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# *The Sawkill Creek and Vandermark Creek Rivers Conservation Plan*
## *Wildlife and Corridors Committee Report*

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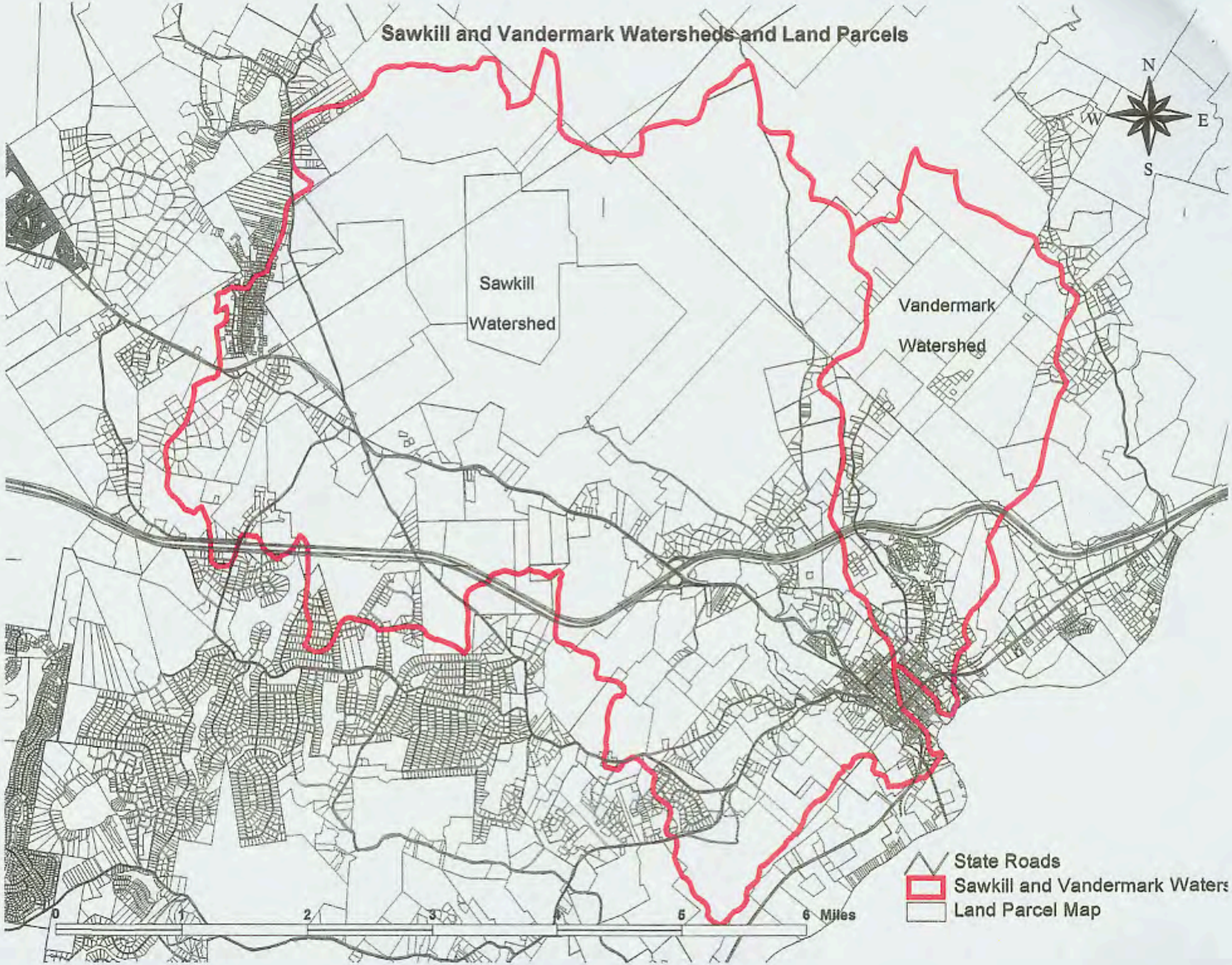
There are three major threats to the terrestrial and aquatic wildlife of the Sawkill and Vandemark watersheds. First, continued development is fragmenting the habitat into smaller and smaller parcels and cutting it off from large blocks of intact forest habitat. This process of fragmentation undermines the ecological suitability of the forest for many species that depend on large expanses of natural forest habitat. Second, the deer population is considerably higher than the carrying capacity of the forest vegetation. Excessive deer browsing has virtually eradicated the forest understory in many parts of these watersheds, thereby removing the food and cover for many species that depend on the naturally dense vegetation of the forest floor. Lastly, eastern hemlock trees are under attack by the asian insect, the woolly adelgid. Hemlocks are a major component of the riparian areas of streams and wetlands in this watershed. Because of excessive deer browsing there is almost no tree regeneration under most hemlock stands. The loss of hemlocks and potential for failed regeneration of new riparian tree stands is likely to cause dramatic changes in the riparian forests of these watersheds. This may lead to increased erosion into streams, rising water temperature, and may undermine the trout fisheries of these streams.

