forestry
Rural & Community Forestry Section
400 Market Street
Harrisburg, PA 17105
Telephone: (717) 418-5203
eMail:. ggilmore@pa.gov

NRCS District Conservationist

Mr. Michael Snyder
USDA Lebanon Service Center
2120 Cornwall Road, Suite 6
Lebanon, PA 17042
Telephone: (717) 272-3908
eMail:. michael.snyder@pa.usda.gov

Please note*: Informal updates to the plan can be made with handwritten notes. Be sure to include a date and initial these notes throughout the management plan*.

PREFACE

The forest trees are aging at Gov. Dick to the point where most stands are now mature. This stage of growth is good, wonderful, and favored by many. The benefits to wildlife are high, the natural resources are protected and conserved, and recreational opportunities abound. However, relatively few forest tree species are present and most of those species produce seedlings that need large quantities of sunlight to survive. This growth trait in and of itself prevents the seedlings from becoming established and thriving under the canopy of their parent tree. In recent times, environmental imbalances have occurred with certain flora (e.g. invasive plants) and fauna (e.g. deer) which most certainly have stressed the environment beyond a point which can be overcome by the forest itself. We, as managers of all the forest resources at Governor Dick, must do our best to correct the imbalances which have occurred and introduce new tree species that can better compete under the shade of our majestic overstory trees.

A simplistic path to that end is to: keep what is healthy healthy; try to correct that which is within our means; and limit the breadth and extent of that which we cannot correct (within our means) from further degrading that which we can.

Follow the guidelines for CDL – the acronym of Competing vegetation, Deer, and Light as described on pgs.31-36. This methodology will guide us to successfully establishing a new generation of seedlings on the forest floor which will one day shade the activities you so love to enjoy at Gov. Dick. The park has so much to offer, let's keep it that way… Sustainably!

NOTES:

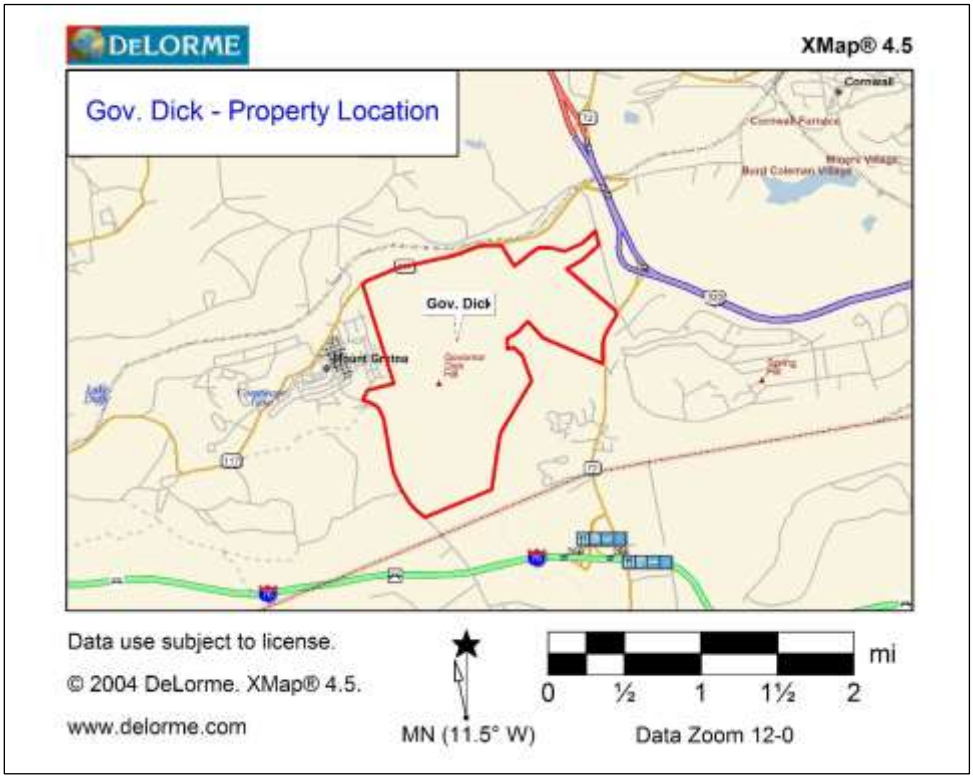
"SILVAH", a US Forest Service computer program, is referred to in this plan numerous times and forms the scientific basis for the prescriptions recommended herein. Refer to Appendix B for further information on SILVAH.

Forestry-specific terms used in this plan are defined in Appendix C.

PROPERTY DESCRIPTION

DIRECTIONS

The property is located east of and adjacent to Mt. Gretna, Lebanon County, Pennsylvania. Road frontage is found along Route 117, Pinch Road, and Route 72. The main entrance and Environmental Center is located south of Mt. Gretna at 3283 Pinch Road. See map below:



GPS Coordinates: 40 14' 13.22" N
76 27' 38.17" W

From the Turnpike: Take the Lancaster-Lebanon exit. Turn right onto Route 72 South. Travel about one mile and turn right onto Cider Press Road. At stop sign, turn right onto Pinch Road. The Environmental Center is at the top of the hill on the right.

From Ephrata: Travel west on Route 322 towards Hershey. Take Mt Gretna exit on right. At bottom of ramp, turn left onto Route 117 North. In the town of Mt Gretna turn left onto Pinch Road. The Environmental Center is one mile on the left.

From Lancaster: Travel north on Route 72 through Manheim. Turn left onto Pinch Road. Travel about 1½ miles. The Environmental Center is at the top of the hill on the right.

From Harrisburg: Travel east on Route 322 past Hershey. Turn right onto 117 South. Remain on 117 South through Colebrook. In the town of Mt Gretna, turn right onto Pinch Road. The Environmental Center is one mile on the left.

TOTAL OWNERSHIP ACREAGE: ..... 1,105 acres

TOTAL FORESTED ACREAGE: ..... 1,093 acres

LANDOWNER RESIDES ON PROPERTY: ..... No

BASIC TOPOGRAPHY (ESTIMATE PERCENT OF TOTAL ACREAGE THAT IS):

Complex topography (many steep ravines and aspects..... ☑
Simple topography (few ravines and changes of aspect)..... ☐

The surrounding topography is typically hilly to mountain-like. Elevations on the property range from +/- 600 feet (above sea level) along Chiques (aka Chickies) Creek in the southern section of the property to around 1,148 feet at the summit of Gov. Dick Hill located near the Observation Tower. Approximately 4,000 feet (horizontal distance) separates the two elevation extremes on this property.

WATERSHED TRACT:

Chesapeake Bay ..... ☑
Delaware River Basin ..... ☐
Ohio River Basin..... ☐

NUMBER OF MANAGEMENT UNITS:..... 9

FOREST ACCESS BY VEHICLES:

Excellent (80% accessible)..... ☐
Fair (at least 25%)..... ☑
Good (at least 50%)..... ☐
Poor (less than 10%) ..... ☐

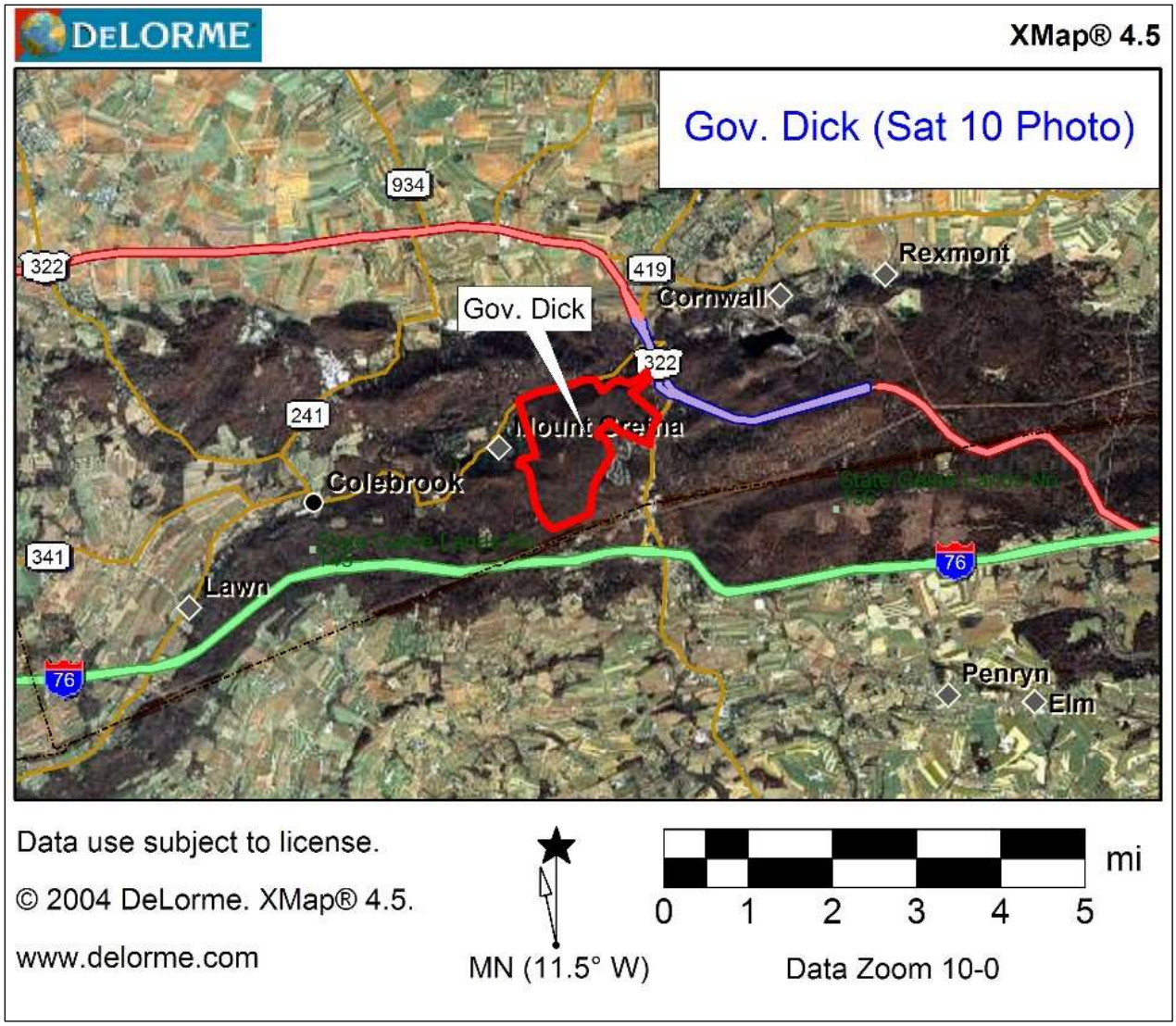
Approximately 50% of the property boundary is adjacent to three different state roads. There are four parking areas along these roads at trail heads. There is a 1.9-mile gated vehicle access road through the middle of the property, and 13.3 miles of trails.

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. The north, east and west slopes of the property can be accessed via improved road segments, dirt roads, and an extensive foot/bike/horse trail system. The south slope is generally accessible via foot and/or mountain bike only.

THE PROPERTY WITHIN THE LANDSCAPE

This property lies within a woodland corridor locally known as Furnace Hills that stretches more or less east-west along the Lebanon County / Lancaster County lines. The north-south width of the Furnace Hills corridor, which includes the Clarence Schock Memorial Park at Governor Dick (hereinafter called 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. Large expanses of farmland, rural communities, and small cities dominate the landscape north and south of this corridor. State Game Lands #145 is situated west of Pinch Road and shares a common boundary with Gov. Dick. See map below.

Interstate 76 runs in an east-west direction across the state forming a migration barrier to most ground dwelling animals. This interstate highway is located less than 2,500 feet from the southernmost boundary of Gov. Dick. The Middle Creek Wildlife Management Area, the largest migratory waterfowl management area in this region of Pennsylvania is located just 12 air miles east-northeast of Gov. Dick.



OWNERS' FOREST MANAGEMENT GOALS

The Board Members of Gov. Dick have drafted a Strategic Plan that embodies the overall mission and goals of the Park (refer to Appendix A.) The following guidelines below were established primarily for the CAP 106 plan:

a. Keep the forest healthy with minimum changes.

b. Address the abundance of mature trees and the lack of regeneration of new growth.

c. Address the lack of evergreens throughout.

d. Keep a percentage of old growth, especially along Pinch Road and high-use/visibility areas.

e. Improve road/trail access.

f. Reduce fire risk.

g. Improve roadside parking.

h. Reduce invasive species.

i. Develop a charcoal history display site.

j. Address options for controlling tick and mosquito populations.

k. Encourage bird walks, native plant workshops, and educational programs.

l. Encourage the Audubon Society's involvement in bird counts and utilize their expertise.

m. Create interpretive trail(s). Trail signs and brochure(s) identifying trees, plants and flowers of the area, and other special interest areas and history.

n. Control deer population.

o. Manage forest for its health, not profit.

p. Don't be afraid to cut trees to manage the tract and provide some income.

q. Favor silvicultural practices that include group selection to encourage natural tree regeneration over clearcutting. It is understood that deer exclosure fences are likely needed to protect project areas where regeneration practices are planned. In many cases, fences should be established prior to harvesting (for several years) to encourage advanced regeneration to become established.

r. Project areas should be used as an educational opportunity for the public. Signs should be displayed to explain the intent, process, reasoning for the practice in a natural unobtrusive way.

s. Use all means necessary to assure the successful outcome of each practice.

PROPERTY HISTORY

Gov. Dick is a 1,105-acre forested site set aside for public education, nature walks and other primitive (non-motorized) recreational activities in a woodland setting located near Mount Gretna, Pennsylvania. The trustees (the Lebanon County Commissioners) are charged with oversight of the land trust and bylaws compliance.

Mr. Clarence Schock granted these lands for public use so that people would have a forested place to enjoy themselves and thereby come to appreciate nature through participation, education and contemplation of its natural community. Excerpts from the original deed recorded on April 22, 1954 are as follows:

> *"…. TO HAVE AND TO HOLD the tract of land above described with the appurtenance IN TRUST forever as a playground and public park, upon the following terms and conditions: The portion thereof which is now forest or woodland shall be maintained as forest and woodland and where possible additional portions shall be planted as forest and woodland; Hunting and shooting and the smoking of cigars, cigarettes, pipes and tobacco shall be prohibited at all times upon the land hereby conveyed; the land shall be posted with notices at least once each year forbidding hunting and shooting, and appropriate notices shall be maintained forbidding the smoking of cigars, cigarettes, pipes and tobacco upon the land;*
>
> *The trust shall be for the enjoyment of persons traveling on foot; and no automobile, vehicle or mobile machinery shall be allowed to move or travel upon roads on the land except upon the business of the trust or with the written permission of the trustee or upon such public roads as may hereafter be built by state municipal authority…"*

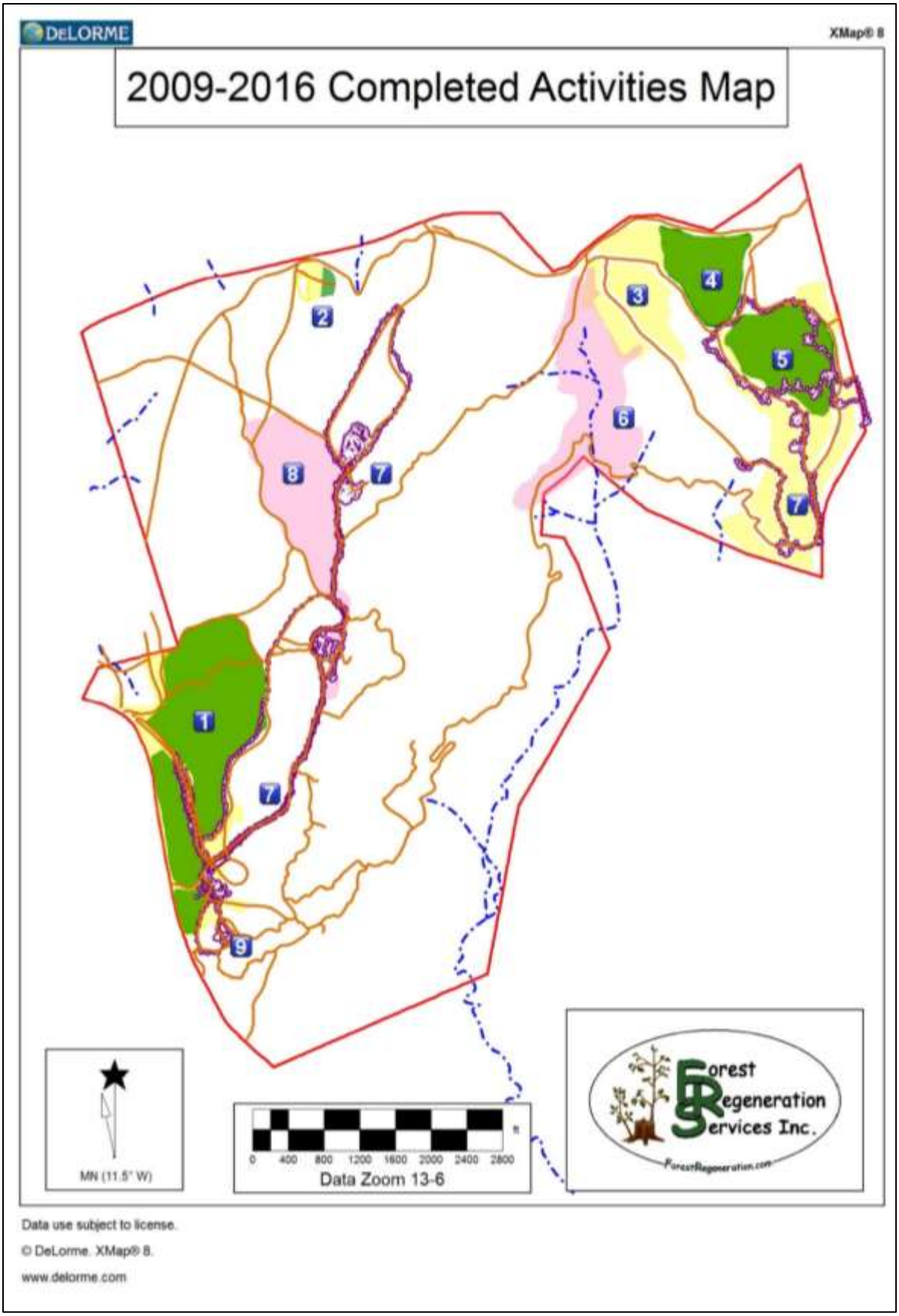
In 1941, Mr. Schock reorganized the SICO Company as a non-profit corporation with earnings to be utilized for the promotion of educational, literary and scientific purposes. In 1955, the SICO Company was renamed to the SICO Foundation, which was later renamed the Clarence Schock Memorial Foundation in 2003. The Clarence Schock Foundation was dedicated to promoting activities for public education, literary and scientific purposes. Recently, the Foundation withdrew from oversight of Gov. Dick. The Lebanon County Commissioners are now the sole trustees of the property.

In 2005, the board of trustees authorized the writing of a Forest Stewardship Plan. Since then, many of the recommendations outlined in that plan were implemented. See chart below.

ACTIVITIES COMPLETED:

The following activities have been completed since 2009. Most activities were introduced in the previous Forest Stewardship Plan written and approved in 2005.

Activities Completed Between 2009 and 2016					
Map #	Date	Practice Code	Project Name/Activity/Practice	General Purpose and Location	Acres
	8/1/18	314	Brush Mgmt. - Trails	Chem, Individual Plant Treatment	32.4
	8/1/18	315	Weed Control - Trails	Chemical, Spot	32.4
	8/1/17	490	Invasive Plant Control - Trails	Chemical, Hand Application	64.8
	8/1/17	612	Plant Seedlings	8200 seedlings protected in fence	41.0
	8/1/17		2016 Marcellus Grant	ADA Handicap Boardwalk Project	
	7/1/16		NRCS - EQIP	Funding for activities	
	12/1/16	106	10 yr. rewrite of FSP		1,105.7
1	2/3/09		Timber Sale - Oak Salvage	Forest Management	67.0
9	7/10/09		Commonwealth of PA	Rain Garden	
	10/16/09		Growing Greener	Funding for Activities	
1	11/19/09		Herbicide - Oak Salvage Sale	48.25 hours + herbicides	
7/8	4/15/10	314	Ailanthus Control	Basal Bark / Hack & Squirt	38.4
1	4/15/10		FENCE - Oak Salvage Sale	Fence Construction by Reiley (53 acres @11,780 lin ft @ $2.28/ft)	53.0
1	4/29/10	612	Tree Planting - Oak Salvage Sale	15000 seedlings	67.0
7	10/7/10		Weed Control - Trails	MAM - Herb application in June	
9	10/22/10		Rain Garden	Growing Greener	
	5/31/11		SILVAH Survey	5/2/11 and 5/26/11	
7	5/31/11		Herbicide - MAM	5 acres MAM 2.4 acres woody	7.4
7	7/8/11	315	MAM Weed Control	bouldering area near radar site	3.7
7	7/20/12	314	Brush Mgmt./ Chem. And Mech. Methods	6.3 ac ailanthus control + 2.4 ac radar site prep.	8.7
	12/19/12		NRCS - EQIP	Funding for Activities	
1	1/10/13	666	FSI/ Tree shears BB, BG	Black birch understory reduction	20.0
5	3/23/13		Timber Sale #1(Rte 72)	Forest Management	49.0
1	4/4/13	666	FSI/ Tree shears BB, BG	Black birch understory reduction	21.0
	5/9/13		NRCS - EQIP	Funding for Activities	
	6/19/13	327	NRCS - EQIP	Radar Site - Warm Season Grass	1.4
3/4	2/27/14		Timber Sale #2	Forest Management	37.0
7	6/4/14		Herbicide Application	Pre-emergent trail spraying	
5/4	6/4/14	382	Fence #1 and #2 Construction	1 = 3919ft. (23 acres), 2 = 3604 ft. (18 acres)	41.0
	7/14/14	666	TSI	Tree Thinning with Shears	18.0
	7/14/14	314	Herbicide - Chem. HEAVY Infest.	Spicebush in Rte. 72 Fence	23.0
6	7/14/14	314	Herbicide - Chem. MEDIUM Infest.	Herb. barberry/headwaters of Chickies Creek	30.0
	7/14/14	587	Structures for Water Control	39 waterbars installed	
	7/25/14		NRCS - EQIP	Apply to 4 payments of 7/14/14	
	8/27/14		2014 Marcellus Grant	Apply to 2 payments of 6/4/14	
	1/1/15		2015 Marcellus Grant	Applied to rewrite of 2016 FSP	
2/5	5/1/15		Timber Sale	Tree salvage and demo area	
	5/29/15		NRCS - EQIP	Funding for Activities	
2	7/1/15		Demo Area Establishment	Prep and Fence	
	8/21/15		2014 Marcellus Grant	Funding for activities	
5/4	7/25/16		Herbicide Application	Fence #1 and #2 Invasive Respray	


