OREGON RIDGE PARK

FOREST HEALTH ASSESSMENT AND FOREST MANAGEMENT PLAN

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For:

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Acknowledgements:

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1.0 EXECUTIVE SUMMARY

"OPPORTUNITY AND RESPONSIBILITY"

"We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect."

Aldo Leopold

With nearly 900 acres of contiguous forest located centrally in Baltimore County, Oregon Ridge Park provides the County's 800,000+ citizens and others in the region with ample opportunity to experience nature in close proximity to their communities. Nearly 6 miles of trails allow visitors to hike throughout a diverse forest community with 90 overstory, understory, and ground-layer plant species. More than 6 miles of streams originate within or flow through the Park, providing habitat for numerous aquatic species, including native brook trout. The casual Park visitor, observing the seasonal changes at Oregon Ridge, likely sees the forest as an aesthetically pleasing and healthy system.

But beyond the general story told by educational exhibits at the Oregon Ridge Nature Center, few visitors likely understand that this invaluable recreational resource exists on a landscape altered greatly by humans over the past two centuries. Visitors and non-visitors alike may assume that the forest system at Oregon Ridge is well-protected by its public ownership and Park designation. The County's environmental managers have been aware, however, that the health of forest ecosystems here and throughout the region are threatened. As a result, Mar-Len Environmental was contracted to conduct an assessment of the health of the Oregon Ridge Park forest and to prepare a forest management plan to address problems revealed by the assessment. The forest assessment has identified significant environmental threats to the health and long-term sustainability of the Oregon Ridge Park forest that, without thoughtful management response, will change and potentially degrade the forest as it now exists.

ASSESSMENT METHODS

The Oregon Ridge Park forest system assessment included three field study components:

1. ***Forest*** - The condition and health of the 895-acre forest system at Oregon Ridge Park was assessed using two methods:
    - Forest overstory, understory, and ground-layer characteristics were assessed quantitatively for 22 stands, presented in Figure 1, using the USDA Forest Service North East Decision (NED) model. Data were collected for 119 separate forest plots within these stands, including measurement of more than 1,700 overstory trees alone. Overall, tens of thousands of data observations were recorded.
    - The herbaceous community was assessed independently for species presence and coverage.
2. ***Streams*** - Streambank erosion and habitat condition were assessed qualitatively by walking all of the 6.2 miles (32,450 linear feet) of headwater and larger streams that originate within or traverse the Park.
3. ***Trails*** - Potential hazard trees (dead trees and large overhanging dead branches) were identified and marked along the 6 miles of recreational trails in the Park.

More detailed information about the forest assessment methods is presented in section in 3.0.

FINDINGS

Forest - The forest system, including its herbaceous plants and wildlife, is the County's most important natural asset at Oregon Ridge Park. This assessment found that:

- ***Canopy Composition*** - The forest is comprised of four forest cover types, of which oak species dominate 80% of the 895 forested acres. Although 30 overstory species and 25 understory tree species exist within the forest stands, trees are found in only two size classes: 84% of all trees fall within the 18+" DBH size class, while the remaining 16% are in the 11-17.9" DBH size class. As documented in the Conservation Fund's 2006 *The State of Chesapeake Forests*, oaks are the most ecologically important species in the Chesapeake Bay region's forests.
- ***Tree Age and Growing Potential*** - Twenty of the 22 forest stands are more than 100 years old and 15 stands are between 108 and 121 years old,

suggesting that the forest was widely harvested in the 1880's and 1890's. Fourteen stands are now relatively crowded, with insufficient room for good continued tree growth. Only one stand (#3), at 140 years old (2nd oldest) and with a stand relative density of 73.6%, has good potential for old growth.

- ***Forest Health*** - A Gypsy moth infestation in 2006 was severe but localized (stand #6). Trees here and in other stands are stressed due to overcrowding and are therefore vulnerable to mortality from repeated infestations.
- ***Regeneration*** - As a result of deer browsing, 54% of the field plots sampled lacked oak regeneration, as well as regeneration of any other native species. All stands lack adequate regeneration.
- ***Ground-layer Composition*** - The ground-layer inventory identified only 48 species, 44 of which are herbaceous. Deer have also greatly impacted the herbaceous community, with 25% of the 127 plots devoid of herbaceous plants due to deer pressure. This is low species diversity for the site conditions.

Streams - Healthy forests in the Park are vital for providing good water quality by intercepting precipitation, shading streams and soil to reduce temperatures, filtering and trapping pollutants, and reducing soil erosion. These forests serve to protect the 6.2 miles of streams in the Park that drain into the Loch Raven Reservoir, as well as to protect the 640 acres of slopes with grades of 15% or greater adjacent to streams. The streams assessment found that:

- ***Stream Channel Stability*** - 18.2% of stream length has excellent stability, 32.1% has good stability, 47.4% has fair stability, and 2.2% has poor stability (see definitions on p. 34). Downed woody debris is causing streamflow blockages in segments of stream sections #2, #5, #7B, and #7.
- ***Habitat Conditions*** - 68.2% of the stream system has excellent habitat conditions, 8.4% has good conditions, 11.3% has fair conditions, and 12.1% has poor conditions (see definitions on p.34). The Baisman Run stream system has excellent habitat conditions for 95.4% of its length.

Trails - The 5.93 miles of trails provide access for citizens to enjoy the aesthetic and ecological benefits of the Park. The trails assessment found that:

- ***Trail Stability*** - Approximately 90% of the trails are in good condition. Portions of the Green and Blue trail, however, are badly eroded in sections.

- ***Hazard Trees*** - As often associated with forest trails, tree hazards are present. A total of 105 trees with dead overhead branches were identified and marked along the trail system, and another 127 dead trees were identified and marked in close proximity to trails.

Detailed findings and discussion are presented in Section 4.0.

MANAGEMENT RECOMMENDATIONS

As the owner of one of the largest continuous tracts of forest land in the County, Baltimore County government has the opportunity and responsibility to practice good forest stewardship at Oregon Ridge Park for the purpose of ensuring a sustainable forest for present and future generations of its citizenry. The following management priorities are recommended for the Park's forests, trails, and streams:

- **Forests** – Baltimore County should actively manage the forest at Oregon Ridge Park with the objective of sustaining a naturally-regenerating oak community due to its high ecological value. In order to sustain an oak-dominated forest, environmental threats currently present such as pests and diseases (e.g., Gypsy Moth), invasive plants, and the high deer population must be controlled. Forest health and vitality will also be improved by reducing environmental stress caused by over crowding. The oak-dominated forest cannot naturally regenerate under the dense canopy in most stands. The closed canopy provides an ideal environment for shade-tolerant species such as red maple and black gum and, without any silvicultural intervention, the existing forest will convert to red maple, beech and black gum. These species do not provide ecosystem services equivalent to that of an oak forest.
- **Trails** – Baltimore County should close and stabilize the portions of the Green and Blue trails with severe erosion. Alternative trail sections should be determined and developed. Hazard trees should also be addressed as a priority for public safety.
- **Streams** – Baltimore County should relocate trail sections with high erosion to reduce transport of sediment to streams. Debris dams that are impeding stream flow should be cleared. Downed woody debris not blocking stream flow should be retained for aquatic habitat.

Sustainable Forest Management - The forest at Oregon Ridge Park was delineated into 22 distinct stands that represent the combination of different plant communities on different landscape features. While there are varying conditions across these stands, as a whole the Oregon Ridge Park's forest can be described as a system vulnerable to undesirable changes. The oak-dominated system that exists today is likely to change to a non-oak forest, which will provide less desirable recreational experiences and significantly less desirable ecological functions.

Based on the technical literature (citations appear in Section 2.3), it is anticipated that changes in the species composition of the forest over time will negatively affect the following ecological functions:

- ***Nitrogen Cycling and Stream Water Quality*** – Although the efficiency of nitrogen cycling in forests is dependent upon many factors including geography, climate, soil types, and forest stand ages, oak-dominated forests throughout the eastern U.S. typically have tighter control on nitrogen cycling than do beech/maple forests, releasing lower levels of nitrates from organic forest floor litter to adjacent streams. Oak forests also maintain a higher ratio of carbon to nitrogen in forest floor litter than other deciduous forest types because of high lignin content, which slows the decomposition rate of downed debris, and the movement of soluble nitrogen compounds through the landscape. Lignins also boost forest soils' capacity for storing and releasing water and cycling nutrients by adding very long-lived (hundreds to thousands of years), degradable-resistant biomass to the humus component, which supports myriad microorganisms and chemical processes that bring resource cycling efficiency and stability to the forest ecosystem. In these ways, oak forests are critical for the maintenance of high stream water quality and productive aquatic habitats at Oregon Ridge.

- ***Wildlife Habitat and Biodiversity*** - Thousands of years of dominance by oak forest types in the eastern United States have produced myriad interdependent relationships between oak forests and wildlife. At every spatial level, from the tallest trees in the canopy to the smallest plants on the forest floor, mammals, birds, amphibians, reptiles and countless insects and microorganisms feed on and are fed upon by other forest inhabitants in a complex food web that is driven by the presence of oaks. Native streamside trees and other plants in oak associations add annual pulses of food resources in the form of leaves and woody debris to macroinvertebrate communities that support high water quality stream system habitats for

aquatic plants, invertebrates, and fish species. Oaks are considered keystone species because of their significant contribution to the structural and biological diversity of the eastern forests and the critical processes that sustain the forest ecosystem. As an example, oak forests play a crucial role in the survival of hatchlings of most eastern forest bird species. In the spring, loopers, inchworms, and spanworms, the caterpillar stages of almost 200 species of forest moths, feed on the young leaves of oaks and other plant species in oak forest communities at a time when forest birds are foraging for hatchling food. Bird foraging reduces the insect pressure on the forest plants, allowing them to grow to their potential. The forest plants provide sufficient habitat for sustaining generations of birds that will consume other insects throughout the year. Oaks are primary hosts for gall wasps, whose larvae extend the food reserves into the summer and fall. From the fall to the winter, oaks continue to provide food in the form of acorn mast, which not only offers food for mammals and game birds, but also overwinters the larvae of acorn weevils that will provide additional food for birds and mammals the following year. In these ways, oak communities anchor a food web that supports a diverse range of higher feeding levels in the forest ecosystem.

As consulting foresters, Mar-Len Environmental considers that the oak-dominated forest that currently exists at Oregon Ridge Park can be perpetuated with sound management. As detailed in this report, for any forest management to succeed at Oregon Ridge, deer browsing must first be controlled. Without control of the deer population, regeneration of oak and other desirable forest species is not possible. Efforts must also be made to control the spread of invasive, non-native plant species. Once deer are controlled, standard sustainable forestry practices can be introduced to stimulate natural oak regeneration. These management recommendations require both a continuous and periodic commitment in order to succeed.

The level of forestry practices necessary to sustain natural oak regeneration is limited. Only parts of 6 of the 22 stands, with a combined area of 183 acres or only 20.4% of the total forest area, require silvicultural treatments for regeneration. A summary of recommended management actions for each stand is presented in Table 1.1, followed by a time schedule for these actions (Table 1.2), and estimated costs (Table 1.3).

More detailed information for management recommendations is presented in Sections 4.2, 4.4, and 4.6.

> *"There is little question that change is the only thing that is constant in forests. I believe that one of the overriding issues is not the fact that changes in oak composition and distribution are probably occurring all across the eastern forests but that the rapid rate of change is unprecedented in the context of biologic and ecologic time frames of the past. We are seeing changes in less than a single generation of oaks that we would have expected in 10 to 20 or more generations. Ecological balances are not being reached as a result of human induced changes. It is imperative that we strive to enhance our understanding of the short and long-term, direct and indirect implications of human activity on our forested ecosystems."*
>
> David Wm. Smith
> Emeritus Professor of Forestry
> Virginia Polytechnic Institute and
> State University
> 2005

Table 1.1: Summary of Forest Stand Management Recommendations for Oregon Ridge Park

Stand #	% Relative Density All species	Basal Area (sf/ac)	Existing Stand Condition	Stand Management Objectives	Recommended Management Action	Recommended Silvicultural Method
1	117.0	157.0	25 sq ft unacceptable stock	oak regeneration	reduce BA to 80 sf/ac	Single Tree Selection
2	124.0	152.0	52 sq ft unacceptable stock	oak regeneration	reduce BA to 80 sf/ac	Single Tree Selection
3	73.6	120.0	optimum for good oak growth	maintain stand health	control invasives	none
4	79.8	140.0	36.7 sq ft unacceptable stock	oak regeneration	reduce BA to 100 sf/ac	thin undesirable trees
5	108.5	133.3	>15 % slopes near stream	maintain stand health	control invasives	none
6	121.8	162.5	recently defoliated	reduce Gypsy moths	control invasives	none
7	110.5	143.3	>15% slopes near stream	maintain stand health	control invasives	none
8	101.5	147.5	steep slopes and streams	maintain stand health	control invasives	none
9	106.5	140.0	slopes and stream crossings	maintain stand health	control invasives	none
10	52.0	140.0	high recreational usage	maintain stand health	control invasives	none
11	66.3	103.3	young - low crowding	oak regeneration	control heavy invasives	none
12	93.4	138.6	40 sq ft unacceptable stock	oak regeneration	control invasives	Shelterwood Harvest
13	103.0	144.0	32 sq ft unacceptable stock; no oak regeneration	oak regeneration	reduce BA to 90 sf/ac; control invasives	Initial thinning to reduce crowding; in 5-8 yrs, create canopy gaps
14	101.8	137.5	steep slopes	maintain stand health	control invasives	none
15	109.7	146.0	32 sq ft unacceptable stock	oak regeneration	reduce BA to 70 sf/ac; control invasives	Single Tree Selection
16	56.8	140.0	former pine dominance	oak regeneration	control invasives	none
17	56.4	113.3	optimum for good oak growth	oak regeneration	control invasives	remove Ailanthus trees
18	92.0	122.0	>15% steep slopes	maintain stand health	none	none
19	106.7	142.0	oak dominated; over crowded	oak regeneration	control invasives	Shelterwood Harvest
20	115.9	130.0	very steep slopes	maintain stand health	control invasives	none
21	120.4	156.0	steep slopes	maintain stand health	control invasives	none
22	124.2	140.0	riparian area	improve stand health	control heavy invasives	remove Ailanthus trees

Note: See glossary for definitions of terms

Table 1.2: Recommended Time Schedule for Stand Management Activities

Stand	Recommended Management Activity	Total Acres	Activity Acres	Target Year #
1-22	Spray to control Gypsy moths	500+	895.7	1
1-22	Inspect annually for Gypsy moths	895.7	895.7	all
1-22	Control deer populations to 10 deer/sq. mi.	895.7	895.7	1
1-22	Control deer annually	TBD	895.7	all
1	Conduct Selection harvest for oak regeneration	37.0	6.0	2
2	Conduct Selection harvest for oak regeneration	33.5	4.4	2
3	Inspect for and control invasives	76.2	76.2	2
4	Selection harvest for regeneration	70.5	44.0	2
5	Inspect for and control invasives annually	18.9	18.9	3
6	Inspect for and control Gypsy moths annually	42.5	42.5	all
7	Inspect for and control invasives annually	24.7	24.7	3
8	Inspect for and control invasives annually	17.9	17.9	3
9	Inspect for and control invasives annually	38.2	38.2	3
10	Inspect for and control invasives annually	16.0	10.0	3
11	Inspect for and control invasives annually	5.2	5.2	3
12	Conduct 1st Shelterwood cut for regeneration	150.9	62.0	4
12	Conduct 2nd Shelterwood cut for regeneration	"	62.0	14
12	Conduct 3rd Shelterwood cut for regeneration	"	62.0	24
13	Conduct Selection harvest for oak regeneration	28.9	15.3	5
13	Conduct Group selection harvest for regeneration		5.0	10
14	Control invasives	17.5	17.5	5
15	Conduct Selection harvest for oak regeneration	44.3	3.3	6
15	Control invasives-eastern boundary	"	5.0	6
16	Inspect for and control invasives annually	14.1	14.1	6
17	Inspect for and control invasives annually	12.2	12.2	6
18	None	37.8	0.0	n/a
19	Conduct 1st Shelterwood cut for oak regeneration	105.6	48.0	7
19	Conduct 2nd Shelterwood cut for oak regeneration	"	48.0	17
19	Conduct 3rd Shelterwood cut for oak regeneration	"	48.0	27
20	Inspect for and control invasives annually	43.9	43.9	7
21	Inspect for and control invasives annually	42.4	42.4	7
22	Inspect for and control invasives annually	17.5	17.5	7

Note: Target Year represents relative sequence across stands and timing for multiple treatments within stands.

Table 1.3: Approximate Costs for Recommended Management Activities

Stand	Activity	Cost/ Unit	# Units	Total Cost
1-22	Spray for Gypsy Moth Control	$40/acre	896	$10,750
3,5-11, 14-17, 20-22	Control Invasive Plants	$150/acre	386	$57,900
1-22	Deer Control	$70/deer	TBD	TBD
Trails	Hazard Tree Removal	$200/tree	127	$25,400
Trails	Hazard Tree Trim	$75/tree	105	$7,875
Trails	Trail Maintenance	TBD/mile	3,168	$18,000
1,2,4,12, 13,15,19	Silviculture/Regeneration Harvests	$0/acre	183	No Cost

Notes: Spraying for Gypsy moths assumes treatment of the entire Park. Spraying is cost-shared by the MD Dept. Of Agriculture (70%) and Baltimore County (30%). Costs shown are the County's portion. Spraying is likely required periodically for all or a portion of the site.

Invasive plant control will be a continuing and variable activity.

Regeneration harvests performed by an industrial forester, as the operator and consultant, incur no cost. Regeneration harvests performed by a private consultant, on bid to commercial operators, incur a 10% commission fee on the total dollar value of the harvest, which is payable after the County is paid in full, so there is no out-of-pocket expense to the County.

2.0 FOREST HEALTH AND THE OREGON RIDGE PARK FOREST

2.1. BACKGROUND

This section presents general background information for the major landscape features associated with the forest system at Oregon Ridge Park, including location, bedrock geology, topography, soils, and hydrology. The forest and its landscape are a dynamic system, each influencing one another. Reference is made to the 22 forest stands delineated for the assessment, as described in detail in Section 3.0.

Location: Oregon Ridge Park, located in the Loch Raven watershed of Baltimore County, consists of 1,037 acres, of which approximately 895 acres are forested. This centrally-located Park contains the second largest acreage of forest owned by Baltimore County. The location of Oregon Ridge Park in the County and its relationship to the Loch Raven Reservoir watershed are presented in Figure 2.1.1.

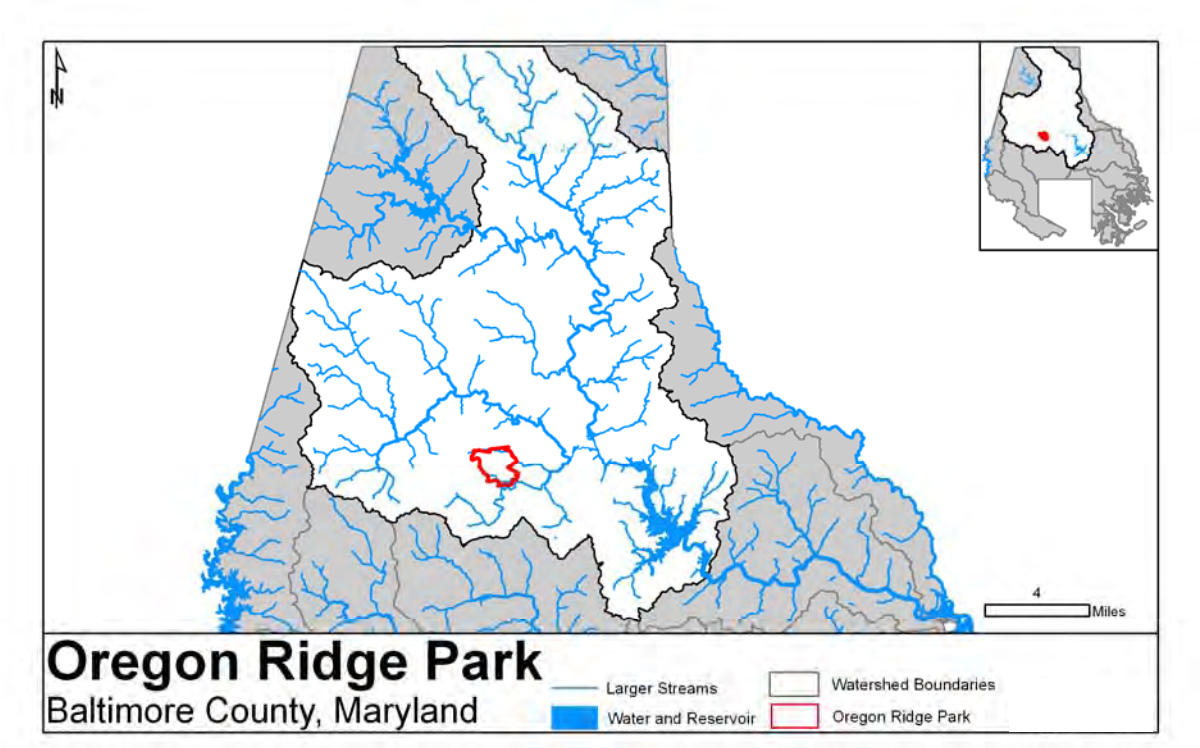

Figure 2.1.1: Location of Oregon Ridge Park and the Loch Raven Reservoir Watershed in Baltimore County.