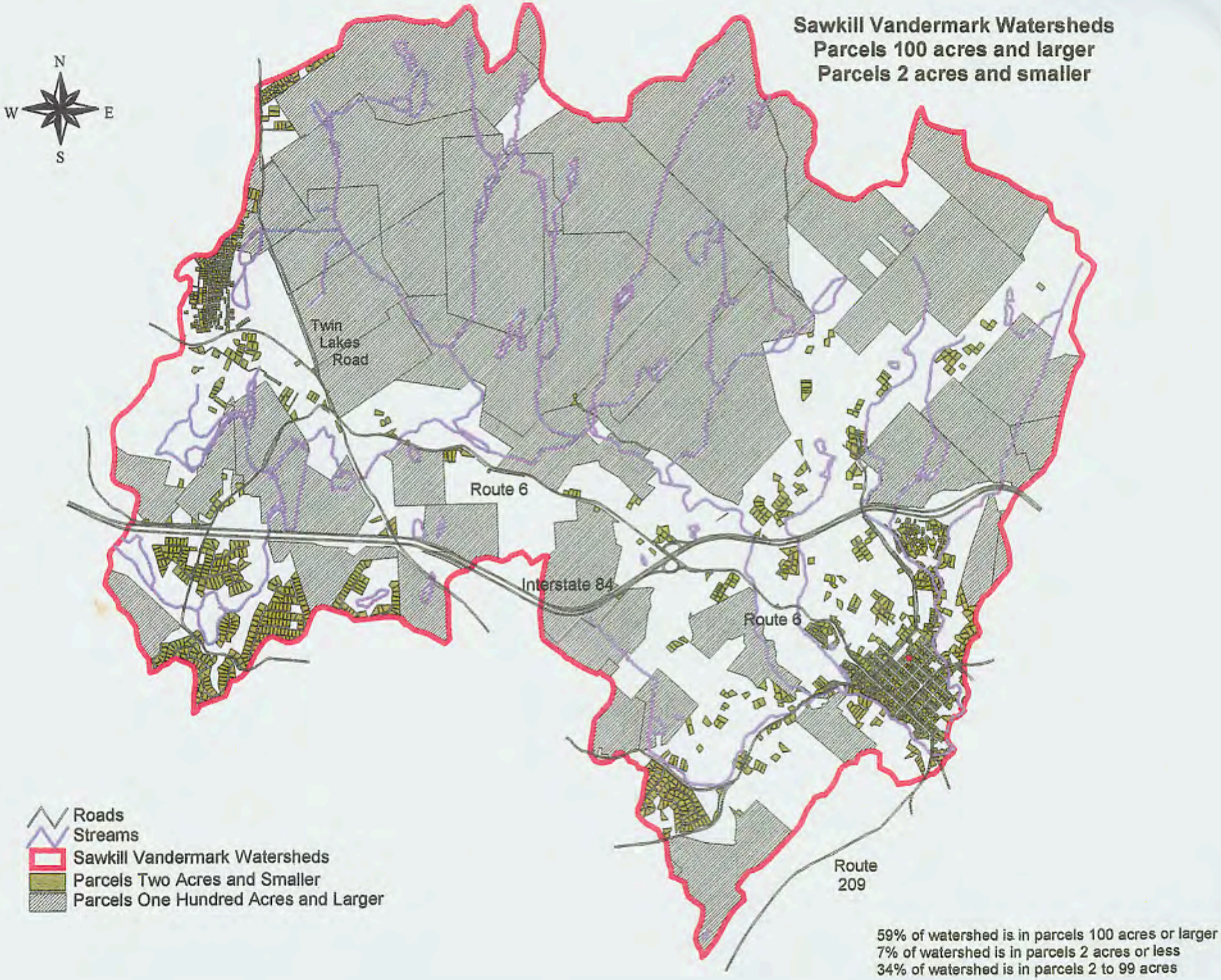
We have evaluated these threats by landscape analysis through computer mapping and by extracting information from recent studies at the Milford Experimental Forest on the impact of deer browsing on the health of the forest.