DeLORME
XMap® 8
2009-2016 Completed Activities Map
1
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MN (11.5° W)
0 400 800 1200 1600 2000 2400 2800 ft
Data Zoom 13-6
Forest Regeneration Services Inc.
ForestRegeneration.com
Data use subject to license.
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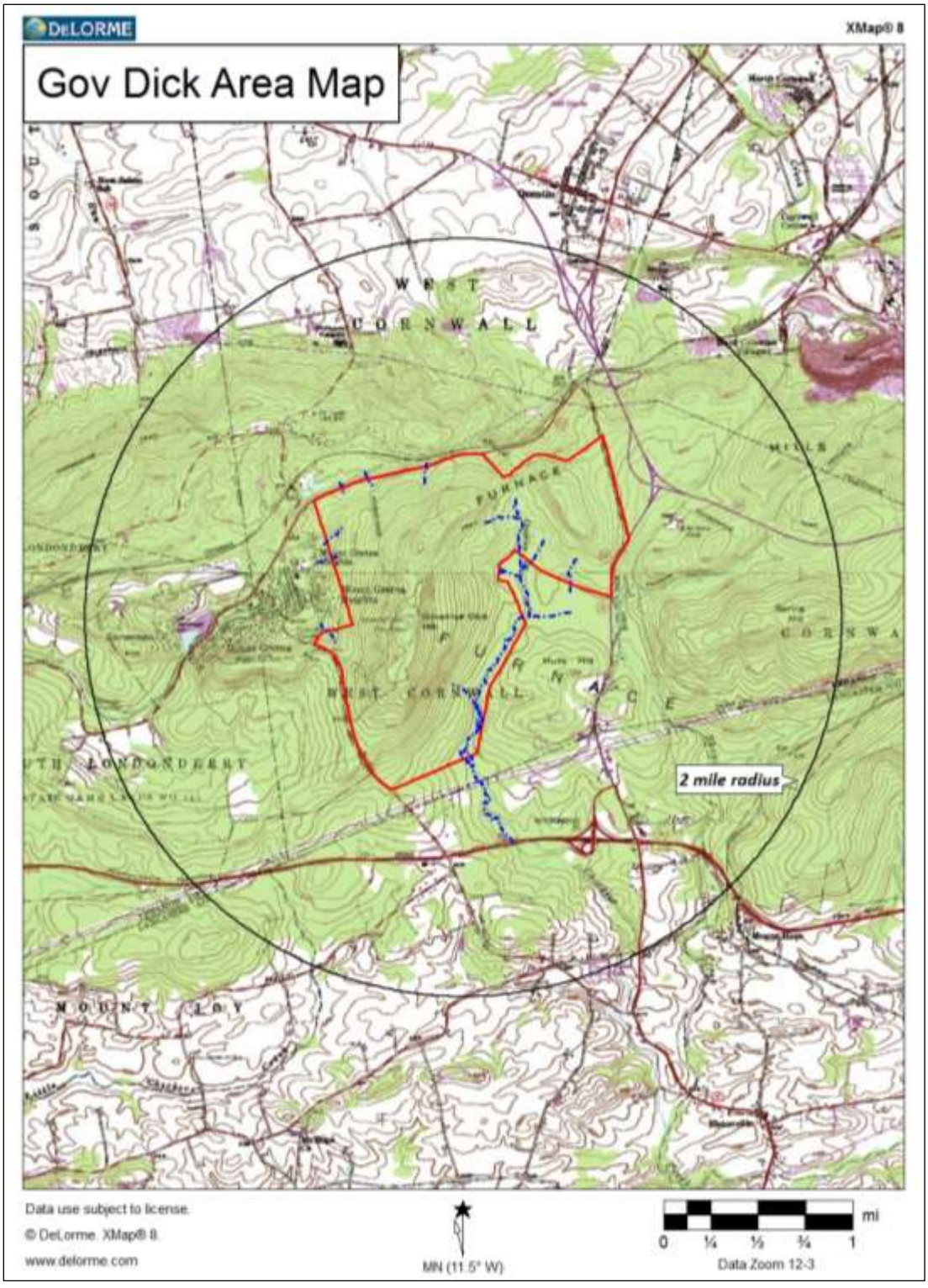
www.delorme.com

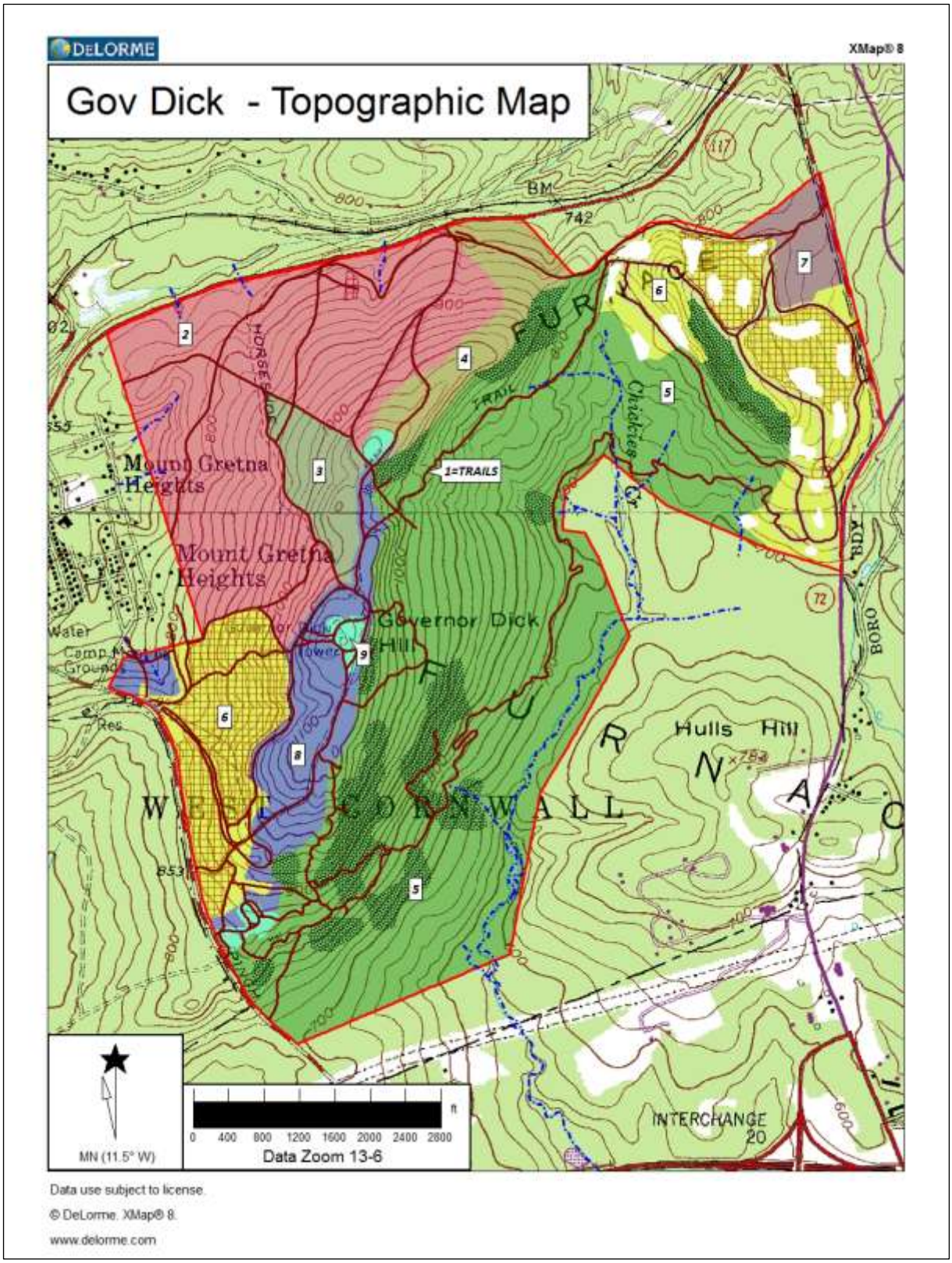
PROPERTY MAPS

TOPOGRAPHIC MAPS

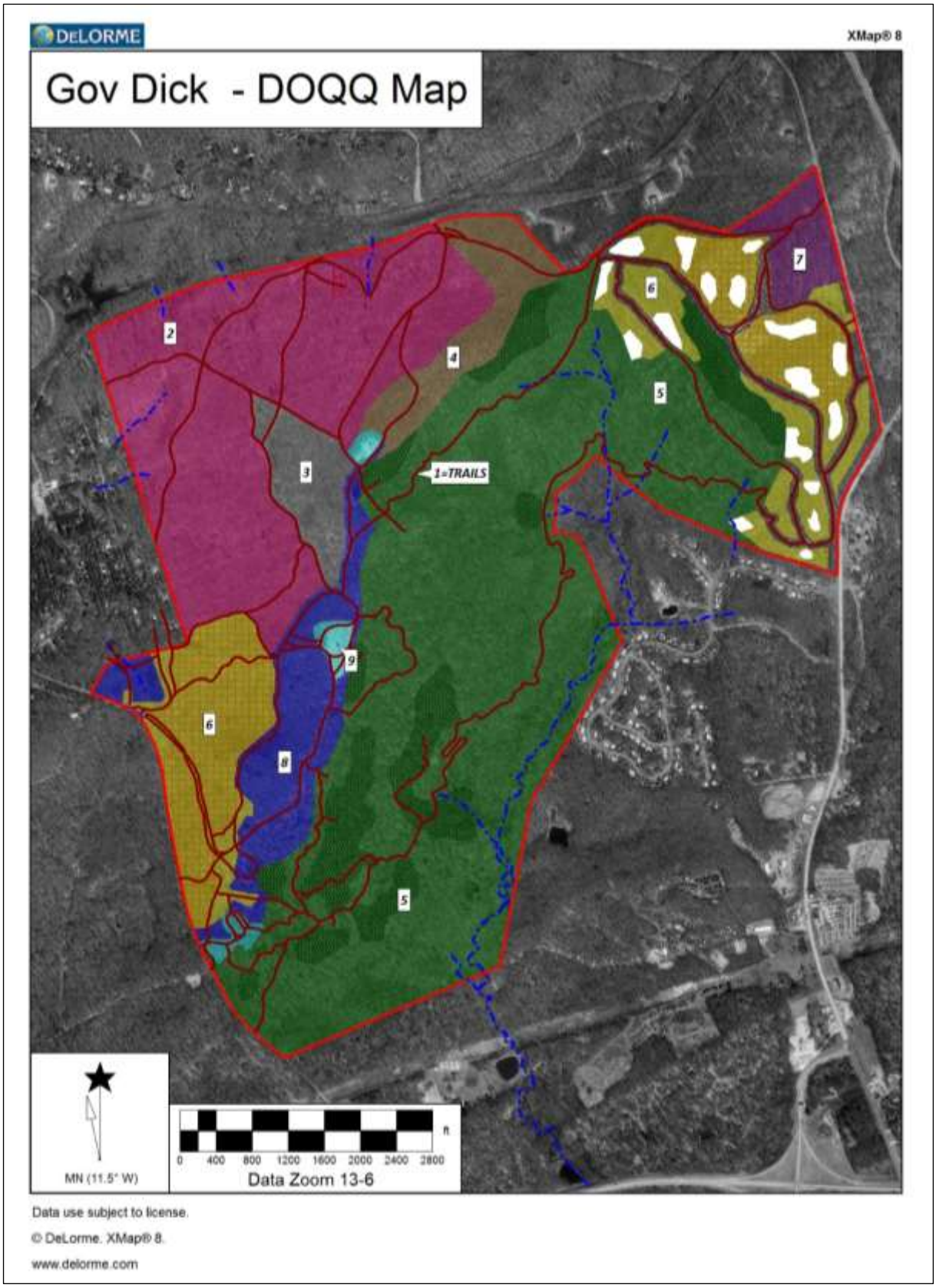
1) Landscape Map



2) Property Map



3) Aerial Photograph



4) Soils Map

Parent Material Name--Lebanon County, Pennsylvania
(Gov Dick Parent Material Map)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Rating Polygons
  - colluvium derived from diabase
  - residuum weathered from diabase
  - residuum weathered from sandstone and siltstone
  - residuum weathered from sandstone and/or residuum weathered from conglomerate
  - Not rated or not available
- Soil Rating Lines
  - colluvium derived from diabase
  - residuum weathered from diabase
  - residuum weathered from sandstone and siltstone
  - residuum weathered from sandstone and/or residuum weathered from conglomerate
  - Not rated or not available
- Soil Rating Points
  - colluvium derived from diabase
  - residuum weathered from diabase
  - residuum weathered from sandstone and siltstone
  - residuum weathered from sandstone and/or residuum weathered from conglomerate
  - Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lebanon County, Pennsylvania
Survey Area Data: Version 10, Nov 16, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 26, 2011—Jul 2, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Natural Resources Conservation Service

Web Soil Survey
National Cooperative Soil Survey

11/3/2016
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Parent Material Name—Lebanon County, Pennsylvania
(Gov Dick Parent Material Map)
Mine Rd
Back Creek
322
117
UoB
UoC
NHE
Oak St
1JpD
Chiquies Creek
NhB
Shearers Creek
WbB
MsB
NhC
Pinch
Lehman Rd
Lebanon Rd
Pinch Rd
76
Map Scale: 1:20,700 if printed on A portrait (8.5" x 11") sheet.
Meters
Feet
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84
Natural Resources
Conservation Service
Web Soil Survey
National Cooperative Soil Survey
11/3/2016
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Parent Material Name

Parent Material Name— Summary by Map Unit — Lebanon County, Pennsylvania (PA075)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1JpD	Joanna loam, 8 to 25 percent slopes, extremely stony	residuum weathered from sandstone and/or residuum weathered from conglomerate	725.1	65.0%
MsB	Mount Lucas extremely stony silt loam, 3 to 8 percent slopes	colluvium derived from diabase	19.2	1.7%
NhB	Neshaminy extremely stony silt loam, 3 to 8 percent slopes	residuum weathered from diabase	7.8	0.7%
NhC	Neshaminy extremely stony silt loam, 8 to 25 percent slopes	residuum weathered from diabase	3.6	0.3%
NHE	Neshaminy extremely stony silt loam, steep	residuum weathered from diabase	189.1	17.0%
UoB	Ungers extremely stony loam, 3 to 8 percent slopes	residuum weathered from sandstone and siltstone	22.9	2.1%
UoC	Ungers extremely stony loam, 8 to 25 percent slopes	residuum weathered from sandstone and siltstone	127.6	11.4%
WbB	Watchung extremely stony silt loam, 0 to 8 percent slopes	residuum weathered from diabase	20.0	1.8%
Totals for Area of Interest			**1,115.3**	**100.0%**

Description

Parent material name is a term for the general physical, chemical, and mineralogical composition of the unconsolidated material, mineral or organic, in which the soil forms. Mode of deposition and/or weathering may be implied by the name.

The soil surveyor uses parent material to develop a model used for soil mapping. Soil scientists and specialists in other disciplines use parent material to help interpret soil boundaries and project performance of the material below the soil. Many soil properties relate to parent material. Among these properties are proportions of sand, silt, and clay; chemical content; bulk density; structure; and the kinds and amounts of rock fragments. These properties affect interpretations and may be criteria used to separate soil series. Soil properties and landscape information may imply the kind of parent material.

For each soil in the database, one or more parent materials may be identified. One is marked as the representative or most commonly occurring. The representative parent material name is presented here.

Forestland Productivity

This table can help forestland owners or managers plan the use of soils for wood crops. It shows the potential productivity of the soils for wood crops.

Potential productivity of merchantable or *common trees* on a soil is expressed as a site index and as a volume number. The *site index* is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that forestland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability. More detailed information regarding site index is available in the "National Forestry Manual," which is available in local offices of the Natural Resources Conservation Service or on the Internet.

The *volume of wood fiber*, a number, is the yield likely to be produced by the most important tree species. This number, expressed as cubic feet per acre per year and calculated at the age of culmination of the mean annual increment (CMAI), indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

Trees to manage are those that are preferred for planting, seeding, or natural regeneration and those that remain in the stand after thinning or partial harvest.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service, National Forestry Manual.

Report—Forestland Productivity

Forestland Productivity–Lebanon County, Pennsylvania				
Map unit symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site Index	Volume of wood fiber	
			Cu ft/ac	
1JpD—Joanna loam, 8 to 25 percent slopes, extremely stony				
Joanna, extremely stony	Northern red oak	65	43.00	Eastern white pine, Virginia pine
	Virginia pine	60	86.00	
MsB—Mount Lucas extremely stony silt loam, 3 to 8 percent slopes				
Mount lucas, extremely stony	Northern red oak	80	57.00	Eastern white pine, Virginia pine, Yellow-poplar
	Virginia pine	75	114.00	
	Yellow-poplar	90	86.00	

Forestland Productivity–Lebanon County, Pennsylvania				
Map unit symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site Index	Volume of wood fiber	
			Cu ft/ac	
NhB—Neshaminy extremely stony silt loam, 3 to 8 percent slopes				
Neshaminy	Northern red oak	80	57.00	Black walnut, Eastern white pine, Japanese larch, Norway spruce, Virginia pine, Yellow-poplar
	Yellow-poplar	90	86.00	
NhC—Neshaminy extremely stony silt loam, 8 to 25 percent slopes				
Neshaminy	Northern red oak	80	57.00	Black walnut, Eastern white pine, Japanese larch, Norway spruce, Virginia pine, Yellow-poplar
	Yellow-poplar	90	86.00	
NHE—Neshaminy extremely stony silt loam, steep				
Neshaminy	Northern red oak	80	57.00	Black walnut, Eastern white pine, Japanese larch, Norway spruce, Virginia pine, Yellow-poplar
	Yellow-poplar	90	86.00	
UoB—Ungers extremely stony loam, 3 to 8 percent slopes				
Ungers	Northern red oak	67	43.00	Eastern white pine, Virginia pine
	Virginia pine	65	100.00	
UoC—Ungers extremely stony loam, 8 to 25 percent slopes				
Ungers	Northern red oak	67	43.00	Eastern white pine, Virginia pine
	Virginia pine	65	100.00	
WbB—Watchung extremely stony silt loam, 0 to 8 percent slopes				
Watchung, extremely stony	Northern red oak	80	57.00	Eastern white pine, European larch, Norway spruce
	Pin oak	85	57.00	

Data Source Information

Soil Survey Area: Lebanon County, Pennsylvania
Survey Area Data: Version 10, Nov 16, 2015

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 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 40-90ft² (50-60ft² 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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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]

An internet database search of the PNDI was conducted and potential conflicts that may impact the natural resource recommendations described in this plan can be found in Appendix D.

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 the ability to quickly expand after a disturbance that increases light on the forest floor.

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

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: Regenerating Hardwood Forests

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.

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.

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.

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.*

PENNSTATE 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 Edley

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

Howard Nuemberger

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

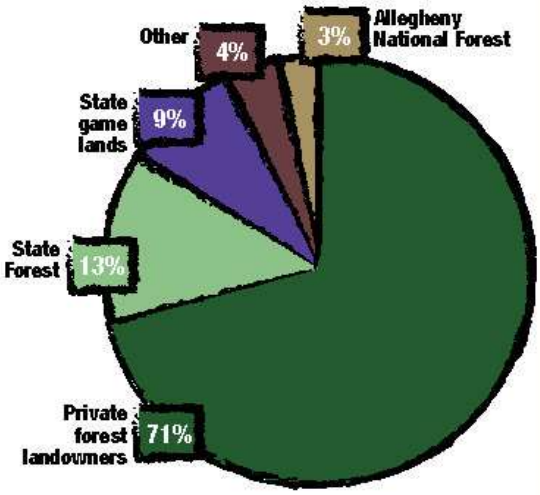
Putting It into Practice

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.*

Prepared by David R. Jackson, extension educator; Michael T. Wolf, former associate extension educator; and James Finley, professor of forest resources.

The authors wish to thank Joseph A. Harding, director, Penn State Forest Lands, for developing the "easy-to-remember" C-D-L acronym, sharing his insight into the C-D-L system of forest regeneration, and providing editorial comments; and Susan L. Stout, research project leader, Warren Forest Sciences Laboratory, USDA Forest Service, for research efforts and editorial comments.

Mixed Sources
FSC

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STAND LEVEL INFORMATION

MANAGEMENT UNIT #1 Roads and Trails

Acres: 184

OBJECTIVE

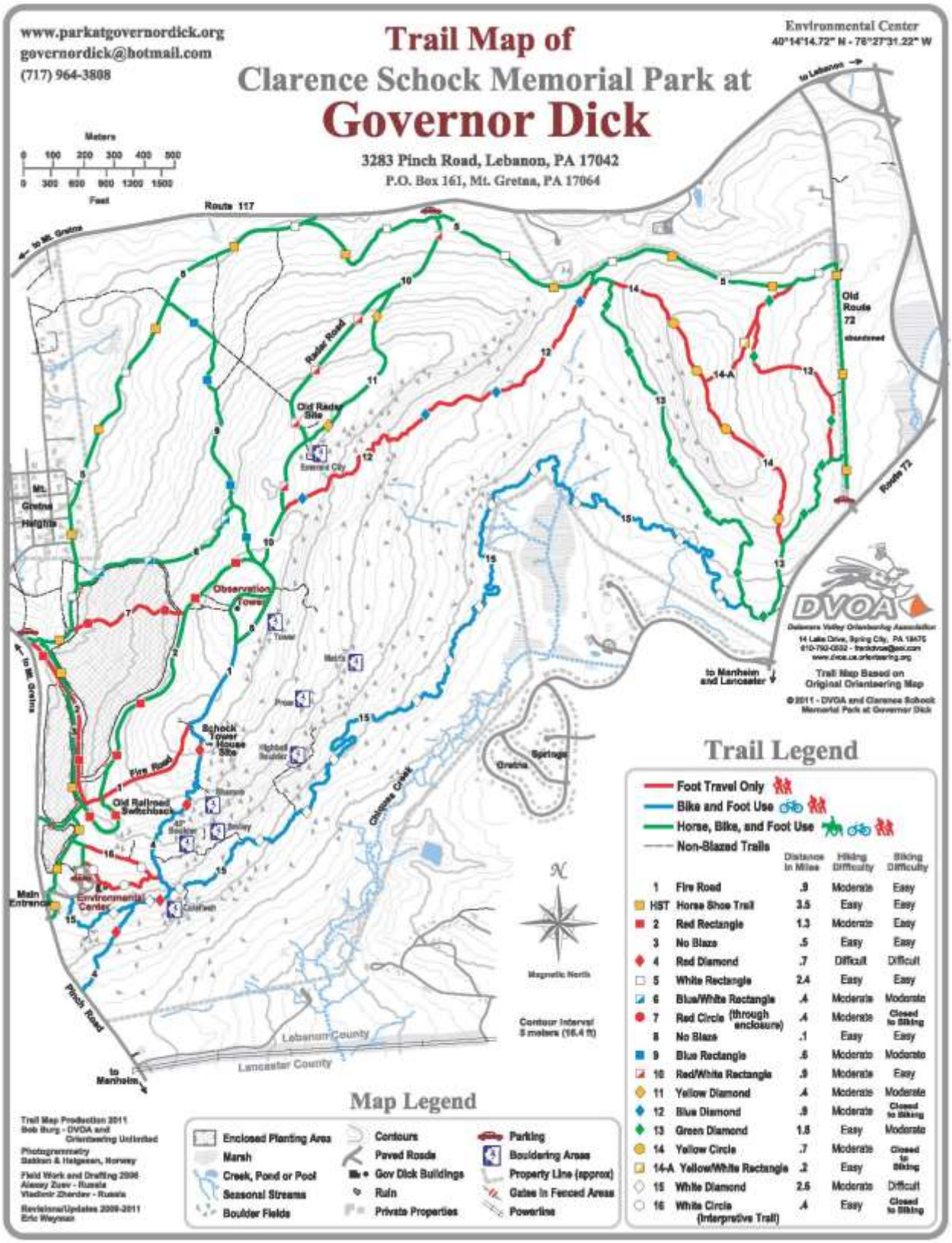
The existing trail system is the "life-blood" of all activities at Gov. Dick. All public activities require at least some use of the trails. In fact, the vast majority of all activities; hiking, biking, horseback-riding, bouldering, and nature studies are accomplished via use of the trails or within 100 feet of the existing trail surfaces. There are obvious exceptions to this statement but the fact remains that the vast majority of all impact (arguably all of which are negative) placed upon the environment by visitors of the park is through the trail system. Therefore, it is imperative that management strategies are *pro-active rather than reactive* to potential environmental problems caused by the public's use of the trail system.