Bedrock Geology: Oregon Ridge Park is located in the Piedmont Physiographic Province of Maryland, which includes most of Baltimore County with the exception of the southeastern portion that lies in the Coastal Plain Province. The Piedmont Province is composed of an underlying hard crystalline igneous rock, which at Oregon Ridge is the Loch Raven Schist. The floor of the valley formed by Oregon Branch on the north side of the Park is composed of Cockeysville Marble, a more-porous metamorphosed limestone formation. Only a small portion of the forest system at Oregon Ridge (stands # 10 (part), 11, 17, and 22) are located on the Cockeysville Marble. The generalized geology of Oregon Ridge Park is presented in Figure 2.1.2.

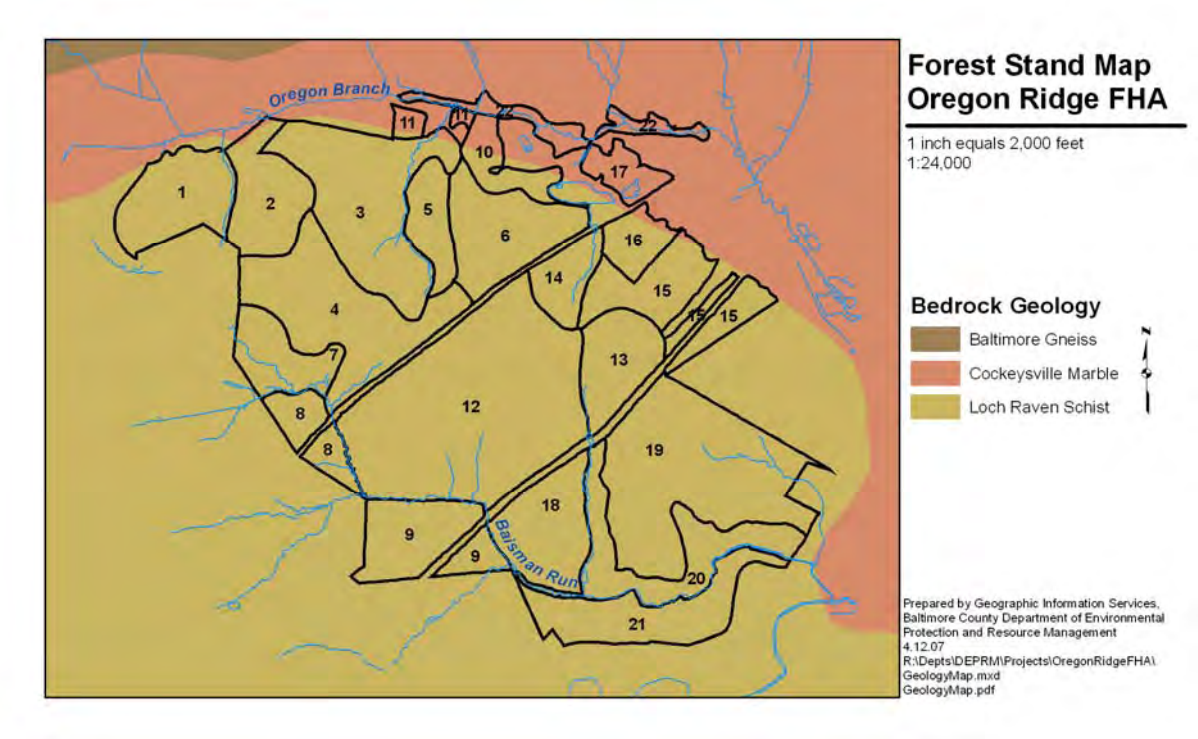

Figure 2.1.2: Generalized Bedrock Geology of Oregon Ridge Park.

Topography: When viewed from the north and east, Oregon Ridge is a prominent topographical feature. Elevations range from about 340 to 630 feet, yielding a local relief of 290 feet. The north and south faces of the ridge are well dissected by headwater tributaries to Oregon Branch and Baisman Run, respectively. As a result, most of the forest stands underlain by Loch Raven schist include considerable areas of steeper slopes: only stands 4, 12, 13, and 19 have large areas of less-steep forest. As presented in Figure 4.3.2 in the Stream Assessment section, 71.4% of the

Park is situated on slopes >15%. The topography of the Oregon Ridge Park and the 22 forest stands is presented in Figure 2.1.3.

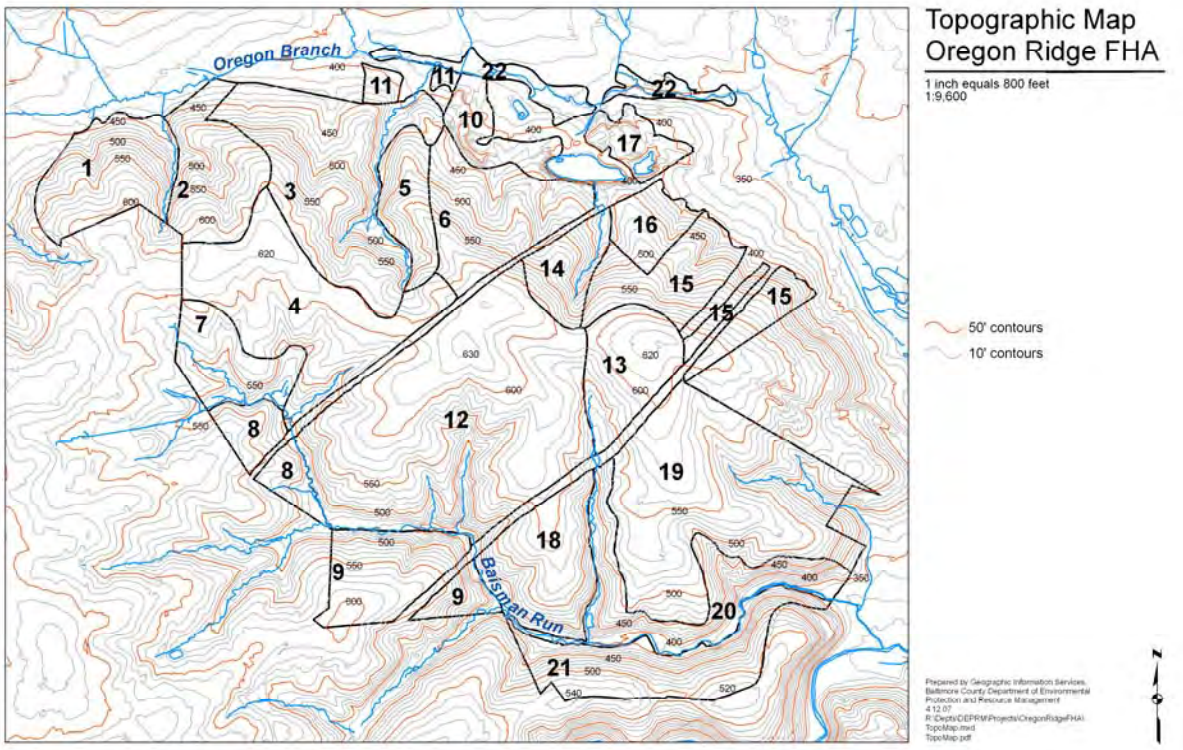

Figure 2.1.3: Topography of Oregon Ridge Park.

Hydrology: The hydrology of Oregon Ridge Park consists of 6.2 miles of stream segments that are part of Oregon Branch and Baisman Run, which drain to the Loch Raven Reservoir. Oregon Branch is located along the northern boundary with numerous first and second order streams flowing into Oregon Branch. Baisman Run extends west to east along the southern boundary of the property and has numerous smaller streams. Detailed information about the area's streams is found in the Stream Assessment Section (4.3).

The Pond Branch sub-watershed of Baisman Run (Stream #6 in this assessment) is currently the focus of intensive ecological studies as a reference site for the Baltimore Ecosystem Study, one of the national Long-Term Ecological Research (LTER) studies performed by a multi-party research collaborative funded primarily through the National Science Foundation. Information about this continuing research is found at: http://www.beslter.org.

Soils: Information about the soils in the Oregon Ridge Park was obtained from the U.S. Department of Agriculture, Soil Conservation Service's 1976 *Soil Survey of Baltimore County Maryland*. The majority of the soils are acidic, well drained and occupy gentle to steep slopes. Seven soil series are present with only man-made soils being non-productive for tree growth. All soils have a site index for oak of 75 or greater. Site index is a measure of site quality based on growth patterns of height dominant or co-dominant trees in even aged stands at age 50. The soils are all considered to be productive for tree growth. The site index for each of the dominant soil types for each forest stand at Oregon Ridge Park is presented in Table 2.1 and the location of major soil types for the Park is presented in Figure 2.1.4. Following the soils map, descriptions of the characteristics of the major soil types are presented.

Table 2.1: Dominant Soils of Oregon Ridge Park

Stand	Soil Type	Soil Name/Slope	Site Index - Oak
1	MbC2 MdE	Manor loam 8-15% Manor soil 25-50%	75-85 75-85
2	MdE MbD2	Manor soil 8-15% Manor loam 15-25%	75-85 75-85
3	MbD2 MdE	Manor loam 15-25% Manor soil 25-50%	75-85 75-85
4	GcC2 GcB2 McC2	Glenelg loam 8-15% Glenelg loam 8-15% Manor channery 8-15%	75-85 75-85 75-85
5	MdE McB2	Manor soil 25-50% Manor channery 3-8%	75-85 75-85
6	McC2 McD2	Manor channery 8-15% Manor channery 15-25%	75-85 75-85
7	GnB McD2	Glenville silt 3-8% Manor channery 15-25%	75-85 75-85
8	MbD2 MbC2 GnB	Manor loam 15-25% Manor loam 8-15% Glenville silt 3-8%	75-85 75-85 75-85
9	MdE GgC2 Cu	Manor soil 25-50% Glenelg channery 8-15% Codorus silt loam	75-85 75-85 95-Poplar
10	Ma	Made Land	
11	HaC2 GcC2 MbD2	Hagerstown silt 8-15% Glenelg loam 8-15% Manor loam 15-25%	85 75-85 75-85
12	McC2 GgC2	Manor channery 8-15% Glenelg channery 8-15%	75-85 75-85
13	EkB2 McC2	Elioak gravelly 3-8% Manor channery 8-15%	75-85 75-85
14	MdE	Manor soil 25-50%	75-85
15	McC2	Manor channery 8-15%	75-85
16	McC3 McD3	Manor channery 8-15% Manor channery 15-25%	75-85 75-85
17	Ma	Made Land	
18	McD2	Manor channery 15-25%	75-85
19	EkB2 McD2 GgC2	Elioak gravelly 3-8% Manor channery 15-25% Glenelg channery 8-15%	75-85 75-85 75-85
20	MhE McD2	Manor & Brandywine 25-65% Manor channery 15-25%	70-85 75-85
21	MdE	Manor soil 25-50%	75-85
22	McB2	Manor channery 3-8%	75-85

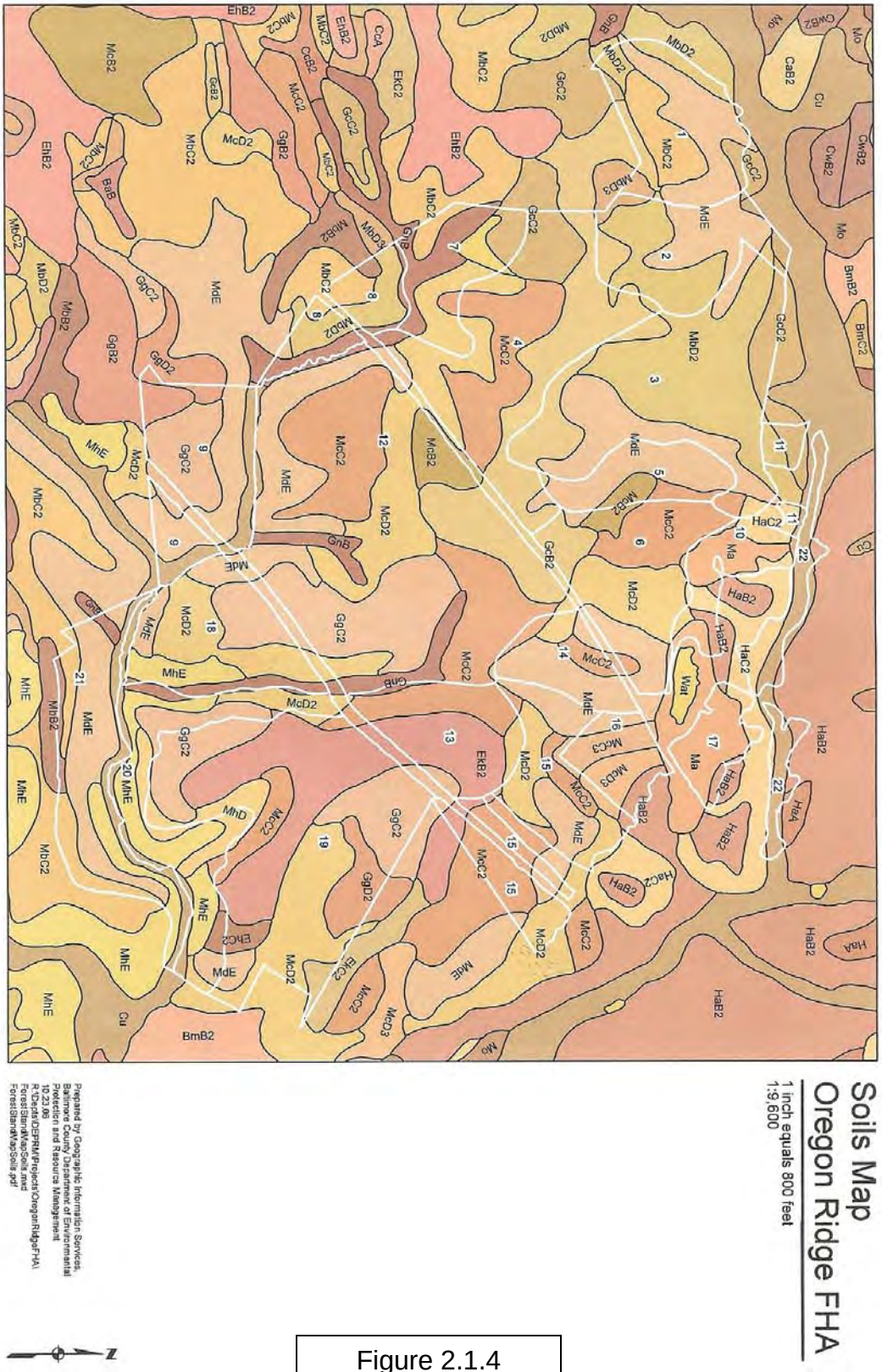
Soils Map
Oregon Ridge FHA
1 inch equals 800 feet
1:9,600
Prepared by Geographic Information Services
Baltimore County Department of Environmental
Protection and Resource Management
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Figure 2.1.4

SOIL DESCRIPTIONS:

Made Land (Ma) consists of land areas that have been created by man. Most made land in Baltimore County has been made from industrial wastes, mostly slag and cinders. Other areas consist of spoil material from excavations, or hydraulic fill from harbor or channel deepening. This land is so variable in nature that on-site investigation is needed to determine suitability and limitations for proposed uses. Capability unit and woodland subclass are not assigned.

Manor series consists of deep, well-drained to somewhat excessively drained, gently sloping to steep soils on uplands of the Piedmont. These soils formed in deep materials that weathered in place, mainly from such acid crystalline rock as mica schist. Consequently, these soils contain large amounts of mica. The native vegetation is mixed upland hardwoods, mainly oaks. Manor soils are easy to work. They are generally medium acid to very strongly acid. Permeability is moderate to moderately rapid and available water capacity is moderate. Slope and hazard of erosion are slight to severe limitations. MbC2,McC3, McD2, McD3, MbD2, MdE are highly productive with limitations to woodland use and maintenance to severe due to erosion hazard and slope. McB2 has major limitations to woodland management. MhE, Manor, and Brandywine very stony loam have slopes of more than 15%, except for a few highly erodible soils. Manor soils are highly productive but limitations to woodland use and management are moderate to severe because of slope and erosion hazard.

Glenelg series consists of deep, well-rained, gently sloping to strongly sloping soils on uplands of the Piedmont Province. These soils formed in material that weathered in place mainly from acid crystalline rocks such as mica schist. The native vegetation is mixed hardwoods, mainly oaks. The Glenelg soils are strongly acid or very strongly acid and are fairly easy to work. Permeability is moderate, and the available moisture capacity is moderate to high. Slope and the hazard of erosion are the main limitations to use. GgC2, Glenelg channery loam, is highly productive, with no limitations.

Glenville series consists of deep, moderately well drained to somewhat poorly are on the Piedmont Province. They are on flats, in depressions at foothills and around the heads of drains. They formed mostly in material weathered in place from underlying micaceous rocks, but in some places the upper part of the soil profile formed in local alluvium. The native vegetation is water tolerant hardwoods.

Glenville soils are fairly easy to work at a favorable moisture content. Wet in spring, these soils have a moderate available moisture capacity but permeability is moderately slow because of the fragipan. Glenville soils are limited for many uses by seasonal wetness, impeded drainage, restricted depth of the root zone, and in sloping areas by the hazard of erosion. GnB is highly productive but has moderate to severe limitations for heavy equipment due to seasonal wetness or high water table.

Codorus series consists of deep, moderately well drained to somewhat poorly drained, level to nearly level soils of the floodplains. These soils are mainly on the Piedmont Province but some extend along the major streams into the upper part of the Coastal Plain. The fluctuating water table is seasonally very high and soils are subject to flooding at irregular intervals. The native vegetation is mixed hardwoods that tolerate wetness. Codorus soils are fairly easy to work where moisture content is favorable; they are generally wet in spring. Available moisture capacity is high and permeability is moderate. Cu is highly productive but has moderate to severe limitations for the use of heavy equipment due to seasonal wetness or high water table.

Hagerstown Series consists of very deep, well-drained, nearly level to moderately sloping soils of the limestone valleys of the Piedmont Province. These soils formed in materials deeply weathered in place from fairly pure limestone marble. The native vegetation is mixed hardwoods including black walnut. Hagerstown soils are fairly easy to work at favorable moisture content. They generally are no more than slightly acid, have a high moisture capacity, and have a high natural content of plant nutrients. Permeability is moderate. There is erosion hazard in sloping areas. HaC2 is highly productive with moderate limitations to use of heavy equipment because of the plastic nature of the clay sub-soil. Plant competition is severe.

Elioak series consists of deep, well-drained, gently sloping to moderately sloping soils on uplands of the Piedmont Province. They are formed in material weathered in place from acid crystalline rocks that are high in mica. The native vegetation is mixed hardwoods, mainly oaks. Elioak soils are fairly easy to work if they are not too severely eroded. They are strongly acid and have high moisture capacity and are moderately permeable. EkB2 is highly productive but has moderate limitations on heavy equipment use because of the plastic nature of the clay sub-soil. Plant competition is moderate to severe.

2.2. HISTORICAL LAND USE BEFORE CONVERSION TO OREGON RIDGE PARK

From the forest stand data collected for this assessment, the estimated age of many of the stands suggests a regeneration time that concurs with the time that smelting operations at Oregon Furnace were transferred to Ashland Iron Works in the early 1850's. In *A History of Baltimore County*, Brooks and Rockel (1979) write that it took 1,500 acres of timber annually to supply enough charcoal for the Oregon Furnace to produce an annual 11,000 tons of pig iron. Some of the timber was probably harvested from what is now the Oregon Ridge forest. The age and size class distribution of the forest gives evidence of the forest being clearcut extensively in the late 1800's. Figure 2.2 is a depiction of the likely occurrence of logging activities that took place during that time.

Figure 2.2: Photo of Original Oil Mural "The Clear Cutting of Oregon Ridge" by Sandy Glover, mid-1990's, at Oregon Ridge Park Nature Center

2.3. IMPORTANCE OF FORESTS FOR WATERSHED FUNCTION

The Oregon Ridge Park forest is a jewel in Baltimore County's park system, offering Park users numerous passive recreational trails through diverse forest types and habitats. The forest provides not only a quiet environment for experiencing its aesthetic beauty, but also numerous opportunities to observe some of the animals that depend upon this complex ecosystem for their survival, especially forest interior dwelling birds. While these assets enhance the enjoyment of those who visit this forest, other less-observable forest functions involve managing the movement of water and nutrients through the watershed. These functions do more than provide beneficial services to the human and wild communities that live in the watershed. In a positive feedback system, they also provide the ecological conditions for sustaining the long-term health and diversity of the forest itself.

