Attachment 43 to PLA-6219
Forest Stewardship Plan for the Susquehanna Riverlands Property of PP&L, Inc.
April 1999

(NRC Document Request 98)

Forest Stewardship Plan

for the Susquehanna Riverlands Property of PP&L, Inc.

Townships of Salem, Conyngham, Hollenback and Nescopeck
Luzerne County, Pennsylvania

RR 1 Box 1797
Berwick, PA 18603
(570) 542-2306

Stewardship Plan: 1,543.5 acres
Total Ownership: 2,556.0 acres

April 1999

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Overall Property Inventory and Recommendations

Introduction

The Susquehanna Riverlands property of PP&L, Inc. comprises several diverse tracts of land with compartments variously classified as utility lands, croplands, natural environments, and timber lands. All of the tracts are clustered near the Susquehanna Steam Electric Station, a nuclear power generating plant that was completed in 1985. The subject tracts include eight of the parcels owned in the general vicinity of the power plant; it does not include the Pond Hill tracts. This management plan addresses the forested lands and the adjacent utility lands that provide habitat for wildlife.

It should be noted that the name Susquehanna Riverlands refers to both the cluster of tracts as a whole, as well as one particular property located along the western shore of the Susquehanna River. In this report, that property is referred to as the Riverlands tract, while the entire cluster of lands is referred to as the Susquehanna Riverlands.

Landowner Management Goals for the Property

PP&L, Inc. is a subsidiary of PP&L Resources, Inc., which has recently entered into a competitive, market-driven energy business environment upon the deregulation of some functions of the energy industry. Susquehanna Riverlands, along with its sister facility, the Montour Project, is seen as offering another reason for energy customers to select PP&L as their supplier. The company's award-winning commitment to environmental education, community service, and land management is both sincere and pragmatic.

The company has a long history of managing their lands for a very beneficial mix of productivity, education, and protection. Multiple-use management is favored. Several years ago, PP&L personnel evaluated, classified, and mapped each parcel of land in order to identify its best contribution to the mix of land uses aimed at meeting the needs of the community and its customers.

The croplands are kept in production through leases to area farmers. Wildlife habitat improvements increase the abundance of game species and provide good hunting to the public; properties on the east side of the river are enrolled in the Farm Game program. Timber is harvested as appropriate for long-term forest health and vigor, as well as for its contribution to the local economy. Wetlands and water courses are protected to ensure their viability and the related opportunities for recreation and the education of school children, their parents and teachers, and the general public.

Oversight of all activities at the Susquehanna Riverlands is provided by some of the personnel located at the Montour Preserve facility. Thus, it is appropriate to quote from its mission statement:

> It is our mission to manage and operate the Montour Preserve in a safe, prudent and cost-effective manner, striving to provide environmental education, recreational facilities and related public programs of the highest quality. Through our resource management activities, we practice soil and water conservation, proper farming techniques, wildlife habitat improvement, timber management and the protection of natural areas.

This statement is equally applicable to the Susquehanna Riverlands. The most important uses of the property include protection of biological diversity and providing environmental education programs. Other uses of paramount importance include managing the land for wildlife, offering good opportunities for public recreation, and maintaining the ability to derive revenue from farming and timber production. Hiking, fishing, hunting, and the appreciation and study of nature are among the most popular activities enjoyed by the public. Integral to all of these uses is maintaining the aesthetic appeal and safety of the property, and to keep all facilities in excellent repair.

Directions to the Property

The central recreational area and the Energy information Center are located on the east side of Route 11, approximately seven miles northeast of Berwick.

The Property within the Landscape

The property is located along the North Branch of the Susquehanna River, and includes the river valley itself as well as portions of the adjacent uplands. Surrounding lands are similar to the Susquehanna Riverlands property, with the addition of residences and businesses along most of the roads.

Situated near the northern edge of the Ridge and Valley Province, the area is a mosaic of woodlands, farmland, and roadside residential and commercial development. The forest fragmentation within the property is moderate, and is similar to that of the surrounding area.

The elevation on the property ranges from 500' above sea level at the Riverlands and Gould Island, to over 1,00' at the highest points on the Susquehanna S.E.S. and East Side tracts, to over 1,200' at the lookout on Council Cup.

Species of Special Concern

The properties are located on the Berwick, Sybertsville, and Nanticoke topographic maps (7.5 minute), which were prepared by the United States Geological Survey. On those maps, the subject tracts are located at the following locations, with the first number the distance in inches up from the bottom, and the second number the distance over from the right side of the map: Berwick: 17.9" & 3.1"; 16.7 & 5.0"; 13.0" & 3.3"; 17.0" & 1.2". Sybertsville: 18.1" & 16.4"; 16.4" & 15.4"; 14.2" & 15.9". Using these measurements, a search of the Pennsylvania Natural Diversity Inventory data bank was conducted to determine whether any species of special concern have been reported on or near the property. No species of special concern were identified through this search.

Aerial Photograph Identification

The Bureau of Forestry aerial photographs covering the subject tracts are designated by the code FL71-1346 and 8A, 9A, 9B, 10A, and 10B.

Wildlife Species Reported

The region in which the Riverlands project is located has an abundance of wildlife species, both game and non-game. John Fridman, PP&L naturalist for the Riverlands properties, has listed many of the species found here. Three major habitat types are located on the property: upland forest, riparian forest, and wetlands.

Mammals

Mr. Fridman reports the following mammalian species common in all three areas: white-tailed deer, gray fox, red fox, raccoon, skunk, red squirrel, gray squirrel, flying squirrel, cottontail rabbit, and opossum. Black bear are more abundant in the upland areas, while beaver, muskrat, and mink are common in the wetland and riparian areas. River otters have been sighted in the Wetlands Natural Area, and have become more abundant in recent years. Smaller mammals such as bats, voles, mice, and moles also inhabit the property.

Reptiles and Amphibians

The most abundant snakes appear to be eastern garter snake, black rat snake, and the northern water snake. Observed less frequently are the eastern hognose snake, copperhead, northern brown snake, milk snake, ring-necked snake, black racer, and the ribbon snake.

The most abundant turtles inhabiting the riverside and wetland areas are the eastern painted turtle, snapping turtle, wood turtle, and spotted turtle. The eastern box turtle is common in the upland forests.

Common amphibians include American toads, spring peepers, southern leopard frogs, green frogs, bull frogs, gray tree frogs, spotted salamanders, red-backed salamanders, slimy salamanders, and red-spotted newts. While widely distributed, they are all more common in the wetland areas.

Birds

The National Audubon Society has designated the Susquehanna Riverlands as an Important Bird Area (IBA) in Pennsylvania. This was done because of the extensive riverside forest that is present here and that is under pressure for development in other locations. This points the importance of maintaining the integrity of these forests.

Birds characteristic of the riverside habitat include Baltimore oriole, yellow-throated vireo, warbling vireo, tufted titmouse, American redstart, red-winged blackbird, and blue-gray gnatcatcher. Those associated specifically with wetland habitats include nesting waterfowl such as wood ducks, mallards, Canada geese, swamp sparrows, and Virginia rails.

Among the less common or declining species in this habitat are least flycatcher, willow flycatcher, American bittern, sora rail, common moorhen, and yellow-billed cuckoo.

Common upland bird species include wood thrush, red-eyed vireo, scarlet tanager, eastern wood pewee, black-capped chickadee, three species of woodpecker, blue jay, red-tailed hawk, and ovenbird.

Other birds species that are found sporadically or in specialized habitats include blackburnian warbler, pine warbler, Canada warbler, Kentucky warbler, hermit thrush, and hairy woodpecker.

Butterflies

Four the past four years, a butterfly count has been conducted at the end of June on the Riverlands property. Generally, the most abundant species during this time have been cabbage whites, clouded sulphurs, silver-spotted skippers, European skippers, eastern tiger swallowtails, and great spangled fritillaries.

Wildlife Habitat Inventory

The property has some excellent wildlife habitat, with an abundance of food-bearing plants (primarily oak trees) and a moderate amount of low and high evergreen cover. There are also many old fields and brushy areas.

Vegetation can be classified according to its utility as habitat that meets the needs of a variety of wildlife species, and this has been done for each of the large tracts on either side of the river. The proportion in each cover type has been compared with target proportions that are known to meet the habitat needs of a variety of wildlife species. The forested acreage is approximately 51% of the assessment area on the west side of the river, and 87% of the assessment area on the east side. Crop lands, utility lands, and mowed lawns account for most of the non-forested area.

Mature (seed-bearing) hardwoods provide food (called mast) for many wildlife species to eat, as well as places for wildlife to rest, hide, and rear their young. Mature hardwoods account for about 60% of the forested area on the west side of the river, and 85% of the forested area on the east side. The recommended goal is to have 25% to 50% of the forest cover in mature hardwoods. This means that some of the mature hardwood acreage can be converted to brushy new forest.

Evergreen cover is valuable for the visual cover it provides, as well as the thermal protection it offers in the winter months. Evergreen cover is approximately 3% of the forested area on the west side of the river, and 4% on the east side. The goal is to have 10% of the forest in this cover type, so there is a need to establish evergreens through natural regeneration and planting.