CURRENT DESCRIPTION

The acreage included in Management Unit #1 is defined as the cumulative area contained within a 100-ft. wide corridor that lies along all "routes of travel" at Gov. Dick. This land area *is not* in addition to the acreage found in other management units but rather a portion of each of the other management units. The extensive network of roads and trails make up about 15.2 miles or 184 acres of transportation corridors through Gov. Dick. For a description of forest types, stocking, dominant species, etc. reference a specific trail segment; determine the corresponding Management Unit(s) in which the trail segment boarders or resides; then read the description for the desired corresponding unit.

Approximately 23 acres of ground surface area is comprised of roads (4.0 miles) and trails (10.6 miles) which together account for less than 2% of the total acreage of the property. Most of the roads are surfaced with crushed stone; the trails are unimproved and constructed only of native soil material. Dirt trails average 6 to 12 feet in width (i.e. cleared vegetation width) and cover approximately 12.9 acres of land. Gravel and paved roads average 15 to 25 feet in width and cover approximately 10.1 acres of land. The trail system at Gov. Dick can be accessed via 14 (approximately) points of entry.

The regionally known Horseshoe Trail traverses the property in an east-west direction. The trail 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.


www.parkatgovernordick.org
governordick@hotmail.com
(717) 964-3888
Trail Map of
Clarence Schock Memorial Park at
Governor Dick
3283 Pinch Road, Lebanon, PA 17042
P.O. Box 161, Mt. Gretna, PA 17064
Environmental Center
40°14'14.72" N - 78°27'31.22" W
Meters
0 100 200 300 400 500
Feet
0 300 600 900 1200 1500
Route 117
to Mt. Gretna
to Lebanon
Old Route 72
abandoned
Route 72
Radar Road
Old Radar Site
Mt. Gretna Heights
Observation Tower
Schock Tower House Site
Fire Road
Old Railroad Switchback
Environmental Center
Main Entrance
Pinch Road
to Manheim
to Manheim and Lancaster
Chickies Creek
Springs
Gretna
Lebanon County
Lancaster County
Magnetic North
Contour Interval 5 meters (16.4 ft)
DVOA
Delaware Valley Orienteering Association
14 Lake Drive, Spring City, PA 19475
610-792-0532 - frankdvoa@aol.com
www.dvoa.us.orienteering.org
Trail Map Based on Original Orienteering Map
©2011 - DVOA and Clarence Schock Memorial Park at Governor Dick
Trail Legend
Foot Travel Only
Bike and Foot Use
Horse, Bike, and Foot Use
Non-Blazed Trails
1 Fire Road .9 Moderate Easy
HST Horse Shoe Trail 3.5 Easy Easy
2 Red Rectangle 1.3 Moderate Easy
3 No Blaze .5 Easy Easy
4 Red Diamond .7 Difficult Difficult
5 White Rectangle 2.4 Easy Easy
6 Blue/White Rectangle .4 Moderate Moderate
7 Red Circle (through enclosure) .4 Moderate Closed to Biking
8 No Blaze .1 Easy Easy
9 Blue Rectangle .5 Moderate Moderate
10 Red/White Rectangle .9 Moderate Easy
11 Yellow Diamond .4 Moderate Moderate
12 Blue Diamond .9 Moderate Closed to Biking
13 Green Diamond 1.5 Easy Moderate
14 Yellow Circle .7 Moderate Closed to Biking
14-A Yellow/White Rectangle .2 Easy Easy
15 White Diamond 2.5 Moderate Difficult
16 White Circle (Interpretive Trail) .4 Easy Closed to Biking
Distance in Miles
Hiking Difficulty
Biking Difficulty
Map Legend
Enclosed Planting Area
Marsh
Creek, Pond or Pool
Seasonal Streams
Boulder Fields
Contours
Paved Roads
Gov Dick Buildings
Ruin
Private Properties
Parking
Bouldering Areas
Property Line (approx)
Gates in Fenced Areas
Powerline
Trail Map Production 2011
Bob Burg - DVOA and Orienteering Unlimited
Photogrammetry
Sakkari & Helgesen, Norway
Field Work and Drafting 2006
Alexey Zuev - Russia
Vladimir Zherdev - Russia
Revisions/Updates 2009-2011
Eric Weyman

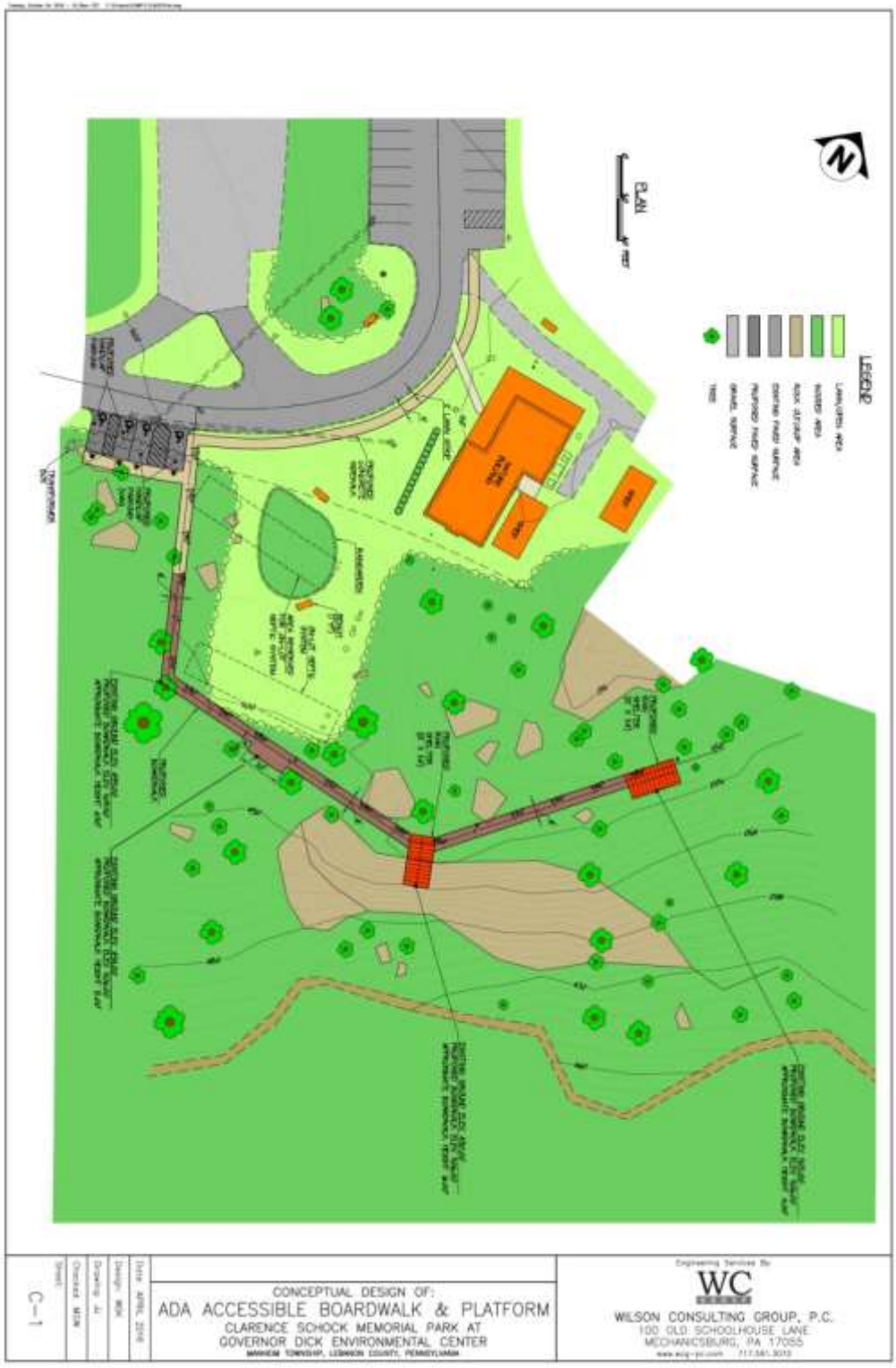
MANAGEMENT RECOMMENDATIONS

Summary of Management Activities

- Systematically reduce invasive plant population by mechanical and/or chemical control methods.
- Implement cultural controls primarily by replacing invasive plants with desirable grasses (as temporary cover), and introducing shade tolerant trees and shrubs.
- Catalog, monitor and plan for the inevitable loss of high-risk overstory trees. Underplant cataloged trees with shade tolerant trees/shrubs and protect from deer browse damage. Remove invasive plants and interfering understory vegetation as necessary to assure successful replacement of the overstory tree.
- Update, expand, improve or create better parking facilities and access corridors at the park.
- Maintain erosion control structures throughout the trail system. Install new erosion control structures as needed to minimize trail degradation.

Details of Management Activities

1) **Trail Corridor Management:** Improve aesthetics and reduce vectoring of invasive plants into interior woodland environments by protecting, reserving, and improving a 100-foot wide transportation corridor along all trails.
2) **Parking Facilities:** Parking facilities are generally *inadequate* relative to the volume of users in all areas including the ***Environmental Center*** located off Pinch Road. Improved parking facilities should be considered for additional parking facilities on Route 117 and Route 72.
3) **Americans with Disabilities Act accessible (ADA) walkway and platform:** Provide recreational opportunities for Americans with disabilities by constructing an appropriate walkway and platform in the area just south and east of the Environmental Center. The preliminary planning and design concept is already underway and monies needed for the concept plans/drawing have already been committed by the Clarence Schock Foundation and by the Lebanon County Commissioners through their Marcellus shale gas program. The preliminary design sketch is included below.


Legend
CONCEPTUAL DESIGN OF:
ADA ACCESSIBLE BOARDWALK & PLATFORM
CLARENCE SCHOCK MEMORIAL PARK AT
GOVERNOR DICK ENVIRONMENTAL CENTER
WILSON CONSULTING GROUP, P.C.
100 OLD SCHOOLHOUSE LANE
MECHANICSBURG, PA 17055
C-1

Discussion regarding the ADA Boardwalk and Platform are summarized by Chuck Allwein, Member Board of Directors as follows:

> *"The board felt we have a lot of activities in the park for people that are physically able, but we really, with the exception of the Environmental Center, have nothing for physically incapable people. We have a lot of IU students that would like to use the Center, but they cannot negotiate the topography. We are surrounded by senior communities, and the seniors would love to get out into nature more. We have seen different parks that have put in boardwalks, a flat walkway into the park. We have a lot of boulders and elevation changes and so in order to put in a walkway it will have to be elevated, some areas more, some areas less. There is going to be an ADA sidewalk from the parking lot to the entrance of the boardwalk and that slope will be within the ADA guidelines. It's going to be a concrete sidewalk, colored similar to the porch of the Center. It's going to be five feet wide and it will skirt the front of the Environmental Center. There will also be a two-foot grass strip between the driveway and the sidewalk so that wheelchairs or folks with walkers will not stumble into the driveway. There is going to be additional handicap parking at the entrance to the boardwalk. The boardwalk is approximately 500 feet long and our thinking is that we will be able to add to that in the future if we so desire. The boardwalk is going to run behind our rain garden and go into the forest. The first section will go basically from zero elevation at the driveway entrance to sixteen feet elevation at the first platform. You will be in the trees at that point. Different bird and insect species inhabit different levels of the forest so this will provide a different viewpoint for people. The first platform is going to be cantilevered and the end of it overlooking trail 15 will be sixteen feet high. The walkway continues through the forest to a second platform that is four feet high and it, too, will overlook trail 4 and trail 15. There is a drop-off at the second platform but not nearly as severe as the first platform…The boardwalk has the potential to be continued to tie in with the Interpretive Trail in a future expansion. This is something the state, when they met with us, was very interested in doing, perhaps doing it in stages so that ultimately it wouldn't just terminate there. It could come around and come back to the Center on the Interpretive Trail."*

4) **Environmental Corridor:** Encourage use of the ***Environmental Center*** by constructing a paved or stoned roadway (similar to the ***Environmental Center*** access road) that leads from the ***Environmental Center*** to main road leading to the Observation Tower. Access should be sufficient to permit the passage of wheelchairs and other devices used by disabled patrons of the park. This section of road should provide many points of interest and act as an Environmental "porthole" into the various physical, ecological, geological and cultural interest points available at Gov. Dick. Various displays of can be created and presented in a natural, aesthetically pleasing arrangement along this "information corridor". Semi-private park bench arrangements (casual circular arrangements) can be created on short spur trails adjacent to the information corridor. These semi-private meeting places will encourage small groups of people to enter into discussions of leisure or educational content. Environmental games can be designed to encourage thought through competition. The possibilities of invoking meaningful thought along this education corridor are endless.

5) **Invasive Plant Mitigation along Roads and Trails:** Most invasive plants are found within 100 feet of an existing trail. Few species of invasive plants were found further than 400 feet from an existing trail (ailanthus and Japanese barberry are a notable exceptions). 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. 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 ever being totally eradicated at Gov. Dick. Therefore, diligently suppress Invasive plant population when management practices warrant their attention. The establishment of a healthier, more resilient forest ecosystem will go far to suppress the damaging effects of invasive plants.

a) The key to controlling most invasive plants is to reduce the amount of exposed mineral soil and sunlight found on the forest floor. Desirable herbaceous and woody understory vegetation, a healthy leaf litter layer and an abundance of woody debris are all factors that can be managed to reduce the amount of exposed soil in the forest.

b) However, bare mineral soil will always be present on and near the trails so management activities should concentrate on reducing the amount of sunlight that reaches the forest floor and planting temporary "grasses" in troublesome areas that seem to have persistent invasive plant populations. This author has noted that areas that have increased levels of light and have been planted with shade tolerant grasses, seeded and properly limed, fertilized and mulched have been highly successful in precluding invasive plants from becoming re-established in certain areas of the park,

6) **Maintain a 100-foot wide corridor along all existing roads and trails as defined below:**

a) **Step 1:** Encourage "total-shading" of the forest floor using all methods stated herein, whenever and wherever appropriate to reduce the likelihood that invasive plants will germinate and grow.

b) **Step 2:** Large trees have and will continue to drop out of the forest canopy along the trail system. Current conditions are preventing natural tree regeneration and replacement from occurring (see CDL requirements beginning on page 33 for further explanation). Therefore, proactively plan for the eventual loss of "high-risk" overstory trees by:

i) Identify and GPS the locations of the most hazardous or high-risk trees *(public participation is encouraged throughout the following practices).*

(1) Over the next ten years identify, catalog and label 100-200 trees that are most at risk. Use the assistance of a forester to identify these trees based on each trees health, vigor, or potential to disturb, disrupt, or negatively affect the existing trail system and the surrounding biota. Also, consider safety concerns with regards to above ground root structures, broken or dead limbs/crowns, and leaning or root-sprung trees.

(2) Underplant each identified tree with 15-25 shade tolerant trees and/or shrubs. Plant indigenous shade-tolerant species to encourage uneven-aged management opportunities in future stands. Include sugar maple, red spruce, American beech, white spruce, dogwood, redbud, and serviceberry in those species to be planted. A site fully occupied with desirable vegetation is much less likely to become occupied with invasive plants.

(3) Protect all seedlings with deer fencing that is appropriate for the number and distribution of seedlings planted. Fencing methods may range from the standard "total area/full height" fencing used elsewhere in the park to individual tree shelters fabricated from an appropriate wire mesh fencing materials. The height, diameter, gauge, and mesh size of the fabricated shelters should be sufficient to protect each seedling until they reach 3 to 4 inches DBH; metal fencing is preferred over plastic; individual "tube-type" plastic tree shelters are not recommended for this type of planting.

(4) Remove invasive plants and interfering understory vegetation as necessary to secure satisfactory growth rates among the planted seedlings.

ii) Provide for replacement of any overstory trees located along the trail system (in the preceding manor) that for whatever reason falls from the canopy; even if the tree was not identified and cataloged as described above.

iii) Maintain a "Catalog of High-Risk Trees" at all times that includes 100 to 200 trees.

iv) On occasion, certain trees may be recommended/desired to be cut within the trail corridor for various reasons. A current example of this dilemma is the Emerald Ash Borers (EAB) decimation of white ash throughout all portions of the property. Though there are very few ash trees along the trail system as a whole, certain individual trees may require felling and replacement as outlined above. The previous forest stewardship plan did not address any mechanism for an inevitability such as this to occur. Therefore, it is recommended that candidate trees (i.e. cataloged as high-risk or otherwise determined to be hazardous or undesirable) be identified and presented to the board for discussion as to how to handle them on a tree to tree basis.

7) **Encourage Shade-Tolerant Plant Species:** Shade tolerant plant species area elemental to perpetually maintaining aesthetic appeal along the trail corridors at Gov. Dick. Shade tolerant species are able to enhance and sustain visually interesting vegetative structuring and provide desirable habitat components lacking elsewhere within the forest. Therefore, encourage the establishment of shade-tolerant species along the various portions of the trail system "perpetually" over time. This is an ongoing project that should not end. Proceed as follows:

a) Select opportunistic sites (areas of increased sunlight) along existing trails to plant shade tolerant woody plant. Include both conifer and hardwood species. Include both overstory and understory species that are native and "colorful". Include species such as red spruce, white spruce, sugar maple, Eastern hophornbeam, American hornbeam, American beech, American holly, basswood, mountain laurel, serviceberry, dogwood and other species of similar shade tolerance. Study their particular soil type requirements and natural plant associations to determine the best species mixes to plant for a specific location.

b) Remove interfering understory vegetation via herbicides wherever encountered.

c) Protect all seedlings with deer fencing that is appropriate for the number and distribution of seedlings planted. Fencing methods may range from the standard "total area/full height" fencing as currently used elsewhere in the park to individual tree shelters fabricated from an appropriate wire mesh fencing materials. The height, diameter, gauge, and mesh size of the

fabricated shelters should be sufficient to protect each seedling until they reach 3 to 4 inches DBH. Metal fencing is preferred over plastic. Individual "tube-type" plastic tree shelters are not recommended for this type of planting.

d) Plant only short, discrete manageable sections of trail up to 100 feet in length and within 100 feet of the trails edge in this manner. Monitor the progress of the plantings over time to assure that these plantings persist. This is an ongoing project that can be enhanced greatly by forming a "Planting Committee" to design projects, select appropriate locations and species to plant, and ultimately prepare, plant, and protect the planted sites. Input from the Audubon Society and other interest groups would make the projects more interesting. The key to a successful planting program is not to become overwhelmed with work, but rather to build a legacy "plant-by-plant" that contributes to the greater good of the park.

8) **Water Control Structures:** Maintain erosion control structures throughout the trail system. Install new erosion control structures as needed to minimize trail degradation due to erosion.

9) **Trails for Special or Restricted Use:** All trails at Gov. Dick are not able to sustain heavy-use traffic such as that from horseback-riders and bike traffic. Hydric soils, steep terrain, excessive rockiness, seasonally wet or weeping grounds, spring seeps and riparian area are all valid reasons to designate certain trail segments as low-impact, "Foot Travel Only" areas. Handicapped accessible trail segments may also be defined and improved for this purpose. Consider suitable trail segments that are easily accessible via well established and safe parking areas.

10) **Park Benches along Trails:** Set park benches at various locations along the trail system. Ideally the benches should be set off the trail far enough to allow unobstructed use of the trails and adequate room for bikes and horses to remain off-trail. A hitching rail and/or bike rack will add greatly to the appeal of the site. Clear and maintain only as much space as necessary to accommodate the facilities heretofore mentioned. Locate park benches only where drainage is excellent and the presence of standing water is never at question. Always locate on slightly sloping ground. Locate near intersections of trails whenever possible. Do not overpopulate the trail system with benches; rather locate sparingly within a 10-minute walk of existing parking areas. This strategy will help accommodate the elderly or handicapped individuals by providing resting facilities within a mild walk of their vehicles. Try to incorporate several cultural, geologic, or physical points of interest at each park bench. Even tree identification plaques will peak many people's interest.

11) **Vistas:** 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 and several lesser "benches" at lower elevations provide ample opportunities to overlook the woodlands below. Several possible vista locations have been marked on the map. Most vista locations are intended to overlook interior woodland environments and not to overview the countryside. Therefore, do not clear trees from the vista. Encourage vista use by constructing short "spur" trails to their location from nearby existing trails. Name each vista location and post at appropriate spur intersection. Visitor familiarity is enhanced when place names can be referenced to locations they visited at Gov. Dick.

MANAGEMENT UNIT #2 North Slope – Mature Mixed Oak

Acres: 225

Forest Type: .....AH21 – Dry Oak – Heath Forest

.....SILVAH - Mixed Oak

Site Index: .....67 for Black Oak

OBJECTIVE

- Initiate the establishment of oak regeneration - reduce negative impacts caused by competing vegetation and invasive plants; high deer population levels, and inadequate light levels that are impeding the development of advance regeneration within the stand.
- Encourage structural diversity by employing mast trees release techniques and group selection methods when overstory removal harvests are scheduled.
- Enhance stand biodiversity by introducing conifers and shade-tolerant species
- Emerald Ash Borer (EAB) – White ash is very scarce in this management unit. Remove Ash from isolated sites where groupings of white ash exist.

CURRENT DESCRIPTION

Dominant Species: .....CO, BO, BB, RO

Basal Area: .....152 sq. ft.

Relative Density:.....120%

Dominant and Co-Dominant Trees:

Merchantable Medial Diameter:.....18.4”

Class:.....Large sawtimber

Limiting Factor to Regeneration (CDL):

Competing Vegetation: .....☑
Deer: .....☑
Light:.....☑

Invasive Species:

☐ Abundant enough to require control before increasing light levels on the forest floor.

☑ Nearby invasive plant populations have likely contributed to the seedbank. Measures to control invasives are likely necessary soon after light levels are increased on the forest floor.

☐ Invasive populations are not likely to have significant impact beyond that of native-aggressive vegetation (e.g. fern, spicebush, pawpaw). Control invasives while controlling other interfering understory vegetation.