Forests play a major role in maintaining or improving the water quality of streams by slowing the movement of soil particles and nutrients from the land to the streams. The complex of root systems holds forest soils in place, while canopy and mid-story tree and shrub foliage dissipate the force of raindrops on the forest floor. In the warmer months, forest shade keeps soils cool and moist, providing microclimates suitable for the maintenance of microbial communities that process and recycle nutrients for forest growth and regeneration. Shade cast from forest trees also reduces stream water temperatures, slowing down some chemical processes that can lead to an increased release of nutrients associated with water quality degradation and the production of by-products that degrade water and habitat values. In the winter, the annual fall deposits of spent leaves and woody debris blanket the forest floor. This mat of detritus warms the soils, allowing the infiltration of melt water, and providing shelter for small animals and microbes that act as decomposing agents during the growing season. These forest functions conserve soil and recycle nutrients in the ecosystem.

Numerous studies of watersheds have provided evidence of the link between healthy forest ecosystems and good water quality (Carlton 1990, Dunne and Leopold 1978). Rainfall interception accounts for a reduction of 2-6% of flood-producing rainfall and 5% of the 40-45 inches of annual precipitation common in the eastern United States. Thick mats of annually renewed organic detritus, which can hold many times its weight in moisture, increase the water-holding capacity of the soils. Soil moisture is further conserved by the high shade of the canopy, which reduces transpiration rates in the lower vegetation during the growing season (18

inches of the 40-45 inches of annual precipitation common in the eastern U.S.). Forests also intercept a variety of elements and materials that would be otherwise deposited into the streams and reservoirs. These forest systems provide a line of defense against atmospheric deposition of heavy metals and acids and intercept groundwater pollutants, physically and chemically rendering them harmless

The compositional and structural diversity of forest ecosystems, including communities of native trees, shrubs, other woody and herbaceous plants, fungi, animals, and beneficial microorganisms, and non-living elements in the landscape, affect the quality and movement of surface and groundwater through watersheds. The maintenance of biological and structural diversity reduces a forest's vulnerability to serious damage from both major disturbances such as ice and wind storms, insect infestations, and disease outbreaks, as well as from more frequent but minor disturbances such as animal activity. Diversity also enhances the forest's resiliency in recovering from disturbance events. Forest diversity and vigor provide an efficient and effective means of protecting water quality and watershed function.

From a habitat perspective, the Oregon Ridge Park forest provides a diverse spectrum of habitat types for forest-dependent plant and animal communities. The compact, non-linear configuration of the forest consists of interior areas far enough away from the forest perimeter to experience fewer disturbances from the surrounding non-forest, even though the forest is crisscrossed with trails, gas line rights-of-way, and a former ski slope. The forest's size, shape, and topographical position results in a range of diverse habitat types along the ridge, on steep to mild slopes, in bottomlands, and along stream sides. All of these characteristics make the Oregon Ridge forest a very special asset of Baltimore County.

Wooded buffers provide a unique habitat for wildlife and probably are the most important areas within the forest. Riparian ecosystems support a greater diversity of wildlife than adjacent upland forest. Many species are restricted to or prefer the stream zone. The increased humidity of these areas is important for herpetofauna such as lizards, frogs and turtles. Root systems of woody vegetation provide cover for fish and aquatic invertebrates. More than eighty species of birds utilize stream side vegetation for summer feeding and nesting. They also provide habitat and food for a variety of fish, birds, mammals, insects and amphibians. Large and connected areas of forest offer the greatest diversity of habitats.

Forests are important to the Chesapeake Bay, as trees protect and improve water quality by reducing runoff and erosion in streams and by filtering out pollutants, including those from the air.

The ultimate health and functional quality of the streams, rivers, wetlands, and Coastal Bays of the Chesapeake Bay Watershed are tied to the dynamic well-being of the watershed's forests. The forest hydrologic cycle is presented below in Figure 2.3.

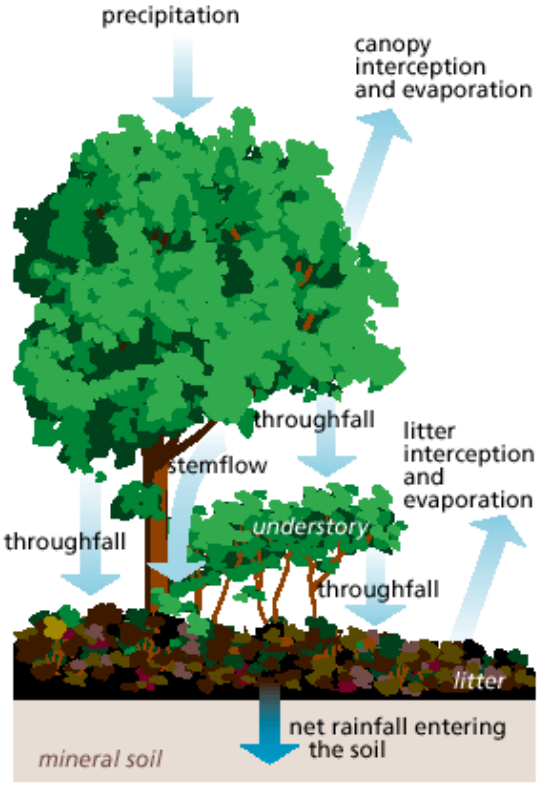

Figure 2.3: The Forest Hydrologic Cycle (MD DNR 2003)

The Oregon Ridge Park forest is especially valuable due to its oak dominance. Two broad areas of ecological function are supported to a high degree by oak forests:

- ***Nitrogen Cycling and Stream Water Quality*** – Although the efficiency of nitrogen cycling in forests is dependent upon many factors including geography, climate, soil types, and forest stand ages (Goodale and others 2002), oak-dominated forests throughout the eastern U.S. typically have tighter control on nitrogen cycling than do beech/maple forests, releasing lower levels of nitrates from organic forest floor litter to adjacent streams

(Lovett and others 2004). Oak forests also maintain a higher ratio of carbon to nitrogen in forest floor litter than other deciduous forest types because of high lignin content, which slows the decomposition rate of downed debris, and the movement of soluble nitrogen compounds through the landscape (Finzi and others 1998). Lignins also boost forest soils' capacity for storing and releasing water and cycling nutrients by adding very long-lived (hundreds to thousands of years), degradable-resistant biomass to the humus component, which supports myriad microorganisms and chemical processes that bring resource cycling efficiency and stability to the forest ecosystem (Fisher and Binkley 2000). In these ways, oak forests are critical for the maintenance of high stream water quality and productive aquatic habitats at Oregon Ridge.

- ***Wildlife Habitat and Biodiversity*** - Thousands of years of dominance by oak forest types in the eastern United States has produced myriad interdependent relationships between oak forests and wildlife. At every spatial level, from the tallest trees in the canopy to the smallest plants on the forest floor, mammals, birds, amphibians, reptiles and countless insects and microorganisms feed on and are fed upon by other forest inhabitants in a complex food web that is driven by the presence of oaks (Johnson and others 2002). Native streamside trees and other plants in oak associations add annual pulses of food resources in the form of leaves and woody debris to macroinvertebrate communities that support high water quality stream system habitats for aquatic plants, invertebrates, and fish species (Sweeney 1992). Oaks are considered keystone species because of their significant contribution to the structural and biological diversity of the eastern forests and the critical processes that sustain the forest ecosystem (Fralish 2004). As an example, oak forests play a crucial role in the survival of hatchlings of most eastern forest bird species. In the spring, loopers, inchworms, and spanworms, the caterpillar stages of almost 200 species of forest moths, feed on the young leaves of oaks and other plant species in oak forest communities at a time when forest birds are foraging for hatchling food (Wagner 2005). Bird foraging reduces the insect pressure on the forest plants, allowing them to grow to their potential. The forest plants provide sufficient habitat for sustaining generations of birds that will consume other insects throughout the year. Oaks are primary hosts for gall wasps, whose larvae extend the food reserves into the summer and fall (Cornell 1983). From the fall to the winter, oaks continue to provide food in the form of acorn mast, which not only offers food for mammals and game birds, but also over-winters the larvae of acorn

weevils that will provide additional food for birds and mammals the following year. In these ways, oak communities anchor a food web that supports a diverse range of higher feeding levels in the forest ecosystem.

2.4 PURPOSE OF THE FOREST HEALTH ASSESSMENT AND MANAGEMENT PLAN

The purposes of this project are to (1) assess the present condition of the Oregon Ridge Park forest, including to identify major stressors that could threaten the forest's long-term sustainability, and (2) to address 12 defined management questions, based upon the assessment data and observations, and to prepare a Forest Management Plan that has as its major objectives the conservation of forest health and regeneration, and structural and biological diversity.

The three major assessments conducted for this study include: (1) forest cover types by delineated stands, including overstory biological and structural characteristics and health, understory and ground-layer biotic and abiotic characteristics, (2) stream conditions, and (3) the trail system.

This Plan provides recommendations for silvicultural operations that may be taken to sustain natural oak regeneration without diminishing the functional value of the forest for water quality, wildlife habitat, passive recreation or forest health. The management recommendations prioritize actions for improving forest health and ecological conditions by the suppression of Gypsy Moth and non-native invasive plants, control of erosion, removal of hazardous trees, and - of paramount importance- the reduction of the white-tailed deer population.

2.5. PRESENT CONDITION OF THE OREGON RIDGE PARK FOREST

2.5.1 INTRODUCTION

Overall, the forest community consists of 22 forest stands in 4 forest cover types. Oak is the dominant cover type, comprising 80% of the 895 acres of forest on site. The majority of the overstory trees within each stand are healthy and exhibit good form and vigor. The average Basal Area, a measure of stand density measured at 4.5 feet above the ground and calculated using tree diameters in square feet per acre average, is 138.6 square feet. Forest stands throughout Oregon Ridge Park are even-aged, with an average of 499 trees per acre in all size classes. The overstory canopy closure on average is 85%, with a 27% midstory canopy closure.

The most significant threats to the sustainability of the forest at Oregon Ridge Park include Gypsy Moth infestations and a lack of tree regeneration due to excessive deer browsing. In the summer of 2006, Gypsy Moth activity resulted in the complete defoliation of Stand 6, and the moths were noted in a total of eight stands. If not suppressed, defoliations over multiple years will result in significant oak mortality in the Park.

The excessive deer population has altered the forest structure, impacted the herbaceous plant community, and hindered natural regeneration of oak, hickory and tulip poplar. These factors affect not only the current health and short-term condition of the forest, but also the long-term provision of forest ecosystem services.

Invasive species are common in the understory and include, but are not limited to, Japanese stilt grass, wineberry, Oriental bittersweet, White garlic mustard, barberry and seedlings of ailanthus. These exotic species thrive and tend to be very aggressive and opportunistic in trying to occupy space currently utilized by native species.

2.5.2 MANAGEMENT QUESTIONS AND ANSWERS

Mar-Len Environmental has been asked to answer the following questions based on the field assessments of the forests of Oregon Ridge Park:

1. ***Are the forest areas sufficiently diverse with respect to species composition and age classes of trees?***

   No: The current forest communities in Oregon Ridge Park lack multi-layered forest structures. Currently, there are 30 overstory species and 25 understory tree species within the forest stands. However, trees are found in only two size classes: 84% of all trees fall within the 18+" DBH size class, while the remaining 16% are in the 11-17.9" DBH size class. For the ground layer, 25% of all sample plots show no woody or herbaceous vegetation. In the remaining sample plots a total of 18 tree, 13 shrub, and 3 woody vine species were found, with one tree, 4 shrubs, and all vines classified as non-native, exotic species. The majority of the stands are close in age and even-aged due to past forest harvesting, including clear-cutting.

2. ***Do the forest areas show evidence of adequate regeneration or regeneration potential?***

No: Fifty four percent of the stands have no regeneration within the plots and all of the stands lack adequate regeneration. The most common regeneration is comprised of red maple and black gum. Both of these species are tolerant to shade. The seed source of the current dominant species (oaks) is adequate to re-populate the forest if corrective measures are taken.

3. Are there forest areas of very high quality that should be or have the potential to be managed for "old growth" conditions?

Yes: Stand No.3 (76.2 acres) has an age of 140 years and a medial DBH of 23.6 inches. Setting aside this stand would comprise eight percent of the Park's forest acreage. Currently this stand has a low relative density due to decline and mortality in mature trees. Natural mortality has created large canopy gaps and downed trees and woody debris.

4. Are the forests adequately protecting water quality, including streams that flow through the forest?

Yes: The majority of the 6.2 miles of streams have adequate canopy closure and channel stability. A detailed stream study is provided in Section 4.3 of this report.

5. Are the forests adequately protecting areas from soil erosion?

Yes: Oregon Ridge, as the name implies, has a central ridge running through the center of the forest with moderate-to-steep, north and south facing slopes. Currently, undisturbed areas show no signs of sheet or gully erosion; however, past activities caused erosion and it is evident that the forest has worked to stabilize the soil once the forest became re-established. As noted elsewhere, however, some of the Park's trail segments are becoming a localized source of erosion.

6. Are there forest areas that show evidence of forest pests, (including deer) or disease that need to be treated?

Yes: Stand No. 6, located directly behind the nature center was completely defoliated by Gypsy Moth. Gypsy Moth was also found in stands No. 3, 4, 5, 12, 13, 19 and 21; however, the impacts were not as severe. Locust leaf minor was noted in Stand 20; however, damage is insignificant. Gypsy Moth currently poses the greatest threat to the sustainability of the forest. Multiple defoliations will cause tree mortality.

Deer populations greatly exceed the carrying capacity of the forest ecosystem. This is evident from the intense browse line, lack of natural regeneration, and alteration of the forest structure. Failure to control the deer population will preclude any success with managing natural regeneration. Deer also pose a threat to the citizens in the community through vehicular accidents and deer-enhanced tick populations, thus increasing the potential for diseases such as Lyme disease, babesiosis, and human granulocytic anaplasmosis, which can be fatal.

7. ***Are there recreational uses or other human uses of the forest areas that threaten forest health?***

   No: Trail use has caused gully erosion on some trails, resulting in sediment transport into adjacent streams. A more detailed trail report and map can be found in Section 4.4 of this study.

8. ***Are there hazard trees that present high risk to public users in frequently-used areas such as trails or adjacent to buildings and roads?*** **Yes:** The Trail Study identified a total of 232 potential hazard trees that could pose a risk to the public. More detailed information in "Trail and Tree Maintenance" report and maps found in Section 4.4.

9. ***Is there evidence that the forest provides adequate habitat for desirable wildlife that would be expected to inhabit the forest?***

   No: Because of the stresses on the vegetation at Oregon Ridge Park from excessive deer browsing, the forest has lost structural diversity, which decreases the number and types of habitats available for the full range of forest-dependent wildlife. Most studies show that forests can sustain deer to a population of up to twenty per square mile (Pennsylvania State University 2002).

   Yes: Even so, the size and shape of the forest (almost 900 acres of contiguous forest in a compact shape) may provide suitable habitat for some forest interior dwelling bird species that can breed in smaller, intact forests (see the Wildlife Recommendations in Section 4.6).

10. ***Are there opportunities to add forest area without conflicting with established non-forest functions?***

    No: At 13% of the Park's area, the open fields at Oregon Ridge Park provide critical habitats for plants and animals that are not found within the forest. These open fields provide additional outdoor education. However,

ground-nesting species are losing valuable grassland habitats due to frequent mowing. Fields receiving occasional mowing should support sizeable populations of Grasshopper Sparrows and Eastern Meadowlarks, both of which are moderately area-sensitive grassland breeding birds (McCann and Battin 1999).

11. Are there areas of the forest that could benefit from silvicultural activities to improve forest health and vitality or ecosystem services of the forest?

Yes: The majority of the 22 stands have densities far in excess of what is desirable for each tree to have maximum growing space. The lack of regeneration is primarily caused by deer browse; however, the oak-dominant forest cannot naturally regenerate under the dense canopy in most stands. The closed canopy has made an ideal environment for shade tolerant species such as red maple and black gum and, without any silvicultural intervention, the existing forest will convert to red maple, beech and black gum, species that do not provide ecosystem services equivalent to that of an oak forest. Forest health and vitality will also be improved by reducing environmental stress caused by over crowding.

2.6. EXPECTED FUTURE TRENDS AND CONDITION WITHOUT MANAGEMENT

Different oak species can grow in a range of light conditions; however, none are considered shade tolerant to the same degree as red maple and black gum. Dense canopy closure will likely hinder the development of those oak species that require greater light for acorn germination, while heavy selective deer browsing on the oaks will suppress seedling development. Good acorn crops are typically produced in two to ten year intervals. During this time, small canopy gaps produced by the death of individual trees may provide some sunlight for oak regeneration. However, oaks that are stressed by insufficient light and repeated deer browsing will not compete as successfully with shade tolerant species as they could with optimum habitat conditions.

Without forest stewardship to produce larger canopy gaps, the oaks will yield dominance to more shade tolerant species. Over time, the forest at Oregon Ridge Park will undergo change to a red maple, black gum, and beech dominated tree community. This change can have a significant impact on the forest's ability to

manage atmospheric inputs of nitrogen, to protect water quality, and to sustain adequate habitats for the animal communities adapted to and dependent upon oak-dominated forests.

2.7. ANTICIPATED LONG-RANGE CONDITION WITH MANAGEMENT PLAN IMPLEMENTATION

If the forest management recommendations as presented herein are followed over a multi-year period to maintain oak dominance in the forest canopy, in association with control of the deer population, invasive species, and forest pests such as Gypsy moth, it can be expected that the Oregon Ridge Park's forest will be characterized as a healthy, sustainable oak-dominated forest that includes the following elements:

- Vigorous and healthy trees and dependent plant communities
- Reduced stresses from pests (Gypsy moth) and diseases
- Managed deer population to insure oak regeneration
- Suppressed or eradicated non-native, invasive plant species
- Forest stands thinned to reduce environmental stresses imposed by overcrowding, and to promote oak regeneration in the increased light through canopy openings
- Streams and their aquatic communities protected by vigorous and healthy adjacent riparian forest buffers
- Neotropical migratory birds and other forest-dependent wildlife species assured adequate forest interior habitat with structural and biological diversity
- Long-term conditions to promote the functional sustainability of the oak-dominated forest ecosystem
- A visually pleasing forest that provides passive recreational opportunities for the citizens of the County and the region.

3.0 ASSESSMENT METHODS

3.1. FOREST STRATIFICATION AND STAND DELINEATION PROCEDURES

Data types were selected to provide the ability to analyze stand level conditions. Forest types, tree size classes, and relative position within the landscape were used to initially stratify the forest. This stratification led to the mapping of 22 different stands. Each stand was sampled using line-transect and plot sampling methods. Transects were laid out in the office against topographic gradients, to capture the greatest degree of diversity. Sampling units were spaced equidistant from each other in an alternating pattern.

Field work was started in May, 2006 and completed in August, 2006. Because forests are dynamic systems and constantly changing due to lightening strikes, storm damage, flooding, natural mortality, and insects and disease, there may be changes in the condition of the forest. The approximate location of each sample plot is presented in Figure 3.1. The GPS data points are listed in Section 7.3.

3.2. SAMPLING PROCEDURES IN OVERSTORY AND UNDERSTORY

Throughout the entire tract, 213 GPS points were set with numbered flags in the field. Basal Area was recorded at each GPS point. Using NED's statistical database, it was determined that 118 over story plots were needed to provide a confidence level of 68%.

The overstory sampling unit evaluated the percent cover of the overstory (>30 feet height) and the mid-story (10-30 feet height). Canopy closure was determined at each plot location. Other data recorded at the overstory sampling unit included tree species, diameter at breast height (BDH), condition (living or dead), tree quality, presence of tree cavities, crown class, crown condition, and presence of insect infestation. Data were also collected along transects between sampling units to evaluate downed biomass, including the diameter, condition, and bark of dead and downed coarse woody debris.

The overstory and midstory trees $\geq$ 2" DBH were counted, utilizing a variable point sampling method to determine Basal Area (BA). Using the BAF (Basal Area Factor)

10 factor prism, two variables can be taken into account: the diameter of the tree, and the distance from the center of the plot. In Figure 3.2 below, trees with a larger diameter have a larger radius. Larger trees can be further away from the center of the plot and still have the radius overlap the sample location, allowing them to be counted. For every inch of diameter, a tree can be 2.75 feet away from the sampling point center and still be counted. For example, a 36-inch diameter tree will be 99 feet (2.75 X 36) away and still be counted in the plot. Trees that appeared to have a diameter as great or greater than the sighting angle of the prism were counted and were used to calculate the Basal Area, the total cross-sectional area of woody tissue in square feet per acre.