Brushy cover is good escape habitat for birds and small mammals. This cover type is 22% of the forested area on the west side of the river, and 8% on the east side. The goal is to have 10% of the forested area in this cover type. The recommended forest regeneration cuttings on the east side of the river will take care of the slight shortfall in that area.

Pole-sized hardwoods have relatively little value for wildlife, but they can be managed to improve the species composition for wildlife food production. This cover type is represented on approximately 15% of the forested area on the west side of the river, and 3% on the east side. There is no target goal for this size class for the purpose of wildlife habitat analysis.

In non-forested areas, herbaceous openings provide an abundance of insects, which are very important in the diets of young turkey poults and grouse chicks. They also provide nutritious forage for deer, which is especially beneficial in the early spring of the year. Crop lands, mowed lawns, and goldenrod fields are not considered to fill this need. Significant herbaceous openings appear to be absent within the Susquehanna Riverlands property. The goal for wildlife species diversity is to have 3% to 5% of the area in this cover type. Mowing of some of the goldenrod fields and utility line corridors would be a fairly economical way to meet this habitat need. There may also be opportunities to establish herbaceous openings when the use of the Kisner fields is transferred to PP&L.

This wildlife habitat analysis shows that there is a need for establishing more evergreen cover and herbaceous openings.

A Rationale for Wildlife Management on PP&L Lands

The diverse backgrounds and interests of visitors to the Riverlands properties calls for broad and diverse goals in managing habitat for wildlife.

A key element in making wildlife habitat decisions is a focus on interactions between wildlife and humans. Such interactions are at the heart of the desire to manage wildlife. These interactions include many types of experiences. Photography, tracking, listening to bird song, stalking and bagging a game animal, taking a scientific census, and watching a snake move through the grass are some of the things that connect people with wildlife.

The stated land management goals include some inherent conflicts, as between biological diversity and managing for white-tailed deer, which can greatly reduce the diversity of native vegetation if not kept in balance with its food supply. Such conflicts are an inherent part of wildlife habitat work.

PP&L has established successful partnerships with the Pennsylvania Game Commission, the National Audubon Society, and other organizations. Such partnerships should continue, because they help to define the objectives for particular parcels of land while ensuring that the efforts of PP&L are recognized and appreciated.

In summary, PP&L's wildlife management philosophy is entirely consistent with Hunter's bedrock objective regarding biological diversity: "to maintain species diversity to ensure that viable populations of all the native species of flora and fauna characteristic of the management area will be present." (Hunter, 1990)

Water Resources

Water is a key component of much of the Susquehanna Riverlands properties. In addition to the river and tributaries are remarkable wetlands as well as a manmade lake and small ponds. the wetlands include riverside forests, marshes, wet meadows, red maple swamps, and pin oak forested wetlands.

Soils

The soils in the Riverlands tract and those along the east side of the river are in the Chenango-Pope-Wyoming association. These soils are nearly level, deep, soils on floodplains and on glacial outwash terraces.

The upland soils are in the Oquaga-Wellsboro-Lackawanna association, which are generally sloping, moderately deep, and well-drained soils on dissected plateaus. These soils are best suited to woodland.

Timber Resources

In the wake of past gypsy moth defoliation and secondary pathogens, some large oak trees have died over the years and their timber value has been lost. There is some mature timber to harvest at this time, and other stands that will yield timber in the future.

Several stands of timber in the East Side tract were cruised to determine their stocking level, species mix, and potential for timber management. A regeneration timber sale is recommended to start a new forest while creating the additional brushy cover that is needed for better wildlife habitat.

Most of the forests are classified as even-aged, meaning that the majority of the trees are within twenty years of age of each other. Such stands can be gradually converted to two-age stands if proper silvicultural techniques are successfully applied, and if deer do not destroy the new seedlings.

Boundary Lines

Most of the property line locations are known and marked, but there is some confusion that should be removed through survey work. This should be followed by correcting some misleading boundary markers and replacing them with a combination of paint blazes and identification signs.

Access

Most of the property is accessible by a system of public roads and parking lots of appropriate sizes. Gated utility roads serve PP&L personnel in carrying out their duties on the East Side property. No new roads are needed.

General Recommendations

Overall

The new management team at the Susquehanna Riverlands has made remarkable improvements in the physical plant a very short time. There is no need for additional physical plant improvements beyond existing plans.

It would be beneficial to develop a statement for Susquehanna Riverlands comparable to the *Montour Preserve Mission and Future Direction* that was created for its sister facility several years ago. Statements reflecting recent organizational changes and marketing strategies should be incorporated into this document so that the facility's role is clearly linked to the company's overall mission and strategy.

If there is not already a relationship with the Pennsylvania chapter of the Nature Conservancy, one should be established. They have expertise in wetlands and riparian ecology. Susquehanna Riverlands appear to be a very suitable location for one of their meetings, which include field trips. 0

Educational Programs

Current programming targets the general public, school children, and teachers. The major educational resources are the river, the wetlands, the canal, the manmade lake, and the forests. The river offers an abundance of opportunities to link natural history with human habitation of the region. The ancient Warrior's Path that once crossed the property can serve as a springboard for linking the historical native-American transportation, commerce, and communication needs to those of the present-day inhabitants.

There is a good opportunity to compare and contrast three types of generating stations used by PP&L, Inc.: coal, hydroelectric, and nuclear (with excellent educational displays and other programming already in place in the Energy Information Center).

A thorough review of the overall scope and content and the educational programming should be undertaken to ensure that the wealth of varied natural and historical resources are being fully utilized. This review would best include recommendations from an ad hoc committee of local educators who have some familiarity with the property. One or two meetings of this group would provide some good suggestions relative to programming, as well as potential sources of funding for additional personnel to do programs. Then a teacher's resource guide should be developed along the lines of the excellent manual for teachers using the Montour Preserve facility. 2 3

Property Maps

Existing Maps

The existing maps for Susquehanna Riverlands are badly outdated in several ways. While generally well done, they are based on aerial photography taken in 1966, and were prepared in 1985. Some of the compartment delineations made at that time now appear to be incorrect, and there are inconsistencies in the numbering of the compartments. They are also somewhat difficult to use.

It should be noted that the mapping of the Riverlands parcel starts with Compartment 16, and that no Compartment 8 for the Susquehanna S.E.S. was found on the map. Other changes to make on the S.E.S. map include merging Compartment 24, which is no longer private land, with Compartment 25, which in turn should be designated as wildlife land rather than cropland. Other revisions in the compartment delineations are also recommended.

Recommendation for New Maps

Current technology makes the creation of maps relatively simple and inexpensive. Topographic features, photography, and key below-ground infrastructure can be shown or hidden as desired. Map updates can be made readily.

While digital mapping systems have many advantages over previous methods, there are even greater advantages to incorporating the mapping as part of a geographic information system. This allows descriptions, data, plans, and record-keeping to be stored in a readily usable form. More important information can be recorded and retrieved; for example, the present report includes only a portion of the information gathered on the property, because to burden a report of this type with too much information would reduce its utility.

It its strongly recommended that new maps be created using a geographic information system, and that the system be used for storing information, planning activities, and recording accomplishments.

Recommended Map Changes

The following changes are recommended to correct the existing maps.

- Susquehanna S.E.S.: Add the new tract between 2 and 23.
  Add the Kisner farm.
  Break 15, 26, and 28 into two stands each.
  Break 21 into four stands.
  Reclassify 25 as Wildlife Land.

- Council Cup: Reclassify 5; it is not a unique natural area.
  Combine 6 and 7.
- Riverlands: Include 19 (now cropland) with 18.
  30B no longer exists; hedgerow was eliminated.
  Reclassify 35 as utility land.
  Remap into smaller compartments.
  Include 21 with 20.
  Split 39 into two compartments at the stream.
- East Side: Remap 1, 2, and 51.
  Expand 11 into 15.
  Reclassify 47 as wildlife land.
  Split 36 into two stands.
  Correct map to show woods line in 48 as the property line.
- Berwick Substation: Reclassify 7 as wildlife land and reduce acreage
- Bell Bend: Combine 2 and 3.