☐ N/A

Invasive Species Present: Japanese barberry, Japanese stiltgrass, ailanthus, garlic mustard, multiflora rose, and elaeagnus.

Interfering Understory Vegetation: Undesirable understory plants may interfere with development of regeneration. Understory plants in this stand include dense low woody cover, dense tall woody cover and dense fern cover.

MANAGEMENT RECOMMENDATIONS

Summary of Management Activities

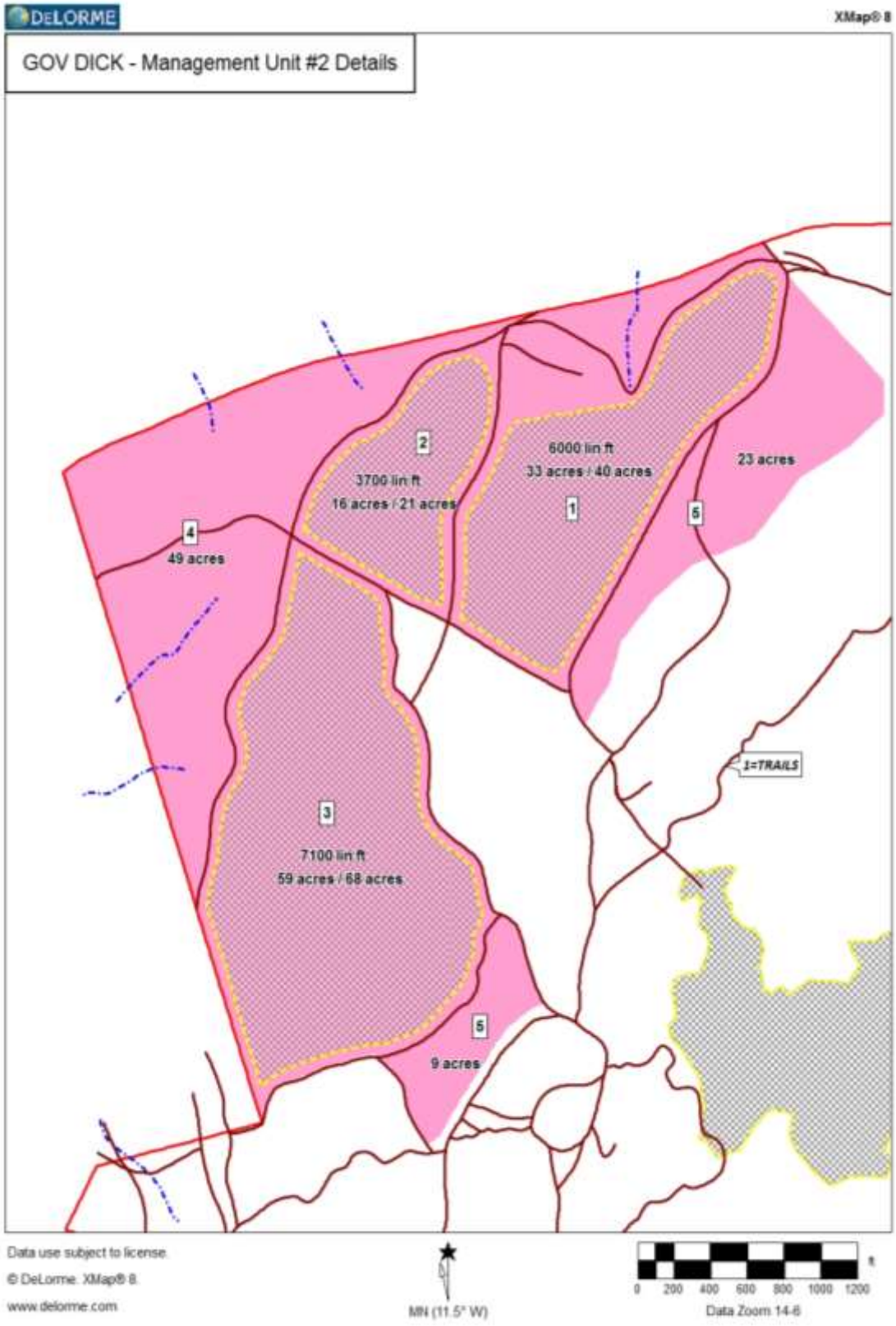
SILVAH recommends: Fence, Site Prep. Burn or Herbicide, Monitor Acorns, Re-inventory.

Seedlings are too scarce at this time. Wait for an acorn crop and re-inventory 2-5 years later. This prescription is appropriate for stands that are between large acorn crops and not affected by shade, but interfering vegetation is a problem and a fence is required to exclude deer. Such stands have an adequate seed source but are lacking oak regeneration. The Deer Impact Index is greater than 3, stocking of interfering vegetation is greater than 30 percent, and stocking of thick duff is 30 percent or less. These stands need time for an acorn crop to occur and for subsequent seedling establishment so it is best not to intervene at this time. Depending on the viability of burning the stand, conduct one or more prescribed fires or apply herbicides per the instructions in the Site Prep Burn or Herbicide descriptions. If using fire, conduct one or more burns according to instructions in the Site Prep Burn description. If applying herbicide, use one or more of the methods described in the Herbicide description. Construct a fence per the instructions in the Fencing description. It is important that these treatments are applied within the same year. Monitor acorn crops and inventory the stand 2 to 5 years after a good acorn crop has established a cohort of new oak seedlings to determine the next treatment.

Additional treatments:

1) *Apply a site-prep burn when conditions are appropriate, or treat the undesirable understory plants with an application of herbicide during the appropriate part of the growing season. This type of prescribed fire prepares an oak stand for eventual oak seedling establishment after a future acorn crop. The objective is to reduce dense understory shade and litter loadings so that a larger proportion of an acorn crop successfully germinates and becomes seedlings. Burning can be done in the dormant season (fall or early spring) or growing season (late spring) and at any intensity. However, high-intensity fires (flame lengths greater than 2 feet) in the late spring decrease dense understory shade more quickly than low intensity fires in the fall or early spring. Generally, multiple fires spread over several years are necessary to reduce dense understory shade to a level that improves the survival and growth of new oak seedlings. Do not burn if an acorn crop has just fallen or if new oak seedlings from a recent acorn crop are needed to help regenerate the stand as fire kills acorns and small oak seedlings (Auchmoody and Smith 1993). Please refer to the silvicultural guide for details about implementing this prescription.*
2) *Current deer levels will likely prevent regeneration developing into a new stand. Fencing is recommended to protect seedlings from deer. A fence can be constructed either before or after treatment. If fencing is constructed after treatment, fencing should be done as soon as possible.*

Details of Management Activities



Stand Prescription:

Mgmt. Unit #	Location Number	Sequence	Practice Description	Acres	Fence Perimeter (lin. Ft.)	Year Planned	NRCS Practice Code	NRCS Scenario Number
2	1 and 2	1	Low Shade Removal	42.2		2017	647	6
	1	2	Fence	33	6,000	2019	382	50
	1	3	Herbicide fern, spicebush, pawpaw, invasives before planting	40		2019	490	3
	1	4	Planting : shade-tolerant species (200 seedlings/acre)	8		2020	612	40
	1	5	Mast Tree Release	33		2026	TBD	
	2 and 3	1	Low Shade Removal	48		2018	647	6
	2	2	Fence	16	3,700	2020	382	50
	2	3	Herbicide fern, spicebush, pawpaw, invasives before planting	21		2020	490	3
	2	4	Planting : shade-tolerant species (200 seedlings/acre)	5		2021	612	40
	2	5	Mast Tree Release	16		2026	TBD	
	3 and 4	1	Low Shade Removal	48		2019	647	6
	3	2	Fence	59	7,100	2021	382	50
	3	3	Herbicide fern, spicebush, pawpaw, invasives before planting	68		2021	490	3
	3	4	Planting : shade-tolerant species (200 seedlings/acre)	13		2022	612	40
	3	5	Mast Tree Release including group selections around white pine	59		2026	TBD	
	4 and 5	1	Low Shade Removal	48		2020	647	6
	4	2	Fence - evaluate need for fence one growing season after the completion of pervious fences	TBD	TBD	TBD	382	50
	4	3	Herbicide fern, spicebush, pawpaw, invasives before planting	49		2020	490	3
	4	4	Mast Tree Release including all White Pine	49		2026	TBD	
	5	1	Low Shade Removal	23.8		2021	647	6
	All		Maintain fence perimeters as needed			All		

1) Remove low shade - by cutting/mowing all black birch and red maple understory trees 2 to 11 inch DBH. Complete 42.2 acres in locations 1 and 2 the first year. Then in the next three years, complete 48 acres each year. In the 5th year complete 23.8 acres of low shade removal. Remove low shade both inside and outside each planned fence perimeter and along all adjacent trail segments.

2) Construct one fence per year for 3 years. Construct each fence one to two growing seasons after low shade removal has been completed in each of three locations.

3) Apply herbicide to interfering understory vegetation and invasive plants both inside and outside of each planned fence immediately before or immediately after the construction of each fence. The timing of the herbicide application will be dependent on which growing season best matches the planned fence completion date.

4) Plant conifers and shade tolerant species within each fence upon its completion. Refer to Mgmt. Unit #1, Section 7 for further detail. Fall planting is preferred but spring planting is acceptable. 200 seedlings per acre should be planted on approximately 25% of the available area within each fence.

5) Allow white pine to naturally reproduce by increasing light levels on the forest floor. This can be accomplished by culling or harvesting groups of trees adjacent to the white pine. Select one of the best white pine specimen trees on each acre to create a ¼-acre opening in the forest opening. If several likely candidates can be found per acre intersperse mast tree release technique as well. Be conservative with group selections since different areas of white pine can be regenerated at varying intervals in the future. This practice is an important concept since it takes advantage of existing conifers to naturally increase the amount of low conifer cover on the property. Plan to increase the size of these openings as seedlings become established in the future.

Desired Future Stand Condition

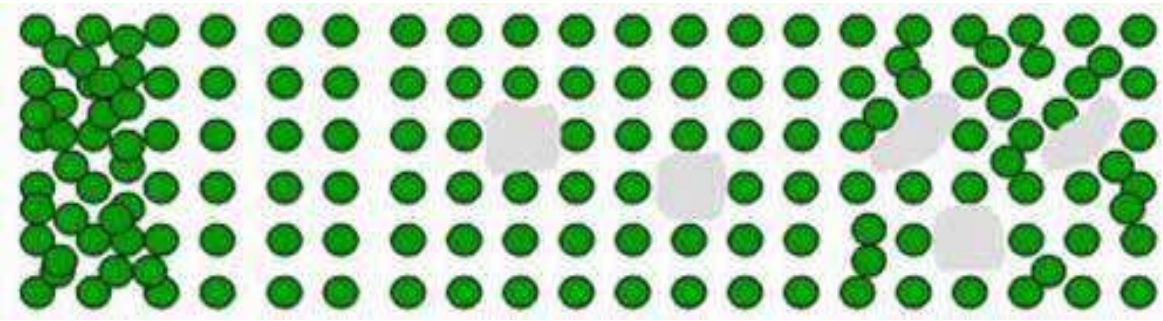
Desired future forest type: Mixed Oak with planted conifers and shade tolerant species, reduce basal area to 120 sq. ft. during the low shade is removal process.

Desired species to naturally regenerate: All Oaks, black gum, sassafras, American beech.

Desired species to plant (if applicable): White pine, white spruce, sugar maple, basswood, others as specified.

Bird's eye view of desired future forest stand (check one):

☐ Wild stand - Some Wildlife	☐ Evenly spaced - Maximizes growth	☐ Evenly spaced with openings Growth + Regeneration	☑ Variable density spaced with openings Some growth + Wildlife + Regeneration



Desired stand structure (check one):

☐ One Canopy Layer ☐ Two Canopy Layer ☑ Three Canopy Layer

MANAGEMENT UNIT #3 Black Birch Saplings

Acres: 28

Forest Type: .....SILVAH - Allegheny Hardwoods

Site Index: .....67 for Black Oak

OBJECTIVE

- Control invasive plant species whenever possible by including appropriate portions of this management unit with other invasive plant control projects when feasible.
- Enhance stand biodiversity by introducing conifers and shade-tolerant species whenever possible by including appropriate portions of this management unit with other planting projects when feasible.
- Emerald Ash Borer (EAB) – Remove Ash from isolated sites where groupings or large individual white ash exist.

CURRENT DESCRIPTION[2]

Dominant Species: .....BB, BC, Misc. Comm. Spp.

Basal Area: .....96 sq. ft.

Relative density:.....77%

Dominant and Co-Dominant Trees:

Merchantable Medial Diameter:.....7.2”

Class:.....Small poletimber

Invasive Species:

☐ Abundant enough to require control before increasing light levels on the forest floor.

☑ Nearby invasive plant populations have likely contributed to the seedbank. Measures to control invasives are likely necessary soon after light levels are increased on the forest floor.

☐ Invasive populations are not likely to have significant impact beyond that of native-aggressive vegetation (e.g. fern, spicebush, pawpaw). Control invasives while controlling other interfering understory vegetation.

☐ N/A

Invasive Species Present: Japanese angelica tree, Japanese barberry, Japanese stiltgrass, ailanthus, garlic mustard, multiflora rose, and elaeagnus.

[2] *Without residuals included.*

MANAGEMENT RECOMMENDATIONS

SILVAH recommends: Defer Cutting (low relative density).

The stand is not yet mature (53 years to maturity) and the user does not wish to begin regeneration now. The relative density is 76.8% which is below the 80% threshold considered necessary for a partial cut. Immature or all-aged stands that are within or below the optimum range of stand density do not need any sort of partial cutting. In such a stand, the best prescription is to leave the stand alone for 10 or 15 years, and then re-examine it to see what treatment is appropriate at that time.

MANAGEMENT UNIT #4 Allegheny Hardwoods

Acres: 39

Forest Type: .....BB - Northern Hardwood (Allegheny)

Site Index: .....90 for Tulip poplar

OBJECTIVE

- Control invasive plant species whenever possible by including appropriate portions of this management unit with other invasive plant control projects when feasible.
- Enhance stand biodiversity by introducing conifers and shade-tolerant species whenever possible by including appropriate portions of this management unit with other planting projects when feasible.
- Emerald Ash Borer (EAB) – Remove Ash from isolated sites where groupings or large individual white ash exist.

CURRENT DESCRIPTION

Dominant Species: .....TP, BB, WA, CO, HIC, AB

Basal Area: .....120 sq. ft.

Relative density:.....64%

Dominant and Co-Dominant Trees:

Merchantable Medial Diameter:.....17.7”

Class:.....Large Sawtimber

Limiting Factor to Regeneration (CDL):

Competing Vegetation: .....☑
Deer: .....☑
Light:.....☐

Invasive Species:

☐ Abundant enough to require control before increasing light levels on the forest floor.

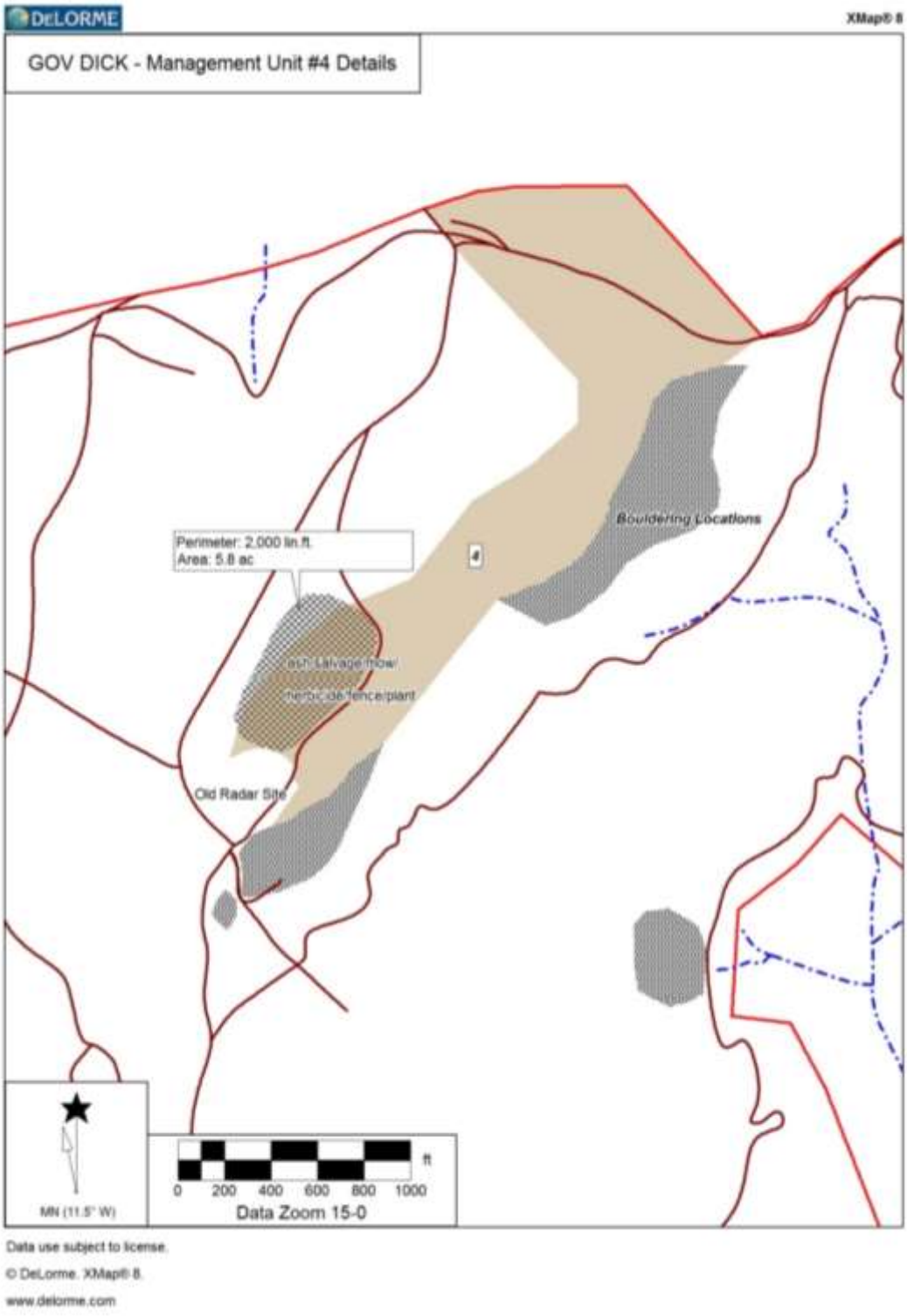
☑ Nearby invasive plant populations have likely contributed to the seedbank. Measures to control invasives are likely necessary soon after light levels are increased on the forest floor.

☐ Invasive populations are not likely to have significant impact beyond that of native-aggressive vegetation (e.g. fern, spicebush, pawpaw). Control invasives while controlling other interfering understory vegetation.

☐ N/A

Invasive Species Present: Japanese barberry, Japanese stiltgrass, ailanthus, garlic mustard, multiflora rose.

Interfering Understory Vegetation: Undesirable understory plants may interfere with development of regeneration. Understory plants in this stand include dense low woody cover, dense tall woody cover and dense fern cover.



MANAGEMENT RECOMMENDATIONS

Summary of Management Activities

SILVAH recommends: Herbicide, fence.

A shelterwood sequence, which would normally be recommended here, may not work because relative density is already low and competitive regeneration is lacking; further reductions in density probably won't help. A combination of high deer density and low seed production will probably make it difficult to get adequate competitive regeneration established. Protect the stand from deer browsing with a fence. Overstory density is low enough and seed supply sufficient for competitive regeneration to become established within 3 - 10 years. Fencing is recommended to protect seedlings from deer.

Warnings:

- The merchantable medial diameter (17.7) is just below the 18-inch decision point in Chart A; the stand may be mature.
- The relative density of AGS (38.4) is just above the 35% decision point in Chart A; the stand may not be mature.

Additional treatments:

- Treat the undesirable understory plants with an application of herbicide during the appropriate part of the growing season. Herbicide is an effective, safe and economical technique for removing vegetation that interferes with establishment and growth of oak regeneration. There are five different application techniques for using herbicides to control interfering vegetation. Each is matched with a specific set of conditions where it will provide effective control. With all, be sure to follow all instructions on the herbicide label, wear appropriate safety clothing and equipment, and follow applicable laws with regard to herbicide applicator licensing. Please refer to the silvicultural guide for details about implementing this prescription.
- Current deer levels will likely prevent regeneration developing into a new stand. Fencing is recommended to protect seedlings from deer. A fence can be constructed either before or after treatment. If fencing is constructed after treatment, fencing should be done as soon as possible.

These prescriptions generally produce the desired results, require an investment, and usually will yield an economic return at the same time. If such investment meets your organization's economic criteria, we recommend it. If not, we recommend no treatment. In the case of regeneration prescriptions, stands generally will not reproduce without the recommended treatment.

Details of Management Activities

Stand Prescription:

1) Emerald Ash Borer (EAB) – This management unit has a higher percentage of white ash than other units. Remove Ash from isolated sites where groupings or large individual white ash exist. Leave already dead ash less than 16" dbh as standing dead trees. Other ash can be left standing if their quality is not sufficient to warrant removal.
2) 5.8 acres have been identified in this unit (see map) that are in particular danger of being overrun with invasives plant populations. Very high concentrations of mile-a-minute (MAM) are located

on the fringes of the "old radar site". This area has had multiple herbicide applications in recent years in attempts to control the situation. The identified site contains white ash in numbers sufficient to trigger a proliferation of MAM in the understory once the ash succumbs to the imminent EAB infestation. Therefore, implement the following procedure as soon as possible to mitigate the potential impact of the "lost" overstory trees.

a) Salvage ash within and near the identified area.

b) Mow all spicebush, witch hazel, Tartarian honeysuckle, multiflora rose and other shrub species. Include black birch and red maple saplings up to 6 inch dbh. in the mowing process. Mowing is needed for aesthetics; to reduce the amount of low shade; and to prepare the site for fencing and planting. Mowing should include all area up to and including the northern side of trail #11.

c) Apply Plateau® or Oust® pre-emergent herbicide (or equivalent) in March or April to prevent MAM from spreading/growing into the prepared area.

d) Apply a broad-spectrum herbicide such as Roundup Pro Concentrate® (or equivalent) at a rate of 3 quarts per acre in the latter part of the 2nd growing season (after the mowing). This application will target sprouts that emerge from the mowed shrub and trees.

e) Construct a deer exclosure fence on the 5.8-acre (approximately 2000 lin.ft.) area any time after the salvage and mowing is complete and before planting as required in the next step.

f) The soil in this area is among the most fertile found at Gov. Dick and is less rocky than most other areas of the property. Plant 200 shade-tolerant species (per acre): Include both conifer and hardwood species which are both overstory and understory species. Include native and "colorful" species such as red spruce, white spruce, sugar maple, Eastern hophornbeam, American hornbeam, American beech, American holly, basswood, mountain laurel, serviceberry, dogwood and other species of similar shade tolerance.

g) Monitor and continue to remove invasive and interfering understory vegetation via herbicides after the planting. Monitor the progress of the plantings over time to assure that these plantings persist.

h) Control invasive plant species whenever possible elsewhere in the management unit by including appropriate portions with other invasive plant control projects when feasible.

i) Follow SILVAH recommendations elsewhere in the management unit if and when time and resources permit. Use same methodology as outlined above.