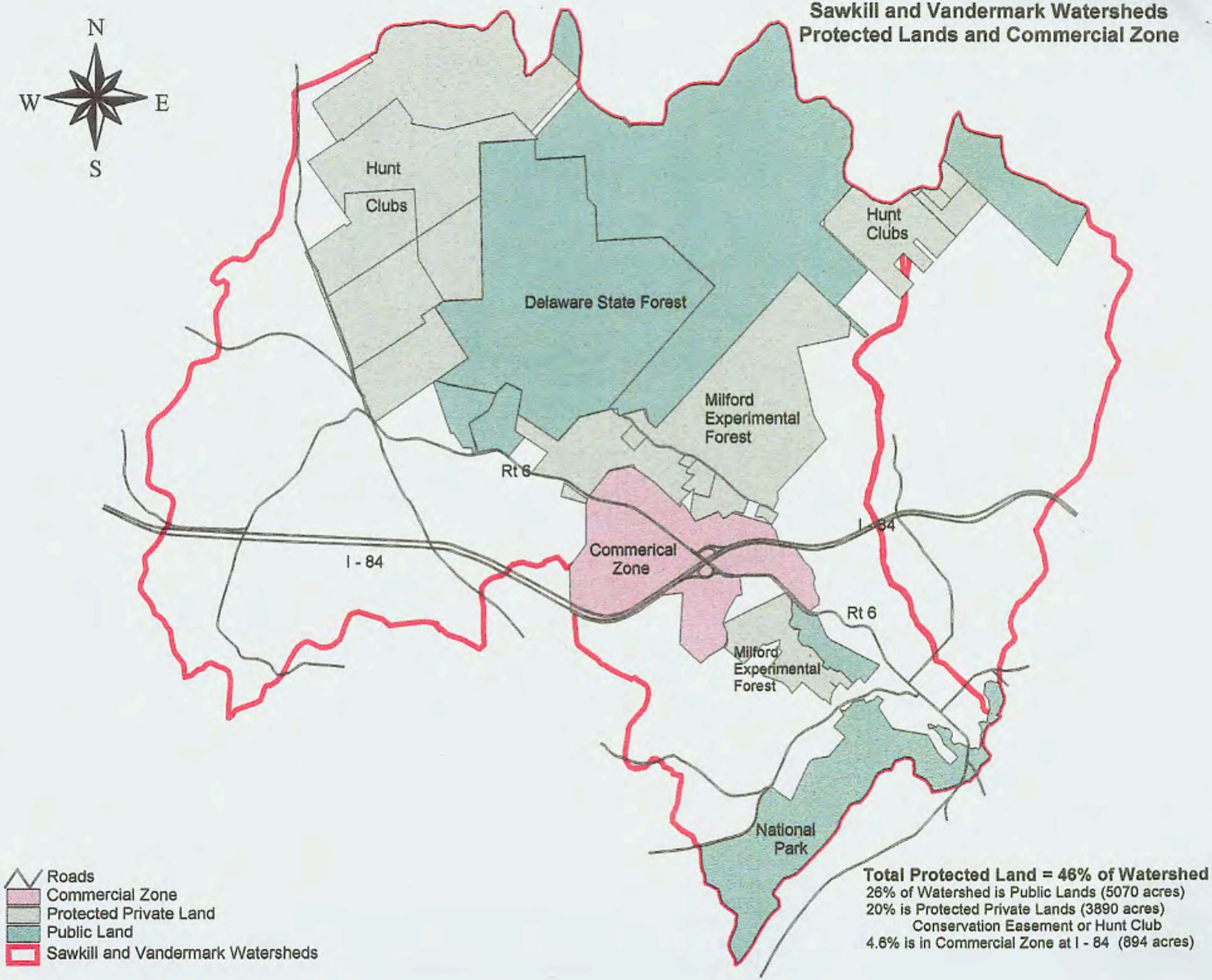
**Forest Fragmentation in the Sawkill Watershed**

We made several maps of the watershed by analyzing digital information in a GIS (geographic information system) map of Pike County. One map "Sawkill and Vandermark Watersheds and Land Parcels" shows the pattern of roads and different parcel sizes throughout the two watersheds. The map "Sawkill Vandermark Watersheds: Parcels 100 acres and larger" shows where big blocks of land are still relatively unfragmented and it also shows where the intensively subdivided portions of the watershed are located. 59% of the watershed is in parcels of 100 acres or larger. These concentrations of large land parcels are found in the headwaters of the watershed and make up a large block of unfragmented forest. Only 7% of the watershed is in parcels of 2 acres or less, and these areas are mostly near the major roads. Thus the forests of this watershed are still in a remarkably unfragmented condition considering that the watershed includes the county seat, an interstate highway, and a major state road.