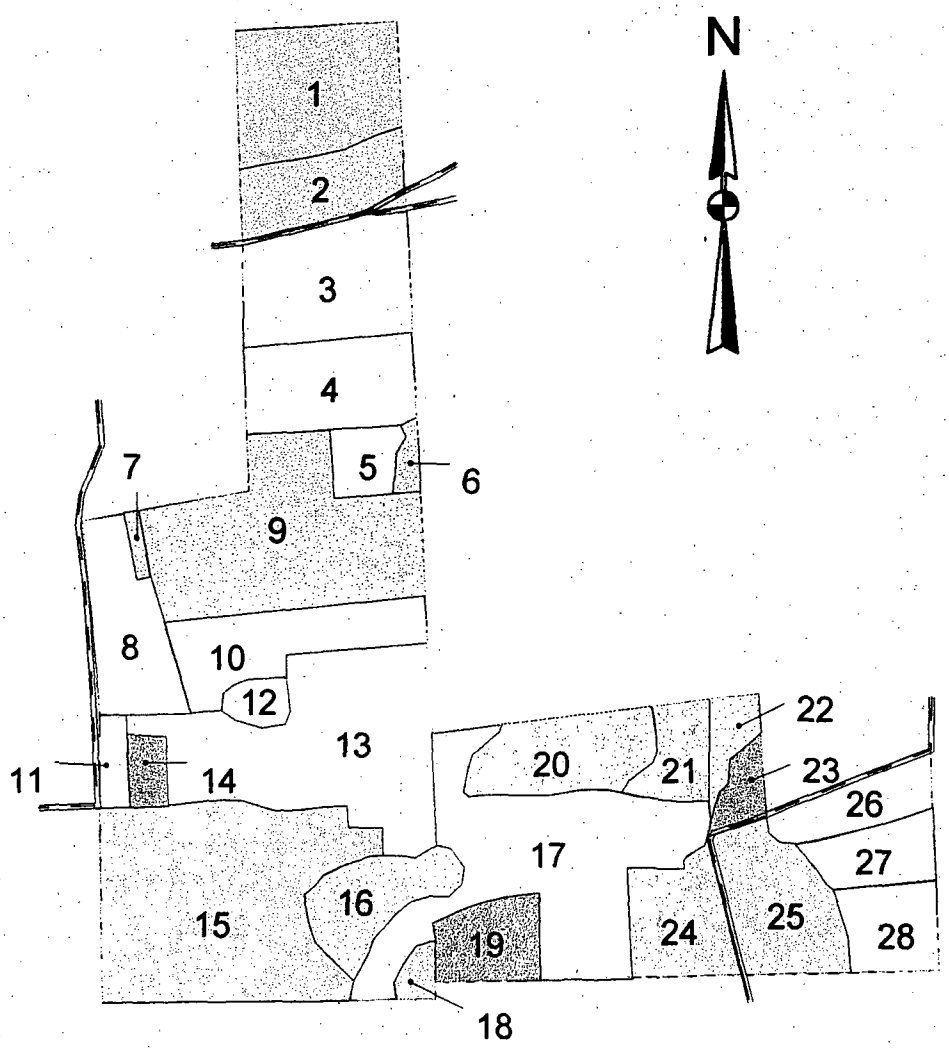
Map of Kisner Tract

Because the Kisner tract is not found on the existing maps, the new map on the following page was created for this report. It uses the same classification system as the rest of the property.

PP&L Susquehanna Riverlands
Kisner Tract

Salem Township, Luzerne County, Pa.

1" = 1000' April 1999



Twp. Roads
Property Lines
Wildlife Lands
Timber Lands
Natural Areas
Crop Lands

Major Tract Descriptions and Recommendations

This section paints a broad-brush view of the tracts of major importance for purposes of wildlife and forest management. More detail on each tract is found in the summary charts on pages 25 and 26.

Susquehanna Steam Electric Station

405.9 Stewardship acres

918.6 total acres

History

Formerly a mosaic of farms and second-growth woodlands, the centerpiece of this tract is the nuclear power plant and its adjacent utility lands. Portions of tract are devoted to assessment areas to gauge any impact of the power plant.

Description

The portions of the property not utilized by the power plant have changed very little in subsequent years. It includes a range of habitats, from croplands, ponds and wetlands to upland oak forests.

Several residences adjoin the property or are located nearby. It appears that most of the mature timber was logged before PP&L took title to this property, for there is little large timber at this date.

Management Objectives for the Tract

Due to security concerns related to the power plant, recreational use of most of the tract should be limited to the current level of hiking and hunting. When full use of the Kisner tract to the west is transferred to PP&L, it will make more sense to manage for improved wildlife habitat.

Recommendations

Tending of the forest and improvement of wildlife habitat can be achieved through various types of pre-commercial cuttings (TSI) and wildlife habitat cuttings listed in the summary of recommendations. A forester should mark or otherwise designate which trees and vines should be cut. All of the recommended projects would meet the goals of the Farm-Game program, so ✓ it is likely that the work could be performed by the Pennsylvania Game Commission labor crews.

In perhaps five to ten years, some of the scattered pockets of mature oaks and yellow-poplars should be harvested in Compartments 1, 2, 12, 17, and 27.

Kisner Tract
135.1 Stewardship acres
246.1 total acres

History
This farm has been purchased by PP&L, but its former owner has retained lifetime rights to the farm and house.

Description
Mr. Kisner is actively farming the property, which includes croplands and orchards. There is also a wetland, and non-farm areas that are too wet for agriculture are wooded. The woodlands appear to be unmanaged.

Management Objectives for the Tract
The management of this tract is likely to be different after Mr. Kisner no longer works the farm. Even though PP&L's position is that they have full timber rights to the property, much of the potential for wildlife habitat improvement is not likely to be realized for several years.

Recommendation
When full rights to the Kisner tract are transferred to PP&L, it is likely that most of the fields will be leased out and that some of the fields will be put to other uses. Some of the marginal fields could be converted to herbaceous cover to meet the shortage in this wildlife habitat category.

Riverlands Tract
273.2 Stewardship acres
393 total acres

History
There is a rich history of human use of this property. The Great Warriors path is found here, as is a substantial portion of the old canal. In more recent years, a manmade lake was created to supply cooling water for the power plant. PP&L converted farms and forests to recreation lands.

Description
This is the heart of the recreational and educational functions of the Susquehanna Riverlands. Water and the habitats it creates are the key to the public's enjoyment of this tract. The river, an old canal, unique wetlands, and the lake are all located here. The riparian forests and forested wetlands are appreciated by children and adult naturalists alike.

Management Objectives for the Tract
This is the property where most of the public use occurs. Because of this and its high visibility, it is especially important to protect its aesthetic values. In addition, the designation by the National Audubon Society as an Important Bird Area carries with it both recognition and responsibility. Much attention has been given to riparian forests and wetlands in recent years, and it is important to make sure that the integrity of the riverside forests is protected. ✓✓ The many educational resources at the site should continue to be utilized.

Recommendations
The possibility of cooperating with the Pennsylvania Fish and Boat Commission to install and maintain a public boat access facility using the access road to the wetlands area should be pursued. The closest existing public boat access points on the river are north of Wilkes-Barre and in Bloomsburg. A boat access point could be used by canoeists traveling from Wilkes-Barre or to Bloomsburg, as well as by those using only the PP&L site. ? 5

A meeting should be held with the local community group interested in building the proposed 18-mile bicycle path on the section of the abandoned railway line to the north of the property. A study is currently underway, and the path could lead onto the Riverlands property. Security issues will need to be addressed, but this may be another chance for community service. ? 6

The remarkable wetlands area includes several types of wetlands in an easily accessible location. It seems to be a natural place for study by regional colleges. Any opportunities to further develop ongoing educational relationships should be pursued.

Gould Island
63.2 Stewardship acres
65 total acres

History
There has apparently been no management work on the island. Channels indicate that it is flooded periodically when the river rises.

Description
A floodplain forest bisected by overhead transmission lines occupies most of the island. Deer cross the river to and from the island. Mile-a-minute weed (*Polygonum perfoliatum*) is a forest weed pest growing in Compartment 2.

Management Objectives for the Tract
The obvious access problem precludes active management of this tract, but the spread of mile-a-minute weed should be checked to reduce the seeds spread by birds.

Recommendation
In addition to controlling the mile-a-minute weed, a simple long-term study could be conducted to determine whether sediment added to the north end of the island is causing it to increase in size.

East Side
515.4 Stewardship acres
715.6 total acres

History
Logging and quarrying helped shape the woodlands on the east side of the river. There has apparently been no forest management.

Description
Primarily forested, much of this tract is on fairly high elevations. The sites are drier than those on the other side of the river. There is much less travel here than on the west side of the river. With the exception of hunting, the use of developed recreational areas is limited to the Council Cup area. In some areas, trespassers have cut down saplings to create brush for wildlife.

Management Objectives for the Tract
A good deal of hunting activity takes place on this tract, and it can continue to provide game and timber for years to come. More improvements in public access to this area should continue to be made, such as the recent additions of parking areas. There is potential for timber management also.

Recommendations
A modified shelterwood regeneration cutting is recommended in 40 and 48. The cutting will take place in two stages, with the first stage starting in late 1999 and the second several years later. The goal is to replace mature trees or those of undesirable species and quality with a new forest that will also provide brushy cover for wildlife habitat. Ferns will need to be sprayed first. ✓

Unlocking the gates to selected access roads during hunting season should be considered, in order to develop more public use and perhaps less vandalism. ?

Council Cup
73.2 Stewardship acres
75.8 total acres

History
Legend has it that native-American councils were held at this site. The second-growth forest itself has not been logged for many years. The only disturbance has been related to necessary infrastructure that supports the distribution of electric power, and the simple amenities offered to those who take in the spectacular view.

Description
Council Cup offers a breath-taking view of the river from a bluff to which one can hike a moderate distance on level ground from a parking area.

Management Objectives for the Tract
Hiking to the scenic view and into other areas on the tract is the primary recreational use for Council Cup.