MANAGEMENT UNIT #5 South Slope - Primitive Areas

Acres: 52

Forest Type: .....TM - Tulip poplar, beech, maple

Site Index: .....90 for tulip polar

OBJECTIVE

- Define and establish a 32-acre site where desirable advanced tree regeneration can be created before stocking falls critically low. Control invasive plant species whenever possible by including appropriate portions of this management unit with other invasive plant control projects when feasible.
- Enhance stand biodiversity by introducing conifers and shade-tolerant species whenever possible by including appropriate portions of this management unit with other planting projects when feasible.
- Emerald Ash Borer (EAB) – Remove Ash from isolated sites where groupings or large individual white ash exist.

CURRENT DESCRIPTION

Dominant Species: .....TP, BB, WO, HIC

Basal Area: 125

Relative Density:.....61%

Dominant and Co-Dominant Trees:

Average Diameter: .....21.1”

Class:.....Large sawtimber

Limiting Factor to Regeneration CDL:

Competing Vegetation: .....☑

Deer: .....☑

Light:.....☐

Invasive Species:

☑ Abundant enough to require control before increasing light levels on the forest floor.

☐ Nearby invasive plant populations have likely contributed to the seedbank. Measures to control invasives are likely necessary soon after light levels are increased on the forest floor.

☐ Invasive populations are not likely to have significant impact beyond that of native-aggressive vegetation (e.g. fern, spicebush, pawpaw). Control invasives while controlling other interfering understory vegetation.

☐ N/A

Invasive Species Present: Japanese stiltgrass, Mile-a-minute, Japanese barberry, multiflora rose, garlic mustard, ailanthus, and Norway maple.

Interfering Understory Vegetation: Undesirable understory plants may interfere with development of regeneration. Understory plants in this stand include dense low woody cover, dense tall woody cover and dense fern cover.

This management unit contains large areas of continuous rock outcroppings. Rock, boulders, and "rubble land" cover 100% of the ground surface on approximately 200 acres of this management unit. At least 85 acres of this area are suitable for prime "Bouldering" activities (see included map for locations). The rocks, boulders, and sometimes steep terrain make it impossible for modern ground equipment to traverse the terrain. Cable logging and/or helicopter logging techniques are both too costly and "not-in-line" with the aesthetic and public use values assigned to this property.

On average, the stand has a relative density of 61%. This density is lower than expected for undisturbed stands of similar size and species composition. Many, many downed trees can be observed throughout the unit but are especially evident in the rockiest, most bouldery and exposed sections of the unit. Many downed trees are over 100 feet tall (including the canopy) and range from 24 to 36 inches dbh. The large, heavy-topped trees likely succumb to windthrow as a result of shallow, uneven rooting caused by the rocks and boulders. Species are mostly comprised of tulip-poplar but also include all oak species and ash. Below is an aerial photo showing a sample of uprooted trees in the management unit.

A real and imminent situation is developing in portions of this management unit that cannot easily be remedied. The causes contributing to this phenomenon are as follows:

- As overstory trees continue to drop out of the canopy, invasive and native-aggressive grasses vines, and shrubs are expanding to take their place. Absolutely no meaningful tree regeneration is occurring in this unit to alleviate the situation.
- Deer are also contributing to the lack of regeneration because of their preferential browsing habits. The remoteness of this unit has created a refuge, of sorts, where deer flee the surrounding communities and game lands in search of sanctuary during and after the deer hunting seasons have ended. Deer yarding activity has been observed in this management unit. Deer yarding is an instinct deer have where they reside and browse for extended periods in a small area so that they (the herd) can collectively conserve energy through the winter months. Coyote kills can attest to this phenomenon as me and other park patrons have noted numerous predation sites (of fawn and yearling remains) in the spring of the year.
- The remote nature and physical characteristics of the terrain severely limit the ability to apply silvicultural prescriptions in a meaningful and coherent manner.

Trees of acceptable quality for future growing stock provide enough stocking by themselves to warrant stand management. Non-commercial saplings and poles represent 9 sq. ft. of basal area and may need to be treated prior to final harvest cutting.

A combination of undesirable understory plants and site limitations are likely to interfere with the development of regeneration. Undesirable plants in this stand include dense low woody cover, dense tall woody cover, dense fern cover and dense grass cover. The limitations on this stand include rocky surfaces.

MANAGEMENT RECOMMENDATIONS

Summary of Management Activities

SILVAH recommends: Fence, artificial regeneration.

A shelterwood sequence, which would normally be recommended here, may not work because relative density is already low and competitive regeneration is lacking; further reductions in density probably won't help. Identify long-term residuals and islands with complex vertical structure. Retain these through the final overstory removal. Favor species (yellow poplar, white oak, black oak, northern red oak and chestnut oak) with high wildlife value for retention and planting.

Warnings:

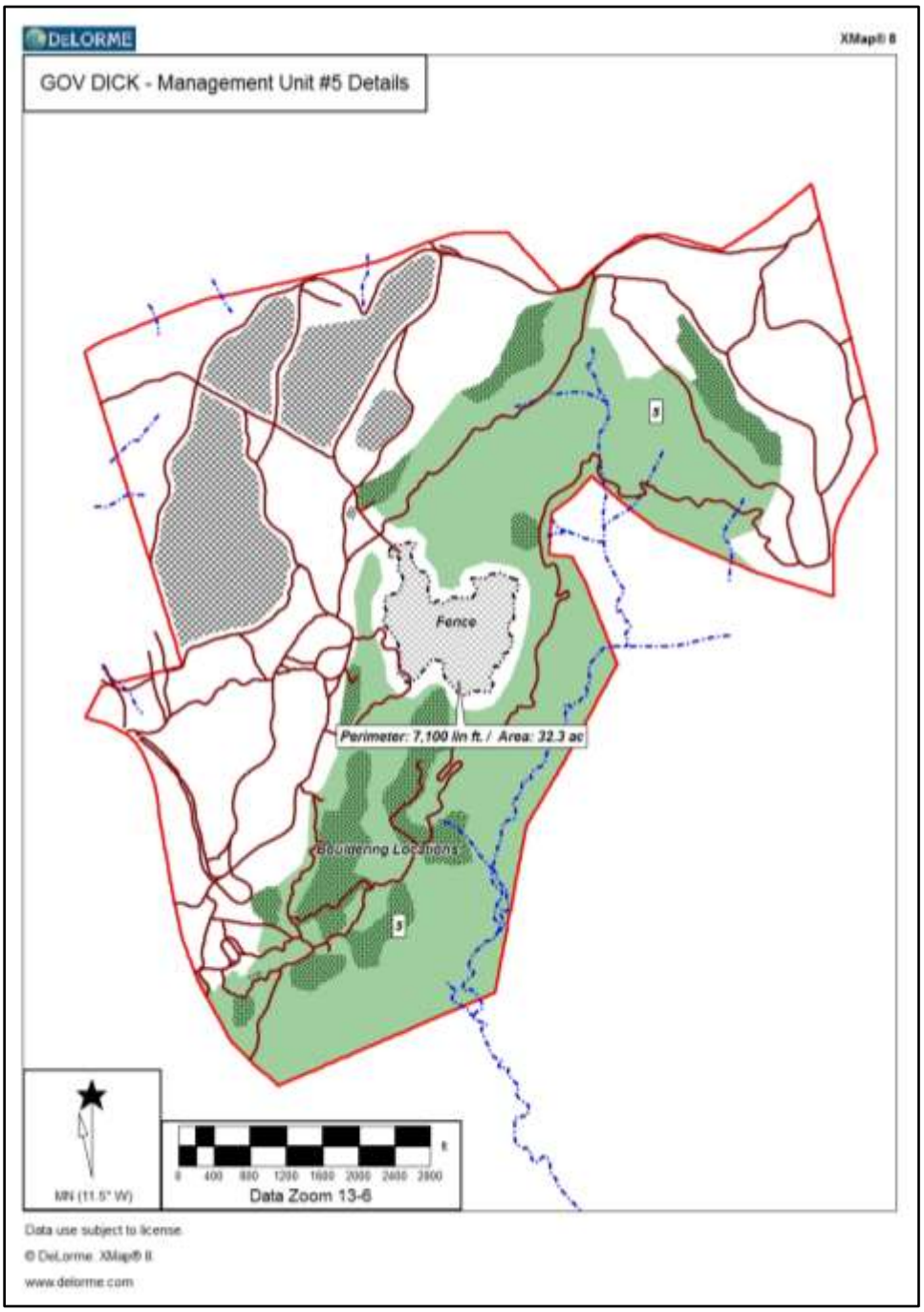
- The relative density of AGS (39.8) is just above the 35% decision point in Chart A; the stand may not be mature.

Additional treatments

- Competitive regeneration is lacking, probably due to inadequate seed supply. Artificial regeneration (tree planting) is suggested. Johnson and others (2002) and Dey and others (2008) provide thorough discussions on the intricacies associated with planting oaks. Please refer to the Silvicultural Guide for details about implementing this prescription.

- Current deer levels will likely prevent regeneration developing into a new stand. Fencing is recommended to protect seedlings from deer. A fence can be constructed either before or after treatment. If fencing is constructed after treatment, fencing should be done as soon as possible.

These prescriptions generally produce the desired results, requires an investment, and usually will yield an economic return at the same time. If such investment meets your organization's economic criteria, we recommend it. If not, we recommend no treatment. In the case of regeneration prescriptions, stands generally will not reproduce without the recommended treatment.

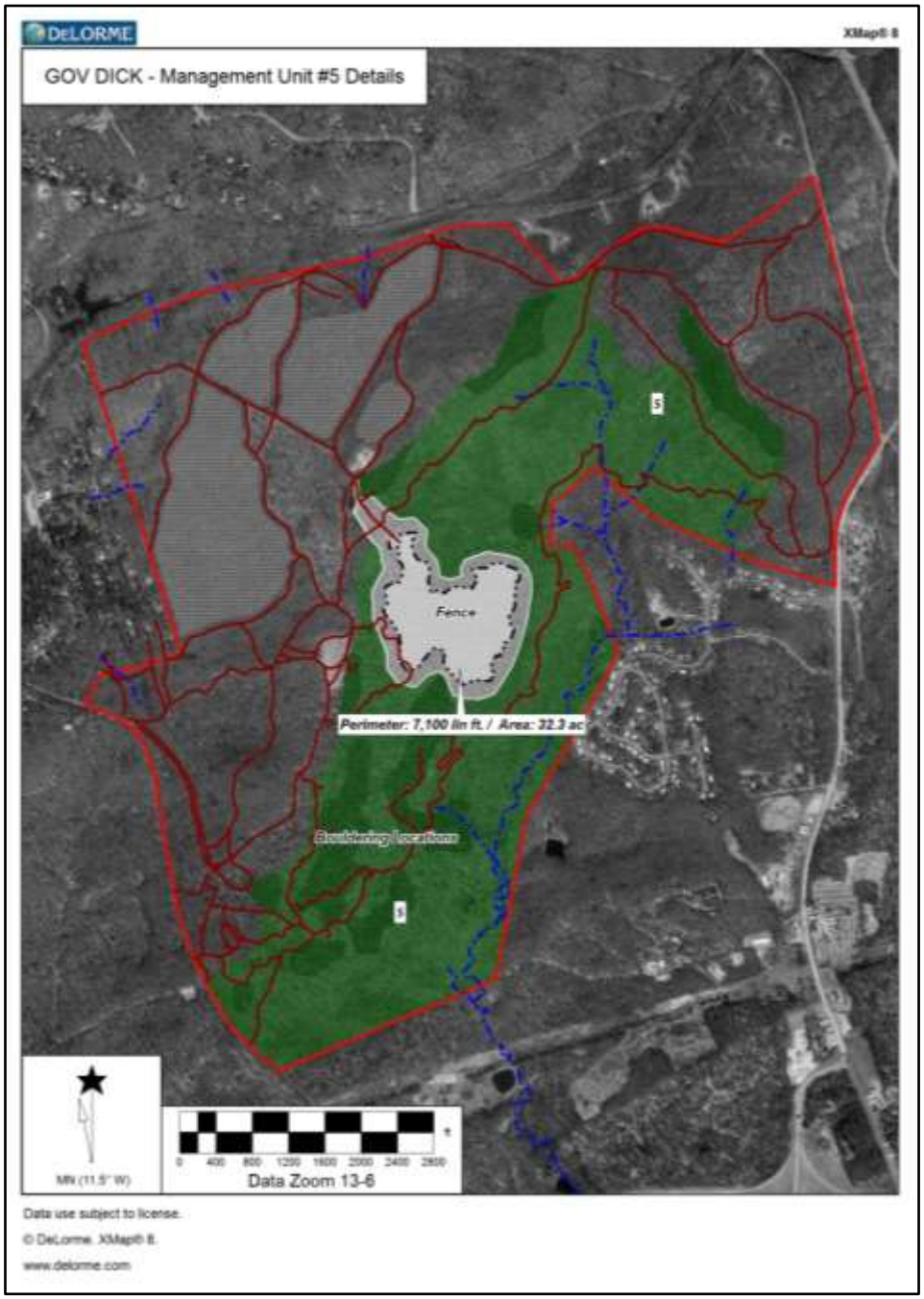


Details of Management Activities

Stand Prescription:

1) Much of this management unit is stable (at this time) and in no imminent danger of decline or collapse. In those areas, little or no action is warranted at this time.

2) However, one area of concern has been defined that needs attention in an attempt to regenerate the site before the site is degraded further. It should be possible to build a 32-acre deer exclosure fence in the location noted on the map below; though site limitations are likely to cause difficulties in construction.



a) First, consult with local Cerulean Warbler habitat specialist to determine the suitability for this site to be considered for a Cerulean Warbler habitat demonstration site. Proceed with his recommendations if conditions are favorable and are able to be integrated into the overall management scheme for this unit.

b) Trees (other than ash) need not be cut during the first stage of the shelterwood sequence as relative density is already low.

c) Herbicide all understory vegetation on the proposed 32-acre fence area AND within approximately 150 feet of the outside perimeter of the fence if rocks, boulders and terrain permit. Total area to be treated is approximately 54-58 acres. The herbicide application outside the fence perimeter should allow natural regeneration to escape significant deer browse damage in hard-to-reach areas amongst the rock and boulders.

d) Construct a deer exclosure fence to encompass approximately 32 acres which is approximately 7,100 lin. ft. in length.

e) Plant 1,000 white spruce and 1,000 white pine in clusters of 20 to 50 seedlings each within the fence. Some clusters should be mostly pine while other groupings should be mostly spruce. Some groupings should be on 10-15 ft. spacing; some should be 15-25 feet apart. Plant where soils permit.

f) Monitor and continue to remove invasive and interfering understory vegetation via herbicides after the planting. Monitor the progress of the plantings over time to assure that these plantings persist. Selective herbicides can be applied over conifers to release for MAM and other invasives if necessary. Consult forester for details.

3) Emerald Ash Borer – Remove ash from the fence area and within the 150-foot wide perimeter around the fence. Other dead trees, leaning trees and others deemed hazardous to the fence should be dropped and utilized if possible.

4) Herbicide interfering understory vegetation and invasive species elsewhere in the mgmt. unit and plant with shade tolerant tree species as time, labor, and resources allow.

Desired Future Stand Condition

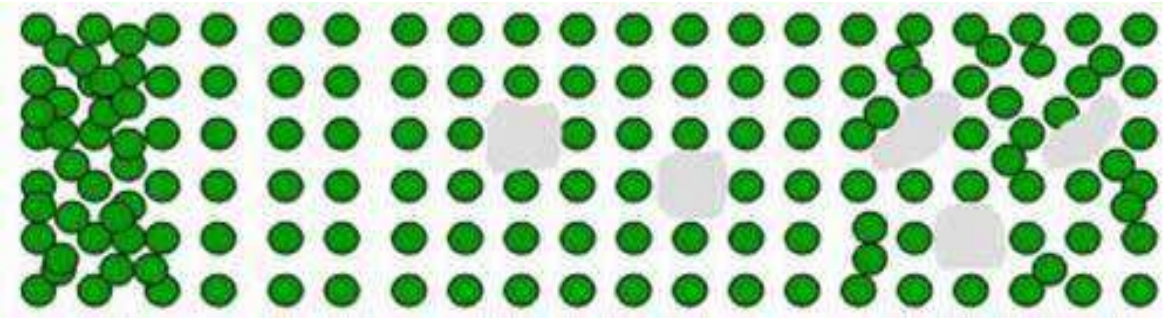
Desired future forest type: TM - Tulip poplar, beech, maple with planted conifers and shade tolerant species, keep basal area at 125 sq. ft. or slightly lower slightly to allow for salvage or TSI removal.

Desired species to naturally regenerate: tulip poplar, black gum, sassafras, American beech.

Desired species to plant (if applicable): White pine, white spruce, sugar maple.

Bird's eye view of desired future forest stand (check one):

☐ Wild stand - Some Wildlife	☐ Evenly spaced - Maximizes growth	☐ Evenly spaced with openings Growth + Regeneration	☑ Variable density spaced with openings Some growth + Wildlife + Regeneration



Desired stand structure (check one):

☐ One Canopy Layer ☑ Two Canopy Layer ☐ Three Canopy Layer

MANAGEMENT UNIT #6 Forest Regeneration Projects

Acres: 161

1) Gypsy Moth – Oak Salvage Sale (after harvest)

   Type of Harvest: .....salvage (dead only)

   Year: 2009

   Acres: 72

   Dominant Species: .....TP, BO, RO

   Basal Area: .....highly variable

   Relative Density:.....highly variable

   Dominant and Co-Dominant Trees:

      Average Diameter: .....greater that 20”

      Class:.....large sawtimber

2) Route 72 Timber Sale (after harvest)

   Type of Harvest: .....shelterwood/thin-harvest/group selection

   Year: 2013

   Acres: 51

      Group Selection (acres): 11

      Shelterwood/thin-harvest: 40

   Dominant Species: .....TP, RO, BO, HIC, WO

   Basal Area: 115

   Relative Density:.....61%

   Dominant and Co-Dominant Trees:

      Average Diameter: .....21.1”

      Class:.....Large sawtimber

3) Trail #5 Timber Sale (after harvest)

   Type of Harvest: .....shelterwood/thin-harvest/group selection

   Year: 2014

   Acres: 38

      Group Selection (acres):.....6

      Shelterwood/thin-harvest:.....32

   Dominant Species: .....TP, RO, BO, HIC

Basal Area (in fence):.....64

Relative Density (in fence): 29%

Dominant and Co-Dominant Trees:

Average Diameter: .....21.6”

Class: .....Large sawtimber

OBJECTIVE

Maintain the integrity of the deer fences and continue controlling invasive and interfering vegetation. Monitor the natural and planted reforestation projects. A decline in any planted species should be noted as well as current conditions that may be causing such decline. Take appropriate actions to reduce the mortality of seedlings if possible. Evaluate the need for interfering understory vegetation control outside the fences and take steps to establish desirable regeneration.

CURRENT DESCRIPTION

Three primary forest regeneration projects have occurred in recent years:

1) Gypsy Moth Salvage Harvest: A 72-acre gypsy moth salvage harvest occurred in 2009. During this harvest “Only Dead” trees were harvested due to sensitivity and scrutiny expressed by the local resident. Little to no advanced regeneration existed at the time of the defoliation and harvest. Since the harvest, several TSI projects have taken place. In 2010 three fences (a, b, and c on the map below) were constructed to alleviate deer browse damage. 15,000 seedlings were planted in the fences shortly after their construction to assist with regeneration of the site. A recent survey concluded that only 27% of the planted seedlings remain alive in the stand today. Poor survival rates are likely due to 1) drought conditions that occurred in the spring and early summer of the planting year and 2) native seedling competition. Then in 2013, a TSI was conducted to reduce the number of black birch poles remaining in the stand after the gypsy moth defoliation. Herbicide activities have been ongoing to control MAM and other invasive plants during the regeneration efforts.

2) Route 72 Timber Sale: In 2013 a planned 51-acre harvest occurred that utilized shelterwood, thin-harvest and group selection methods. The purpose of this harvest was to diversify the stand structure through species richness; enhancement of vertical structure and to initiate regeneration which is sorely lacking on the property. A deer exclosure fence (item “d” on map below) was constructed in 2014 that included 23 of the original 51 harvested acres. Group selection harvest occurred on approximately 11 of the 51-acre harvest area.

3) Trail #5 Timber Sale: In 2014, another planned 38-acre harvest occurred that included the same management strategies and techniques as the Route 72 Timber Sale. A deer exclosure fence (item “e” on attached map) was constructed in 2014 that included 18 of the original 38 harvested acres. Group selection harvest occurred on approximately 6 of the 38-acre harvest area.

Herbicide applications were conducted in the summers of 2014, 2015 and 2016 consecutively on the Route 72 and Trail #5 fence projects. The persistence of MAM, ailanthus seed germination and

garlic mustard populations required consecutive applications to reduce the threat to planned tree seedling planting that occurred in November 2016.

8,200 seedlings were planted in the two fences (combined) that included 2,000 white spruce, 2,000 white pine, 2,000 red oak, 1,100 sugar maple, and 1,100 black cherry.