The map "Sawkill and Vandermark Watersheds: Protected Lands and Commercial Zone" shows how much of the watershed is in a protected status. 26% of the watershed is in public ownership as part of the Delaware State Forest, the Delaware Water Gap National Recreation Area, and Grey Towers National Historic Landmark. Another 20% of the watershed is unlikely to be developed in the near future because it is owned by


Sawkill and Vandermark Watersheds and Land Parcels
N
W
E
S
Sawkill
Watershed
Vandermark
Watershed
State Roads
Sawkill and Vandermark Waters
Land Parcel Map
0
1
2
3
4
5
6 Miles


Sawkill Vandermark Watersheds
Parcels 100 acres and larger
Parcels 2 acres and smaller
N
W
E
S
Twin Lakes Road
Route 6
Interstate 84
Route 6
Route 209
Roads
Streams
Sawkill Vandermark Watersheds
Parcels Two Acres and Smaller
Parcels One Hundred Acres and Larger
59% of watershed is in parcels 100 acres or larger
7% of watershed is in parcels 2 acres or less
34% of watershed is in parcels 2 to 99 acres


Sawkill and Vandermark Watersheds
Protected Lands and Commercial Zone
N
W
E
S
Hunt
Clubs
Hunt
Clubs
Delaware State Forest
Milford
Experimental
Forest
Rt 6
I - 84
I - 84
Commerical
Zone
Rt 6
Milford
Experimental
Forest
National
Park
Roads
Commercial Zone
Protected Private Land
Public Land
Sawkill and Vandermark Watersheds
Total Protected Land = 46% of Watershed
26% of Watershed is Public Lands (5070 acres)
20% is Protected Private Lands (3890 acres)
Conservation Easement or Hunt Club
4.6% is in Commercial Zone at I - 84 (894 acres)

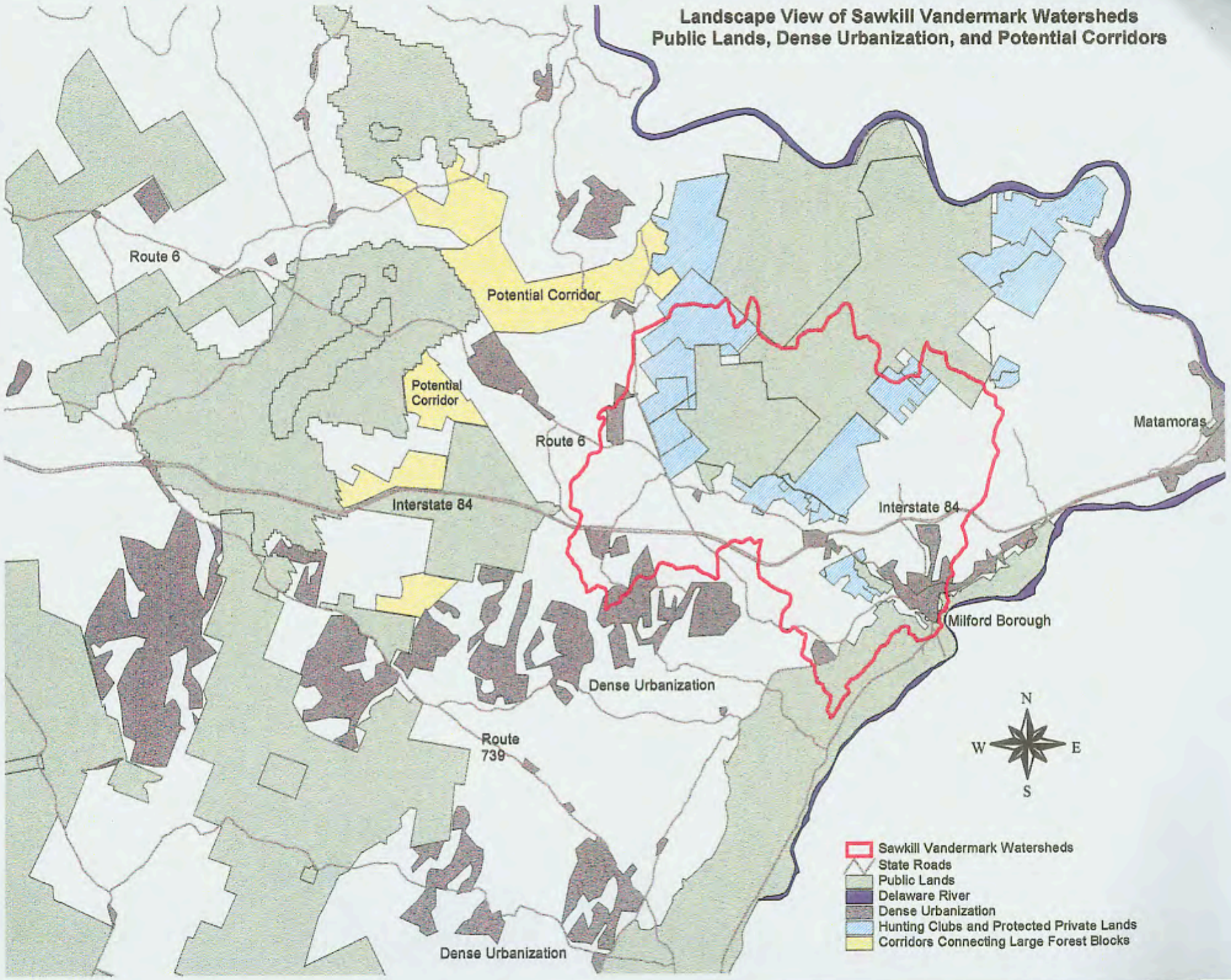
hunting clubs or is protected by conservation easements. Thus 46% of the watershed is not only in big parcels but is either fully or partially protected from future development. Meanwhile, 900 acres or 4.6% of the watershed is zoned for intensive commercial development near the interchange of I-84 and Route 6. Although intensive commercial development of this land would have minimal impact to the wildlife habitat in most of the watershed, it could have a major impact on the Sawkill Creek and the aquatic life of its lower reach as well as on the Milford Borough public water supply.