Each understory sample assessed the forest floor ground cover (herbaceous and woody cover from 0 to 2 feet in height) within a 5.26 foot radius (0.05 acre) area, and the shrub cover from 3 to 10 feet in height within a 1/100 acre plot. The data collected in these understory sampling units included regeneration of sprout origin; shrub, moss, litter, rock, fern, grass and sedge cover; riparian plot; and deciduous, ericaceous, and wetland shrubs; wetland ground vegetation; ground and shrub species observed, and the percent cover of each species. Trees per acre ranging from ≥2" in diameter and natural regeneration were collected within the 1/100 acre plot.

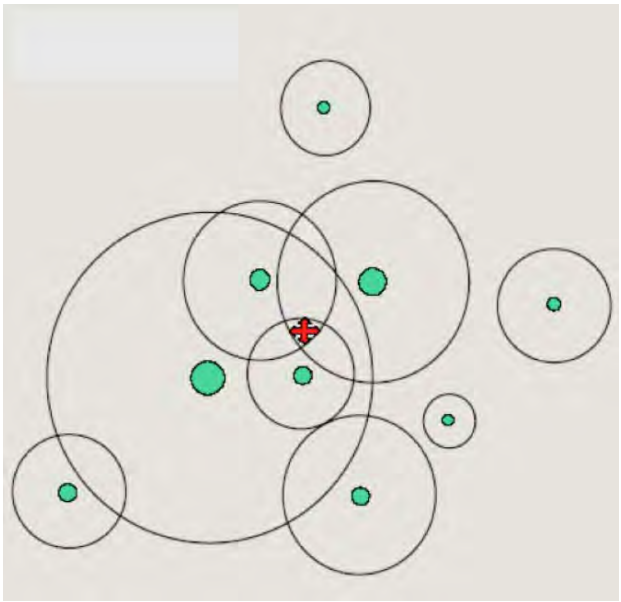

Figure: 3.2: Plot with Sampling Points. Source: Mueller-Dombois and Ellenberg, 1974.

3.3. NORTHEAST DECISION MODEL

NED is a collection of software tools created to help natural resource managers develop goals, assess current and future conditions, and produce management plans for forests in the eastern United States. The contract for the Oregon Ridge Park assessment requested use of NED-1. After Mar-Len Environmental was selected to conduct the assessment, we determined that the use of NED-2, an enhanced version of NED, could be more useful and proceeded with that version with Baltimore County's approval. The tools are being developed by the USDA Forest Service in cooperation with many others. NED-2 emphasizes the analysis of inventory data for various forest resources on a management area up to several thousand hectares (1 ha = 2.47 acres). The resources it addresses include visual quality, ecology, forest health, timber, water, and wildlife. NED-2 evaluates how a management unit as a whole, or an individual stand, may provide conditions required for specific goals Twery and others 2005).

NED-2 users may select a variety of reports including tabular summaries, general narratives, and goal specific analyses. An extensive hypertext system provides the user with information about the goals, the desired conditions that support those goals, and related data used to analyze the condition of the forest, in addition to detailed information about the program itself and the rules and formulas used in the analyses. The software is written in C++ using an application framework, and the inferencing component that handles the rule bases uses Prolog. NED-2 is part of a series of software products developed collectively under the name NED.

NED software is intended to help resource managers develop goals, assess current and future conditions, and produce sustainable management plans for forest properties. The software tools are being developed by the USDA Forest Service, Northeastern Forest Experiment Station. NED is coordinated by research work unit NE-4454 in Burlington, VT, in cooperation with other research units in the Northeastern, North Central, and Southern Research Stations. Many state and educational institutions also work in conjunction with the Forest Service on this project. Thus, as the geographical scope of the project expanded, the software originally known as the Northeast Decision Model lost the regional reference in its name and has become simply NED.

3.4. STREAM ASSESSMENT METHODS

A stream assessment was performed for the 6.2 miles of streams within Oregon Ridge Park using a modified version of the Rapid Stream Assessment Technique (RSAT), developed for Montgomery County, Maryland, by the Metropolitan Washington Council of Governments (Galli 1996). The stream study was performed in the month of June, 2006. All flowing first order or greater streams were labeled, as presented in the Findings Section in Figure 4.3.1. Each stream was traversed and broken into an average of 300-foot segments for data collection. Of the six factors traditionally used in the RSAT evaluation, Mar-Len Environmental utilized channel stability and riparian habitat conditions.

Channel stability is indicative of hydrologic flow regime alteration and general condition of physical aquatic habitat. Four categories were scored:

- **Excellent:** 80% or greater of the bank network stable, no evidence of bank sloughing, slumping or failure.
- **Good:** 71-80% bank network stable, infrequent signs of bank sloughing, slumping or failure.
- **Fair:** 50-70% bank network stable, recent signs of bank sloughing, slumping or failure.
- **Poor:** less than 50% of bank network stable, recent signs of bank sloughing, slumping or failure.

Riparian Habitat Condition provides insight into changes in stream energetics, temperature regime, and both aquatic and terrestrial habitat conditions. Four categories were scored:

- **Excellent:** 200 feet or greater mature forest along both banks.
- **Good:** Forest buffers generally more than 100 feet wide along both banks.
- **Fair:** Riparian areas predominantly wooded but with major localized gaps.
- **Poor:** Riparian areas mostly non-woody vegetation; narrow width riparian areas.

Results of the stream assessment are presented in Section 4.3.

4.0 FINDINGS AND RECOMMENDATIONS

4.1. SUMMARY DESCRIPTION ACROSS FOREST STANDS

The 895± acre forest contains 22 stands, which were delineated based upon forest type, size classes of the dominant trees (overstory), age, and stand conditions. Stand delineation divides the forest into smaller management units that allow more detailed data on forest species composition, structural diversity, tree health status, and landscape features. Stand delineation also allows a fine-tuned assessment of current or potential problems arising from a range of stressors, including serious plant decline from disease, insect infestation, and severe competition from crowding. Other products of the stand assessment include observations of erosion, soil compaction, and hazard trees along trails, stream and wetland conditions, and the impacts of deer and exotic, invasive plants and animals on forest health and sustainability.

Four forest types and 2 size classes were identified within the overstory of the 22 forest stands. Fifteen of the stands are dominated by oak forest types, 5 stands by oak/tulip poplar associations, and the remaining 2 stands by other species of hardwood forest types. Stand sample plots identified 30 tree species in the overstory, 25 tree and shrub species in the understory plots, and 34 woody and 44 ground-layer species at the ground level.

Throughout the forest, the size class defined as large sawtimber (23.5+ inches dbh) is three times as common as the small sawtimber size class (11.5 to 17.5” dbh). The majority of the stands are close in age, due to past human activities, which may have included charcoal production for the Oregon Furnace. Smaller size classes, from regeneration to sapling to pole (5 to 11.5” dbh) are virtually absent. Plants in this group were not found in 25% of the sample plots. Several factors, which are likely contributing to the lack of regeneration include a mostly closed canopy, which blocks light for the seedlings of shade-intolerant tree species, high deer browsing pressure, and the distribution of exotic, invasive plant species that not only compete for habitat and nutrients (Webster and others 2006), but in some cases, emit substances that retard growth into the surrounding soil. An example of the latter is Garlic mustard (Prati and Bossdort 2004).

4.2. STAND-BY-STAND REPORTS AND MANAGEMENT RECOMMENDATIONS

4.2.1 INTRODUCTION

All silvicultural recommendations are made for the sole purpose of establishing natural regeneration. Quercus is the genus in which all oaks are classified. This genus has three subgenera, of which only two are found in the United States: Lepidobalanus, which includes the white oaks, and Erythrobalanus, which includes the red and black oaks. The red oak group takes two years to produce an acorn crop while the white oak group develops acorns annually. Both produce maximum acorn production from age 50 to 200 years (Eyre 1980).

All plants with chlorophyll require sunlight to become established and survive. Adequate sunlight is crucial for successful oak regeneration. Trees that compete best for full sunlight are often found in the upper canopy of the forest.

Tulip poplar trees are one of many forest tree canopy species that require full sunlight to become established and are considered intolerant to shade. As a group, oak species in the Eastern forests are considered mid-tolerant and can become established in, but can not thrive in, partial shade as when overtopped.

The forests enjoyed by citizens today are the result of frequent clearing or large scale disturbances, where soil disturbances created ideal seed beds for acorns to become established. Repeated fires aided oak regeneration and canopy removal provided adequate sunlight, which increased the plants' photosynthetic production and in turn stimulated regeneration.

A study by Hix et al. (1991) in Maryland found that oak regeneration in general decreased after Gypsy moth defoliation. The combination of weakened trees and repeated deer browsing on oaks gives competing vegetation such as red maple, black gum, beech and exotic invasive species greater advantage in occupying forest openings. The population of Red Maple and other species that are negatively affecting the growth and development of oaks and Tulip Poplar through aggressive competition should be controlled by mechanical or chemical means.

4.2.2 REQUIREMENTS FOR SUCCESSFUL REGENERATION OF OAK STANDS

As detailed below, the number of oak seedlings per acre necessary to sustain oak regeneration, up to 77,000 per acre where deer pressure is high, vastly exceeds the current number of tree seedlings of all species at Oregon Ridge Park. The forest health assessment found an average of only 269 tree seedlings per acre, considering all species. This reinforces the concept that deer control is a critical pre-requisite for successful regeneration of the future forest at Oregon Ridge Park.

The following information is an e-mail from Susan L. Stout, Research Project Leader, USDA Forest Service, Northern Research Station (P.O. Box 267, Irvine, PA 16329-0267). She reports this summary from Pete Knopp (U.S. Forest Service):

> "I would advise someone to not just think only about the number of seedlings, but what SIZE they are, and how much other vegetation is already occupying the site.
>
> Here's a per-acre workup that is based on stocked plot counts we use, under the assumption of regeneration data taken on 6-ft radius plot, (representing one 385th of an acre; that is, the plot size is chosen by selecting the number of trees per acre we expect when the stand reaches an average diameter of 6").
>
> The values I'm showing are "per acre" values.
> Definitions of oak seedling sizes are as follows:
> **New oak** = seedlings < 6 inches tall or with root collar less than 1/4 inch diameter.
> **Established oak** = seedlings 6 inches to 3 ft tall or with root collar diameter between 1/4 inch and 3/4 inches.
> **Competitive oak** = seedlings over 3 feet tall or root collar diameter > ¾ inches.
>
> - **New oak seedlings** required when you have deer pressure:
> Very High deer = 77,000, High deer = 38,516, Medium deer = 19,258 per/ac.
> - **Established oak seedlings:**
> Very High deer = 38,516, High deer = 19,258, Medium deer = 9,629 per acre.

- **Competitive oak seedlings:**
  These are assumed out of reach of deer and/or very readily grown out of reach of deer once released, so the number of competitive oak seedlings doesn't vary with deer pressure. Instead, the required number of competitive oak seedlings varies with Site Quality:

  Good site (high fertility and moisture) = 1,156 per acre.
  Fair site (so-so or fair nutrients and moisture) = 770 per acre.
  Poor site (poor nutrients and dry sites) = 385 per acre.

4.2.3 STAND RECOMMENDATIONS

Note: Deer must be controlled prior to any type of activities to increase regeneration in ALL stands, as well as removal and control of undesirable vegetation that hinders the development of the desired natural regeneration, especially Red Maple.

Stand 1:
Currently this stand has a relative stand density of 117%. This coupled with a BA of 157 sq.ft. per acre average makes this stand grossly over stocked. To reduce environmental stress and aid in oak regeneration, a single tree selection harvest is needed to reduce the BA to 80 sq.ft. of acceptable growing stock. The thinning will open the canopy and allow sunlight to reach the forest floor creating a more conducive environment for oak regeneration. The thinning will remove 25 sq. ft. of unacceptable growing stock and 50 sq. ft. of the least desirable acceptable trees. The majority of this stand has slopes of 15% or greater and a large un-cut buffer should be left along the stream in the stands eastern boundary. On the northern portion of the stream, trash, car parts, and urban debris in general should be removed. Grapevine should be cut and eradicated as it is hindering the development of native trees.

Stand 2:
Management objectives for this stand should be to favor oak trees with acceptable form and vigor by reducing the relative density, which is currently 124%. The BA is 152 sq.ft. per acre, average, with 52 sq.ft. in unacceptable growing stock. A single tree selection should be undertaken to remove all of the unacceptable growing stock as well as 20 sq.ft. of acceptable growing stock, leaving a residual BA of 80 sq.ft. per acre average of acceptable stock. A minor population of wineberry, found around plot #1, should be controlled and monitored.

Stand 3:
This stand contains 8% of the acreage in forest at Oregon Ridge and should be left alone for potential old growth. Currently this 140 year old stand has a low relative density of 73.6% which is optimum range for good tree growth. This stand contains a large stream and wetland system as well as steep slopes. Canopy gaps and downed large trees are common. The stand should be inspected annually for invasive plants, which are currently not a problem, and they should be eradicated as needed.

Stand 4:
This is one of the least sensitive sites, in that only 33% of the site has slopes 15% or greater. The relative density is 79.8%, which is not over stocked; however, the BA is 140 sq.ft. per acre average and contains 26% undesireable trees. Because the stand has almost no oak or tulip poplar regeneration, a thinning to reduce the undesirable trees can ensure that the seed crop is from a high quality genetic pool. The BA should be reduced to 100 sq.ft., where only acceptable growing stock is left. This can be done in a light thinning for pulpwood. The stand should be re-inspected in ten years and its stocking should be re-evaluated. Wineberry, Japanese stilt grass, multiflora rose and ailanthus were found within the site with a high population of exotics found west of plot #5. They should be removed per recommendations in Section 4.6.

Stand 5:
This sensitive stand borders a stream along its entire western boundary, and the entire site contains slopes of 15% or greater. Due to the site sensitivity, no activities involving equipment are recommended; however, the stand should be checked on an annual basis for invasive/alien plants and controlled as needed.

Stand 6:
Recently defoliated, the highest priority is to reduce the Gypsy Moth population before the second defoliation occurs (defoliated 2006). The relative density is high and the trees are currently under stress due to crowding. A second defoliation may cause a high mortality rate which will need to be addressed for public safety. This area is currently utilized for hiking, a weather monitoring station, and an educational exhibit of a historic Indian dwelling. Wineberry is located in and around plot #6 and should be eradicated.

Stand 7:
This sensitive stand borders a stream along its entire southern boundary with 78% of the site containing slopes of 15% or greater. Due to the site sensitivity, no activities involving equipment are recommended; however, the stand should be checked on

an annual basis for invasive/alien plants and controlled as needed. Japanese stilt grass, wineberry and multiflora rose are found in and around Plot #2, #4 and #5.

Stand 8:
Access to the stand is very difficult, as the site contains steep slopes and numerous streams, making active management almost impossible. The stand should be checked on an annual basis for invasive/alien plants and controlled as needed. Wineberry and barberry are currently in and around plot #3.

Stand 9:
This stand is also difficult to access due to slopes and stream crossings. Currently, the stand has a high BA of 140 sq.ft. per acre average and a relative density indicating that it is over-stocked at 106%. This stand has been harvested in the past, probably prior to the adjacent development to the south. No silvicultural activities are recommended outside of control of invasives, which include Japanese stilt grass, barberry and wineberry, with the highest populations around plots #1, #10 and #13.

Stand 10:
This stand is currently used for recreation. Paved trails and educational signs are posted throughout a large portion of this stand. Due to its high recreational usage, no silvicultural activities are recommended with the exception of monitoring and controlling invasive species annually. Japanese stilt grass, wineberry and bittersweet in and around plots #1 and #3 but not uncommon to the rest of the stand. These plants should be eradicated.

Stand 11:
This young stand is the result of secondary succession where old fields have converted back to forest. Crowding is currently low with a relative density of 66.3%. The focus should be on controlling the high percent of invasive shrubs and other understory plants. The recent survey revealed there was no regeneration in native species. Invasive plants are heavy throughout the entire stand and consist of wineberry, Japanese stilt grass, barberry, ailanthus, bittersweet and multiflora rose. These plants should be eradicated and inspected yearly.

Stand 12:
This is the largest stand, consisting of 150.90 acres with 62 acres containing relatively flat areas that will not impact stream integrity should silvicultural management be undertaken. This stand has a relative density of 93.4% making the stand slightly over stocked. The BA is 138.6 sq.ft. per acre average with 29% or 40 sq.ft. of BA in unacceptable growing stock. To ensure that oak and tulip poplar

dominate the forest in the future, a shelterwood harvest should be undertaken to increase desirable natural regeneration. It is recommended that the harvest be carried out over a period of 20 years. Listed below in the Silvicultural Systems section, is a detailed description of the shelterwood process. Invasive plants such as Japanese stilt grass, honeysuckle vine, barberry and wineberry can be found in and around plots #11, #14, #18 and #33. These plants should be eradicated and the site inspected yearly.

Stand 13:
The majority of this stand, 15.32 acres, is available for management. It is dominated by mixed oak species, which account for 80% of all trees on site. Oak regeneration is almost non-existent. To ensure a future oak-dominant stand, the current BA of 144 sq.ft. per acre average should be reduced to a BA of 90 sq.ft. of acceptable growing stock utilizing a single tree selection harvest. The initial thinning will ensure that genetically viable seeds are produced for the future and that the additional reduction in crown competition will allow for more mast production. Five to eight years after the initial cut, one half to one acre openings should be created to allow oak and tulip poplar to become established in full sunlight. This process is called Group Selection and is detailed in the Silvicultural Systems Section in this report. Invasives should be controlled post-harvest, including wineberry and barberry near plots #3 and #7. Areas should be inspected yearly.

Stand 14:
No activity involving equipment is recommended for this stand due to its steep slopes and the sensitive nature with the relationship to the stream. Control invasive wineberry near plots #1 and #3, and inspect and treat yearly.

Stand 15:
This stand is comprised of three contiguous areas. The eastern-most portion is dominated by highly invasive exotic plants that need suppression. The main body of this stand has a relative density of 109% with only 40 seedlings per acre. To ensure a future stand, a single tree selection reducing the current BA of 114 sq.ft. per acre average to 70 sq.ft. of acceptable growing stock will help facilitate natural regeneration with the sunlight hitting the forest floor through canopy gaps. Single tree selection, however, does favor more shade tolerant species and invasive plants must be controlled. Dense oriental bittersweet as well as wineberry are hindering the development of understory plants around plot #10.

Stand 16:
A result of secondary succession, pines once dominated this stand. Pines currently occupy less than 4% of the species composition. A priority is to remove all invasive

and exotic species such as oriental bittersweet, barberry, and multiflora rose, which now dominate the understory. Japanese stilt grass is found around plot #7 and vines are heavy in the overstory. These should be cut and controlled.

Stand 17:
A priority is to remove all invasive, exotic species which now dominate the overstory and understory. Large Ailanthus trees are providing seed sources that are probably moving off site and these trees should be cut and their stumps should be treated with triclopyr to prevent re-sprouting. See section 4.6.

Stand 18:
This stand is bordered by streams on three sides and has no access for management. Eighty four percent of this area contains 15% slopes or greater; therefore, no management is recommended.

Stand 19:
This oak-dominated stand has an effective age of about 120± years. This stand contains approximately 20 seedlings per acre average. The relative density is 107%, which makes this stand over crowded. Currently the BA is 142 sq.ft. per acre average and, in order to allow natural regeneration to establish after the deer are controlled, a shelterwood harvest should be carried out. This three-step system is detailed in the Silvicultiural Systems section below.

Stand 20:
Because this is a very steep stand (100% steep slopes) with highly erodible soils, no management is recommended. Invasives should be monitored yearly. Baisman Run extends along its entire southern boundary. Japanese stilt grass and wineberry exist in light populations and should be monitored and controlled.

Stand 21:
This stand is 90% steep slopes and contains Baisman Run along its entire northern boundary. No management with equipment is recommended. Invasive plants should be monitored yearly and controlled. Japanese stilt grass was found near the stream channel north of plot #5. No management is indicated due to the sensitivity of the site; however, invasive plants should be eradicated.

Stand 22:
The entire site is considered a riparian area and has a highly invasive understory that needs to be controlled and monitored yearly. Garlic mustard, oriental bittersweet, privet, wineberry, multiflora rose, and ailanthus seedlings are found throughout the stand.

A summary of recommended management actions for each stand is presented in Table 1 in the Executive Summary.