Recommendations
There is a need for better roadside signs leading to the parking area from the major roads. In addition, there should be signs leading people from the parking lot to the new walking route along the gated access road; this route offers better footing and a shorter walk to the scenic vista. 1

An informational sign or map identifying some of the locations viewed from the overlook could be installed. Additional information on the history of transportation and information exchange along the river could be included. This would mention the river itself, the canal, the Great Warriors path, present roads, telephone lines, and the communications made possible by the electric lines supplied by the power plant. Related to the theme of transportation, another sign identifying the most common bird species passing by during spring and fall migration could be developed.

The property lines should be clearly posted with "No Hunting" signs, ?✓ especially on the east side where hunters wander onto the property into an area with hikers who are not wearing bright clothing.

The woodland in the northeast portion should be evaluated for its potential to be managed as a protected older second-growth forest. In time, it may take on some of the characteristics of an old-growth forest.

Listing of Major Forest Types

Broadly speaking, all of the subject parcels are located within the oak-hickory type of eastern U.S. forests. Yet within this large type are several smaller forest types that are listed below. These names of forest types are taken from ***Forest Cover Types of the United States and Canada***, which was published by the Society of American Foresters. The abbreviations preceding the names are those used in the tables listing the cover type of each compartment. Following the forest types are the abbreviations for other trees and shrubs, as well as a few other terms.

Forest Types

BC-Maple: Black Cherry-Sugar Maple-Red Maple
CO: Chestnut Oak (high, dry sites); includes other oaks and red maple
Hem: Hemlock; may include red oak, white oak, red maple, etc.
Misc.: Miscellaneous types; not a distinctive mix of species
Pioneer: early-succession trees: aspen, black birch, red maple, etc.
PO: Northern Pin Oak (wet sites); may include red maple, sycamore, etc.
RB-Syc.: River Birch-Sycamore (floodplain sites); silver maple, etc.
RM: Red Maple; may include many other species, including oaks
RO: Northern Red Oak; includes white oak, black oak, red maple, hemlock
SM-Elm: Silver Maple-Elm (floodplain sites); includes river birch, basswood, green ash, red maple, and black walnut
WO-BO-RO: White Oak-Black Oak-Red Oak; includes hickory, red maple
YP-EH: Yellow-Poplar--Eastern Hemlock; includes red maple, oaks

Other Abbreviations

Asp: Aspen
Aut: autumn-olive
BB: black birch
Blue: blueberry
DBH: diameter at 4.5'
EG: evergreen
GB: gray birch
G'rod: goldenrod
MFR: multiflora rose
MLV: maple-leaved viburnum
PH: pignut hickory
RS Dog.: red-stemmed dogwood
SM: silver maple
STM: striped maple
WP: white pine
Aus. pine: Austrian pine
Bass: basswood
BL: black locust
BW: black walnut
Dog: dogwood
ERC: eastern redcedar
GM: gypsy moth
Hack: hackberry
ML: mountain laurel
PC: pin cherry
RP: red pine
SH: shagbark hickory
Spice: spicebush
VP: Virginia pine
WSR: white snakeroot

Susquehanna S.E.S - 926.4 acres

Unit	Classification	Acres	Forest Type	Species	Notes	
1	Timber Land	20.3	WO-BO-RO	RM,Hem,RO	14"+ DBH	
2	Timber Land	41.4	RM	RM,aspen,RO	8"-14" DBH	
2A	Timber Land	4.8	WO-BO-RO	WO,BO,RO	8"-14" DBH	SE
2B	Natural Env't	0.9	WO-BO-RO	RO,WO,BB	14"+ DBH	NW
3	Natural Env't	5.3	WO-BO-RO	BO,RM, BB	8"-14" DBH	
4	Utility Land	17.3	G'rod	Dog., ERC		
5	Natural Env't	24.3	mixed	BB,VP,BO	8"-14"+ DBH	
5A	Natural Env't	1.2	RM	RM,BO,YP	I.A. Study Plot	
6	Utility Land	52.8				
7	Wildlife Land	4.8	mixed	YP,BB, Asp	good WL habitat	
9	Wildlife Land	21.3	mixed	Asp,BB,RM	incl. hedgerow	
10	Wildlife Land	10.2	PO	RM,PO	forested wetland	
11	Utility Land	377.2	mixed	G'rod, oaks	wooded inclusion	
12	Natural Env't	81.6	YP-EH	YP,WA, Hem	Rec: timber sale	
13	Natural Env't	3.5	WO-BO-RO	RO,RM,WP	8"-14" DBH	
14	Unique Nat'l Area	14.8	Hem	Hem,BB,RO	8"-14" DBH	
15	Timber Land	12.7	Pioneer	BB,RM,Asp	8"-14" DBH	
16	Timber Land	11.5	WO-BO-RO	YP,BO,WP	14"; windthrow	
17	Natural Env't	3.7	WO-BO-RO	RO,WO,BO	14"+ DBH	
18	Wildlife Land	9.6	G'rod			
19	Wildlife Land	30.4	G'rod			
20	Wildlife Land	8.8	RM	VP,RM,WP	8"-14"+; windthrow	
21	Timber Land	29.7	mixed	RM,VP,RP,NS	4 stands incl EG	
22	Timber Land	10.7	WO-BO-RO	BO,WO,SO	8"-14" DBH	
23	Natural Env't	3.9	WO-BO-RO	RM,RO,SO	8"-14"; ground fire	
23A	Natural Env't	2.1	RP & oaks	RP,PO,RO,BB	8"-14" DBH on rd	
24	Private Land	2.3	mixed			
25	Crop Land	18.5	G'rod	G'rod, spice	pond, old pasture	
26	Natural Env't	9.1	mixed	BB,RM,BC	two stands	
27	Timber Land	16.9	RM	RM,WA,YP	YP is over 14"	
28	Wildlife Land	9.7	WO-BO-RO	WO,CO,BO	8"-14" DBH	
29	Wildlife Land	7.6	G'rod	WA,MFR,ERC	incl. tree "island"	
30	Crop Land	18.3				
31	Wildlife Land	10.6	PO	PO,RM	forested wetland	
32	Crop Land	7.7				
33	Utility Land	20.9	G'Rod		wooded inclusion	

Kisner Tract - 238.3 acres

Unit	Classification	Acres	Forest Type	Species	Notes
1	Timber Land	14.7	mixed	N: BB,YP,Aspen S: BO, WO, RO	8"-14" ditch
2	Natural Env't	6.4	WO-BO-RO	RO-BO-CO	8"-14" Rec: Look for possible timber sale in 10 yrs.
3	Crop Land	9.2			
4	Crop Land	12.4			
5	Crop Land	3.5			
6	Timber Land	0.9	RM	RM,BC,Syc	8"-14"
7	Timber Land	0.5	RM	RM-YP-BC	
8	Crop Land	9.2			
9	Orchard	24.2	Orchard	apple	Comm'l. Orch.
10	Crop Land	9			
11	Crop Land	1.6			
12	Crop Land	1.8			
13	Crop Land	22.3			
14	Wildlife Land	1.8	PO	PO	4"-8"
15	Timber Land	29.7	PO	PO,WO	stream, wet
16	Natural Env't	6.2	WO-BO-RO	PO,WO,RM	swamp
17	Crop Land	24.4			
18	Timber Land	1.4	Plantation	RP	Plantation
19	Timber Land	6.2	WO-BO-RO	WO,PO,RO	4"-8"
20	Timber Land	6.7	RM	RM,WO,BC	4"-8"; like 21
21	Timber Land	6.4	PO	PO,WO,SP	8"-12"; understocked
22	Natural Env't	3	PO	PO,SH,SP	wetland
23	Wildlife Land	1.8	G'rod	WP,SP,Spruce	EG cover developing
24	Timber Land	6.2	WO-BO-RO	RO,WO,SP	Rec: Look in 10 yrs for possible TSI
25	Timber Land	11	PO	PO,WO, SH	
26	Crop Land	5.1			
27	Crop Land	5.8			
28	Crop Land	5.1			

Riverlands - 393 acres

Unit	Classification	Acres	Forest Type	Species	Notes
16	Utility Land	34.1			Energy Info Ctr.
17	Wildlife Land	2.3	plantation	WP	6"-10" 20 yrs old
18	Crop Land	4			
19	Wildlife Land	4.4			now cropland
20	Wildlife Land	1.9	RB-Syc	RB,SM,BW	thick saplings
21	Wildlife Land	3.9	SM-Elm	SM,shrubs	hedgerows
22	Wildlife Land	1.2	SM-Elm	SM	Rec: cut SM
23	Wildlife Land	2.2	SM-Elm	SM,BC, BL	exc. WL habitat
24	Crop Land	5.9			
25	Crop Land	9.1			
26	Natural Env't	22.2	SM-Elm	SM,BC,Bass	exc. WL habitat
27	Natural Env't	10.9	RB-Syc	RB,SM,Syc	I.A. Study Plot
28	Crop Land	30			
28A	Wildlife Land	5	G'rod	Asp,SM,RB	early succession
28B	Utility Land	0.9			lawn & bldgs.
29	Recreational Land	73.6	lawns with shade trees		park facilities; includes lake
30	Crop Land	28.9			
30A	Wildlife Land	5.5	SM-Elm	SM,Syc,WA	
30B	Wildlife Land	2.8	crops		now crop land
31	Utility Land	1.2			under power line
32	Natural Env't	3.8	SM-Elm	SM,Bass,Hick	14"+ DBH
33	Utility Land	5.7	lawns,bldgs.		I.A. Study Plot
34	Natural Env't	3.8	SM-Elm	Bass,RO,SM	8"-14"& up DBH
35	Wildlife Land	2.1	G'rod	SM,Syc,Aut.	stockpiles, etc.
36	Wildlife Land	1	G'rod	Sumac,BL	
37	Natural Env't	13.1	RM	WA,RM,BC	forested wetland
38	Wildlife Land	4	RM	RM,Bass,SH	forested wetland
39	Wildlife Land	12.3	Pioneer	RB,elm,RM	marsh
40	Wildlife Land	7.8	G'rod	BL, Aut	
41	Wildlife Land	2.9	marsh	alder,SM,Syc	incl. open water
42	Natural Env't	7.9	mixed	PO,Syc,YP,RO	exc. riverside trail
45	Rec'l. Land	1.3			parking lot
46	Unique Natural Area	42.6	diverse forested wetlands	many wetland trees & shrubs	outstanding natural area
47	Wildlife Land	20.9	G'rod	alder thicket, many tree sp.	wetlands and pond
48	Wildlife Land	13.8	SM-Elm	WA,BW,RO	riverside forest