So the good news is that the headwaters of the Sawkill watershed support a large block of continous forest habitat, and they are quite well protected. These are forests and water resources that, if they are well managed, can continue to support abundant wildlife and fishery populations well into the future. This block of forests is relatively continuous with forested areas that extend eastward into the headwaters of the Crawford Branch, Cummins Creek, and Little Bushkill watersheds. Recently the Pennsylvania Chapter of the Nature Conservancy identified this larger block of contiguous forest in the five watersheds as one of the key roadless areas in Pennsylvania deserving immediate attention and protection.

**Forest Connections at a Larger Scale**

The most significant opportunities for wildlife conservation will be found at a larger scale than the Sawkill and Vandemark watersheds. Pike County has a series of large blocks of public land and hunting clubs, each of which makes up a significant area of relatively roadless and continuous forest. These blocks of forest are separated by private land in various stages of fragmentation and development. The large forest blocks create ideal habitat for wildlife species that require relatively undisturbed forestland, such as bobcats, fishers, and goshawks. Many species of neotropical songbirds require large areas of unfragmented forest to breed successfully in order to avoid nest parasitism by cowbirds. If the land between the blocks of public land is intensively developed, then each block of public land will become a habitat island, with little potential for movement of wildlife between patches of habitat. The end result will be a progressive loss of diversity and abundance of wildlife species in the whole region. Consequently, one of the primary objectives of wildlife conservation in this region should be to protect forested corridors connecting the large blocks of protected forestland. The resulting combination of large blocks of protected forestland and forested corridors connecting them will function as a large interconnected network of natural habitat. This network can sustain healthy wildlife populations even though other parts of the landscape are progressively developed with residential and commercial projects.

The map "Landscape View of the Sawkill Vandermark Watersheds" shows the dense urban development that is found in large subdivisions south of interstate 84 and near 2001, as well as the big blocks of public land that are separated into islands of protected forest. The map also Theyshows an example of several potential corridors that would sustain the flow of wildlife between these blocks of public forestland.