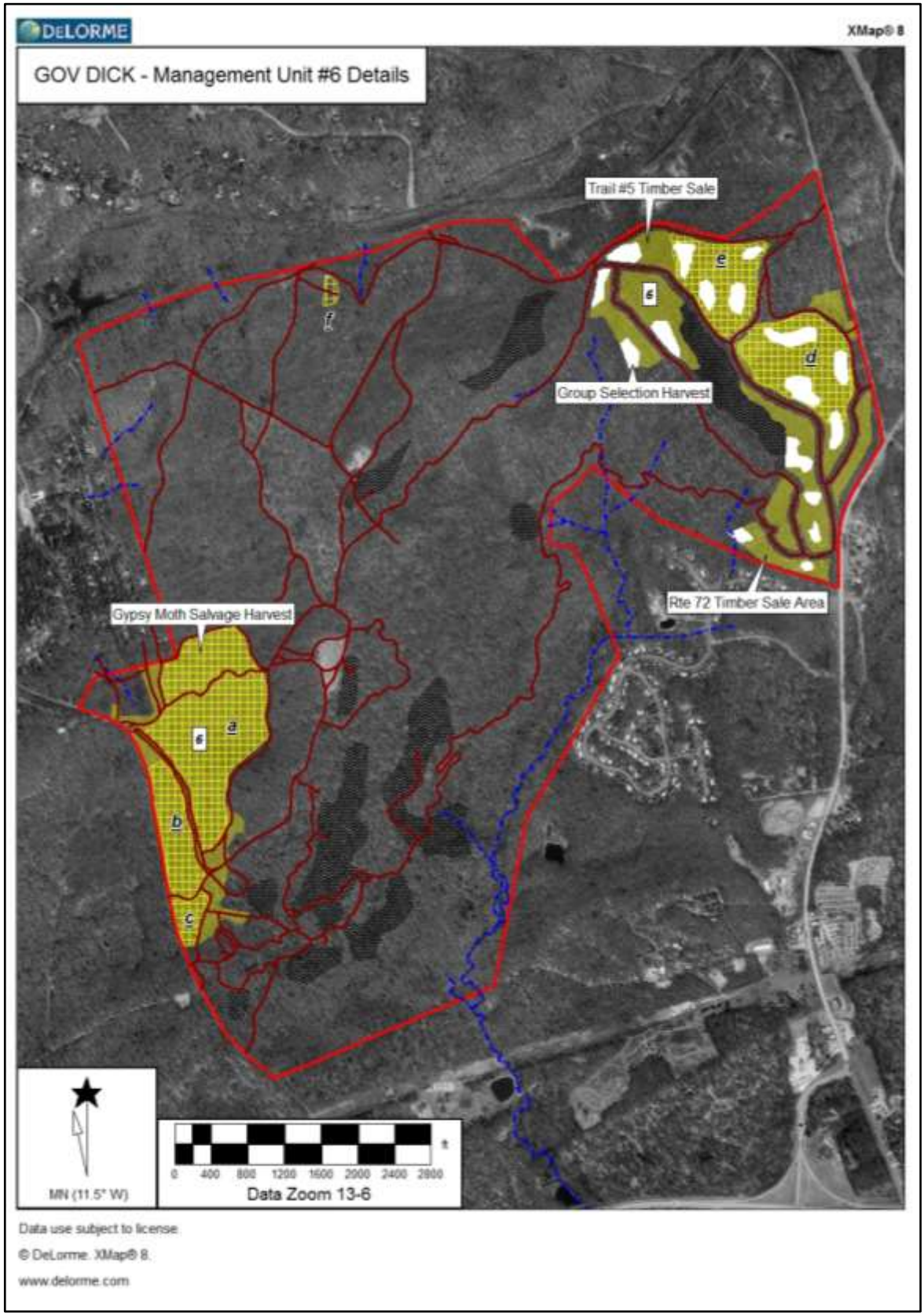
The two recent timber harvest areas model the desired level of stand structure complexity that should be encouraged throughout the property. Note the types of silvicultural harvests that were employed and the varying degrees of canopy cover that has been created. Figure 1 shows how varying degrees of crown removal affect the amount of sun reaching the forest floor and how this phenomenon influence the species of tree that is able to germinate and grow in that environment.

Figure 1: Effects of specified silvicultural harvest on light levels reaching the forest floor

A "CDL" demonstration site has been created to just off Route 117 at location "f" on the map below. This demonstration site exemplifies the concept of "CDL" and is further explained on pages 33-38 of this document. Appendix E details the concept and layout of the demonstration site.

MANAGEMENT RECOMMENDATIONS

1) The fences represent a substantial investment in the development of future forests. Therefore, maintain the integrity of all fence perimeters. Repair or reconstruct damaged fence sections promptly. Monitor fences (perhaps by using game "trail" cameras) for the presence of deer. Always exclude deer from the fences, especially during the initial 3 years after their construction. The fences at Gov. Dick are relatively small. Just one deer trapped within a fence during the early stages of tree seedling development can mean the difference between a successful and unsuccessful regeneration project.
2) Monitor and continue to remove invasive and interfering understory vegetation via herbicides after the planting. Monitor the progress of the plantings over time to assure that these plantings persist.
3) Evaluate the need for interfering understory vegetation control outside the fences and take steps to establish desirable regeneration.


DeLORME
XMap® 8
GOV DICK - Management Unit #6 Details
Trail #5 Timber Sale
e
6
d
Group Selection Harvest
f
Rte 72 Timber Sale Area
Gypsy Moth Salvage Harvest
6
a
b
c
MN (11.5° W)
0 400 800 1200 1600 2000 2400 2800 ft
Data Zoom 13-6
Data use subject to license.
© DeLorme. XMap® 8.
www.delorme.com

MANAGEMENT UNIT #7 Mature Black Birch

Acres: 21

Forest type:.....BB - northern hardwood

.....SILVAH - Oak-hardwoods

Site index:.....67 for BO

OBJECTIVE

- Consult with local Cerulean Warbler habitat specialist to determine the suitability for this site to be considered for a Cerulean Warbler habitat demonstration site.
- Establish advanced regeneration on forest floor within the next ten years.
- Enhance stand biodiversity by introducing conifers and shade-tolerant species whenever possible by including appropriate portions of this management unit with other planting projects when feasible.
- Emerald Ash Borer (EAB) – Remove Ash from isolated sites where groupings or large individual white ash exist.

CURRENT DESCRIPTION

Dominant Species: .....BB, BO, WO, TP, AB

Basal Area: 120

Relative Density:.....79%

Dominant and Co-Dominant Trees:

Average Diameter: .....17.4”

Class:.....Large sawtimber

Limiting Factor to Regeneration CDL:

Competing Vegetation: .....☑

Deer: .....☑

Light:.....☐

SILVAH: Narrative Summary and Analysis (2016 inventory data)

Non-native invasive species have the potential to displace native vegetation, including desirable timber species. There was one invasive in the overstory (ailanthus), no invasives in the overstory, and seven that were found outside the plots (ailanthus, Japanese barberry, Japanese stiltgrass, garlic mustard, multiflora rose, Norway maple and Tatarian honeysuckle)

This northern hardwood stand is dominated by Black Birch, Black Oak, White Oak, Yellow-poplar and Beech which together comprise 88 percent of the basal area.

This is a large sawtimber stand with average medial diameter of 17.4 inches.

If this stand is managed under an even-age silvicultural system, the several species groups will mature at markedly different times. The average time to maturity (MDM = 18 inches) is 4 years. The manager wishes to regenerate the stand now. Effective stand age is about 112 years.

If this stand is managed under an all-age silvicultural system, the distribution of diameters, proportion of sawtimber, and density of shade-tolerant species would make it difficult to apply selection cutting.

Relative stand density is 79 percent of the average maximum stocking expected in undisturbed stands of similar size and species composition. This density is in the optimum range for best individual tree growth. At this relative density, growth rate of the biggest trees is probably excellent, while growth rate of the medium and smaller-sized trees is probably good and mortality due to crowding low.

Thinning to provide more growing space for the better stems is not necessary at this time.

Total growing stock amounts to 120 sq. ft. of basal area per acre. Net total volume in all trees, to a 4-inch top, is 30.7 cords per acre; if divided into pulpwood and sawtimber, the net merchantable volume is 19.7 cords of pulp wood and 7386.9 board feet of sawtimber (International 1/4 inch log rule). The total stand value is estimated to be about 784 dollars per acre.

Trees of acceptable quality for future growing stock provide a fully stocked stand by themselves. Non-commercial saplings and poles represent 13 sq. ft. of basal area and may need to be treated prior to final harvest cutting.

Competitive regeneration of all types is insufficient; harvest cuttings at this time will not likely result in a satisfactory new stand.

Undesirable understory plants may interfere with development of regeneration. Undesirable plants in this stand include dense low woody cover, dense tall woody cover and dense fern cover.
Treatment Description with Marking Instructions (2016)

MANAGEMENT RECOMMENDATIONS

Summary of Management Activities

SILVAH recommends: Shelterwood seed cut, herbicide, fence.

Use a Two-cut Shelterwood sequence to increase competitive regeneration. The first (seed) cut should reduce relative stand density to 60 percent to provide for the establishment of a large number of additional advance seedlings without allowing them to grow rapidly enough to become attractive to deer. The seed cut made now can be followed in 5 to 10 years by final overstory removal (assuming adequate competitive seedlings develop). A combination of high deer density and low seed production will probably make it difficult to get adequate competitive regeneration established. Overstory density is low enough and seed supply sufficient for competitive regeneration to become established within 3 - 10 years. Fencing is recommended to protect seedlings from deer.

Additional treatments

- Treat the undesirable understory plants with an application of herbicide during the appropriate part of the growing season.
- Current deer levels will likely prevent regeneration developing into a new stand. Fencing is recommended to protect seedlings from deer. A fence can be constructed either before or after treatment. If fencing is constructed after treatment, fencing should be done as soon as possible.

Cut Guides: Reduce relative stand density to 60%. Within the size and quality constraints favor the best trees wherever possible. Try to preserve seed sources of scarce species if they are desired in the regeneration; strive for uniform spacing among residuals whenever possible.

Details of Management Activities

1) First, consult with local Cerulean Warbler habitat specialist to determine the suitability for this site to be considered for a Cerulean Warbler habitat demonstration site. Proceed if conditions are favorable.
2) Or wait 5-10 years, and then initiate the establishment of advanced regeneration using the SILVAH prescription outlined above. Time fence construction to coincide with dismantling of adjacent fences.
3) Enhance stand biodiversity by introducing conifers and shade-tolerant species whenever possible by including appropriate portions of this management unit with other planting projects when feasible.
4) Emerald Ash Borer (EAB) – Remove Ash from isolated sites where groupings or large individual white ash exist.

MANAGEMENT UNIT #8 Historical/Cultural and High Use Sites

Acres: 70

Forest Type: .....refer to Mgmt. Units #2, #4, and #5 for details

OBJECTIVE

- Maintain unit for historical, cultural and social values and activities.
- Assimilate activities discussed on Mgmt. #1 and #9 whenever prudent to do so and as resources allow.

CURRENT DESCRIPTION

This management unit is better defined by its historical, cultural and social significance rather than by the forest components found in it. Just as the existing trail system is the "life-blood" of all activities at Gov. Dick; Mgmt. Unit #8 can be characterized as the visual backdrop through which pass perhaps 80% of all visitors. Nearly everyone uses this management unit and the related trail system to traverse from the Environmental Center to the Tower at the summit of Gov. Dick Hill at one time or another. It is easy to identify the portions of this management unit that would otherwise belong to either Mgmt. Units #2, #4, or #5 if it weren't for the public's daily use of this unit.

MANAGEMENT RECOMMENDATIONS

- Maintain unit for historical, cultural and social values and activities.
- Assimilate activities discussed for Mgmt. Unit #1 and Mgmt. Unit #9 into "like" projects for Mgmt. Unit #8 whenever prudent to do so and as resources allow.

MANAGEMENT UNIT #9 Environmental Center & Other Open Space

Acres: 12

OBJECTIVE

- Provide opportunities to educate the public.
- Encourage meadow areas to flourish to prevent encroachment from invasive species.

CURRENT DESCRIPTION

Open space is found in three locations at Gov. Dick:

1) The Environmental Center located off Pinch Road is surrounded by 4 acres of open space.
2) A beautiful 5-acre meadow was recently created at the summit of Governor Dick Hill adjacent to the Observation Tower.
3) The third location is at the old army radar station site (2,000 feet north of the Observation Tower). Just a few years ago this 3-acre radar site harbored many herbaceous and woody invasive plant species. With assistance from the NRCS, the site is well on its way to supporting a newly established meadow of warm season grasses.

The Observation Tower itself 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. 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 provide 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 the Tower) is about 2,400 feet in length and rises 262 feet in elevation along its course; average grade is 9% slope.

MANAGEMENT RECOMMENDATIONS

- **Environmental Corridor:** Encourage use of the ***Environmental Center*** by constructing a paved and stoned roadway (similar to the ***Environmental Center*** access road) that leads from the ***Environmental Center*** to main road leading to the Observation Tower. This section of road should provide many points of interest and act as an educational "portal" into the various physical, ecological, geological and cultural interest points available at Gov. Dick. Various displays can be created and presented in a natural, aesthetically pleasing arrangement along this "information corridor". Semi-private park bench arrangements (casual circular arrangements) can be created on short spur trails adjacent to the information corridor. These semi-private meeting places will encourage small groups of people to enter into discussions of leisure or educational content. Environmental games can be designed to encourage thought-through-

competition. The possibilities of invoking meaningful thought along this education corridor are endless.

- **Encourage Public Involvement:** Seek public participation from special interest groups to participate in educational workshops. A workshop can be charged with the responsibility to identify naturally occurring points-of-interest or design suitable educational "displays" and construct said display at appropriate points along the trail system. The possibilities are endless. Do not however, proliferate, over stimulate, or otherwise "clutter" the natural surrounding with "things" that are unappealing. Upon first glance at such a display, intrigue and genuine interest should be invoked. Employ local chapters of amateur and professional "nature" groups in the development of historic, cultural, geological, or physical points of interest. The Audubon Society, American Chestnut Foundation, Wild Turkey Federation, Boy Scouts of America, et.al. would be good candidates for such a task. Notable themes may include: charcoal hearth history and accompanying demonstration sites, rocky outcrops and their geologic origin, small gauge rail lines and their significance, and timber harvest sites that offers a pictorial timeline depicting successional stages of forest development (to be added to indefinitely).
- Encourage meadow areas to expand to fully occupy the open space at the Radar Site. Maintain the health and vigor of existing meadows. Test for nutrient needs, then lime and fertilize as determined by the nutrient test.

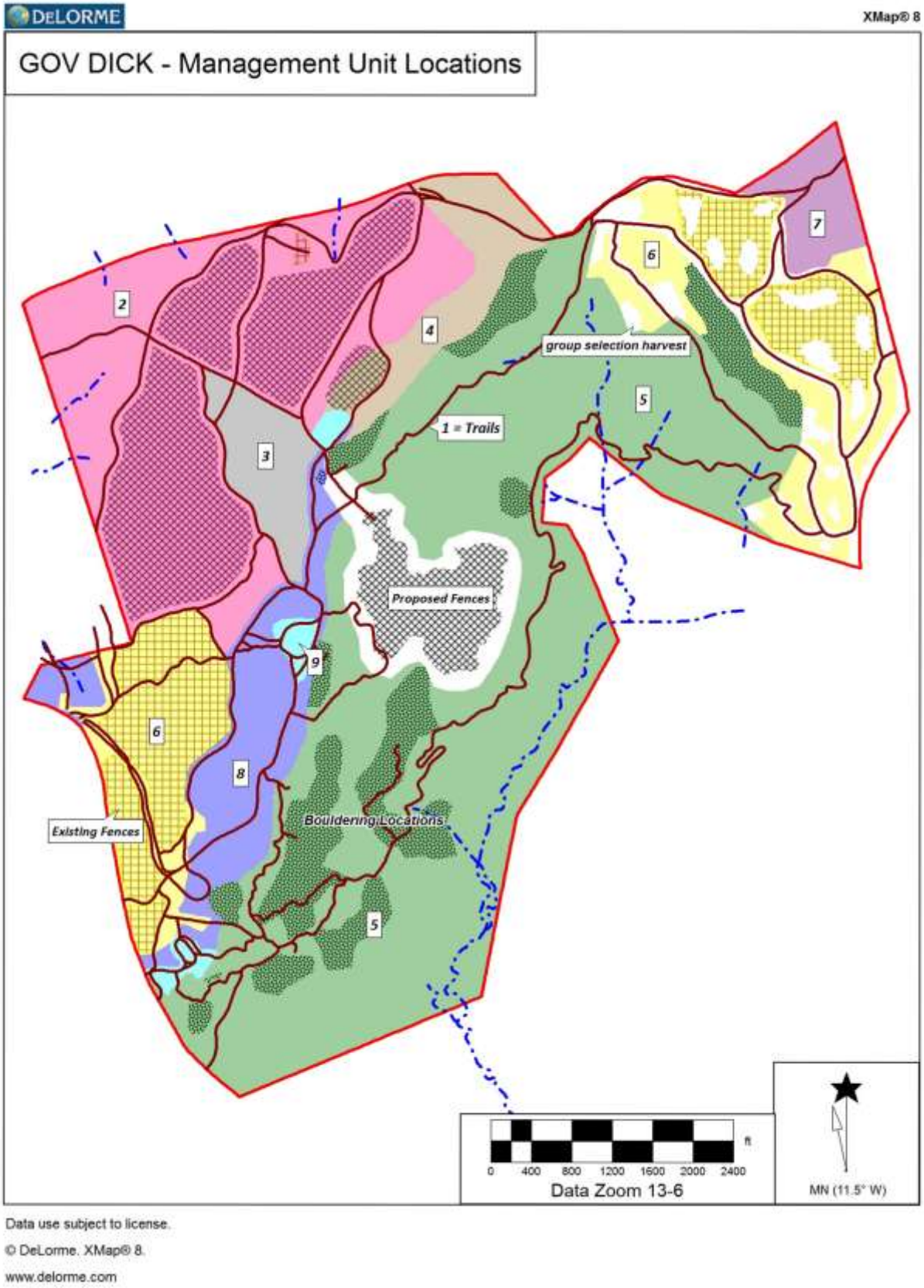
MANAGEMENT ACTIVITY SCHEDULE (by Management Unit)

Mgmt. Unit #	Location Number	Sequence	Practice Description	Acres	Fence Perimeter (lin. Ft.)	Year Planned	NRCS Practice Code	NRCS Scenario Number
1			ADA accessible walkway and platform			2017		
			Continue to treat invasive plant within 100 ft. corridor throughout trail system - determine location and amount on a yearly basis			All		
			Catalog and label 100-200 high risk trees over next 10 years			All		
			Underplant cataloged trees with seedlings, protect with fencing and remove competition - determine location and amount on a yearly basis			All		
			Encourage shade-tolerant species - determine location and amount on a yearly basis			All		
2	1 and 2	1	Low Shade Removal	42.2		2017	647	6
	1	2	Fence	33	6,000	2019	382	50
	1	3	Herbicide fern, spicebush, pawpaw, invasives before planting	40		2019	490	3
	1	4	Planting : shade-tolerant species (200 seedlings/acre)	8		2020	612	40
	1	5	Mast Tree Release	33		2026	TBD	
	2 and 3	1	Low Shade Removal	48		2018	647	6
	2	2	Fence	16	3,700	2020	382	50
	2	3	Herbicide fern, spicebush, pawpaw, invasives before planting	21		2020	490	3
	2	4	Planting : shade-tolerant species (200 seedlings/acre)	5		2021	612	40
	2	5	Mast Tree Release	16		2026	TBD	
	3 and 4	1	Low Shade Removal	48		2019	647	6
	3	2	Fence	59	7,100	2021	382	50
	3	3	Herbicide fern, spicebush, pawpaw, invasives before planting	68		2021	490	3
	3	4	Planting : shade-tolerant species (200 seedlings/acre)	13		2022	612	40
	3	5	Mast Tree Release including group selections around white pine	59		2026	TBD	
	4 and 5	1	Low Shade Removal	48		2020	647	6
	4	2	Fence - evaluate need for fence one growing season after the completion of pervious fences	TBD	TBD	TBD	382	50
	4	3	Herbicide fern, spicebush, pawpaw, invasives before planting	49		2020	490	3
	4	4	Mast Tree Release including all White Pine	49		2026	TBD	
	5	1	Low Shade Removal	23.8		2021	647	6
	All		Maintain fence perimeters as needed			All		
3			Standard activities when appropriate			All		
4		1	Low Shade Removal	5.8		2017	647	6
		2	Fence	5.8	2,000	2019	382	50
		3	Pre-emergent herbicide for MAM, stiltgrass and garlic mustard seedbank	5.8		2017	490	5
		4	Herbicide spicebush, witch-hazel, bb, rm, fern and invasives before planting	5.8		2018	490	3
		5	Planting : shade-tolerant species (200 seedlings/acre)	3		2019	612	40
5		1	Herbicide interfering understory vegetation and invasives	58		2018	490	3
		2	Fence	32	7,100	2018	382	50
		3	Plant 2000 conifers	10		2019	612	40
		4	Herbicide and plant as resources allow - determine location and amount on a yearly basis			All	TBD	
6	b		Determine needs of fence "b" and implement asap			2017		
	a,c		Dismantle fences "a" and "c"			2018		
	d,e		Assess progress of regeneration in fences "d" and "e" / update dismantle date			2022		
			Maintain fence perimeters as needed			All		
			monitor and continue to remove problem vegetation - determine location and amount on a yearly basis			All	TBD	
7			Evaluate and update desired course of action for this mgmt. unit			2022		
			Standard activities when appropriate			All		
8		1	Standard activities when appropriate			All		
9		1	"Environmental Corridor" Project			Any		

MANAGEMENT ACTIVITY SCHEDULE (by Year)

Year Planned	Mgmt Unit #	Location #	Sequence	Practice Description	Acres	Fence Perimeter (lin.ft)	NRCS Practice Code	NRCS Scenario #
2017	1			ADA accessible walkway and platform				
2017	2	1 and 2	1	Low Shade Removal	42.2		647	6
2017	4		1	Low Shade Removal	5.8		647	6
2017	4		3	pre-emergent herbicide for MAM, stiltgrass and garlic mustard seedbank	5.8		490	5
2017	6	b		Determine needs of fence "b" and implement asap				
2018	2	2 and 3	1	Low Shade Removal	48		647	6
2018	4		4	Herbicide spicebush, witch-hazel, bb, rm, fern and invasives before planting	5.8		490	3
2018	5		1	Herbicide intefering understory vegetation and invasives	58		490	3
2018	5		2	Fence	32	7,100	382	50
2018	6	a,c		Dismantle fences "a" and "c"				
2019	2	1	2	Fence	33	6,000	382	50
2019	2	1	3	Herbicide fern, spicebush, pawpaw, invasives before planting	40		490	3
2019	2	3 and 4	1	Low Shade Removal	48		647	6
2019	4		2	Fence	5.8	2,000	382	50
2019	4		5	Planting : shade-tolerant species (200 seedlings/acre)	3		612	40
2019	5		3	Plant 2000 conifers	10		612	40
2020	2	1	4	Planting : shade-tolerant species (200 seedlings/acre)	8		612	40
2020	2	2	2	Fence	16	3,700	382	50
2020	2	2	3	Herbicide fern, spicebush, pawpaw, invasives before planting	21		490	3
2020	2	4 and 5	1	Low Shade Removal	48		647	6
2020	2	4	3	Herbicide fern, spicebush, pawpaw, invasives before planting	49		490	3
2021	2	2	4	Planting : shade-tolerant species (200 seedlings/acre)	5		612	40
2021	2	3	2	Fence	59	7,100	382	50
2021	2	3	3	Herbicide fern, spicebush, pawpaw, invasives before planting	68		490	3
2021	2	5	1	Low Shade Removal	23.8		647	6
2022	2	3	4	Planting : shade-tolerant species (200 seedlings/acre)	13		612	40
2022	6	d,e		Assess progress of regeneration in fences "d" and "e" / update dismantle date				
2022	7			Evaluate and update desired course of action for this mgmt unit				
2026	2	1	5	Mast Tree Release	33		TBD	
2026	2	2	5	Mast Tree Release	16		TBD	
2026	2	3	5	Mast Tree Release including group selections around white pine	59		TBD	
2026	2	4	4	Mast Tree Release including all White Pine	49		TBD	
All	1			determine location and amount on a yearly basis				
All	1			Catelog and label 100-200 high risk trees over next 10 years				
All	1			competition - determine location and amount on a yearly basis				
All	1			Encourage shade-tolerant species - determine location and amount on a yearly basis				
All	2	All		Maintain fence perimeters as needed				
All	3			Standard activities when appropriate				
All	5		4	herbicide and plant as resources allow - determine location and amount on a yearly basis			TBD	
All	6			Maintain fence perimeters as needed				
All	6			monitor and continue to remove problem vegetation - determine location and amount on a yearly basis			TBD	
All	7			Standard activities when appropriate				
All	8		1	Standard activities when appropriate				
Any	9		1	"Environmental Corridor" Project				
TBD	2	4	2	pervious fences	TBD	TBD	382	50

MANAGEMENT UNIT LOCATIONS



APPENDIX A

STRATEGIC PLAN

The Clarence Schock Memorial Park at Governor Dick
Strategic Plan
2016-2021

Summary

This five-year strategic plan was developed by the Clarence Schock Memorial Park at Governor Dick Strategic Planning Committee in June, 2016. The committee received oversight from the Clarence Schock Governor Dick Trust Board of Directors: Raymond Bender, Chairman; Dave Eichler, Vice-chairman; Frank Eichler; Harrison Diehl; Charles Allwein and Tom Harlan. The committee members were Jane Gockley, Diana Sprucebank, Adam Hartman, Fred Long, and Audrey Wells.