Gould Island - 65 acres

Unit	Classification	Acres	Forest Type	Species	Notes
1	Natural Env't.	19.1	RB-Syc	Syc,WA,BC, Hack, SM	8"-14" & larger
2	Utility Land	1.8		G'rod, grass, forbs	mile-a-minute weed gas pipeline
3	Wildlife Land	13.8	RB-Syc	WA,RB,Syc	good 8"-14" WA, but no access
4	Natural Env't.	20	SM-Elm	SM, Syc, elm, RB, Hack,	some very large SM & Syc
5	Natural Env't.	10.3	RB-Syc	RB,Syc,BL, RO	thick spice, WSR

Bell Bend - 99.7 acres

Unit	Classification	Acres	Forest Type	Species	Notes
1	Wildlife Land	3.6	RM	RM,WA,GB 8"-14"	Rec.: Cut RM to release oak seedlings.
2	Utility Land	9.3	old field with shrubs & trees	G'rod, grass, sumac, Dog., MFR	
3	Utility Land	14.5	old field	G'rod, blue, Aut., elderberry	Combine with 2 for management purposes.
4	Natural Env't.	17.7	pioneer trees & shrubs	Aus.Pine,RM	good WL habitat
5	Utility Land	15.7	old field	G'rod, grass, A.Olive,Sumac	Rec.: Gate access road. Add to htg. area?
6	Wildlife Land	9.5	WO-BO-RO	BO, VP, RM	4"-8" and 8"-14" DBH poletimber
7	Natural Env't.	7	old field	G'rod, grass, Aut., sumac, pines	
8	Wildlife Land	22.4	WO-BO-RO	BO, RM, GB	pond, ATV trails

East Side - 715.6 acres

Unit	Classification	Acres	Forest Type	Species	Notes
1	Natural Env't.	102.8	WO-BO-RO, SP	CO,RO, YP,RM,SP, WO,BO,WP	Rec: Combine and remap with 2 & 51. Stone Crusher, pond
2	Timber Land	5.6	CO	CO,BO,WO	See unit 1 notes.
3	Timber Land	10.3	WO-BO-RO	CO,WO,Hem	10"-14"DBH
4	Natural Env't.	9.5	WO-BO-RO	CO,RO,WO	8"-12" DBH
5	Utility Land	22.2			
6	Timber Land	4.1	WO-BO-RO	RO,CO,VP	4"-8" DBH
7	Timber Land	11.8	mixed	VP,CO,RO	
8	Timber Land	2.1	WO-BO-RO	WO,BB,VP	8"-12" DBH cut by trespassers
9	Rec'n Land	0.9			Parking Area
10	Wildlife Land	7.2	Misc.	BW,SH,BB, Aut, PO	4"-8" DBH exc. WL habitat
11	Wildlife Land	0.9	Pioneer	SP,Asp,BB	Expand into 15 for 4.4 acres total
12	Crop Land	1			
13	Crop Land	3.5			
14	Natural Env't.	11.9	Misc.	BW,SH,Syc	
15	Timber Land	50	WO-BO-RO	RO,BO,VP	See unit 11 notes.
16	Crop Land	13.1			
17	Utility Land	6			
18	Crop Land	4.1			
19	Crop Land	14.5			
20	Natural Env't.	14.4	SM-Elm	SM,WA,BW	riparian forest
21	Crop Land	7.8			
22	Crop Land	8.7			
23	Crop Land	0.7			
24	Crop Land	29.2			
25	Crop Land	35.1			
26	Natural Env't.	25.6	SM-Elm	SM,willow,RM	riparian forest
27	Timber Land	2.4	SM-Elm	SM,willow	drainage way
28	Timber Land	4.8	Pioneer	Dog-RM-Sumac	good WL habitat

East Side - 715.6 acres (cont'd.)

Unit	Classification	Acres	Forest Type	Species	Notes
29	Natural Env't	2.5	RB-Syc	BW,RB,BC	8"-14" DBH
30	Wildlife Land	9.8	Misc.	BW,BL,BC	wetland
31	Rec'n Land	0.6		BW, NS	Parking Area
32	Wildlife Land	6.8	SM-Elm	SM,BC,GB	Rec:Cut grapes in BC
33	Natural Env't	4.6	RM	RM	many multiple stems
34	Utility Land	52.8	Pioneer	BL,Aut, sumac	thick WL cover
35	Natural Env't	6.1	SM-Elm	Elm,BW,SM	4"-14" DBH
36	Timber Land	7.3	S: YP,BO N: BW,WA	YP,BO,RO,WA	Rec:Regeneration timber sale with PP&L okay
37	Wildlife Land	4.1	mixed	YP,BB	Parking Area Rec:Cut trees.
38	Wildlife Land	4.4	mixed	BB,ERC,WA	Rec: Cut trees in 5 years.
39	Timber Land	10.4	Pioneer	Asp,RM	Rec: Cut trees.
40	Timber Land	100	RO	RO,YP,WA	Rec: timber sale
41	Wildlife Land	3.5	mixed	MFR,RM,BB	good WL habitat
42	Natural Env't	3.8	G'rod	Aut	good WL habitat
43	Wildlife Land	11.6	Pioneer	MFR,Spice.	Rec: WL cutting
44	Wildlife Land	6	pioneer	Asp,WA,RB	Rec: WL cutting
45	Wildlife Land	1.8	pioneer	Asp,WA	Rec: WL cutting
46	Timber Land	5.7	WO-BO-RO	BB, YP,oaks	8"-14" DBH
47	Timber Land	5	shrub/sapling	rasp.,haw.,crab.	no timber Rec: Cut some grapes.
48	Timber Land	25.6	YP	YP,BB	Rec: Shelterwood.
49	Natural Env't	10.1	pioneer	Asp,WA,BW	4"-8" DBH Rec: Cut 10 yrs.
50	Timber Land	3.8	WO-BO-RO	RO,WO,BB	8"-12" DBH
51	Natural Env't	18.4	WO-BO-RO	RM,RO,Asp,WA, BB,SP,WO	8"-14" DBH See Comp't 1 notes.

Council Cup - 75.8 acres

Unit	Classification	Acres	Forest Type	Species	Notes
1	Unique Nat'l. Area	3.1	CO	mixed	includes cliff
2	Recreation Land	3.7	WO-BO-RO	RO,BO, CO,STM	8"-14" DBH includes overlook, picnic tables, benches
3	Natural Env't.	2.7	WO-BO-RO	BO, RM, BB, VP	some RO over 14"
4	Utility Land	2.6	pioneer	Asp, BB, RM, RO, G'rod	under 4" DBH
5	Unique Nat'l. Area	33.6	WO-BO-RO	BO,RO,WO, BB, WP, YP, MLV	3'-4' stream channel good WP regen'n Rec.: build trail
6	Natural Env't.	6.5	CO	CO,BO,WP, RM,Hem,BC	8"-14" DBH good regen'n.
7	Natural Env't.	23.6	WO-BO-RO	CO,WP,BO, Asp, PC, VP	8"-14" DBH WP is 14"+ DBH good regen'n.

Berwick Substation - 42 acres

Unit	Classification	Acres	Forest Type	Species	Notes
1	Natural Env't.	6.3	CO	CO, RO, BO Hic	Hem provides EG cover
2	Utility Land	7.8	G'rod, shrubs	Aut., sumac	
3	Timber Land	8	BC-Maple	BC,RM,CO, WA,RO,BO	8"-14" DBH Rec: TSI for BC, RO
4	Crop Land	2.1	G'rod, shrubs	brambles	Rec: Lease field
5	Crop Land	14.8			
6	Wildlife Land	0.7	Pioneer	sumac	
7	Timber Land	2.3	WO-BO-RO	WO,Hic, Hem, WP	diameter limit cutting 5-10 years ago Rec: Reclassify as WL land and reduce acreage.

Projects Schedule, 1999-2009

Some projects are perennial, and so are not listed below. These include controlling purple loosestrife and maintaining the hiking trails.