Landscape View of Sawkill Vandermark Watersheds
Public Lands, Dense Urbanization, and Potential Corridors
Route 6
Potential Corridor
Potential Corridor
Route 6
Interstate 84
Interstate 84
Matamoras
Milford Borough
Dense Urbanization
Route 739
Dense Urbanization
N
W
E
S
Sawkill Vandermark Watersheds
State Roads
Public Lands
Delaware River
Dense Urbanization
Hunting Clubs and Protected Private Lands
Corridors Connecting Large Forest Blocks

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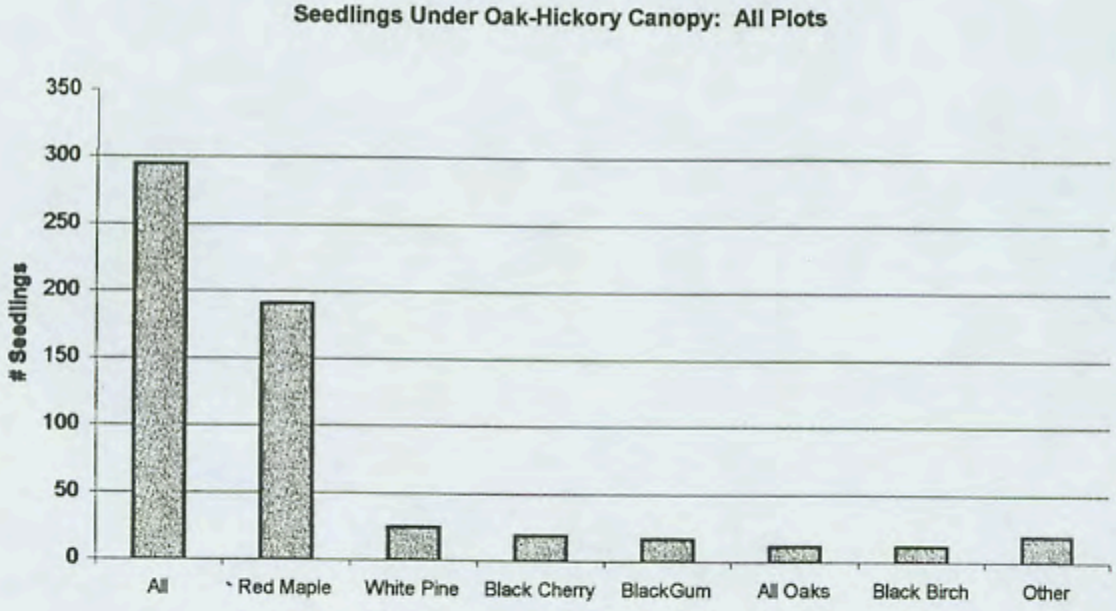
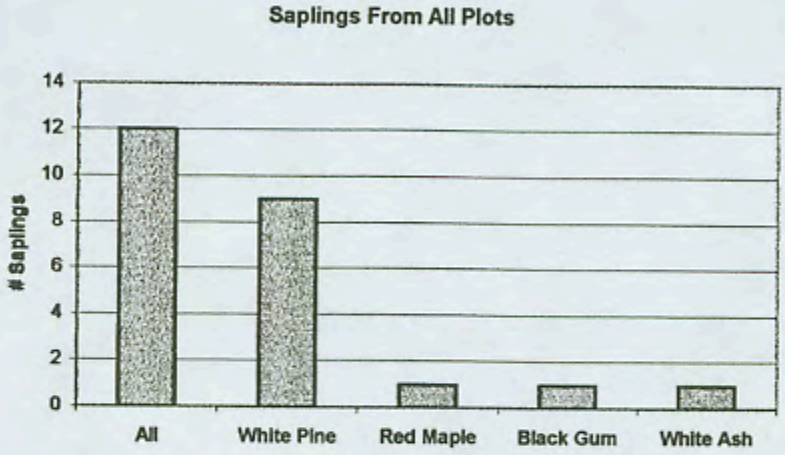
**Managing the White-Tailed Deer Herd**

White-tailed deer populations are now at such high levels that they pose a tremendous threat to the health and diversity of the Pocono forests. At the Milford Experimental Forest, which consists of 1,400 acres within the Sawkill Watershed, we have carried out deer pellet counts for three seasons, and have estimated the deer population at about 35 to 40 deer per square mile. Probably a much more useful measure of the deer population is found by looking at the impact they are having on the forest vegetation. In most parts of the Milford Experimental Forest there is very little woody vegetation on the forest floor. Few tree seedlings can grow through the deer browse and make it into the canopy. Thus there is very little forest regeneration. For the last three years we have monitored 8 permanent plots to measure the impact of deer on all types of vegetation in the forest understory. What we have found is disturbing. See the two graphs below. The permanent plots are all located within mixed oak and hickory forests with some white pine. Yet there is very little oak represented in the seedlings, and essential no oaks saplings are able to survive under the heavy pressure from deer browsing. What these plots demonstrate is that the forest understory ecosystem is missing in much of our experimental forest. And this is typical of what is found throughout much of the Sawkill and Vandermark watersheds.