4.2.4 TYPES OF SILVICULTURAL SYSTEMS FOR REGENERATION

At the time of the inventory in 2006 and currently, inventory work shows that the forest within Oregon Ridge Park exhibited extensive and intensive lack of natural regeneration. The sustainability of the forest, and its value, are dependent upon the continued recruitment of small trees, seedlings, shrubs, and herbaceous plants. Silvicultural treatments that guide the existing forest community toward the development of advanced regeneration (seedlings, saplings, etc.) are called ***reproductive methods*** and are rightly considered to be a part of a complete silvicultural system. Compounding the constraints on the choice of regeneration systems is the presence of extremely high deer populations, which is the principal cause of the present lack of suitable advanced regeneration. Deer control needs a commitment, prior to any regeneration activity.

A recommended time schedule for these management actions is presented in Table 2 of the Executive Summary, followed by estimated costs (Table 3).

The following sub-sections describe several types of reproductive methods including the advantages and disadvantages of each. Following the descriptions, several Stand Visualization System (SVS) diagrams are presented as generated by the NED software. The SVS diagrams include visualizations of current conditions for a selected stand and two visualizations of the stand for future years as the forest responds to the silvicultural treatment.

1. SINGLE TREE SELECTION METHOD

Selection is a regeneration method in which individual trees are periodically (commonly every 10-15 years) harvested based on their density, size, species, quality, condition, and spacing. Selection is used to create and maintain an uneven-aged stand. When individual trees are selected for harvest (individual-tree selection), they are replaced either by new seedlings or by small trees already present. Individual-tree selection is best suited for shade-tolerant species. Aesthetically, individual selection has the least visual impact of any regeneration method. The overall integrity and appearance of the forest is only slightly modified, and after a few years much of the residue from the harvest will have decomposed.

SELECTION	
Advantages	Disadvantages
• Maintains continuous forest cover on land. • Usually perceived as having less visual impact. • Forest usually less susceptible to wind, insect, and disease damage. • Reproduction not exposed to heavy competition from herbs and shrubs. • Can combine intermediate and regeneration harvests into one. • Some form of natural reproduction will occur. • Beneficial to some forms of wildlife.	• Takes more skill to implement than other regeneration methods. • More expensive in terms of inventory, marking, and harvesting. • Trees harvested are variable in size. • Some damage to residual trees may result. • Some residual trees may develop epicormic branching. • May be detrimental to some wildlife species requiring openings and early successional vegetation.

Stand Visualization System Diagrams for Single Tree Regeneration Selection

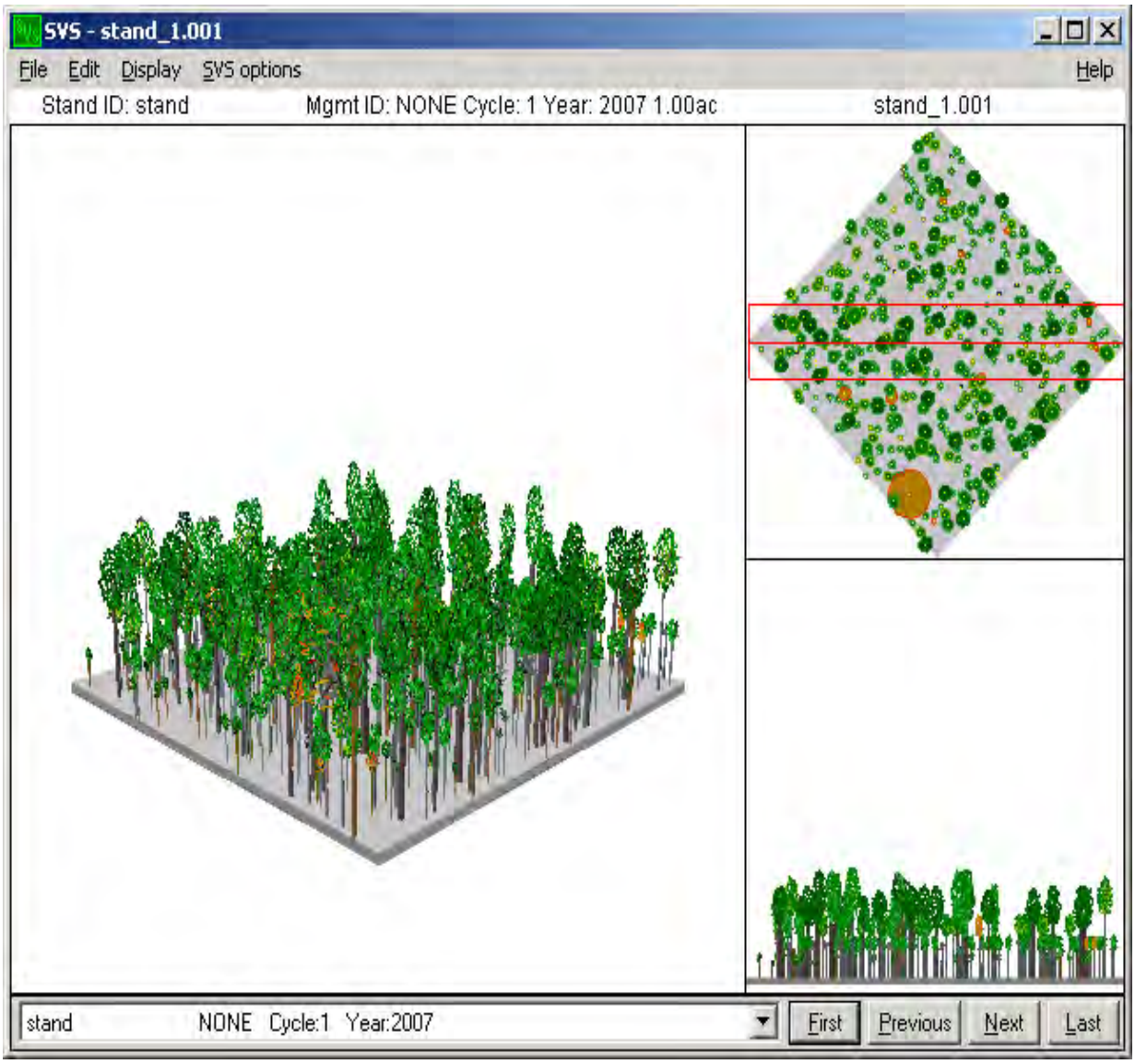

Figure 4.2.4.1a: Single Tree Selection

Visualization of a stand fully stocked with a Basal Area of 157 square feet per acre. This method is recommended for Stands 1, 2, 4 and 15.

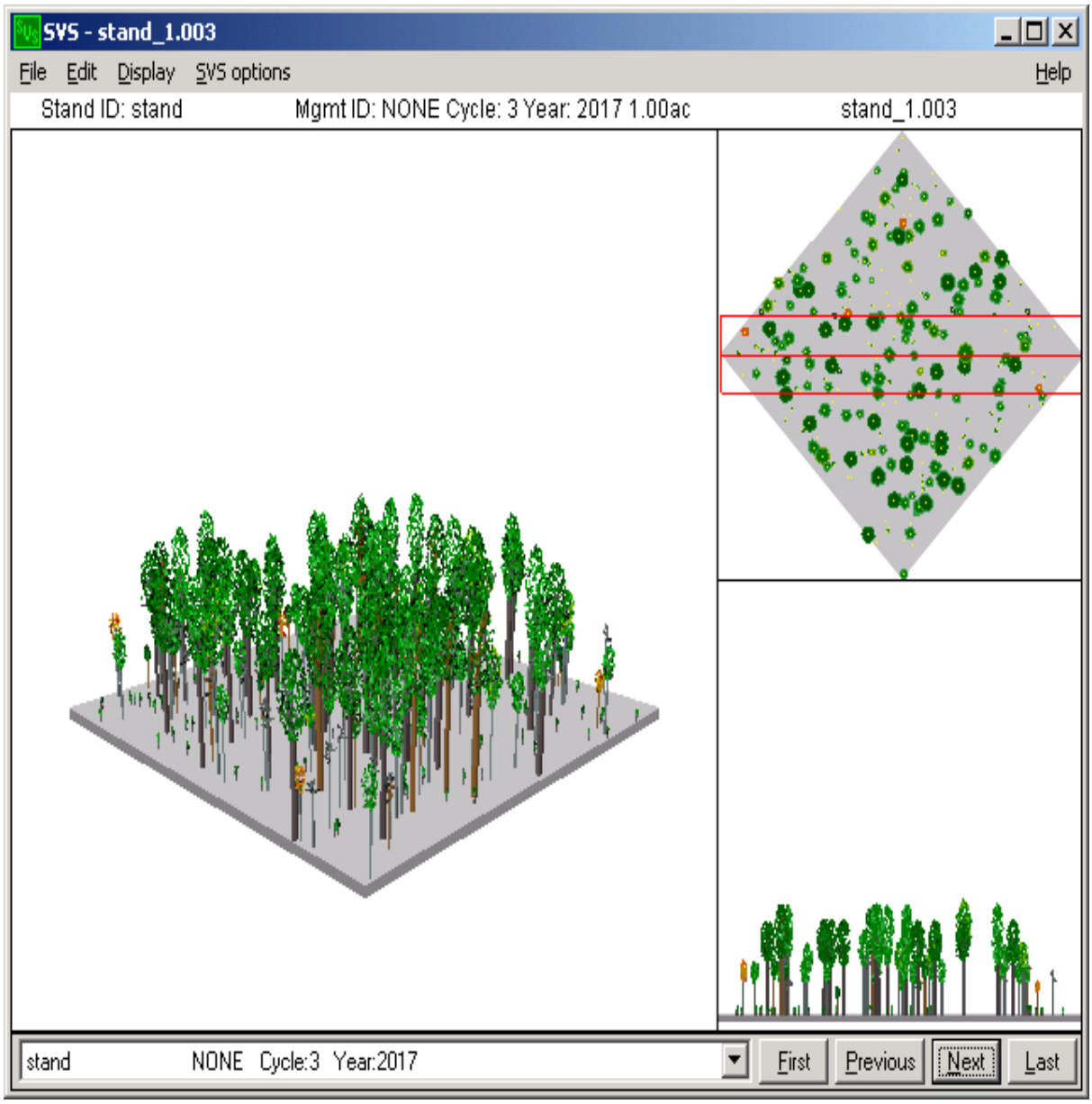

Figure: 4.2.4.1b: Single Tree Selection

Visualization ten years after the Basal was reduced to 80 square feet per acre; note spacing and canopy gaps to allow sunlight to reach the forest floor.

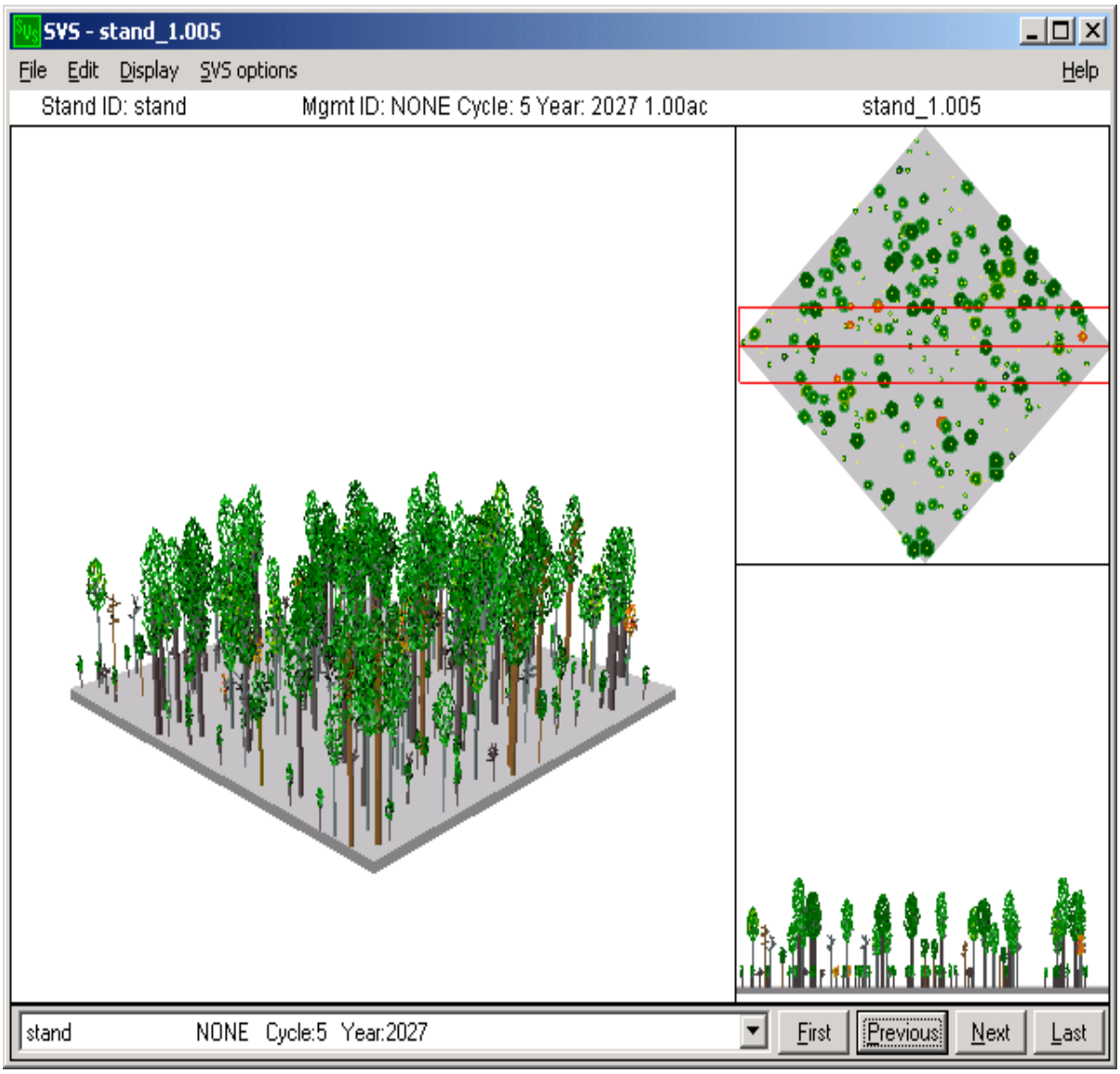

Figure: 4.2.4.1c Single Tree Selection

Twenty years following initial thinning to encourage oak regeneration

2. GROUP SELECTION METHOD

The group selection system mimics natural forest processes by creating small canopy gaps. Such canopy gaps would normally occur due to individual and group mortality of trees. The periodic opening of canopy gaps leads to the formation of microclimates at and near the ground that are conducive to seedling emergence and development. Regeneration takes place under the protective cover of the older trees and approaches the process of the indigenous forest. The existing humus layer provides a favorable medium for seed germination and provides a protective environment for seedling development.

The group selection method, an uneven-aged silvicultural system, is used to convert an even-aged forest to an uneven-aged condition. Techniques to recreate adequate advanced regeneration through the group selection method include an initial preparatory felling to allow the best individual trees to expand their crowns and become more prolific seed producers, and five to eight years later the creation of one-half acre to one acre plots. This method requires:

a. The identification of individual trees by vigor and species that will contribute good genotypes for the next generation;

b. Orderly guidance of the forest community to a site specific condition; and

c. Opening the forest canopy to allow the degree of light needed, to stimulate the development of the desired species of seedlings, to reach the forest floor. The release of the residual trees from crown level competition will also stimulate seed production, while continuing to provide watershed protection and an aesthetically pleasing environment.

Advantages of the group selection method also include (Matthews 1989):

a. It is very flexible and well-suited to small forest areas where intensive working and close supervision are possible.

b. It can accommodate a wide variety of species, from light-demanders to those that endure shade.

c. Variation in sites can be matched to specific species and plant communities.

d. It provides protection to tree species which are sensitive to frost, drought, and cold winds.

e. The likelihood of damage by wind is reduced.

f. The soil is protected through the gradual and cautious removal of the overstory.

g. There is less risk of encroachment by invasive and exotic species.

h. There is a reduced chance of insect infestation.

i. Nitrogen sequestering remains high because the openings are buffered by adjacent stands.

j. The variation in heights and sizes adds to the aesthetic value of the areas being converted.

Disadvantages of the group selection method include:

a. Silvicultural skill is needed in selecting groups for regeneration as well as for retention.

b. The work of felling and extraction is scattered and at a small scale. It must be done by skilled workers under close experienced and knowledgeable supervision.

An option at Oregon Ridge is to aid the process of natural regeneration with artificial stocking to reduce the risk of failure, correct deficiencies in stock and provide the appropriate species composition to ensure that the stand moves toward its optimum ecological range.

Generalized Procedure:

1. The stand is reviewed to determine if the forest type is on its optimum site, or if the forest type will be redirected over the course of the initial phase of the group selection system.
2. The relative density of the dominant trees will be reduced to 50 percent for regeneration of shade intolerant species or 60 -70 percent for shade tolerant species.
3. Stocking of advanced regeneration will be reviewed periodically to determine the need for supplemental planting.

4. The second cut will occur when the forester has identified the satisfactory level of advanced regeneration. The second cut will lower the relative density to 25 percent. Trees that are left as the super dominants should be capable of withstanding the temporary open conditions and be resistant to wind throw and epicormic branching. These trees (25 percent) will form the standards for this high forest configuration. These standards will remain for 175 to 200 years.

Stand Visualization System Diagrams for Group Selection Regeneration Method

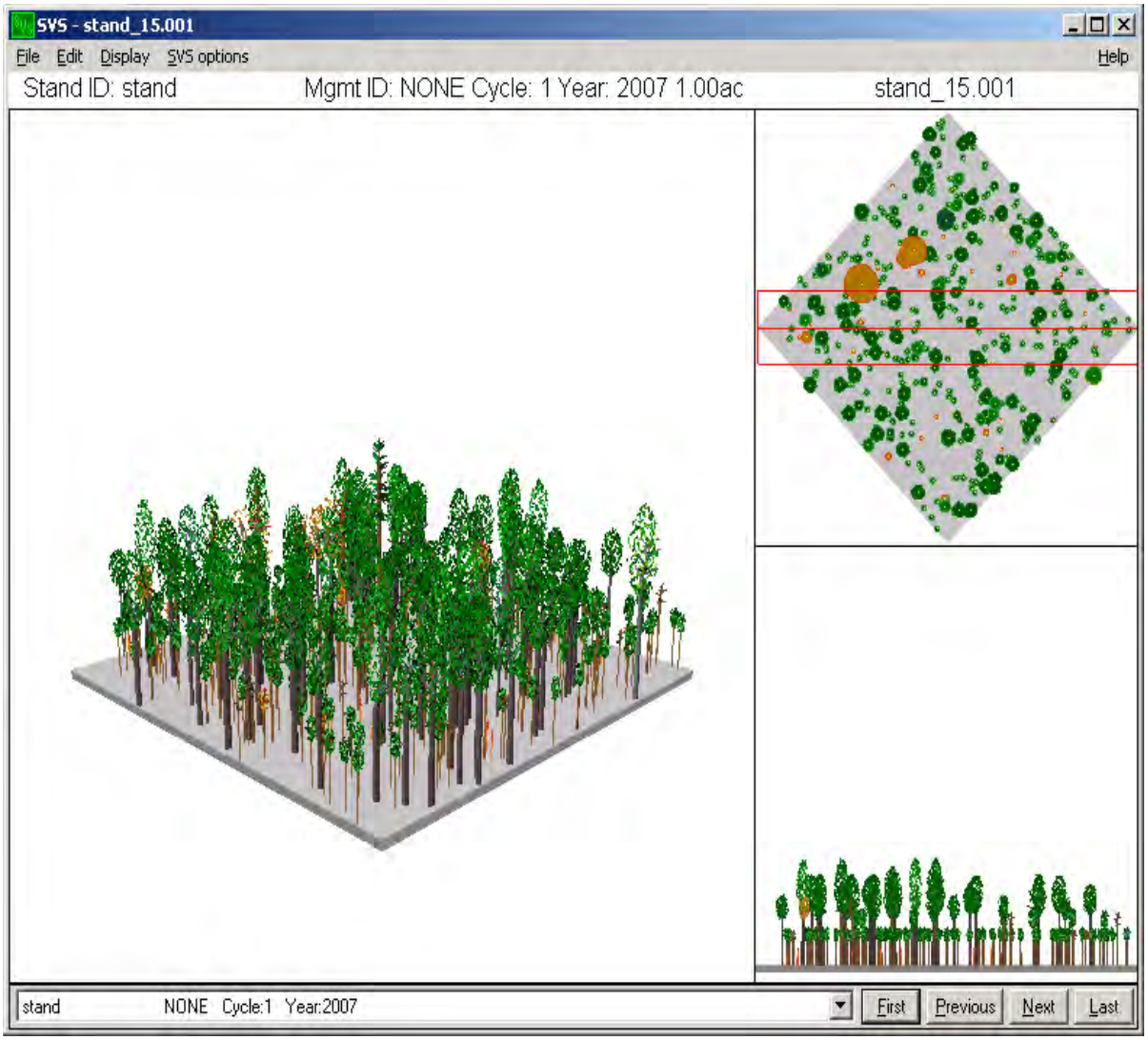

Figure 4.2.4.2a: Group Selection

Group Selection method recommend for Stand 13.
Visualization is of a fully stocked stand.