This schedule is flexible, and can be modified as needed to reflect any funding available from cost-share programs and the proposed timber sales.

1999

Susquehanna S.E.S.

- Survey any property lines whose locations are not clearly known.
- Clear and repaint any unmarked boundary lines with brush-on paint; include Compartments 21 and 31.
- Correct property signs in 16.

Riverlands

- In 42, remove the "Dead Tree" and the "Evergreen Grove" trail signs.
- Replace or remove the benches in 43.
- Improve the signs on the RR trail.
- In 39, cut red maples trees with grape vines to create grape tangles.
- In 22, cut the silver maple trees to create wildlife habitat.

Gould Island

- Control the mile-a-minute weed in 2.

East Side

- Mark the south line of 40.
- Make plans for the shelterwood timber sale in 48 and the NE part of 40. This will include spraying in July to control hay-scented fern.
- Consider regenerating 36 also if aesthetics can be adequately addressed.
- Have the PGC crew cut down marked trees in 37 and 39.

Bell Bend

- In Compartment 1, cut down the red maples to release the oak seedlings.
- Survey and mark the west property line through the forest.
- In 8, remove the collapsed shed and the junk that fills it.

Berwick Substation

- Lease 4 for crop production if possible.

Council Cup

- Monitor 3 for oak decline and gypsy moth population build-up.
- Develop and install various types of recommended signs.

2000-2003

Susquehanna S.E.S.

- In 3, 5, 22, and 23, cut grapevines in trees such as RO, WA, RM, and YP.
- In 9, cut some trees to develop brushy regeneration and grape tangles.
- In 27, cut YP and RM sprouts.
- In 21, conduct TSI for spacing and quality of red maple trees.
- Mow 29 in August as needed to maintain a brushy field edge.

Riverlands

- Develop a trail booklet for the Wood Duck Trail.
- In 46, improve signs on RR trail and install a bench.
- In 17, thin WP for health and to maintain evergreen cover.
- Cut silver maples in 22 and red maples in 29; to create grape tangles.
- In 39, cut red maples to create grape tangles.
- In 42, cut grapevines growing in butternuts.
- Mow 40 in August for herbaceous vegetation.

East Side

- In 15 and 45, make wildlife shrub and tree release cuttings.
- In 43 and 45, make grape tangles and cut aspen (but not at head of gully).
- In 47, cut BB, and the grapes growing in desirable trees.
- In 44 cut low-forked dog., aspen, and RM; cut grapes in good trees.
- In 32, cut grapevines in black cherry trees.
- Evaluate the success of regeneration in the shelterwood in 40 and 48.

Council Cup

- Mark the northeast property line of 5.
- Build a trail through 5.

2004-2009

Susquehanna S.E.S.

- Conduct a timber sale in 1, 2, 12, 17, and 27.
- Mow 29 as needed in August to maintain a brushy field edge.

Riverlands

- In 30A, cut some trees to release shrubs.

East Side

- Have the PGC crew cut down the trees in 38 and 49.

Kisner Tract (if PP&L takes over the property by this time)

- Plant evergreens in 19 and 25.

Signature Page

Plan Writer's Pledge

To the best of my knowledge, this Forest Stewardship plan contains:

- an accurate representation of the landowner's interests and objectives for the property;
- an accurate assessment of all the natural resources present on the property addressed in the plan;
- management recommendations in keeping with the landowner's interests and abilities, and considering the inherent value of all resources on the property.

Stephen E. Jaquith — 30 April 1999

Stephen E. Jaquith — Date

Landowners' Pledge

We accept the recommendations contained in the Forest Stewardship plan, and will make an honest effort to follow them for the ten-year period covered by the plan.

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

We understand that a service forester or consultant will periodically review the implementation of our Forest Stewardship plan to assist us in maintaining "Stewardship Forest" status. To enable him or her to carry out this responsibility, we will make available copies of plan amendments and/or timber harvesting prescriptions before carrying out a major activity. We understand that we are not obligated to obtain approval from the service forester, but that he or she may advise us if prescriptions do not appear to serve the goals of our Forest Stewardship plan or meet program standards.

We understand that as a "Forest Steward" we are eligible (but not obligated) to request Stewardship Incentive Program (SIP) cost-share assistance to help implement approved practices recommended in the plan or subsequent amendments.

If we choose to withdraw from the Forest Stewardship Program, we agree to return to the service forester the sign that designates our property as a "Stewardship Forest."

PP&L, Inc. - Kevin R. Drewencki — Date

Bureau of Forestry Approval

This Forest Stewardship plan meets the requirements established by the Pennsylvania Bureau of Forestry for Forest Stewardship plans developed using cost-share assistance.

Nicholas P. Lylo — 6/2/99

Nicholas P. Lylo — Date

Appendix 1

Glossary of Selected Forestry Terms

Advance Regeneration - tree seedlings and saplings that have become established under an existing stand of trees

Canopy - the upper level of a forest, consisting of the branches and leaves of taller trees

Cavity Trees - trees that contain one or more holes that are, or could be, utilized by wildlife (including birds, mammals, and insects such as bees)

Conifers - cone-bearing trees such as pine, spruce, fir, and larch; most are evergreens (larch is an exception)

Crop Trees - individual trees selected for release from the competition of adjacent trees; trees are selected for their ability to meet the landowner's goals, which are usually some combination of timber, wildlife habitat, and aesthetics

Crown - the portion of a tree above the main trunk, consisting of branches and foliage

DBH - the diameter of a tree as measured 4.5 feet above the ground ("diameter at breast height"). This is the diameter referred to for trees.

Dieback - the dying of the ends of branches

Edge - the junction of two different cover types, such as field and forest

Hydric - in reference to soils that have developed in wet conditions

Mast - all fruits of trees and shrubs used eaten by wildlife. Hard mast includes nutlike fruits such as acorns and beechnuts. Soft mast includes the fleshy fruits of black cherry, black gum, and serviceberry.

Overstocked - a condition of a forest in which trees are so closely spaced that their growth and development are slower than they would be if the trees had more growing space

Overstory - trees in the upper level, or canopy, of the forest

Poletimber - trees 4 to 10 inches in diameter, as measured 4.5 inches above the ground (this measurement is abbreviated as DBH)

Riparian Area - the aquatic ecosystem of rivers or streams and the adjacent lands that affect or are affected by the aquatic environment

Sawtimber - a relatively well-formed tree large enough to yield at least one log that can be sawn into lumber

Shelterwood - a method of regenerating a forest through a series of cuttings of carefully selected trees.

Stand - a group of trees growing in the same area; the species mix, age, condition, etc. of the trees distinguish one stand from another

Timber Sale - ideally, a carefully controlled harvest of trees selected for the purpose of improving the future growth and development of the existing forest or establishing a new forest.

Timber Stand Improvement (TSI) - intermediate treatments, generally performed in stands less than 50 years old, with the purpose of improving growth and composition of the forest by giving more growing space to the trees best suited for meeting the landowner's objectives.

Understocked - a condition of a stand of trees which is not fully utilizing the space available

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

Wetland - an area that is either covered by shallow water (such as a marsh, swamp, or bog) or that is transitional between water and land (where the water table is at or near the land surface)

Wildlife habitat - the native environment of an animal (including birds, fish, mammals, and insects), ideally providing all elements required for life, growth, and reproduction: food, cover, water, and space

Wolf Tree - a large, open-grown tree with a very large, full crown and a limby appearance; of low timber value, but often a good wildlife tree

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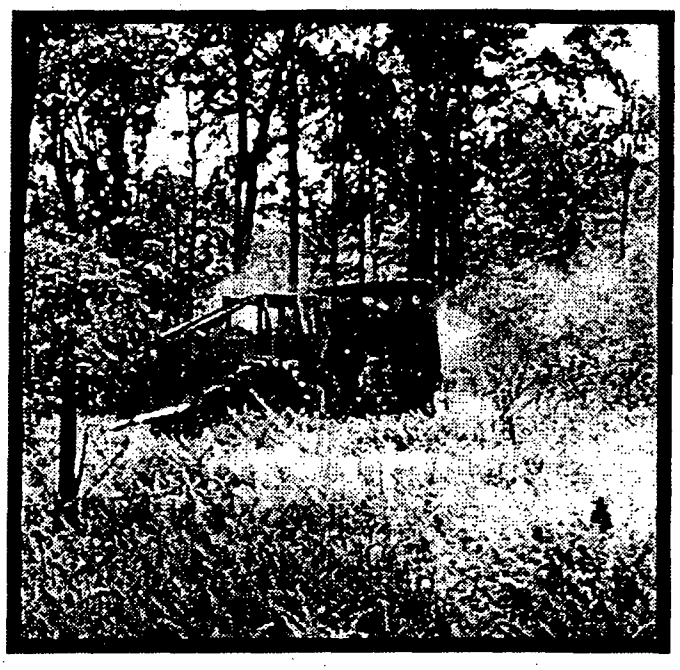
Controlling Understory Vegetation During the Regeneration Harvest

and

ReGenesis
Limited Liability Company



"Forest Regeneration Starts Here!"

ReGenesis LLC

Forest Regeneration Starts Here!