What this means is that the forest cannot regenerate after a natural disturbance like a windstorm or insect attack or after a timber harvest, unless we go to the great expense of buiilding a deer fence to allow the vegetation to recover. It also means that the normal dense understory which provides food and habitat for many mammals, ground nesting birds, amphibians, reptiles, insects, and wildflowers has been essentially removed from the forest. Already in Pennsylvania three species of plants have been extirpated from the state because of the impact of deer. .




Although an overabundant deer population may sound good for hunters, the opposite is actually true. We have run a public check station for the last two years in Milford. Pike County deer, because they have overbrowsed their own habitat, are generally small and in poor condition compared to other regions where the deer are in balance with their food supply. For instance, the following graph shows the average weights of bucks brought to our check station in the 2000 hunting season. The average weight of a 1.5 year old buck was 88 pounds. Compare this with a Virginia county with high quality habitat, where the average weight of 1.5 year old bucks was 103 pounds. In Pike County we are growing small deer with small antlers. Hunters have a lot to gain from improving the deer habitat.

**Pike County 2000 Deer Statistics**

| Buck Age | Average Weight |
|---|---|
| 0.5 | 56 |
| 1.5 | 88 |
| 2.5 | 102 |
| 3.5 | 114 |
| 4.5 | 130 |

Consequently, one of the most important ecological challenges in this watershed is to bring the deer population back into balance with the forest habitat. Creating a sustainable deer herd will restore critical habitat for many species that are currently severely impacted by overbrowsing by deer. And a sustainable deer herd will once again make it possible to manage the forest for both economic and ecological purposes.

**Losing the Eastern Hemlock and the Impact on Watersheds**

About a decade ago the Hemlock Woolly Adelgid first entered this region This small insect that is found on the underside of hemlock twigs, sucks the sap from the twigs and kills the needles. Hemlocks are an abundant species in this region, and they play an especially important role in the riparian forests that buffer streams and wetlands. Here they stabilize vulnerable soils, keep stream temperatures cool, provide thermal insulation for many animals in the winter, and provide essential resources for species such as porcupines. In the last three or four years, the woolly adelgid has entered a number of

tributary watersheds along the Delaware River and has weakened and killed many hemlocks where it has spread. It is already well established in the lower mainstem of the Sawkill watershed, where many hemlocks have lost a considerable amount of their needles.

Overabundant deer make the loss of hemlocks even more damaging. In most hemlock stands in this region there is very little advanced regeneration of any tree species. Thus when the hemlocks die from the woolly adelgid infestation, there is no established woody vegetation to take their place. Under the high deer pressure it will be difficult for any tree species to recapture the sites where the hemlocks died. Thus the progressive dying of hemlocks is likely to turn a riparian forest into a very different kind of ecosystem, one dominated by ferns, grasses, and other non-woody vegetation. The conifer riparian forests are a hallmark of the beauty of the Pocono region. The loss of hemlocks and potential failure to regenerate a new riparian forest will have a profound impact on people and on the ecology of the watersheds. Soil erosion, rising water temperatures, and degradation of trout habitat are all possible outcomes of the loss of hemlocks further exacerbated by excessive numbers of white-tailed deer.

To get an idea of how much of the watershed might be affected by the loss of hemlocks, we made a map of all the streams in the watershed with a 200 foot riparian buffer on both sides of the stream or wetland. Then we digitized a map of the conifer stands within that riparian area from aerial photographs taken in 1992, mapping only those stands with at least 50% conifers. We ground-truthed the conifer stands against parts of the Milford Experimental Forest where we had already made field studies of the percentage of conifers and hardwoods. The map "Stream Buffer 200 Feet -- Conifers: Hemlocks and Pines" shows that *24% of the total riparian forest* in the Sawkill and Vandermark watersheds consists of conifer stands. Hardwood stands make up 73% of the riparian zone. The map "Stream Buffer 200 Feet: Houses and Non-Forested Land" shows that only 3% of this riparian area is non-forested. There are 251 houses within this riparian area in the watersheds, mostly in the lower reaches of the streams. With a quarter of the riparian forest in conifers, the Sawkill and Vandermark Watersheds are very likely to be seriously impacted by the loss of hemlocks.