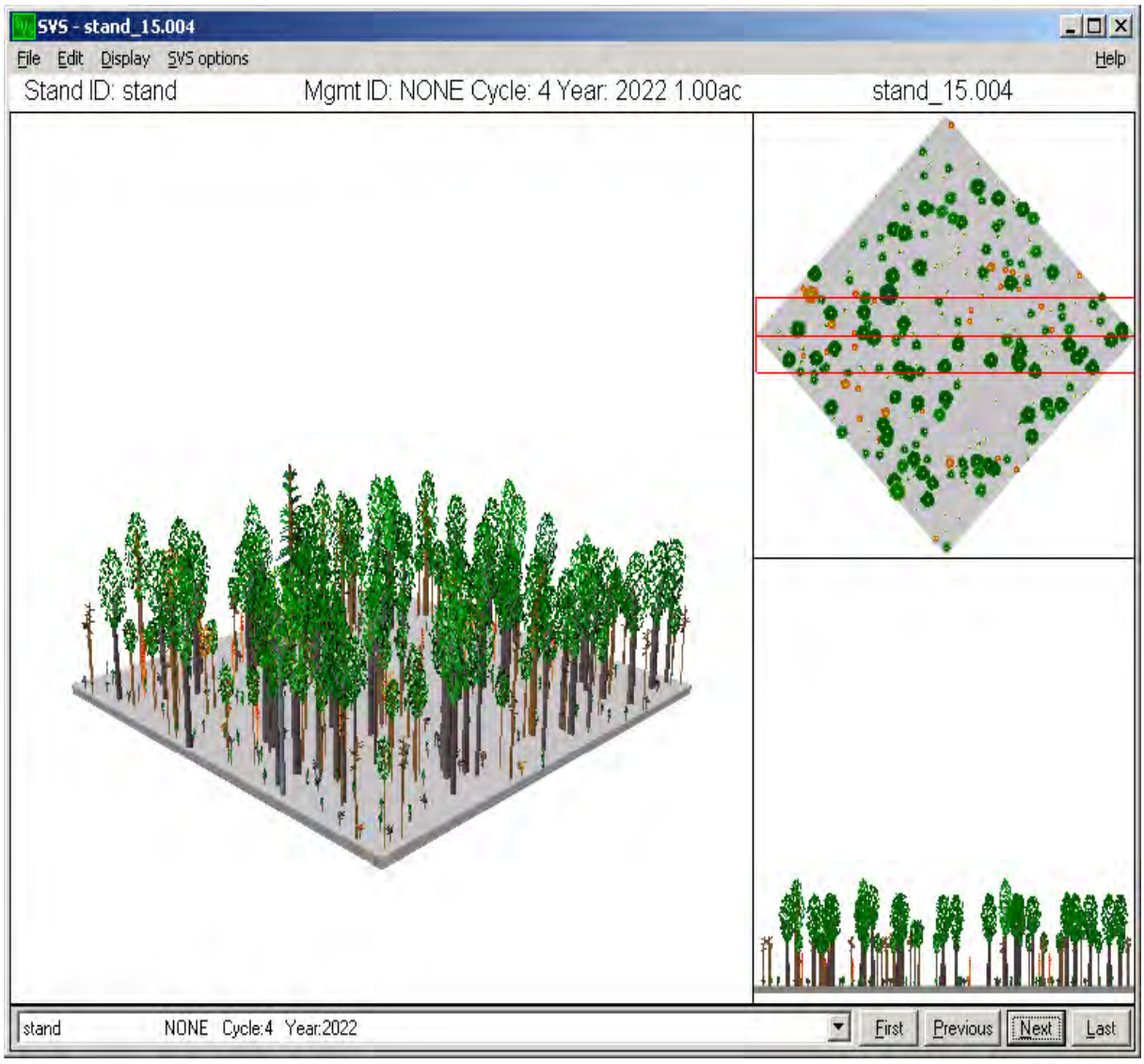

Figure: 4.2.4.2b: Group Selection

Visualization , 15 years post group selection where groups of trees were removed to create larger canopy openings ½ acre or less

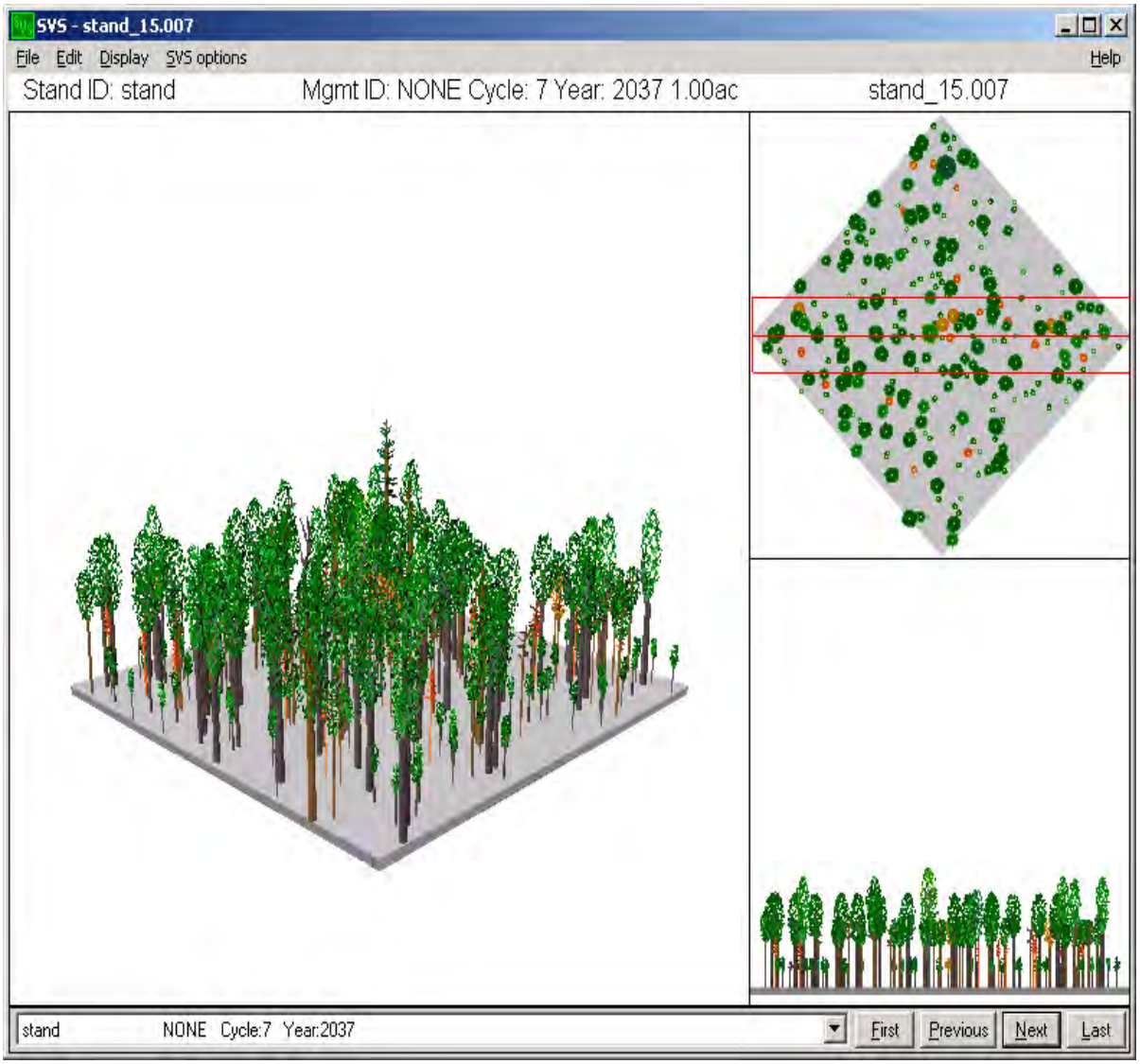

Figure: 4.2.4.2c: Group Selection

Visualization , 20-years after creating openings. The release of residual trees from crown level competition stimulates seed production.

3. SHELTERWOOD METHOD

The shelterwood method produces an even-aged stand, but in contrast to opening patches, this method commonly consists of a series of two or more partial cuts spaced over several years. The major ecological objective of a

shelterwood is to create a partially shaded and protected environment in the understory where young trees can become established and grow. This is particularly beneficial for species that initially do not compete well with other trees and shrubs due to lack of sunlight. Once the desired reproduction is well-established, the remaining larger trees are harvested. One advantage of the shelterwood method is that it produces far less negative visual impact than a clear cut because the harvested area always is dominated by trees, while the debris (branches, tops, etc.) generated by the harvest is less visible.

A two or three cut shelterwood system has been used to reproduce a variety of hardwood species. In a three-cut system, the first cut removes enough of the stand to stimulate the crowns to increase seed production and hastens the decomposition of soil surface organic matter to form a suitable seedbed. Several years later (commonly 5 yrs. to 10-15 yrs.), a second cut removes approximately half of the remaining stand to create conditions suitable for the establishment and early growth of young trees. Finally, several years later when adequate regeneration has become established, the remaining trees are harvested. Some care is necessary during the final harvest to minimize damage to the young, even-aged stand that is developing. The final cut can be eliminated and mature trees can be left to grow, creating a more uneven–aged forest.

SHELTERWOOD	
Advantages	Disadvantages
• Reproduction of desirable species may be more certain than with clear cutting. • Slash disposal less of a problem than with clear cutting. • May be more effective with heavy-seeded species such as oaks. • Less invasion of undesirable vegetation than with clear cutting. • Opportunity for genetic improvement in the regenerated stand.	• Requires a market for small and low-quality trees. • Remaining trees must be wind-firm. • Requires more technical skills of forester and logger than clear cutting. • Removal cutting damages some young trees. • Epicormic branching on trees in final harvest may result in decreased quality.

Stand Visualization System Diagrams for Shelterwood Regeneration Method

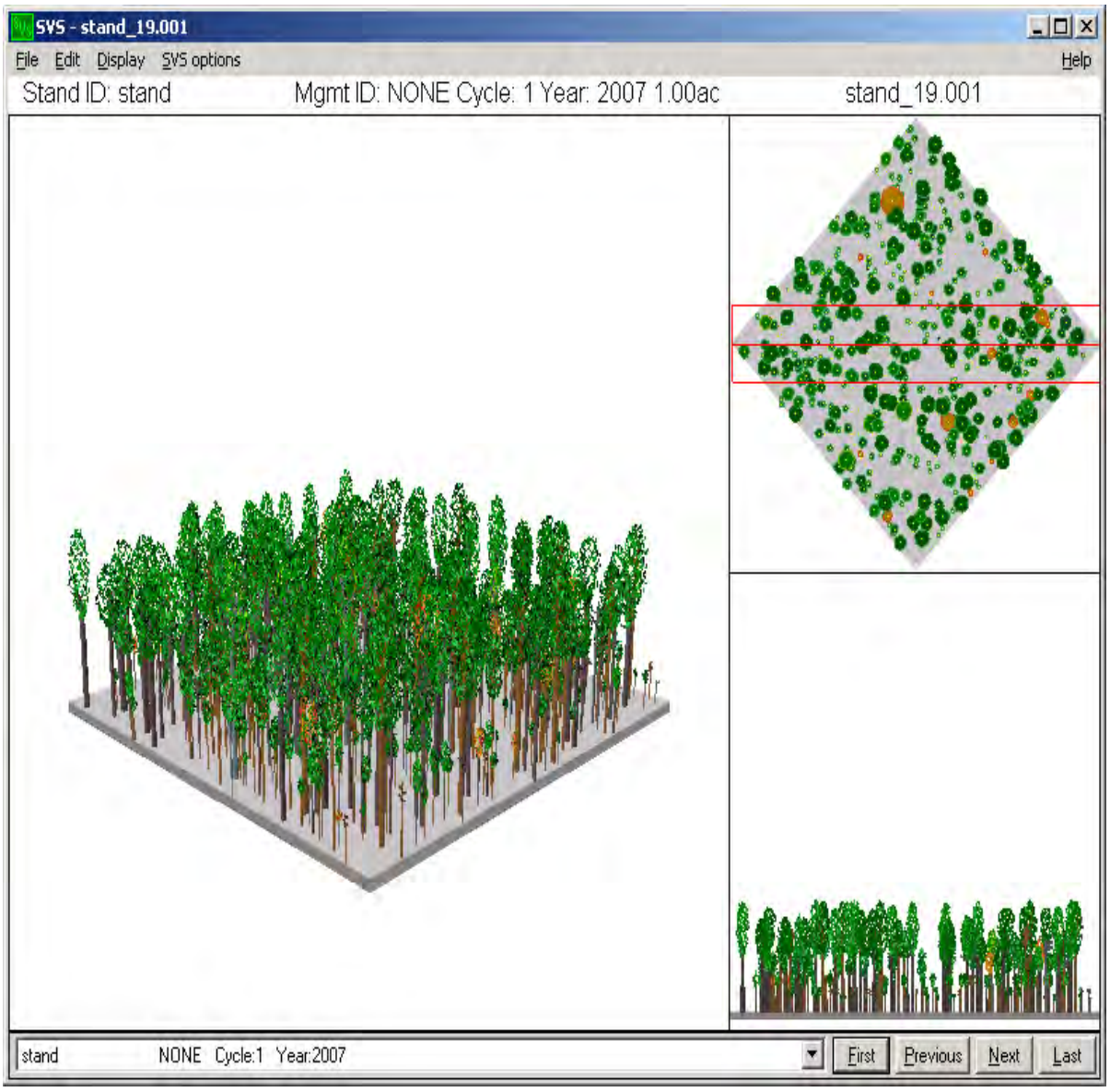

Figure 4.2.4.3a: Shelterwood Selection

The method is recommended for Stands 12 and 13.
Visualization of overstocked stand with little to no regeneration and a dense canopy.

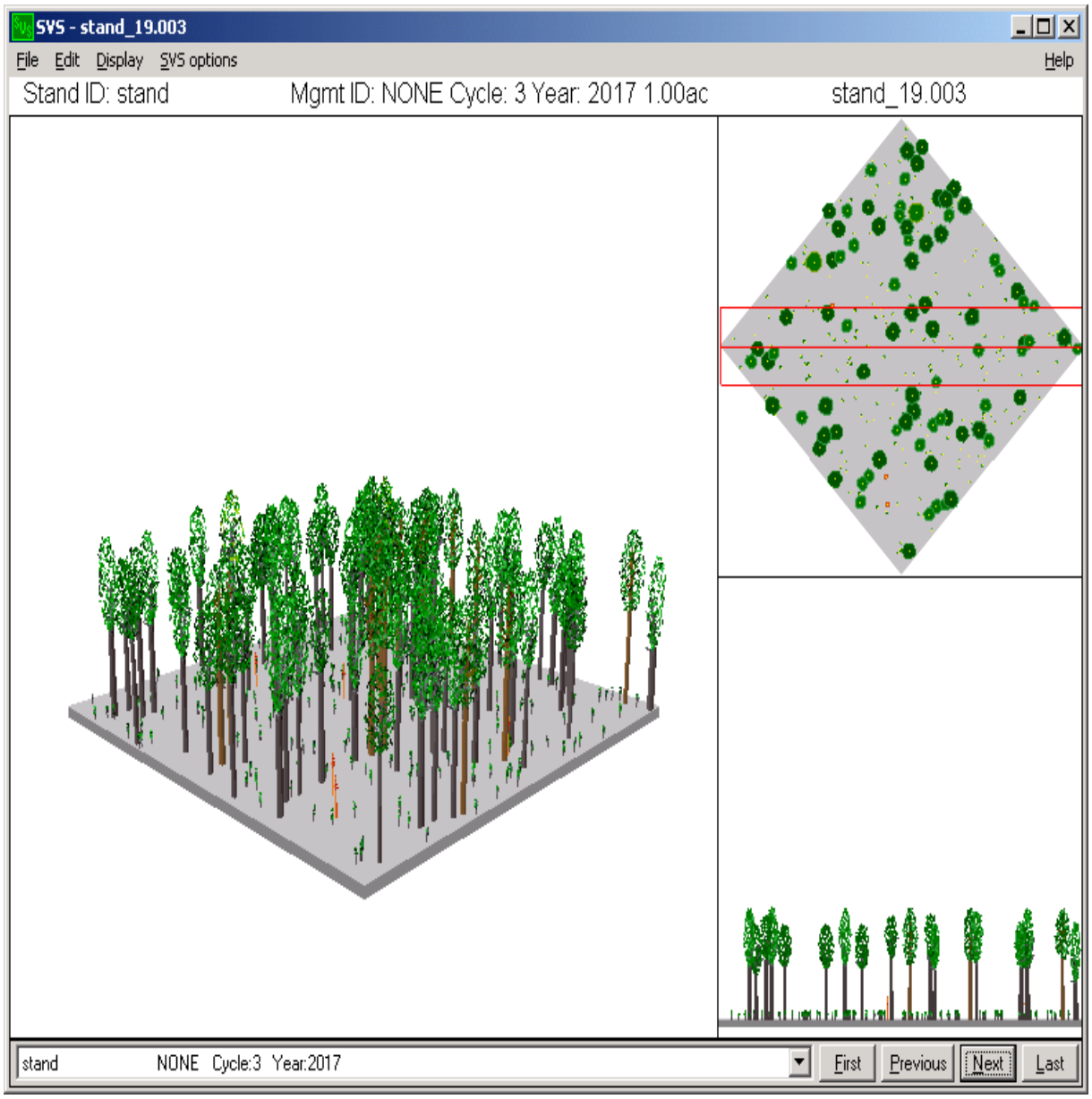

Figure: 4.2.4.3b: Shelterwood Selection

Visualization, first thinning involves removing a large portion of the trees, leaving high quality seed trees.

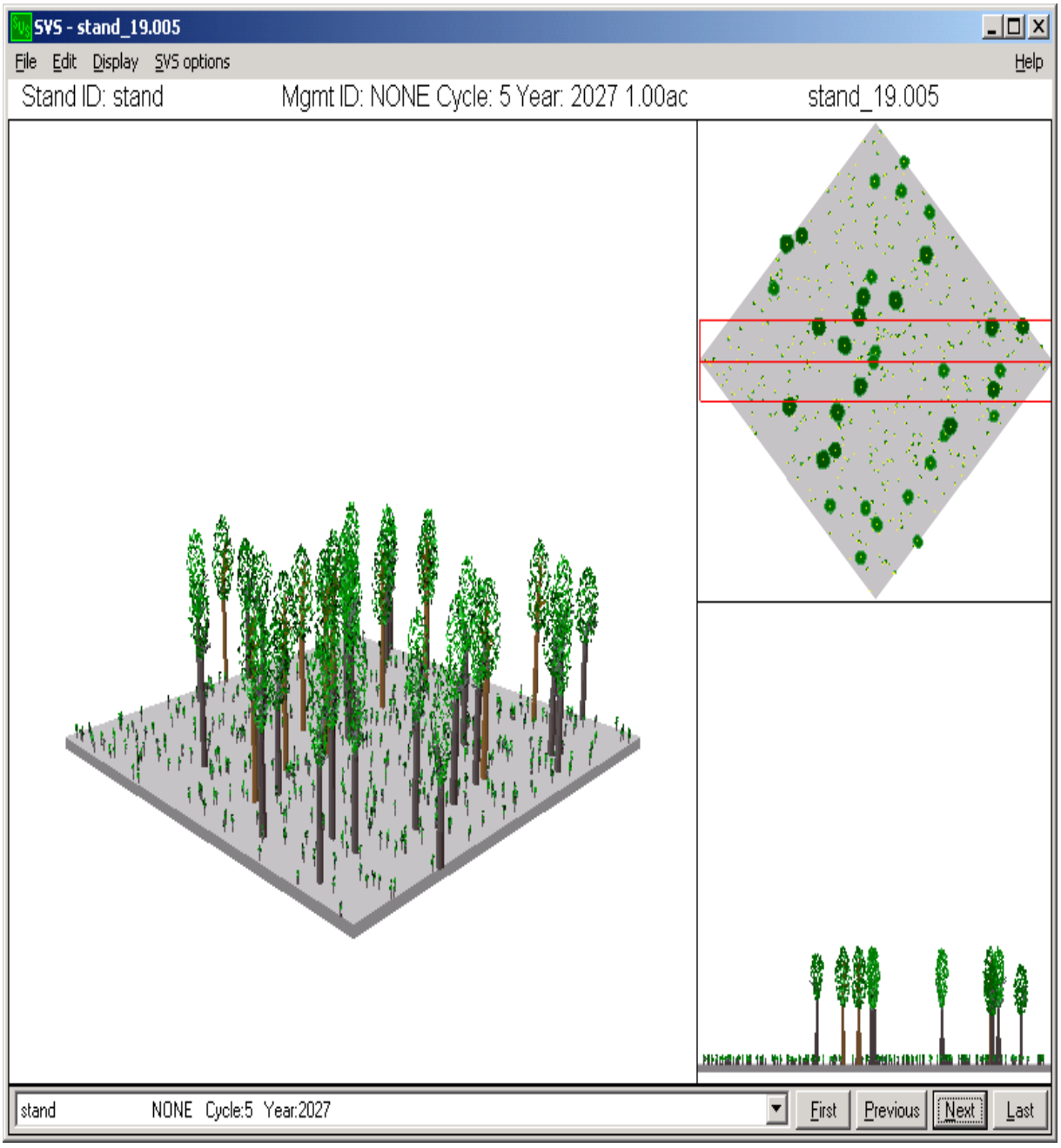

Figure: 4.2.4.3c: Shelterwood Selection

Visualization, shows a second thinning further reducing stand density 10 years after the first thinning.