This booklet is intended to give landowners, foresters and other natural resource professionals basic background information relating to the application of herbicides in the forest environment. It relates specifically to the control of undesirable understory vegetation during the regeneration harvest. Several concepts presented herein are simplified to enhance clarity and understanding.

THE FORMATION OF REGENESIS LLC

ReGenesis Limited Liability Company was founded to provide foresters with the means to control undesirable understory vegetation during the most critical period of even-aged forest management — *the regeneration harvest.* Skilled personnel apply the forest herbicide applications with "state-of-the-art" techniques. ReGenesis works hand in hand with foresters and other natural resource professionals to determine the technical aspects of herbicide selection, timing, and site preparation techniques needed to improve the chances of natural tree reproduction after a prescribed regeneration harvest.

IMPORTANT TERMS AND CONCEPTS

Sustainable forestry embodies a forest management concept that provides desired forest products and resources now without compromising the capabilities of the forest to provide similar products and resources in the future. Forest landowner's who practice sustainable forestry can expect to achieve a higher level of satisfaction and a broader array of benefits from their forest resources. Sustainable forest management can:

1) increase the total income derived from forest products through sustainable periodic timber harvests;

2) enhance wildlife diversity and/or increase species

populations via habitat manipulation;

3) maintain soil, air and water quality to sustain environmental health and vitality; and

4) increase overall biodiversity and aesthetics by creating or preserving desired habitat components.

The key element of sustainable forestry is forest regeneration. At some point(s) in the development of the forest, there comes a time when mature, damaged, diseased or dying timber is removed from the forest. This removal can occur either by timber harvesting or by some natural disturbance such as a killing insect defoliation or damaging wind event. In any case, sustainable forestry requires the planning for and the subsequent establishment of tree regeneration at the time the timber removal event occurs. Otherwise sustainable forestry cannot be *sustained* without a plausible way of ensuring timber stand renewal.

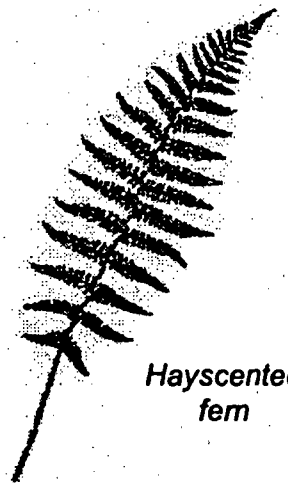
New York fern

Therefore, the concept of sustainable forestry mandates a commitment to reforestation; and reforestation can be achieved either through natural regeneration or through artificial means such as planting. Obviously natural regeneration is much more desirable than planting due to the cost and labor associated with artificial reforestation.

Regeneration harvests are timber harvests designed to initiate natural reproduction of tree species immediately after cutting. A regeneration harvest must remove sufficient crown cover to allow significant amounts of sunlight to reach the forest floor so the germination and growth of shade intolerant trees can occur. ***Shade intolerant trees*** (sun-loving trees) are generally considered the most desirable tree species because they often are highly valued for their timber production and/or wildlife utilization characteristics. Black cherry, oaks, white ash, yellow poplar, hickories, black walnut and aspen are examples of trees that exhibit a strong preference for abundant sunlight. ***Shade tolerant species*** are often the least valuable and include American beech, Eastern hemlock, maples, and a host of understory shrub species.

There are three primary types of harvests used to initiate

tree regeneration in even-aged stands in Pennsylvania. ***Clearcutting*** is a type of regeneration harvest that removes all trees from the stand at one time. The new timber stand develops from stored seed, seed entering from adjacent stands, sprouts, or ***advanced regeneration*** (i.e. already existing saplings). ***Shelterwood cuts*** and ***seed tree harvests*** are two types of regeneration harvests that allow for the removal of trees in stages. Shelterwood and seed tree cuts have several advantages over clearcuts. They allow superior quality trees to remain in the stand to provide a continual source of seed, and they provide varying degrees of shelter for an otherwise harsh, dry microclimate. These characteristics help assure the establishment of abundant quantities of natural regeneration. After adequate advanced regeneration becomes established, a clearcut or ***final harvest*** is conducted to remove all overstory trees, thereby releasing the newly established trees to form a new stand.



Hayscented fern

Historically, forestland managers have relied on natural reproduction to reestablish timber species after a regeneration harvest. However, regenerating desirable hardwood tree species in the forests of Pennsylvania today has become difficult. The two main factors attributing to this phenomenon are white-tailed deer and interfering understory vegetation. Either singularly or in combination, they often limit the ability of a forest to reproduce naturally.

Deer selectively browse favored tree seedlings and leave less palatable plants to flourish. Unfortunately many of these seedlings and saplings we favor as timber species are also highly favored food sources for deer. This habit of selective browsing alters the species composition of vegetation found in the understory of the forest environment. Now in the absence of competition, the less palatable species (such as striped maple, beech root suckers, shrubs, vines, ferns, grasses and sedges) persist and expand into the growing space formerly occupied by desirable tree regeneration.

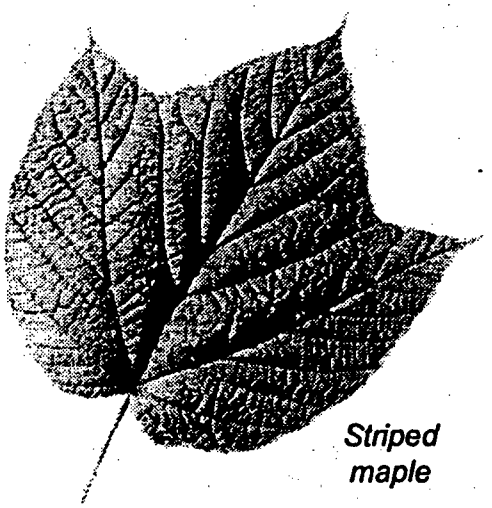
Other factors that contribute greatly to the expansion of undesirable species are ***intermediate harvests*** and ***natural***

disturbances. Intermediate harvests such as thinnings increase the amount of available light in the understory of the forest. Natural disturbances such as insect defoliation and disease can create similar conditions. When the forest floor is exposed to increased levels of sunlight, shade tolerant vegetation begins to grow and expand at a faster rate. Unfortunately, the establishment of shade tolerant understory vegetation is undesirable because they interfere with the establishment of desirable tree species. Ferns, striped maple, beech, and grasses are examples of undesirable species that are well adapted to invading disturbed sites with partial sunlight. In most cases, stands that have even moderate levels of interfering understory vegetation have lost the capacity to reproduce themselves through natural regeneration.

WHY HERBICIDES ARE NEEDED IN THE FORESTS

Without forest regeneration, you will postpone income from final harvest, lose future revenues, incur substantial additional reforestation costs, increase the risk of losing existing trees to natural disasters, and have degradation of wildlife habitat quality.

Successful reproduction of desirable timber species during the regeneration harvest is a prerequisite to sustainable forestry. A final harvest cannot be conducted in the absence of significant quantities of advanced regeneration. Otherwise, natural reproduction within the stand will likely fail. If the regeneration harvest fails, more intense silvicultural practices must ensue to recapture the growing space lost to undesirable understory vegetation and the final harvest must be postponed until such time as successful regeneration occurs. Furthermore we will also lose the ability to manipulate existing habitats which is an essential tool in creating biodiversity, aesthetics, environmental health and forest vitality.



Striped maple

QUESTIONS AND ANSWERS

1. **When is an herbicide spray application warranted?** Herbicide spray applications are associated with timber harvests designed to promote forest tree regeneration. The application of herbicide may be necessary to remove existing understory vegetation that competes for light, water and nutrients needed to establish tree seedlings. Generally speaking, if more than 30% of the total area contains competitive understory vegetation, then herbicide control may be warranted. Spray applications may also be appropriate for timber harvests designed to salvage timber from a recent insect or disease outbreak, particularly if stand density is reduced to a point where conditions become favorable for the establishment of advanced regeneration.

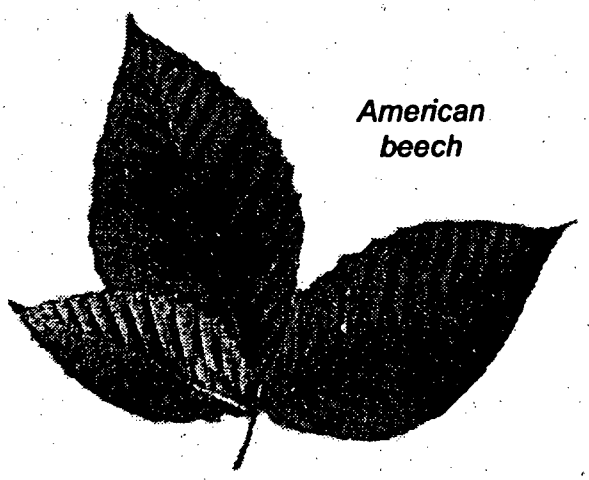
2. **What types of vegetation can be controlled?** The three most common types of interfering understory vegetation found in Pennsylvania are ferns, beech brush, and striped maple. Other species such as mile-a-minute vine, honeysuckle, bittersweet, mountain laurel, multiflora rose, poison ivy, grasses and others present problems for forest regeneration in certain parts of the state.