The purpose of the strategic plan is to build on Clarence Schock Memorial Park's strengths and assets and to provide guidance to the board and staff during the upcoming five years. By following the *Director's Guide to Best Practices* and referring to the *Peer-to-Peer Consult Final Report* by DCNR Peer-to-Peer Consultant Francis Velasquez the Strategic Planning Committee identified four priority goals that will guide the organization's future activities.

The planning process included reviewing Francis Velasquez' assessment of our strengths, weaknesses, opportunities, and threats (SWOT) and comparing that assessment to the SWOT analysis done by each committee member. Current mission and vision statements were reviewed and updated with better wording while a brand-new values statement was drafted. This review led to the development of four strategic goal areas: Environmental Education, Recreation, Conservation, and Funding. The committee subsequently has drafted objectives for each of these goals.

Mission, Vision, and Values Statements

Mission: Clarence Schock Memorial Park at Governor Dick provides use of park land as a public park and playground while maintaining and preserving it as a forest forever in accordance with the terms of the Clarence Schock Deed of Trust. In this capacity, it conserves and manages park lands and offers a variety of recreational and educational opportunities.

Vision: Clarence Schock Memorial Park at Governor Dick strives to be the county leader in environmental and conservation education, local history interpretation, and outdoor recreation. Programs in these areas reflect strong stewardship principles and sound management of resources with a commitment to public service.

We value:

- Integrity and honesty.
- Commitment from the board, staff, volunteers, and visitors to do what is best to promote and maintain the park.
- Sound and authentic environmental education programs that cultivate attitudes of responsibility for and conservation of our natural resources.
- Respect for all life.
- Personal experience in nature. This promotes the physical, emotional, intellectual, and spiritual health of people of all ages and encourages a lifelong conservation ethic.
- Good stewardship that will ensure the sustainability of our park's resources, local resources, and the earth.
- Safe and responsible use of park resources.

Strategic Plan 2016-2021

Clarence Schock Memorial Park at Governor Dick, Mt. Gretna, PA

GOAL I: Be Lebanon County's leader in environmental and conservation education.

Objectives:

a. Expand our educational programs and services to reach broader audiences of all ages.
b. Build our capacity, i.e., board, staff, and funding, to serve the community, schools, future members, and others.
c. Expand educational programs with an emphasis on environmental ethics and respect for the natural world.
d. Incorporate high-quality interpretive displays in the Environmental Center and on the trails.
e. Increase involvement and visibility in the local communities by participating in community-wide events.
f. Develop partnerships with local businesses and community groups to support large events.
g. Improve facilities to accommodate large groups, i.e., provide more restrooms.
h. Promote awareness and knowledge of the natural world through digital and electronic media, particularly with QR codes on trail signs.
i. Revitalize all school programs, on campus and off, to be developmentally appropriate, to meet state academic standards, and to accommodate more school groups from Lebanon County and neighboring counties.
j. Place directional signs at roads leading to the Environmental Center.

GOAL II: Provide a safe natural area where people can connect to the natural world.

Objectives:

a. Maintain the trail system with vigilance as use increases.
b. Develop programs that encourage the use of trails for nature study as well as for physical, mental, and spiritual fitness.
c. Broaden community awareness about the relationship between a high-quality life and a healthy environment.
d. Pursue new recreational opportunities within the park.
e. Provide safe and ample parking near route 72. (Ray)

GOAL III: Set the example for environmental stewardship and conservation by protecting our natural resources.

Objectives:

a. Promote recreational uses that are compatible with the sustainability of the natural resources at Governor Dick Park.
b. Follow the recommendations of the Forest Stewardship Plan prepared by a certified forester.

c. Provide programs that explain forest management and its benefit to wildlife and the forest.
d. Increase the involvement of volunteers for trail maintenance.

GOAL IV: Develop capital and revenue streams that support our mission, operation, and longevity.

Objectives:

a. Increase funding through a membership program whereby individuals may financially support our mission.
b. Increase funding through sales of climbing gear, tee shirts, and other items.
c. Hold an annual fundraising event.
d. Incorporate large events for fundraising, i.e., night bike rides, 5K race, a summer day camp, and others.
e. Explore increasing support from the community and corporations.
f. Develop annual sources of income to grow the principle of our endowment.

APPENDIX B

SILVAH – DEFINITION

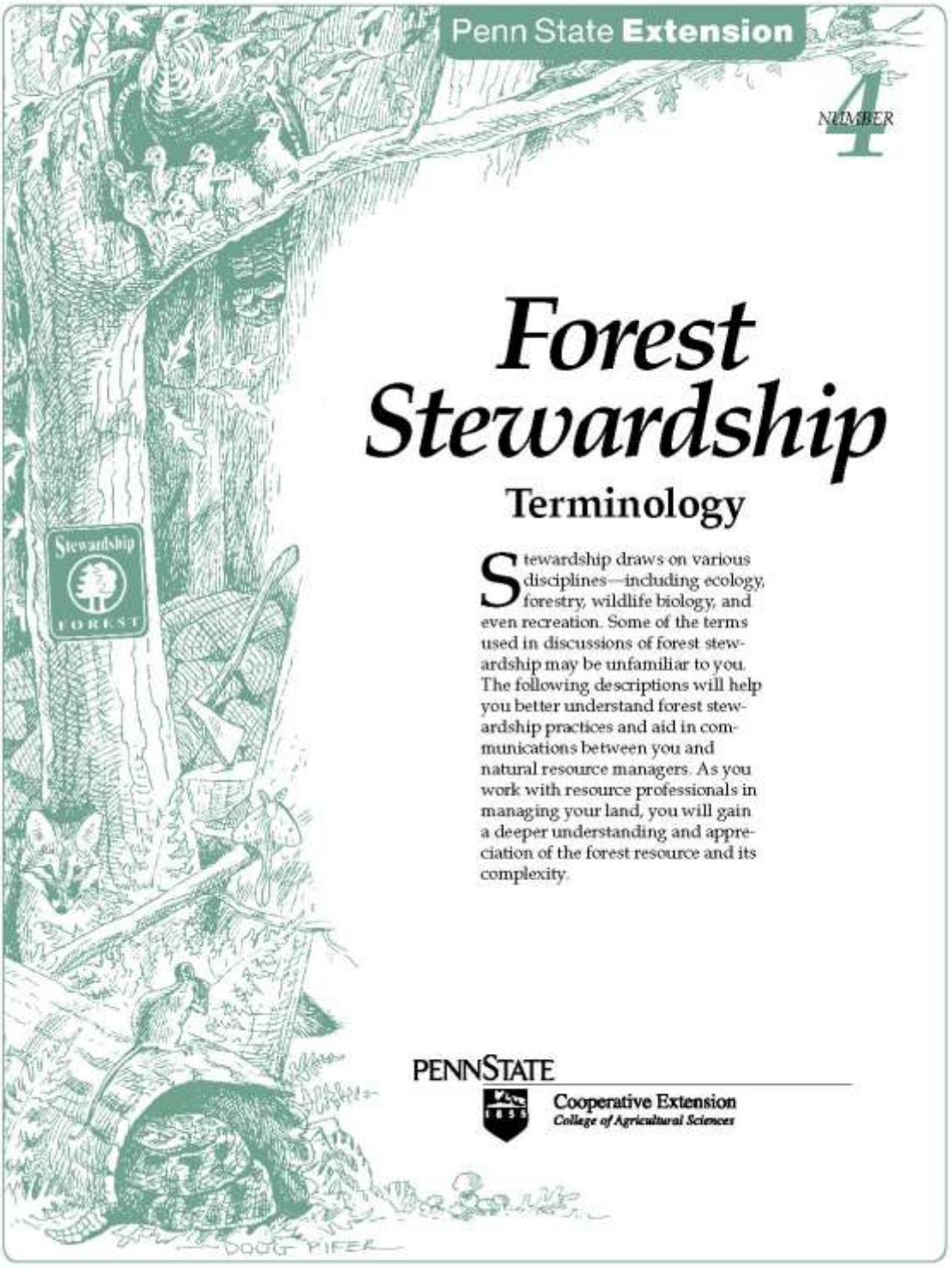
A computer program developed by the US Forest Service Northern Experimental Station that quantifies, analyzes, and recommends silvicultural decisions for hardwood stands. The latest version of the software is entitled "SILVAH 7 – Decision Support for Managers of Allegheny Hardwood and Mixed Oak Ecosystems." The USFS website describes SILVAH as:

SILVAH (short for **Silv**iculture of **A**llegheny **H**ardwoods, but now also applicable to mixed oak forests) is a computer tool for making silvicultural decisions in hardwood stands of the mid-Atlantic and upper Appalachian region. It is an "expert system" in that it recommends appropriate treatments based upon user objectives and overstory, understory, and site data provided by the user. SILVAH also contains a wildlife attributes report, forest stand growth simulator, provides the ability to test alternative cuts, enables development of a forest-wide inventory database, and facilitates other forest management planning functions.

SILVAH is the computerized implementation of a systematic approach to silviculture, in which current conditions are identified through a systematic inventory of overstory and understory. These conditions are evaluated using an objective set of research-based standards and the constraints and objectives of the land-manager. Then a prescription is recommended to move the stand closer to the manager's objectives. The silviculture behind the SILVAH system in Allegheny, northern hardwood, and mixed-oak forests is described in two publications titled Prescribing silvicultural treatments in hardwood stands of the Alleghenies and Prescribing regeneration treatments for mixed-oak forests in the Mid-Atlantic region.

APPENDIX C

FOREST STEWARDSHIP TERMINOLOGY



Advanced regeneration—seedlings or saplings present in the understory before harvesting mature trees in the overstory.

Aesthetics—forest value, rooted in beauty and visual appreciation, affording inspiration, contributing to the arts, and providing a special quality of life.

Afforestation—the establishment of forest trees by planting or seeding an area not previously forested.

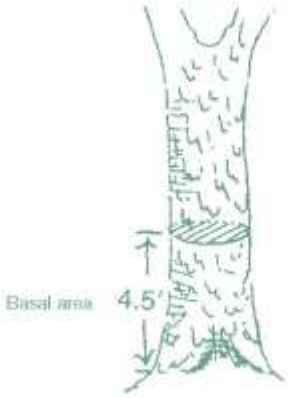
Agroforestry—a cultivation system combining agriculture and forestry where trees and crops are interplanted; not common to Pennsylvania.

Allegheny hardwood type—a portion of the northern hardwood forest in Pennsylvania, of which black cherry, white ash, and tulip poplar are major components.

Area sensitive species—plants or animals with very specific habitat requirements that are susceptible to population decline when their habitat is altered.

Aspect—the orientation of a slope with respect to the compass; the direction toward which a slope faces; north facing slopes are generally cooler than south facing slopes.

Basal area—a measurement of the cross-sectional area of a tree trunk in square feet at breast height. Basal area (BA) of a forest stand is the sum of the basal areas of the individual trees, and is reported as BA per acre.



Best management practices (BMPs)—practices recommended by agencies or organizations to control pollution and erosion off a harvested site.

Biological diversity—the variety of plants and animals, the communities they form, and the ecological functions they perform at the genetic, stand, landscape, and regional levels.

Biological maturity—the point in the life cycle of a tree at which there is no net biomass accumulation; the stage before decline when annual growth is offset by breakage and decay.

Biological simplification—the reduction of biological diversity that results from altering the environment in ways that favor, either directly (e.g., through management) or indirectly (e.g., through pollution), certain species over many others.

Biomass—the total weight of all organisms in a particular population, sample, or area; biomass production may be used as an expression of site quality. Biomass is also defined as a wood product, usually in the form of wood chips, for energy production.

Biome—the largest ecological unit, distinguished by an extensive complex of terrestrial communities, corresponding to a particular climatic zone or region, and associated with an environmental region such as the northern coniferous forest, the Great Plains, the tundra, or as in Pennsylvania, the eastern temperate hardwood biome.

Board foot—a unit of wood 1 inch thick, 12 inches long, and 12 inches wide. One board foot contains 144 cubic inches of wood.

Bole—the main trunk of a tree.

Browse—portions of woody plants including twigs, shoots, and leaves used as food by such animals as deer.

Buffer strips—forestland left relatively undisturbed to lessen visual or environmental impacts of timber harvesting, usually along a road or waterway.

Canopy—the upper level of a forest, consisting of branches and leaves of taller trees. A canopy is complete (or has 100 percent cover) if the ground is completely hidden when viewed from above the trees.

Carrying capacity—the maximum amount of animal or plant life that a particular forest environment can support indefinitely without ecosystem degradation, given the limitations of food, shelter, competition, predation, and other available resources; usually expressed in terms of an individual species.

Clearcutting—a harvesting and regeneration technique that removes all the trees, regardless of size, on an area in one operation. Clearcutting is most often used with species like aspen or black cherry, which require full sunlight to reproduce and grow well, or to create specific habitat for certain wildlife species. Clearcutting produces an even-aged forest stand.

Commercial forestland—see *timberland*.

Community—a collection of living organisms in a defined area that function together in an organized system through which energy, nutrients, and water cycle.

Conservation—the wise use and management of natural resources to ensure its existence and function in perpetuity.

Consumptive activities—forest uses which involve the removal of something from the site (hunting, fishing, timber harvesting). Nonconsumptive activities include hiking, bird watching, and nature study.


Clearcutting

Corridor—a strip of wildlife habitat, unique from the landscape on either side of it, that links one isolated ecosystem "island" (e.g., forest fragment) to another. Corridors allow certain species access to isolated habitat areas, which consequently contributes to the genetic health of the populations involved.

Covert—a geographic unit of cover for wildlife (usually game); for example, a thicket or underbrush sheltering grouse or deer.

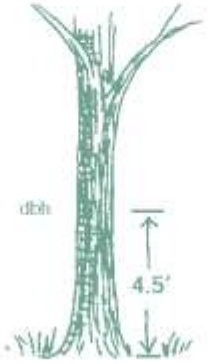
Crop tree—a term traditionally reserved to describe a tree of a commercially desirable species, with the potential to grow straight, tall, and vigorously. However, a crop tree can be one selected for nontimber purposes (varying with landowner objectives), such as mast production or den tree potential.

Crown class—an evaluation of an individual tree's crown in relation to its position in the canopy and the amount of full sunlight it receives. The four recognized categories are: dominant (D), codominant (C), intermediate (I), and overtopped or suppressed (S). (See figure above.)

Cull—a tree of such poor quality that it has no merchantable value in terms of the product being cut. However, a timber cull tree may have value for wildlife or aesthetics.

dbh—see *diameter at breast height*.

Deforestation—the unintentional or intentional conversion of land use from forest to nonforest. Associated with nonrenewable timber harvesting practices in ecologically sensitive areas, such as tropical rainforests.



Crown classes

Den tree—a tree with cavities in which birds, mammals, or insects such as bees may nest (also known as cavity tree).

Diameter at breast height (dbh)—the diameter of the tree measured at 4.5 feet above ground level. The abbreviation generally is written without capital letters and without periods.

Diameter-limit cut—a timber harvesting treatment in which all trees over a specified diameter may be cut. Diameter-limit cuts often result in high-grading.

Disturbance—a natural or human-induced environmental change that alters one or more of the floral, faunal, and microbial communities within an ecosystem. Timber harvesting is the most common human disturbance. Windstorms and fire are examples of natural disturbance.

Easement—the transfer of rights (usually development) associated with the land to a conservancy or public agency through purchase or donation. Easements are used as a conservation tool to retain the natural resources on land and reduce its likelihood to be used in undesirable ways.

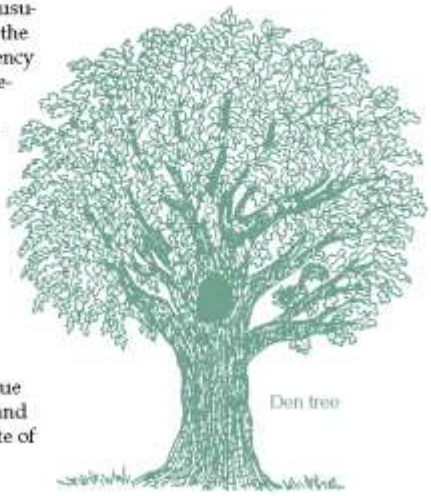
Ecology—the study of interactions between living organisms and their environment.

Economic maturity—the point in the life cycle of a tree or stand when harvesting can be be most profitable, i.e., when the rate of value increase of an individual tree or stand falls below a desired alternative rate of return.

Ecosystem—a natural unit comprised of living organisms and their interactions with their environment, including the circulation, transformation, and accumulation of energy and matter.

Ecotype—a genetic subdivision of a species resulting from the selective action of a particular environment and showing adaptation to that environment. Ecotypes may be geographic, climatic, elevational, or soil related. Red maples and northern red oaks are both adapted to moist soils, but can also be found on drier sites where the genetic difference is their enhanced ability to retain water.

Edge—the boundary between open land and woodland or between any two distinct ecological communities. This transition area between environments provides valuable wildlife habitat for some species, but can be problematic for sensitive species, due to increased predation and parasitism.



Even-aged stand

Emergent wetlands—a class of wetland dominated by grasses, sedges, rushes, forbs, and other rooted, water-loving (possibly broad-leaved) herbaceous plants that emerge from the water or soil surface; marshes are an example.

Endangered species—species in danger of extinction throughout all or a significant part of their range. Protection mandated by the United States Endangered Species Act, 1973.

Epicormic branching—branching that occurs on the tree trunk after other branches have developed higher; usually occurs from drastically modified environmental conditions, such as increased sunlight.

Even-aged stand—a group of trees that do not differ in age by more than 10 to 20 years or by 20 percent of the rotation age.

Extirpation—the eradication of a species from a portion of its natural range.

Forest—a biological community dominated by trees and other woody plants.

Forest health—the condition of a forest, taking into consideration its age, structure, vigor, and the presence of insects and diseases.

Forest interior dependent species—animal species that depend upon extensive areas of continuous, unbroken forest habitat to live and reproduce, and are susceptible to higher rates of predation and population decline when interior forest habitat is fragmented or disturbed.

Forest inventory—the survey of a forest landowner's property. Inventories are conducted by sampling plots to estimate average conditions across forest stands. The summation of stand data represents the inventory. (See *stand analysis*.)

Forest recovery—the complex natural process by which floral, faunal, and microbial communities respond to disturbance in the forest ecosystem. More resilient ecosystems respond rapidly to disturbance, returning to the pre-disturbance ecological state within a relatively short time period (perhaps decades as opposed to centuries).

Forest stewardship—the wise care and use of forest resources to ensure their health and productivity for years to come.

Forest types—associations of tree species that commonly occur because of similar ecological requirements. Pennsylvania's three major forest types are oak-hickory, northern hardwoods, and Allegheny hardwoods.

Forested wetland—an area characterized by woody vegetation over 20 feet tall where soil is at least periodically saturated with or covered by water.

Fragmentation—the segmentation of a large tract or contiguous tracts of forest to smaller patches, often isolated from each other by nonforest habitat. Results from the collective impact of residential and commercial development, highway and utility construction, and other piecemeal land use changes.

Genotype—growth or development characteristics dependent on genetic information. The genetic constitution of an organism or a species in contrast to its observable characteristics.

Girdling—a method of killing unwanted trees by cutting through the living tissues around the bole. Can be used instead of cutting to prevent felling damage to nearby trees. Girdled trees can provide cavities and dead wood for wildlife and insects.

Guild—species similar in their habitat needs as well as their response to habitat changes (e.g., ovenbird and woodthrush). One species in a guild is often used to represent the others when developing a stewardship management plan.

Habitat—the geographically defined area where environmental conditions (e.g., climate, topography) meet the life needs (e.g., food, shelter) of an organism, population, or community.

Girdling

Harvesting—the process of cutting, removing, and processing trees from the forest.

High-grading—a type of timber harvesting in which larger trees of commercially valuable species are removed with little regard for the quality, quantity, or distribution of trees and regeneration left on the site; often results when a diameter-limit harvest is imposed.

Horizontal structure—the spatial arrangement of plant communities; a complex horizontal structure is characterized by diverse plant communities within a given geographic unit.

Improvement cut—any cutting treatment used to alter species composition and tree spacing to realize ownership objectives. Thinning is a type of improvement cut.

Indicator species—species with such specialized ecological needs that they can be used for assessing the quality, condition, or extent of an ecosystem on the basis of their presence and density, or the accumulation and effect of materials in their tissues.

Interfering plants—competing plants that interfere with the germination and growth of desirable seedlings by casting dense shade across the forest floor.

Land ethic—the principles and values guiding our use and treatment of the land. Forest stewardship is a land ethic. (See *forest stewardship*.)

Logger—the professional hired to harvest trees from the forest.

Management plan—a document prepared by natural resource professionals to guide and direct the use and management of a forest property. It consists of inventory data and prescribed activities designed to meet ownership objectives.

Mast—all fruits of trees and shrubs used as food for wildlife. Hard mast includes nutlike fruits such as acorns, beechnuts, and chestnuts. Soft mast includes the fleshy fruits of black cherry, dogwood, and serviceberry.

Maturity—see *economic maturity* and *biological maturity*.

Microsite—the environment at a small, localized area; includes biotic, climatic, topographic, and soil conditions at the specific site.

Multiple use and value—a conceptual basis for managing a forest area to yield more than one use or value simultaneously. Common uses and values include aesthetics, water, wildlife, recreation, and timber.

Natural resources professionals—specially trained and educated natural resources managers who work with landowners and the land to achieve sustainable goals from wildlife to harvesting and regeneration.

Neotropical birds—birds that breed in the northern hemisphere during summer months, and winter in tropical regions (e.g., woodthrush or barn swallows). One-third of Pennsylvania's breeding birds are neo-tropical migrants.

Niche—the physical and functional location of an organism within an ecosystem; where a living thing is found and what it does there.

Nonindustrial private forestland (NIPF)—see *private forestland*.

Nonrenewable resource—a naturally occurring resource whose quantity is diminished by use.

Old-growth—forests that approximate the structure, composition, and functions of native forests prior to European settlement. They vary by forest type, but generally include more large trees, canopy layers, standing snags, native species, and dead organic matter than do young or intensively managed forests.

Patch—a small area of a particular ecological community surrounded by distinctly different ecological communities, such as a forest stand surrounded by agricultural lands or a small opening surrounded by forestland.

Patch dynamics—the process of recolonization by plant and wildlife species following the creation of a patch. Small patches and ones close to a source of plant and animal species will be recolonized faster than larger, more isolated patches.