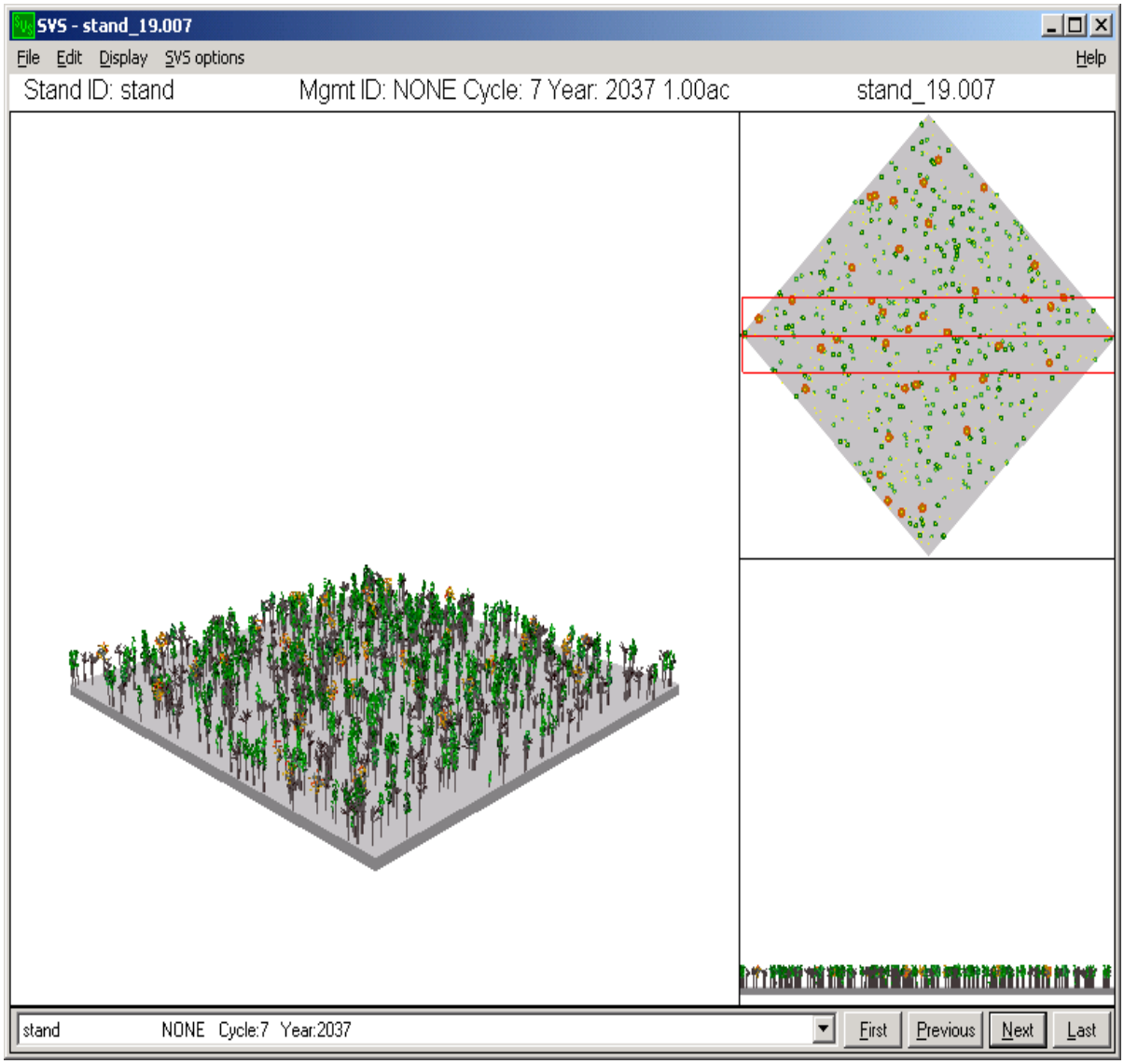

Figure:4.2.4.3d: Shelterwood Selection

Visualization, twenty years after initial thinning. All overstory trees are removed, allowing Oak and Poplar regeneration (1-3 inches in diameter) to receive full sunlight for maximum growth.

4.2.5 ENVIRONMENTAL CONCERNS

Protecting the soil and water resources is an important concern during forest regeneration activities. Tree removal typically requires the use of heavy equipment that can disturb the porous organic layer of the forest floor. Mineral soil exposed to the erosive forces of raindrops can be carried in surface runoff to streams, causing habitat and water quality degradation. The implementation of best management practices (BMPs) can substantially reduce soil erosion and its negative effects. BMPs include such activities and considerations as the proper location and construction of skid trails and management roads; preservation of forested buffer strips along streams; diversion of runoff into the forest from roads and trails; and seeding of landings, roads, and trails upon completion of the harvest.

Prior to any silvicultural operations, a Maryland licensed forester must certify that erosion and sediment control plans for Forest Harvest Operations have been designed in accordance with approved ordinances, regulations, standards and criteria as stated in (COMAR 26.17.01.07.B.3.i). An approved Forest Harvest Operation Plan must be submitted and accepted by the Baltimore County Soil Conservation Service as well as the Baltimore County Department of Environmental Protection and Resource Management.

Two reservoir watersheds that successfully practice recommended silvicultural activities in order to enhance and assure natural regeneration and therefore forest sustainability are the Quabbin Reservoir in Belchertown, Massachusetts (the primary supply for Boston) under the guidance of a professional forester, and The City of Frederick, Maryland watershed, located on 7,000 acres in western Frederick County and managed under the guidance of Maryland Department of Natural Resources Forests and Wildlife Service.

4.3. STREAM ASSESSMENT FINDINGS

The forest at Oregon Ridge Park serves to protect water quality and aquatic habitat for approximately 6.2 miles of streams that drain to the Loch Raven Reservoir. Portions of two named stream systems, Oregon Branch and Baisman Run, originate in and traverse Oregon Ridge Park. Oregon Branch, with approximately 13,770 feet or 2.61 miles of headwater and main stream channels within the Park, flows eastward along the northern boundary. A small portion (1,470 feet) of the Oregon branch system drains to the Park's quarry, which is used for swimming. Overall, about 30.83 % of the entire Oregon Branch stream system is located in Oregon Ridge Park. Baisman Run travels west to east along the southern boundary of the Park. Approximately 18,680 feet or 3.54 miles of numerous smaller streams are located within the Park, which accounts for about 84.43% of the entire Baisman Run stream system. The stream system within Oregon Ridge Park is presented in Figure 4.3.1.

As suggested by its name, Oregon Ridge is especially important topographically as a source area for stream flow. Of the 32,450 feet of stream channels in the Park, 15,120 feet or 46% are first or second order headwater streams. This includes approximately 6,570 feet or 48% of the portions of Oregon Branch located in the Park and 8,550 feet or 46% of the portions of Baisman Run located in the Park.

As a ridge feature, Oregon Ridge Park is dominated by areas of steep slopes. These slopes underlie 639.64 acres or 71.4% of the Park's forest. A Stream Side Management Zone analysis, which shows all slopes $\geq$15% and their relationship to existing first order or greater streams, is presented in Figure 4.3.2.

The methods used for the stream assessment at Oregon Ridge Park are presented in Section 3.4.

The streams assessment found that:

- ***Stream Channel Stability*** - 18.2% of stream length has excellent stability, 32.1% has good stability, 47.4% has fair stability, and 2.2% has poor stability (see definitions on p. 34). Downed woody debris is causing streamflow blockages in segments of stream sections #2, #5, #7B, and #7.

- ***Habitat Conditions*** - 68.2% of the stream system has excellent habitat conditions, 8.4% has good conditions, 11.3% has fair conditions, and 12.1% has poor conditions (see definitions on p.34). The Baisman Run stream system has excellent habitat conditions for 95.4% of its length.

The following is a summary of the assessment results for each stream segment:

Oregon Branch Stream System Segments:

Stream Segment #1

Approximate length: 1,500 ft.
Stability Rating: 40% Excellent, 20% Good, 40% Fair.
Habitat Conditions: 100%-Excellent-Good shade, forested.
Stream bottom: silt, gravel, cobble and a few boulders.
Woody debris: limbs and small branches.

Stream Segment #2

"Oregon Branch" approximate length: 6,300 ft.
Stability Rating: 47% Good, 53% Fair.
Habitat Conditions: 28% Good, 53% Fair and 19% Poor
Stream bottom: gravel and cobble and occasional large rock outcrops.
Woody debris: 2-8" debris occasionally; some large debris, locust willow and walnut blocking the stream.

Stream Segment #2A

Approximate length: 150 ft.
Stability Rating: 100% Good.
Habitat Conditions: 100%, Poor.
Stream bottom: silt and gravel.
Invasive plants on stream banks.

Stream Segment #2B

Approximate length: 300 ft.
Stability Rating: 100% Good.
Habitat Conditions: 100%, Poor.
Stream bottom: quartz rock bottom, cobble and gravel.
Invasive plants on stream banks.

Stream Segment #2C

Approximate length: 600 ft.
Stability Rating: 50% Fair, 50% Poor.
Habitat Conditions: 100%, Poor.
Stream bottom: very rocky in the second 300 ft. segment.

Stream Segment #3A

Approximate length: 900 ft.
Stability Rating: 100% Excellent.
Habitat Conditions: 100% Excellent.
Stream bottom: silt and cobble quartz.
Woody debris: large trees across channel, 14-30" DBH; no obstructions.

Stream Segment #3B

Approximate length: 450 ft.
Stability Rating: 100% Excellent.
Habitat Conditions: 100% Excellent.
Stream bottom: silt and cobble quartz.
Woody debris: large trees across channel; no obstructions.

Stream Segment #3

Main Channel; Approximate length: 2,100 ft.
Stability Rating: 85% Good, 15% Fair.
Habitat Conditions: 70% Excellent, 15% Fair, 15% Poor.
Stream bottom: silt to boulders, quartz boulders are common.
Woody debris: 2-10" DBH trees common; trees up to 24"DBH in channel.
Erosion from "Red Trail" goes into stream.

Stream Segment #4

Approximate length: 1,470 ft.
Stability Rating: 50% Excellent, 50% Fair.
Habitat Conditions: 50% Excellent, 15% Good, 35% Poor.
Stream bottom: pebbles and boulders common.
Woody debris: numerous trees across channel up to 16" DBH; no obstructions.
Hikers crossing near pond causing erosion.

Baisman Run Stream System Segments:

Stream Segment #5A

Approximate length: 460 ft.
Stability Rating: 100% Excellent.
Habitat Conditions: 100% Excellent.
Stream bottom: mostly silt and some cobble.
Woody debris: Branches and twigs.

Stream Segment #5B

Approximate length: 1,200 ft.
Stability Rating: 100% Excellent.
Habitat Conditions: 100% Excellent.
Stream bottom: cobble, small quartz boulders.
Woody debris: 1-12" DBH debris common.
Numerous springs feed this section.

Stream Segment #5

Main Channel, Approximate length: 600 ft.
Stability Rating: 100% Good.
Habitat Conditions: 100% Excellent.
Stream bottom: cobble, small boulders.
Woody debris: some large woody material in stream, 12-18" DBH, causing some damming.

Stream Segment #6

Approximate length: 2,830 ft.
Stability Rating: 20% Excellent, 65% Good, 15% Poor.
Habitat Conditions: 90% Excellent, 10% Poor.
Stream bottom: some cobble and small boulders.
Woody debris: one large white oak recently uprooted; three mature trees down at headwaters.
The poor ratings were located on the right of way segment.

Stream Segment #7A

Approximate length: 400 ft.
Stability Rating: 100% Fair.
Habitat Conditions: 100% Excellent.

Stream bottom: silt to cobble, solid rock common.
Woody debris: small trees and branches.

Stream Segment #7B

Approximate length: 900 ft.
Stability Rating: 100% Good.
Habitat Conditions: 100% Excellent.
Stream bottom: cobble and small boulders.
Woody debris: small woody debris, areas of minor damming.
Multiple springs feed this first order stream, large wetlands.

Stream Segment #7C

Approximate length: 560 ft.
Stability Rating: 100% Fair.
Habitat Conditions: 100% Excellent.
Stream bottom: cobble, quartz, small boulders.
Woody debris: 2 12' DBH trees, roots exposed on bank.

Stream Segment #7

Main channel of "Baisman Run," Approximate length: 9,730 ft.
Stability Rating: 6% Good, 94% Fair.
Habitat Conditions: 94% Excellent, 6% Poor.
Stream bottom: Gravel to boulder, areas of solid rock base common.
Woody debris: branches common; large trees, predominantly oak, causing damming at Sections 10, 20, 21 and 24.

Stream Segment #8

Approximate length: 1,000 ft.
Stability Rating: 100% Excellent.
Habitat Conditions: 100% Excellent.
Stream bottom: silt base with a little rock.
Woody debris: few trees, 6-12" DBH, across channel.
Forest<100 ft. wide on the R/W side of stream; however, stream appears to be well protected.

Stream Segment #9

Approximate length: 1,000 ft.
Stability Rating: 100% Good.

Habitat Conditions: 100% Excellent.
Stream bottom: cobble, small boulders, quartz.
Woody debris: common, 2-12” DBH; old decaying debris.
Old logging road crosses stream.

4.4. TRAIL AND TREE MAINTENANCE RECOMMENDATIONS

Oregon Ridge Park presently includes about 5.93 miles or 31,310 feet of recreational trails. About 90% of the trails are in good condition. Two trails, the Virginia Pine (Green) Trail and the Laurel (Blue) Trail, are badly eroded in the steeper sections. Relocation and/or closing of these trails is recommended. Moderate erosion on the sloping sections of the Red Trail and Yellow Trail can be repaired and reduced by filling with compacted crusher-run stone and installation of water bars.

The timber steps on the Loggers (Red) Trail near the lake are in fair condition but should be monitored. Steps on the Lake (Orange) Trail are deteriorated and need repair, especially the hand rails.

Hazardous trees were marked along the trails for a total of 105 possible trims, which consist of dead branches that could fall on the trail and that need to be removed or trimmed, and 127 dead or dying trees that are candidates for felling. Trees to be trimmed have one spot of yellow paint, whereas possible removals have two spots of yellow paint.

The number of hazard trees on various trails is presented in Table 4.4.

Table 4.4: Number oif Hazard Trees at Oregon Ridge Park.

Trail	**Trees to Trim**	**Trees to Remove**
Red Trail	36	50
Tan Trail	9	12
Blue Trail	16	7
Green Trail	8	7
Orange Trail	3	4
Short Cut Trail	3	6
Yellow Trail	30	41
Total	**105**	**127**

The location of hazardous trees is presented In Figure 4.4: Hazardous Tree Survey and Trail Notes.

Note: **X** denotes approximate location of trees to be removed (two yellow spots on tree)
O denotes trees to be trimmed (one yellow spot on tree)

4.5. GROUND-LAYER PLANT SURVEY

A ground-layer plant study was performed at Oregon Ridge Park between June and August, 2006. This study is part of the general forest health assessment. Oregon Ridge Park is mostly forested with some open fields, including a gas line transmission right-of-way. The majority of the herbaceous species data collected were from forested portions of the site, with some data taken in open wetland areas, where noted. A total of 127 plots were sampled for the 22 canopy stands. The 127 plots contained 48 species, which are listed in Table 4.5, including 5 woody shrub and vine species and 43 herbaceous species, as described in Brown and Brown (1984).

Herbaceous plants were sampled using a 500th acre plot. Plot centers were the same random plot centers used for sampling trees and shrubs. All herbaceous plants in the plot were noted and given a percent cover class.

The dominant plant species sampled was Virginia Creeper *(Parthenocissus quinquefolia)*, found in 24% of the plots, followed by Partridge Berry *(Mitchella repens)* in 21% of the plots, Indian Cucumber *(Medeola virginiana)* in 20% of the plots, and Trefoil (*Desmodium sp.)* in 14% of the plots. Virginia Creeper (woody), was listed as a herbaceous plant because most of the specimens found in the plots were herbaceous rather than woody. New York Fern *(Thelypteris noveboracensis)* was found in 6% of the plots. ± 25% of the plots sampled contained no herbaceous species.

A few random wetland/riparian plots were also sampled and were dominated by Skunk Cabbage *(Symplocarpus foetidus)* and Jewel Weed (*Impatiens capensis).* Although not noted as a dominant species, Hay-scented Fern *(Dennstaedtia punctilobula)* and New York Fern *(Thelypteris noveboracensis)* were frequently observed between plot transects throughout a number of the stands where openings in the forest canopy occurred.

Two species, Wild Leek *(Allium tricoccum)* and Wild Comfrey *(Cynoglossum virginianum)*, were not noted in a previous study conducted by Redman (1999) but were found on this site. An unidentifiable orchid was found between plot 7-1 and 7-2 and is believed to be Pink Lady's Slipper *(Cypripedium acaule)*.

There were also numerous patches of non-native invasive species such as Japanese Stilt Grass *(Microstegium vimineum)* and Oriental Bittersweet *(Celastrus orbiculatus)*, probably the result of anthropogenic activity.

Another observation of note includes the presence of Hop Hornbeam *(Ostrya virginiana*) (stand 9, plot 10), which is not typical of this area and occurs more frequently in Western Maryland. In addition, two 14-16" diameter American Chestnut trees *(Castanea dentata)* were found growing along the edge of the gas line right-of-way.

The herbaceous plant community at Oregon Ridge Park is typical of a rural/suburban mesic forest. Plant diversity is relatively low compared to that in a more open environment such as that found on the utility right-of-way. Canopy closure ranges from 80-95%, which limits light to the forest floor, resulting in reduced numbers of sun-loving herbaceous plants. There appears to be a large population of white-tailed deer within the Park, as evidenced by a prominent browse line and the lack of dense herbaceous plant cover.

Table 4.5: Ground Layer Plants Sampled in Plots at Oregon Ridge Park.

Common Name	***Scientific Name***
Oriental Bittersweet	*Celastrus orbiculatus*
Wineberry	*Rubus phoenicolasius*
Virginia Creeper	*Parthenocissus quinquefolia*
New York Fern	*Thelypteris noveboracensis*
Skunk Cabbage	*Symplocarpus foetidus*
Jack In The Pulpit	*Arisaema triphyllum*
Christmas Fern	*Polystichum acrostichoides*
Violet	*Viola sp.*
Jewel Weed	*Impatiens capensis*
Indian Cucumber	*Medeola virginiana*
Partridge Berry	*Mitchella repens*
Rattlesnake Plaintain	*Goodyera pubescens*
Spotted Wintergreen	*Chimaphila maculata*
Panic Grass	*Panicum sp*
Broad Beech Fern	*Phegopteris hexagonoptera*
False Solomon's Seal	*Smilacina racemosa*
May Apple	*Podophyllum peltatum*
Cinnamon Fern	*Osmunda cinnamomea*

Wild Yam	*Dioscorea villosa*
Enchanters Nightshade	*Circaea quadrisulcata*
Wild Leek	*Allium tricoccum*
Sedge	*Carex pensylvanica*
Sedge	*Carex sp.*
Trefoil	*Desmodium sp.*
Wild Licorice	*Galium circaezans*
Club Moss	*Lycopodium sp.*
Bellwort	*Uvularia perfoliata*
Japanese Stilt Grass	*Microstegium vimineum*
Grape Fern	*Botrychium sp.*
Sorrel	*Oxalis europea*
Club Moss	*Lycopodium obscurum*
Hayscented Fern	*Dennstaedtia punctilobula*
Wild Comfrey	*Cynoglossum virginianum*
Bedstraw	*Galium sp.*
Strawberry	*Fragaria sp.*
Sedge	*Carex amphibola*
Bulrush	*Scirpus atrovirens*
Deer Tongue Grass	*Dichanthelium clandestinum*
Strawberry	*Fragaria virginiana*
Rue Anemone	*Anemonella thalictroides*
Avens	*Geum arvense*
Pink Ladies Thumb	*Polygonum persicaria*
Ground Ivy	*Glechoma hederacea*
Drop Seed	*Tovara virginiana*
Clear Weed	*Pilea pumila*
Wood Fern	*Dryopteris marginalis*
Garlic Mustard	*Alliaria petiolata*
Mile-A-Minute Weed	*Polygonum perfoliatum*

4.6. GENERAL RECOMMENDATIONS FOR CONTROLLING GYPSY MOTH, DEER, AND EXOTIC, INVASIVE PLANT SPECIES AT OREGON RIDGE PARK

This section of the Assessment and Management Plan contains recommendations for the following categories of management actions:

4.6.1 INSECT CONTROL

The most pressing threat to the forest is the presence of Gypsy Moth, which defoliated Stand #6 and is present in other stands throughout Oregon Ridge. The entire tract should be sprayed in March-April of 2007. Oak species dominate more than eighty percent of all the forest acreage and is one of the favorite foods of the Gypsy Moth. The moth was currently noted in plot samples within eight stands.