3. **What chemicals are used most frequently in Pennsylvania forest herbicide applications?** DuPont manufactures OUST, a preemergent and postemergent herbicide. Preemergence treatments control or suppress weeds through root uptake during seed germination. Postemergence herbicides control through root and foliar uptake. OUST will provide a diminishing residual effect for a period of 9 to 12 months. OUST cannot be applied to surface water or wetland areas that include surface water. Monsanto manufactures ACCORD, a postemergent herbicide that controls or suppresses vegetation through foliar uptake. Unlike OUST, ACCORD exhibits no residual action to control vegetation.

4. **Are the chemicals safe?** ACCORD and OUST both carry a "CAUTION" signal word on their label indicating they are among the lowest toxicity of all herbicides suitable for forest application in Pennsylvania. ACCORD bonds strongly to soil particles preventing this product from leaching out of the soil profile and entering ground water. This affinity between product and soil particles remains until the product is degraded.

ACCORD degrades primarily through microorganism degradation under both aerobic and anaerobic conditions in soil. OUST does not bind strongly to soil and is slightly soluble in water. However, studies show that a majority of the parent compound stays within the top 3 inches of soil. OUST is rapidly broken down in soil by the action of microorganisms, by the chemical action of water, and through the action of sunlight. OUST is unlikely to degrade groundwater quality when used in accordance with product labeling.

5. **When to use ACCORD only.** ACCORD is best applied alone when the target species are primarily striped maple, beech brush, and other broadleaf vegetation. Do not use ACCORD alone when a heavy seed bank of grasses and sedges is suspected and significant forest floor disturbance is expected. Forest floor disturbance during a regeneration harvest stimulates the germination of grass and sedge seed. Also, do not use ACCORD alone when ferns are present. Fern rhizomes are broken into segments by the treads of the spray equipment during the herbicide application. Control of the surviving "root" segments will require a residual herbicide such as OUST. A key factor to successfully applying ACCORD only is to minimize ground disturbance during the regeneration harvest.



6. **When to use OUST only.** OUST is best applied alone when the target species is light to moderate fern cover and interfering understory woody vegetation is minimal. OUST has better control on young ferns earlier in season. OUST will kill much of the existing regeneration, though red maple seedlings are somewhat resistant to this herbicide.

7. **When to use OUST without surfactant.** Use OUST without surfactant when fern cover is light to moderate and significant amounts of advanced regeneration are present. The addition of surfactant is not required for control of hayscented and New York fern. Spray late in the herbicide season to

minimize mortality of desirable seedlings. Northern red oak and black oak are slightly sensitive to the application of OUST without surfactant. OUST causes leaf burn and terminal dieback on other species such as birch and yellow poplar, but most seedlings survive and grow rapidly the following year. Black cherry and white ash seedlings are most sensitive to OUST.

8. **When to apply ACCORD + OUST in combination.** ACCORD and OUST tank mixed together are most effective at controlling mixed understory vegetation. Heavy fern cover also requires a mixture of OUST and ACCORD. Fern control is significantly greater with this mixture than with ACCORD alone. If in doubt about the efficacy of ACCORD alone or OUST alone, then use both in combination.

9. **Special concerns for the control of striped maple.** Striped maple can reach heights greater than 20 feet and form particularly dense stands. These growth traits present special problems that inhibit adequate coverage of herbicide during the spray application. Reducing the spray swath distance from 80 feet to perhaps 60 feet in moderate cover or 40 feet in very dense cover can compensate for stand density. However, mechanical limitations prohibit the control of striped maple that exceeds 20 feet in height. In stands where a significant percentage of striped maple is greater than 20 feet it may be necessary to a) cut all the stems greater than twenty feet in height, then herbicide the site the following spray season, b) herbicide the stand, then cut and basal spray all stems that survived the initial herbicide spray application, or c) conduct a shelterwood harvest which includes the cutting of all understory trees down to 1" DBH, then herbicide 2 seasons following the harvest. *Option C is probably most cost effective.* The control of larger diameter stems is strongly dependent on optimizing the timing of the herbicide application.

10. **Can planted conifers be released from competing hardwood and herbaceous vegetation by using herbicides?** Yes, ACCORD can be applied to conifer stands after buds set in August. Other herbicides are also available depending on specific situations. It is best to release pines before they are three feet tall so as to minimize mechanical damage during the spray application.

11. **When is the best time to spray herbicide?** Begin

spraying ferns around the first of July. Begin spraying striped maple and beech brush in late July or whenever terminal growth stops and buds are set. Generally: spray ferns early, spray striped maple and beech brush later, when in combination spray at the time best suited for striped maple.

12. <u>How late in the season can herbicides be applied?</u> ACCORD can be applied up until the time at which the leaves begin to yellow. This is usually around mid to late September in Pennsylvania. OUST can usually be applied all the way to the end of September. In any case, frost marks the end of the herbicide season for ACCORD and OUST.

13. <u>When to "spray first, then harvest".</u> In most cases, herbicides are applied to the uncut stand then followed by a shelterwood or seed tree cut. It is best to herbicide before a harvest if:

a) little disturbance is expected during the regeneration harvest. Examples include: winter harvesting with moderate to heavy snow cover; frozen conditions that minimize the exposure of bare mineral soil; light harvests where relatively small quantities of wood products are removed from the site; harvest sites that allow skidding activities to be limited to a few main trails during the timber harvest.

b) or, the standing relative density is already less than 75% overstory stocking. In this case: herbicide first; then delay final harvest until adequate regeneration becomes established. Regeneration may take longer at this relative density, but the established tree seedlings will rapidly outgrow any grasses or sedges that develop at the time of overstory removal.

14. <u>When to "harvest first, then spray".</u> Harvest first, then spray if there will be significant disturbance to the forest floor during the regeneration harvest.

a) For ACCORD only applications: Herbicide the growing season following the harvest to allow full germination of grass and sedge seed which has been stored in the seed bank.

b) For OUST only or ACCORD + OUST applications: Herbicide immediately follow the regeneration harvest since residual herbicide action will prohibit the growth of newly germinated during the current growing season.

These scenarios require adequate numbers of seed trees be left evenly dispersed over the site to insure abundant seed production immediately following the harvest. Care must be

taken to lop slash close to the ground to minimize interference with equipment during the herbicide application.

15. **How long must the spray site remain undisturbed before and after the actual herbicide spray date?** Do not conduct a harvest or otherwise disturb the spray site 4 to 6 weeks prior to the scheduled herbicide application. Do not conduct a harvest or otherwise disturb the spray site for at least 3 to 4 weeks after the herbicide spray application. Wait till leaf fall before disturbing the site to maximize translocation of the herbicide(s) to the root system.

16. **What special precautions must be taken immediately after the herbicide spray application?** Stay out of the spray site for at least 12 hours after the spray application.

17. **When can I expect to see results after the herbicide spray application?** "Brownout" should occur within 2 to 3 weeks for fern, grasses, and beech brush. Overall understory control can be determined near the end of the first growing season following the herbicide spray operation. A significant portion of the striped maple that is injured following the herbicide application will succumb to mortality the second season after the application. Adequate levels of advanced regeneration may take 3 to 10 years to become established.

18. **How much vegetation control is enough?** Although it is desirable to achieve as high a percent kill as possible it is not necessary to achieve 100% kill. Most sites will include areas of excessive slope, rockiness, wetness, or other obstacles that prevents machinery from traversing the site at recommended intervals. Even sites that have been completely sprayed may have logging slash, windthrown trees, or other barriers that shelter small areas from herbicide during the spray application. After treatment, competing understory vegetation should be present on less than 15% of the total area to be considered acceptable.

19. **How long will the herbicide treatment remain effective?** If the competing vegetation has been reduced below the 15% post spray threshold, the treatment should remain effective for 4 to 8 years. This window may be extended to 8 to 10 years if used in conjunction with other measures such as deer fencing. During this time advanced regeneration must become firmly established and released.

20. **Have my goals been met by the forest herbicide spray**

application? This question should be answered in two phases: 1) *Did the herbicide application succeed?* Yes, if we achieve the 15% post spray threshold as discussed in as discussed in Question 18, above. 2) *Did we achieve an adequate level of regeneration after the herbicide application?* Your actual regeneration success will depend on a number of different factors including, but not limited to, seed crops, deer browsing, species composition, and weather anomalies. Forest herbicide spraying is only one tool that can be used to promote desirable regeneration within a forest environment. Consult a forester for further advice to help increase your odds of answering this question favorably.

21. How much does it cost? This will vary depending on herbicide(s) used, species being controlled, terrain, etc. Please call for a quote.

For further information, contact::

ReGenesis LLC

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Note: *This booklet may be photocopied for use in Pennsylvania Forest Stewardship Plans.*

Disclaimer: *The information contained herein does not in any way replace or supercede the information on the pesticide product label or other regulatory requirements. Please refer to the herbicide product labeling for complete directions for use, safety, and handling. This information relates specifically to herbicide spray applications conducted by ReGenesis LLC, PO Box 319, Lawn, PA 17041-0319. Phone/Fax: (717) 964-2264 and may not be appropriate for a particular use.*