Phenotype—outward appearance or physical attributes of an organism resulting from both the effects of the environment and genetic makeup.

Pole stand—a stand of trees with dbh ranging from 5 to 9 inches.

Population—a group of individuals of one plant or animal taxon (species, subspecies, or variety).

Precommercial thinning—the removal of trees (sapling to pole stage) to concentrate growth on desired trees; usually does not generate financial return.

Preservation—a management philosophy or goal which seeks to protect indigenous ecosystem structure, function, and integrity from human impacts. Management activities are generally excluded from "preserved" forests.

Private forestland (PFL)—forestland owned by a private individual, group, or corporation not involved in wood processing.

Rare species—species which exist only in one or a few restricted geographic areas or habitats or occur in low numbers over a relatively broad area.

Reforestation—the reestablishment of forest cover by natural or artificial means on areas recently supporting forest cover.

Regeneration—the replacement of one forest stand by another as a result of natural seeding, sprouting, planting, or other methods; also young trees which will develop into the future forest.

Regeneration cut—a timber harvest designed to promote and enhance natural establishment of trees. Even-aged stands are perpetuated by three types of regeneration cuts: seed tree, shelterwood, and clearcutting. Uneven-aged stands are perpetuated by selecting individual or small groups of trees for removal (e.g., the selection system).

Release—removal of overtopping trees to allow understory or overtopped trees to grow in response to increased light.

Renewable resource—a naturally occurring resource that is not reduced in quantity and ability for future use as a result of current use.

Renewal—growth of a new forest plant community.

Residual stand—trees remaining following any cutting operation.

Riparian zone—an area adjoining a body of water, normally having soils and vegetation characteristic of floodplains or areas transitional to upland zones. These areas help protect the water by removing or buffering the effects of excessive nutrients, sediments, organic matter, pesticides, or pollutants.

Rotation—the planned time interval between regeneration cuts in a forest.

Salvage cut—the removal of dead, damaged, or diseased trees with the intent of recovering value prior to deterioration.

Sapling—a small tree, usually defined as being between 2 and 4 inches dbh.

Sawlog—a log large enough to yield lumber. Usually the small end of a sawlog must be at least 6 to 8 inches in diameter for softwoods and 10 to 12 inches for hardwoods.

Second growth—the forests re-established following the removal of virgin (i.e., previously unharvested) or

old-growth stands. Most of Pennsylvania's forests are either second or third growth.

Seed tree cut—a regeneration cut where mature trees are left standing in a harvested area to provide seed for regeneration of the cut-over site.

Seedling—a young tree originating from seed that is less than 4 feet tall and smaller than 2 inches in diameter at ground level.

Selection cut—a regeneration cut designed to create and perpetuate an uneven-aged forest. Trees may be removed singly or in small groups. A well-designed selection cut removes trees of lesser quality and trees in all diameter classes along with merchantable and mature high-quality sawlog trees. Should be differentiated from "select" or "selective" cuts, which often equate to high-grading.

Selective cut—a timber harvesting treatment in which the largest, most valuable trees are removed. Selective cuts often result in high-grading.

Shelterwood—a regeneration cut designed to stimulate reproduction by removing all overstory trees. This is achieved by a series of cuts over several years. Gradual reduction of stand density protects understory trees and provides a seed source for stand regeneration.

Silviculture—the art, science, and practice of establishing, tending, and reproducing forest stands.

Site—the combination of biotic, climatic, topographic, and soil conditions of an area; the environment at a location.

Site quality—the inherent productive capacity of a specific location (site) in the forest affected by available growth factors (light, heat, water, nutrients, anchorage); often expressed as tree height at a given age.

Skid road—roads incorporating water control and erosion structures designed for frequent use by skidding equipment.

Skid trail—trails used infrequently to drag logs to skid roads.

Slash—branches, tops, and cull trees left on the ground following a harvest. Although some of this material can be used for firewood, slash may be arranged in brush piles to provide wildlife cover. Left scattered, slash can protect seedlings and sprouts from deer browsing and reduce soil erosion.

Snag—a standing dead tree with few branches, or the standing portion of a broken-off tree. Snags may provide feeding and/or nesting sites for wildlife.

Species—a subordinate classification to a genus; reproductively isolated organisms that have common characteristics, such as eastern white pine or white-tailed deer.

Species richness—the number of species present in a community or a defined area.

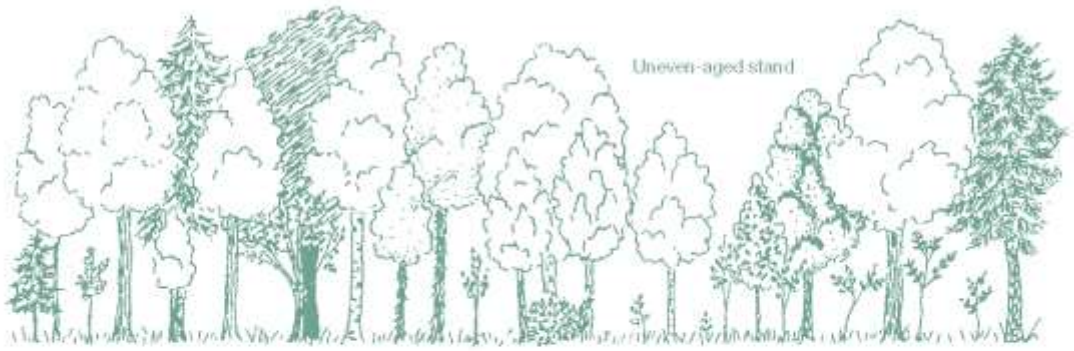
Spring seep—a class of wetland created by groundwater emerging on lower slopes in small pools surrounded by vegetation. These create snow-free zones critical for wildlife feeding during winter.

Stand—a grouping of vegetation sufficiently uniform in species composition, age, and condition to be distinguished from surrounding vegetation types and managed as a single unit.

Stand analysis—the inventory of stands by species composition, average diameter, basal area, crown closure, regeneration, interfering plants, and tree quality to establish a baseline for silvicultural prescriptions. Stand analysis should occur before harvesting takes place.

Stewardship plan—a guide prepared by an approved natural resources professional that tells landowners what their resources are, what conditions they are in, and what can be done to help them achieve their goals.

Stream management zones—areas adjacent to waterbodies where unique management strategies are applied to protect water quality and maintain stream temperature through shading. Zone width is normally 50 feet, but varies according to site.



Stumpage—the commercial value of standing trees.

Succession—the natural series of replacements of one plant community (and the associated fauna) by another over time and in the absence of disturbance.

Sustainability—caring for the water and wildlife that rely on forests and working to ensure continuant and improved health of forest resources so that future generations receive the same or increased benefits.

Sustained yield—historically, a timber management concept in which the volume of wood removed is equal to growth within the total forest. The concept is applicable to nontimber forest values as well.

Tending—the process of caring for the forest in such a way to ensure its sustainability while advancing the owner's objectives.

Thinning—removal of trees to encourage growth of other selected individual trees. May be commercial or precommercial.

Threatened species—a species likely to become endangered in the foreseeable future, throughout all or a significant portion of its range, unless protected.

Timber cruise—the process of estimating the quality, quantity, and characteristics of trees in a forest.

Timberland—forestland producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year), and not withdrawn from timber utilization. Formerly known as commercial forestland.

Timber stand improvement (TSI)—a combination of intermediate treatments designed to improve growth and composition of the forest; often spoken of as TSI.

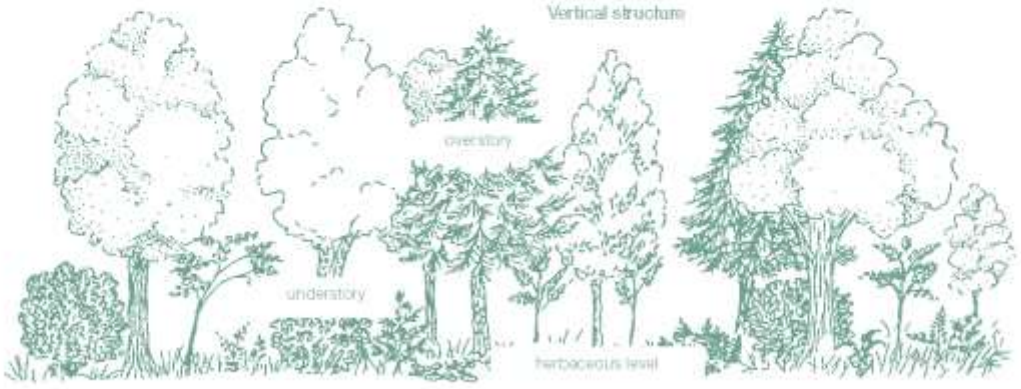
Tolerance—a characteristic of trees that describes the relative ability to thrive with respect to the growth factors (light, heat, water, nutrients, anchorage). For instance, a "shade-tolerant" species may thrive at low light levels.

Understory—the smaller vegetation (shrubs, seedlings, saplings, small trees) within a forest stand, occupying the vertical zone between the overstory and the herbaceous plants of the forest floor.

Uneven-aged stand—a group of trees of various ages and sizes growing together on a site.

Urban forestry—the professional management of natural resources in and around urban areas, including trees and associated vegetation, wildlife, and open space.

Vernal or autumnal ponds—a class of wetland characterized by small, shallow, temporary pools of fresh water present in spring and fall, which typically do not support fish but are very important breeding grounds for many species of amphibians. Some species completely depend on such ponds; examples are spring peepers and mole salamanders.



Vertical structure—the arrangement of plants in a given community from the ground (herbaceous and woody shrubs) into the main forest canopy; a complex vertical structure is characterized by lush undergrowth and successive layers of woody vegetation extending into the crowns of dominant and codominant trees. (See *crown class*.)

Virgin forest—a forest that has never been harvested or altered by humans.

Watershed—a region or area defined by patterns of stream drainage. A watershed includes all the land from which a particular stream or river is supplied.

Wetlands—areas which are either transitional between land and water (where the water table is at or near the land surface) or areas of land which are covered by shallow water (such as marshes, swamps, bogs, and fens). Although only 2 percent of Pennsylvania remains as wetlands today, these areas fulfill an essential role in our landscapes by maintaining water quality, stabilizing shores and stream banks, controlling floods and erosion, and providing critical habitat to many plant and animal species.

Wolf tree—a large, excessively branchy tree which occupies more space in the forest than surrounding trees. Wolf trees have high wildlife and aesthetic value, but little if any timber value.

Woodland—see *forest*.

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The Forest Stewardship Program is administered nationally by the USDA Forest Service and is directed in Pennsylvania by the DCNR Bureau of Forestry with assistance from a statewide steering committee. The Forest Stewardship Program assists forest landowners in better managing their forestlands by providing information, education, and technical assistance. For more information about program services, contact the Pennsylvania Forest Stewardship Program, DCNR Bureau of Forestry, PO Box 8552, Harrisburg, PA 17105-8552; phone: 717-787-2160. For more information about publications, contact the Pennsylvania Forest Stewardship Program, Department of Ecosystem Science and Management, 416 Forest Resources Building, University Park, PA 16802-4705; phone: 800-235-9473.

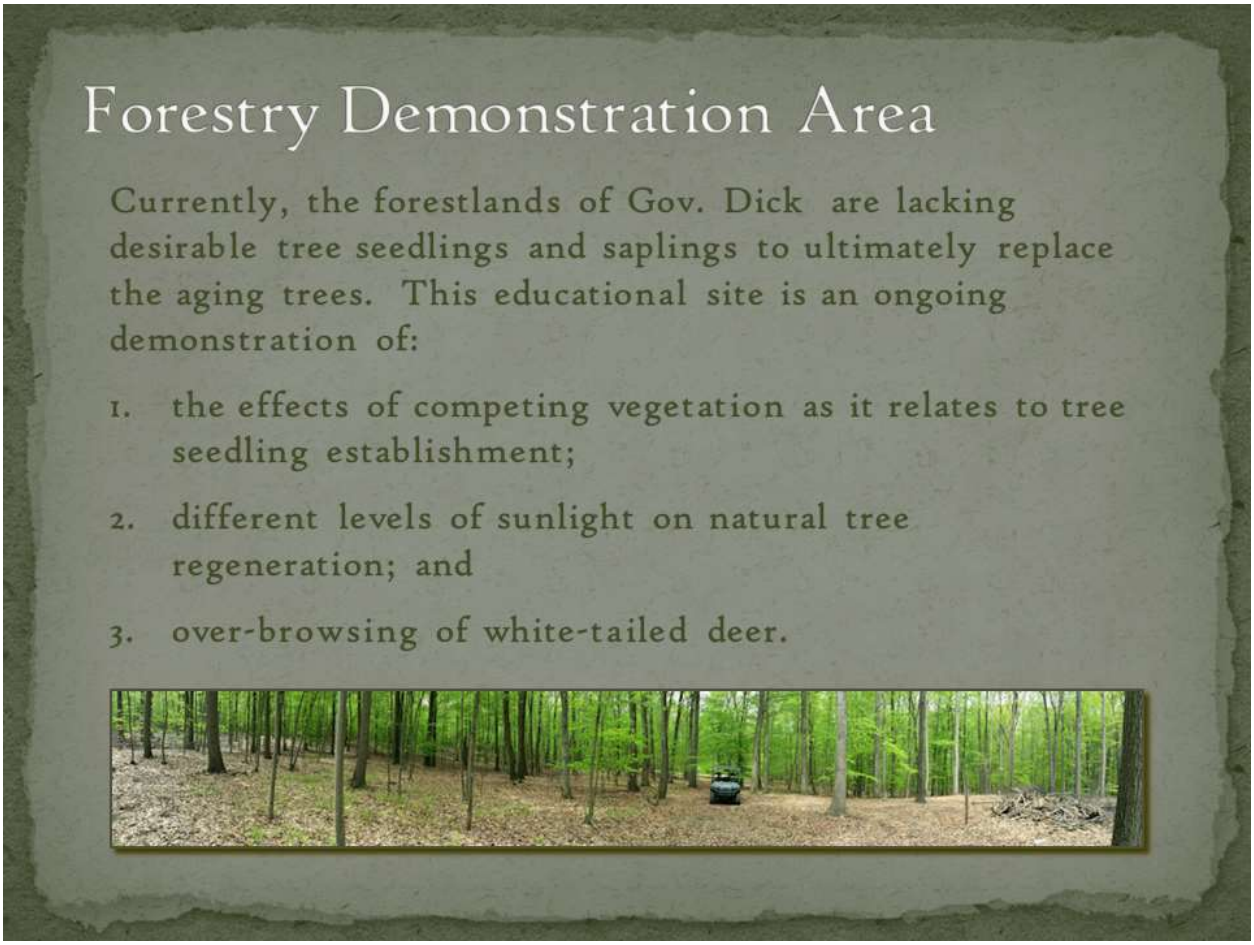
APPENDIX D

PNDI SEARCH RESULTS

APPENDIX E

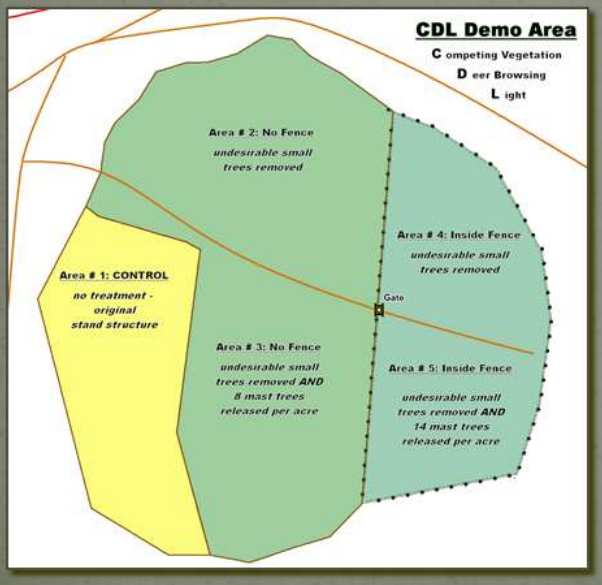
FORESTRY DEMONSTRATION AREA

Competing Vegetation, Deer Browsing, Light (CDL)



Forestry Demonstration Area

This demonstration area is divided into five specific areas:



- Four areas have been altered to allow varying degrees of sunlight to reach the forest floor.
- Two of those areas are surrounded by a deer-exclusion fence.
- One area remains unaltered to act as a visual barometer for the rest.

Forestry Demonstration Area

CDL Demonstration Area

(established 2015)

"CDL" is an acronym for:

- Competing Vegetation
- Deer Browsing
- Light

These three factors determine whether or not natural tree regeneration can occur on any given sight.

Forestry Demonstration Area

Competing Vegetation

Some vegetation inhibits tree seedling growth. Most times it is well-established prior to the tree seed germination, and as such it can easily out-compete the growth rate of desirable tree seedlings. Therefore, if this vegetation exists, it must be controlled to allow for seedlings to grow.

Forestry Demonstration Area

Deer Browsing

Deer preferentially feed on native vegetation with some tree species being most desirable. Tree seedlings and stump sprouts stand little chance of survival should deer be even slightly abundant in an area.

Forestry Demonstration Area

Light

The quantity of light on the forest floor is determined by the amount of vegetation in the forest. Since the prominent tree species of Pennsylvania thrive in sunlight, germination and survival need large amounts of sunlight. Many of the tree species at Governor Dick require more sunlight to germinate and grow than is currently available.

Forestry Demonstration Area

- **Area 1** - Representative of how the entire demonstration area looked before any vegetation was removed.

Forestry Demonstration Area

- **Area 2** - Mid-story black birch, black gum and red maple were removed to increase sunlight by approx. 5% on the forest floor. These trees ranged from 1" to 10" diameter at breast height (d.b.h.)

Forestry Demonstration Area

- Area 2 - Brush piles were constructed from the downed trees to create cover for wildlife. Amphibians thrive in this moist habitat.

Forestry Demonstration Area

- Area 3 - Undesirable small trees were removed in area 3 as well. However, larger trees were also harvested to further increase the amount of available sunlight for seedling growth. Stumps of the harvested overstory trees are marked with a PINK flag (Post #7). Now we might expect to encourage more "shade intolerant" tree species to germinate and grow. You could expect to see cherry, ash and poplar to enter into the picture.

Forestry Demonstration Area

- Area 3 - PINK bands can be found on 6 very large trees in this plot. Remember our goal to increased light on the forest floor to allow seed to germinate. Thinking ahead, we will need a healthy, viable seed source. These pink banded trees were specially selected because of their superior health, vigor and species desirability.

Being stronger and healthier means that more nuts, acorns, drupes and samaras can be produced. Therefore, other trees touching the crown of the selected few have been removed. This harvest technique is known in forestry as "Mast Tree Release" and is used to accelerate growth on specimen trees that exhibit qualities desired in the future forest.

Forestry Demonstration Area

- Area 4 and 5 (deer exclusion fence) –

In much of Pennsylvania deer are overabundant and always very hungry. Therefore, protection from over browsing must be considered, especially on non-huntable grounds such as Gov. Dick. Deer congregate here to a fault; eating themselves out of house and home. If tree seedlings do manage to become established, they are soon consumed by deer. The fence will demonstrate the highly negative effect that "too many deer" have on the environment.

Forestry Demonstration Area

- **Areas 4 and 5 -** Fences are a temporary, effective, but costly means of protecting newly established seedlings, usually lasting for a for a period of 6 to 10 year. At this age the seedlings should reach a height sufficient to protect terminal buds from deer browse damage. Other than the fence, the treatment in Area 4 is identical to that of Area 2. Likewise for Area 5 as it relates to Area 3 albeit with several more trees per acre designated as mast trees. See map for clarification.

Forestry Demonstration Area

First summer's growth.. Off to a good start!

Invasive Species

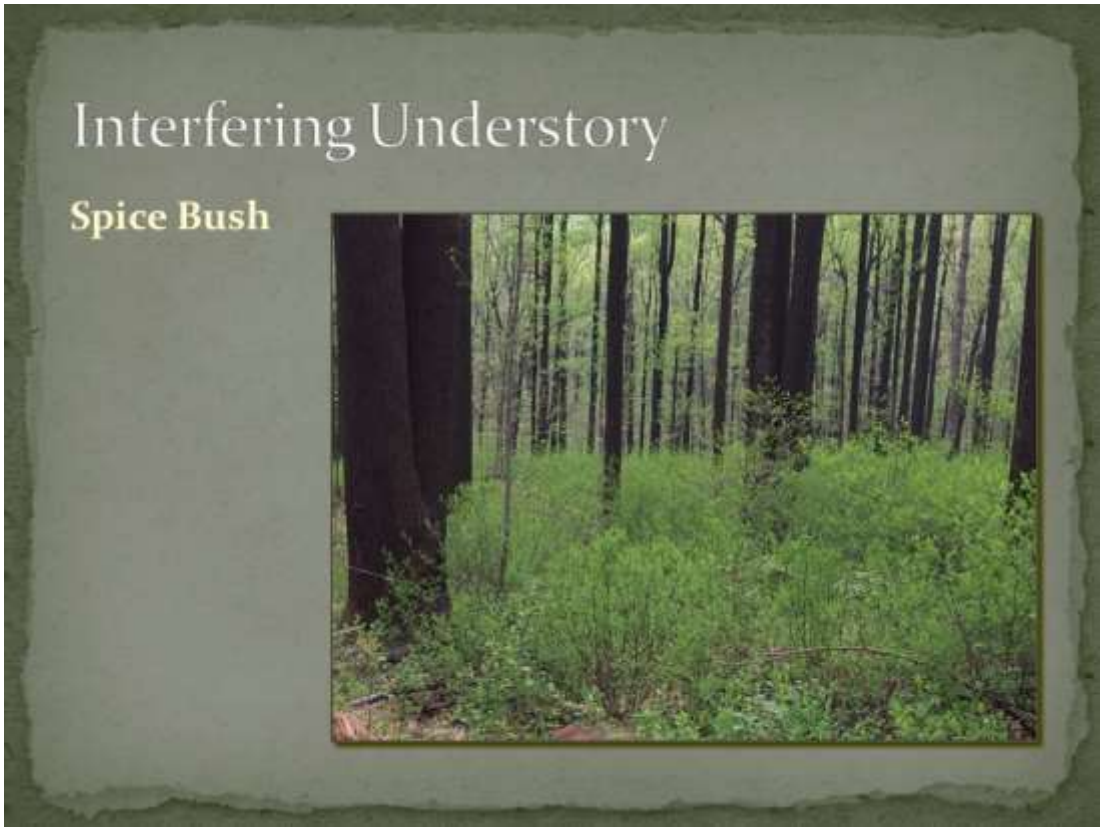
- Not native to United States
- Highly prolific
- Typically have no predators for natural control
- Uncontrolled populations take over vast areas prohibiting natural plant species to exist
- Spread by humans, livestock, and wildlife

Invasive Species

Norway maple – just one tree... so many seedlings


Invasive Species
Eastern tent caterpillars
Gypsy moth egg masses


Invasive plants and interfering understory vegetation must always be monitored and controlled when needed.


Interfering Understory
Spice Bush

APPENDIX F

SILVAH - MANAGEMENT UNIT PRINTOUTS