4.6.2 DEER CONTROL

Due to the excessive browsing and lack of natural regeneration, the deer population far exceeds the carrying capacity of the forest, greatly affecting regeneration of the forest. Studies show, according to the 2006 publication, *The State of the Chesapeake Forests*, that densities greater than 20 deer per square mile restrict regeneration and diversity of woody vegetation. Densities of even ten deer per square mile can limit the full regeneration of the forest understories.

Deer control, to be effective, should be in the form of hunting. Although the site is 1,000+ acres, home sites do border most of the Park. Professional sharp shooters can be hired to hunt at night when the park is closed. Currently there are only 281 seedlings (all species) per acre, average, and any effort to restore and regenerate the forest for the future must include deer control or the efforts will be futile.

4.6.3 INVASIVE PLANT CONTROL

Open fields and edges adjacent to the forest, which are more prone to invasive plants, should be inspected. If found, invasive plants should be controlled to prevent their spread into the forest.

4.6.4 FOREST RESTORATION AND INVASIVES CONTROL

Mar-Len Environmental recommends the following goals for integrated restoration of the forest at Oregon Ridge Park:

Goals:

- Restore the forest's ecological integrity by reducing the environmental stresses imposed by exotic invasive plants.
- Restore the natural distribution of native trees and shrubs.
- Restore natural tree regeneration to levels adequate to quickly recover control of hydrology and nutrient cycling following large-scale disturbances.

The restoration process can be done on any scale with the following sequence in order to add balance to the required silvicultural activities. Mechanical, manual and chemical treatments will all be part of the tool box for eradication and control. A small tractor or Bob-cat, on level-to-moderate slopes, can push or pull out some of the larger shrubs and vines that are hindering the establishment of native plants. Smaller shallow-rooted plants can be manually pulled out or can be chemically treated by spot spraying selected shrubs and vines. Cut stumps can also receive an herbicide application. The control will be vital to the success of the re-establishment. Prior to eradication of any alien plants, native shrubs in close proximity, if using a chemical treatment, should be flagged for identification to remain and be protected from herbicides.

Vines: Vines should be controlled first. Vines on the site include: Oriental bittersweet, Japanese Honeysuckle, Tear thumb and Grapevine. Grapevine is a native vine and an excellent wildlife food but should be cut if it becomes too aggressive. Vines can be controlled by the three methods described above. The larger vines too tall to spray should be cut first then sprayed. **Systemic** herbicides are most effective and include glyphosates and triclopyr. Both herbicides will migrate into the roots when sprayed on the foliage and kill the entire plant. Triclopyr is also effective as a stump treatment when painted on freshly cut stumps. Both herbicides, when applied as a foliar spray, should be used when the plants are in full foliage and actively growing.

Alien Shrubs: Due to the dense canopy closure, alien shrubs are present but do not have a strong hold on the forest. These shrubs include: Multiflora rose, Japanese honeysuckle, Japanese Barberry, Privet and Wineberry. The larger shrubs where possible can be pushed or pulled out with equipment preferably before they are full with seed. Where cutting is appropriate, treat the stumps with triclopyr to prevent re-sprouting. Smaller shrubs can be dug out or sprayed. Foliar spray is most effective but should be limited to spot spraying, not broadcast spraying, which could damage natives. Systemics are effective for foliage application.

Grasses: The major grass of concern is Japanese Stilt Grass, which has no biological control. **Systemic** herbicides are most effective and include glyphosates and triclopyr.

Follow up: No treatment will be effective with one application since sprouting and root suckering usually occurs. Birds also spread the seed and new plants may become established due to available sunlight once larger shrubs are removed. Inspect the site throughout the growing season and spot spray the leafed out plants or cut and treat the stumps.

INVASIVE PLANTS AT OREGON RIDGE PARK

The following descriptions and preferred control methods are provided for the major invasive plants at Oregon Ridge Park. The source of photos is *Least Wanted* (Swearingen, Jil M., National Park Service, Washington, DC, http://www.nps.gov/plant/alien)

Multiflora rose (*Rosa Multiflora*)
Characteristics: thorny shrub, with clusters of white to pink flowers. Multiflora rose develops bright red fruit or rose hips. It is spread by wildlife dispersing the seed and by forming new plants.
Control: Frequent cutting or mowing of the plants through the growing season is effective. Application of triclopyr to freshly cut stumps and spraying re-growth with a herbicide during the growing season may be the most effective.

Privet (*Ligustrum vulgare*)
Characteristics: stout shrub with many branches, oval leaves on short stalks. Privet has small white flowers that grow in clusters at the end of branches and blue black berries. It is spread by seeds dispersed by wildlife; new growth also grows from stumps.
Control: dig out all small plants or spray leaves of large plants with a herbicide and triclopyr on fresh cut stumps.

Japanese Honeysuckle (*Lonicera japonica*)
Characteristics: Japanese honeysuckle is a semi-evergreen vine, with white to yellow tubular flowers. It is spread by seeds dispersed by wildlife.
Control: prescribed burning and herbicides are a good method of control. While mowing may reduce the spread of vegetative stems (on R/W), spraying herbicides on the leaves of the plant is found to be most effective. It may be necessary to re-spray sprouting plants.

Honeysuckle Shrub (*Lonicera spp.*)
Characteristics: a tall bush from 6 to 15 feet high, with white to yellow flowers and red to orange fruits with many seeds. It is spread by wildlife dispersing seeds and by vegetative sprouting.
Control: Hand removal of small plants and treatment with herbicides are the only methods of treatment.

White garlic mustard (*Alliaria petiolata*)
Characteristics: leaves and stems have a garlic like odor when crushed. The plant forms clusters of small white flowers, each flower has petals in the shape of a cross.
Control: Hand removal of plants, including roots is effective for scattered plants. For clusters, cut plants low to the ground to prevent flowering and seed production and spray with a herbicide. Once White garlic mustard is removed re-establish native ground covers such as phlox or ferns.

Oriental bittersweet (*Celastrus orbiculatus*)
Characteristics: woody, deciduous vine with glossy finely toothed leaves. Oriental bittersweet has abundant clusters of small greenish flowers, globular greenish yellow fruits and red seeds.
Control: vines can be pulled out by the root, or cut to ground level. Re-sprouting leaves can be sprayed with a herbicide.

Oriental Bittersweet (Celastrus orbiculatus) growing at Trustom Pond National Wildlife Refuge Photo by Lisa Gould

Tear Thumb (*Polygonum perfoliatum*)
Characteristics: fast growing weeds with vine-like stems and light blue green triangular leaves. Spines on stems are downward curving. Tear thumb bears a blue fruit and black seeds.
Control: The roots pull out easily to remove plants by hand. The most effective treatment is spraying with glyphosate and later applying a pre-emergent to the soil to prevent seeds from germinating.

Japanese Stilt Grass (Microstegium vimineum)
Characteristics: The leaves are pale green, lance-shaped, asymmetrical, 1-3 in. (3-8 cm.) long, and have a distinctive shiny midrib. Japanese stilt grass is especially well adapted to low light conditions. It threatens native plants and natural habitats in open to shady, and moist to dry locations. Where deer are over-abundant, they may facilitate its invasion by feeding on native plant species and avoiding stilt grass.
Control: For extensive stilt grass infestations, use of a systemic herbicide such as glyphosate is a more practical and effective method. Be careful to avoid application to non-target plants because glyphosate is a non-specific herbicide that will kill or damage most plant species it contacts.

Wineberry (Rubus phoenicolasius)
Characteristics: The hairs give the canes a reddish color when seen from a distance. Under favorable conditions canes may grow up to 9 feet. Leaves consist of three heart-shaped, serrated leaflets with purplish veins and are silvery white tomentose on the underside
Control: Manual, mechanical and chemical means of control are available. Removal of plants by hand pulling or use of a 4-prong spading fork can be effective especially if the soil is moist and the roots and any cane fragments are removed or by treating the canes with a systemic herbicide like glyphosate or triclopyr.

4.6.5 WILDLIFE RECOMMENDATIONS

Wildlife has four basic requirements for survival: food, water, cover and breeding space. Little can be done to provide space and water. However, food and cover can be managed for the benefit of wildlife. Management of wildlife is based on ecological principles. Forest wildlife management on this tract can be in the form of attracting wildlife species by creating natural snags and by creating an edge through developing access roads or trails. An edge allows a variety of habitats to exist in close proximity to each other. Large and small mammals will utilize even small openings.

Neotropical migratory birds are long-distance migrants that breed in North America and winter in Central and South America. They represent well over half (119 of 202) of all bird species that breed in Maryland and over two thirds of the breeding bird species in the eastern United States. This large, diverse group includes a variety of songbirds including warblers, thrushes, vireos and tanagers, as well as our state bird, the Baltimore Oriole. Other Neotropical migrants include Maryland's smallest bird, the Ruby-throated Hummingbird, nighthawks, swallows, cuckoos and a number of hawk and woodpecker species. Recent and growing international concern over declining populations of many Neotropical migrant species has prompted conservation initiatives throughout the Western Hemisphere. The loss and fragmentation of habitat, especially on the breeding grounds, have been implicated as important factors in these declines. Species of particular concern are forest and grassland breeding birds that require large contiguous tracts of habitat in which to successfully breed. The loss of habitat where Neotropical migrants concentrate during migration is also drawing increasing attention within the scientific and conservation communities.

A source of concern at Oregon Ridge is fragmentation caused by utility rights-of-way. Species can also be impacted due to habitat degradation resulting from over browsing of native forest vegetation by white-tailed deer, and invasions of exotic, invasive plant species. The largest, most-contiguous and least-disturbed forest tracts are considered priority conservation areas for forest-nesting birds. Oregon Ridge is considered regionally important given its relatively large size and location within a predominantly forested landscape and the potential for even greater habitat quality through the reduction of deer density.

The following are general wildlife recommendations for Oregon Ridge Park:

1. ***Create and maintain soft forest edges.***
   Most forest borders at Oregon Ridge are hard abrupt edges. Forest birds nesting in forests near hard (vs. soft) forest edges tend to experience low nest success. Hard edges also provide little if any nesting habitat for early successional forest and edge-nesting birds. Managing forest borders as soft feathered edges will increase reproductive success of forest breeding birds. It also represents a tremendous opportunity to increase both the quantity and quality of edge habitat without causing additional forest loss or fragmentation.

2. ***Reduce the availability of feeding areas for non-forest dwelling birds.***
   Control the habitat for Brown-headed Cowbirds, Common Grackles and European Starlings in artificial non-forested habitats (e.g., grassy roadside berms, forest openings, frequently mowed fields) using the following management practices:

   a. Along roads that must be maintained, maintain canopy closure over the roadbed and establish a soft forest-roadside edge.

   b. In fields, maintain a grass height of at least 10 inches during April - August.

3. ***Monitor and control white-tailed deer populations at or below carrying capacity to reduce over browsing of forest understory vegetation.***
   The loss of forest structural diversity and changes in forest composition due to high deer densities have likely had substantial and long-term impacts on the ecological integrity of the forest communities and their ability to support FIDS. Forest interior dwelling species that require a dense shrub and/or herb layer probably have been most seriously affected (e.g., Hooded Warbler, Kentucky Warbler). Effective forest breeding bird conservation requires the maintenance of deer densities at or below habitat carrying capacity. A combination of regulated hunting and a reduction in the amount of hard edge habitat are recommended.

4. ***Implement the following field mowing practices.***

   a. Do not mow fields during April-August, the breeding season for most grassland bird species.

b. If mowing must occur during April-August, minimize impacts to nesting birds using the following guidelines:

(1) Limit mowing to those periods outside of May-early July, the peak nesting period for most grassland birds in this region.

(2) Mow on a rotational basis, leaving at least half of the field un-mowed during May-early July, or for at least 6 consecutive weeks within this period. Allow the un-mowed portion to occur in one large contiguous block or, minimally, leave un-mowed areas in large blocks

(3) Maintain a cutting height of at least 10 inches.

(4) Do not mow at night.

c. To increase habitat diversity within fields, use an annual rotational mowing system in which some sections are left un-mowed each year.

d. Favor early spring (March -early April) mowing over late summer - fall (August - October) mowing to provide winter habitat for grassland birds,

5. Create and maintain soft edges along grassland-forest borders.

Soft, feathered edges at least 10 feet in width provide breeding habitat for a variety of early successional forest and edge-nesting birds that might otherwise be absent or much less abundant in grassland if only a hard forest edge or border existed. They also provide hunting and singing perches for many grassland birds and may reduce nest predation rates for birds nesting in the adjacent forest.

6. Create snags.

Standing dead trees (snags) and dead parts of live trees offer both room and board for many forms of wildlife. Tree cavities in live or dead trees are used by 35 species of birds and 20 species of mammals. The objective is to create 3 snags per acre (minimum). In addition to the standing snags, trees can be felled and left on the ground. Downed logs create a new ecosystem, as decomposed logs provide new habitats for micro-organisms, insects, amphibians, reptiles, and plants. There is life in dead trees and the Oregon Ridge forest is currently fully-stocked with plenty of trees to create snags.

Snags can be created by girdling, which involves cutting a band between 1"-6" wide through the bark and completely around the tree. This practice will kill the tree, thus creating a snag. Maple or tulip poplar trees of poor form make

excellent candidates for snag creation because of their soft wood, which is easily girdled, and they are also more easily excavated by cavity-building wildlife species. By selecting trees of poor form, the quality of the forest can be improved at the same time. At least one tree per acre that is greater than 18 inches in diameter should be chosen because pileated and red-bellied woodpeckers will not utilize smaller trees. Oak trees should not be used for creating snags because of the contribution that oak species make to the forest acorn crop, the majority of the hard mast in the forest. Favoring the oaks as crop trees will insure good crown growth, thus insuring good acorn production for forest regeneration.

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6.0 GLOSSARY OF FORESTRY TERMS

This section includes terms referenced in the report text. Thanks to Nancy Pywell, Extension forester, Pennsylvania State University, whose bulletin, "Forestry Terminology," provided the framework for this Glossary.

A

A.G.S – Acceptable Growing Stock. A tree that has no damage or disease, has good form and vigor, and exhibits crown condition adequate to ensure survival.

association - a collection of plants with ecologically similar requirements, including one or more dominant species from which the group derives a definite character.

B

basal area (of a tree) - the cross-sectional area of the trunk 4 1/2 feet above the ground; **(per acre)** the sum of the basal areas of the trees on an acre; used as a measure of forest density.

biological diversity or biodiversity - the variety of life in all its forms and all its levels of organization. Biodiversity refers to diversity of genetics, species, ecosystems, and landscapes.

BMP'S – Best Management Practices

breast height - 41/2 feet above ground level. See diameter at breast height.

browse - parts of woody plants, including twigs, shoots, and leaves, eaten by forest animals.

C

canopy - the continuous cover formed by tree crowns in a forest.

carrying capacity - the maximum number of individuals of a wildlife species that an area can support during the most unfavorable time of the year.

codominant tree - a tree that extends its crown into the canopy and receives direct sunlight from above but limited sunlight from the sides. One or more sides of a codominant tree are crowded by the crowns of dominant trees.

community - A collection of living organisms thriving in an organized system through which water, energy, and nutrients cycle.

crop tree - a young tree of a desirable species with certain characteristics desired for wood value, water quality enhancement, or wildlife or aesthetic uses.

crown - the uppermost branches and foliage of a tree.

D

deciduous - shedding or losing leaves annually; the opposite of evergreen. Trees such as maple, ash, cherry, and larch are deciduous.

diameter at breast height (dbh) - standard measurement of a tree's diameter, usually taken at 4 1/2 feet above the ground.

dominant trees - trees that extend above surrounding individuals and capture sunlight from above and around the crown.

E

ecology - the study of interactions between organisms and their environment.

ecosystem - organisms and the physical factors that make up their environment.

edge - the boundary between two ecological communities, for example, field and woodland. Edges provide wildlife habitat. Consideration of an edge can reduce the impact of a timber harvest.

epicormic branching - the development of branches from buds inside the bark, resulting from an abrupt change in a tree's environment due to a range of disturbances, either natural or human-caused.

even-aged stand - a stand in which the age difference between the oldest and youngest trees is minimal, usually no greater than 10 to 20 years.

F

forest - a biological community dominated by trees and other woody plants.

forest types - associations of tree species that have similar ecological requirements. Maryland forest types include Allegany hardwood, loblolly-shortleaf, northern hardwood, oak-gum-cypress, oak hickory, and oak-pine.

forester - a degreed professional trained in forestry and forest management. In Maryland, all foresters must be registered with the state.

G

group selection - a process of harvesting patches of trees to open the forest canopy and encourage the reproduction of unevenaged stands.

H

habitat -the ecosystem in which a plant or animal lives and obtains food and water.

hardwoods - a general term encompassing broadleaf, deciduous trees.

herbaceous vegetation - low-growing, non-woody plants, including wildflowers and ferns, in a forest understory.

M

mast - nuts and seeds, such as acorns, beechnuts, and chestnuts, of trees that serve as food for wildlife.

O

old-growth forest - a wooded area, usually greater than 200 years of age, that has never been altered or harvested by humans. An old-growth forest often has large individual trees, a multi-layered crown canopy, and a significant accumulation of coarse woody debris including snags and fallen logs.

overstocked - the situation in which trees are so closely spaced that they compete for resources and do not reach full growth potential.

overstory - the level of forest canopy that includes the crowns of dominant, codominant, and intermediate trees.

R

regeneration - the process by which a forest is reseeded and renewed. Advanced regeneration refers to regeneration that is established before the existing forest stand is removed.

regeneration cut - a harvest designed to promote natural establishment of trees.

release - to remove overtopping trees that compete with understory or suppressed trees.

S

sapling - a tree at least 4 1/2 feet tall and up to 4 inches in diameter.

sawtimber stand - a stand of trees whose average dbh is greater than 11 inches.

selection harvest - the harvest of all individual trees or small groups at regular intervals to maintain an uneven-aged forest. Selection harvests are used to manage species that do not need sunlight to survive.

shelterwood harvest - the harvest of all mature trees in an area in a series of two or more cuts, leaving enough trees of other sizes to provide shade and protection for forest seedlings.

silviculture - the art and science of growing forest trees.

site - the combination of biotic, climatic, topographic, and soil conditions of an area.

site index - a measure of the quality of a site based on the height of dominate trees at a specified age (usually 25 or 50 years), depending on the species.

snag - a dead tree that is still standing. Snags provide important food and cover for a wide variety of wildlife species.

sprout - a tree growing from a cut stump or previously established root system.

stand - a group of forest trees of sufficiently uniform species composition, age, and condition to be considered a homogeneous unit for management purposes.

stand density - the quantity of trees per unit area, usually evaluated in terms of basal area, crown cover and stocking.

stocking - the number and density of trees in a forest stand. Stands are often classified as understocked, well-stocked or overstocked.

stratification - division of a forest, or any ecosystem, into separate layers of vegetation that provide distinct niches for wildlife, such as canopy, understory, and herbaceous vegetation.

succession - the natural replacement of one plant (or animal) community by another over time in the absence of disturbance.

T

thinning - a partial cut in an immature, overstocked stand of trees used to increase the stand's value growth by concentrating on individuals with the best potential.

U

UGS - Unacceptable growing stock. Trees that have poor form or vigor, or that are damaged or diseased, that makes them a poor risk for long term survival.

understocked - a stand of trees so widely spaced, that even with full growth potential realized, crown closure will not occur.

understory - the level of forest vegetation beneath the canopy.

uneven-aged stand - three or more age classes of trees represented.

W

watershed - a region defined by patterns of stream drainage. A watershed includes all the land that contributes water to a particular stream or river.

well-stocked - the situation in which a forest stand contains trees spaced widely enough to prevent competition yet closely enough to utilize the entire site.

wildlife habitat - the native environment of an animal. Habitats ideally provide all the elements needed for life and growth: food, water, cover and space.