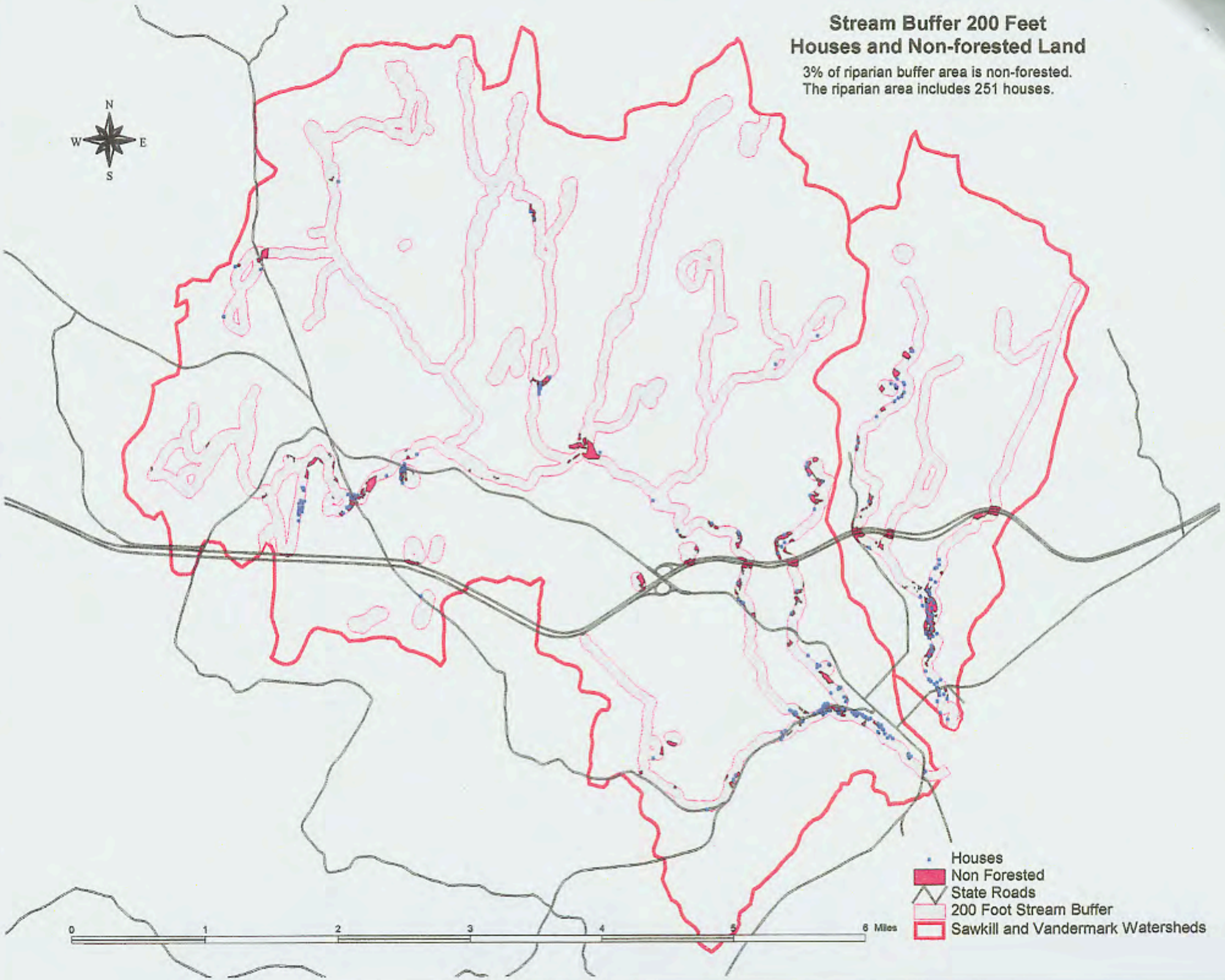
There are no proven strategies to control the hemlock woolly adelgid. Experimental releases of several insect predators of the woolly adelgid have been tried in the Northeastern states, but none has proven effective in slowing or stopping a adelgid infestation up to now. But research is continuing to find effective controls.

**Summary**

This analysis of the ecological threats to the wildlife of the Sawkill and Vandermark Watersheds points out that there are three significant threats to the long-term sustainability of wildlife, fisheries, and forest health in this watershed:

1. The two watersheds have a large amount of protected forest habitat in their headwaters. However, the wildlife in this watershed is likely to be impacted significantly if the connections between this large block of forest is cut off from

Stream Buffer 200 Feet
Conifers: Hemlocks and Pines
Conifer stands make up 24% of the total riparian area within 200 feet of streams and wetlands. Hardwood stands make up 73% of riparian zone.
N
W
E
S
Savantine Creek
Craft Brook
Pinchot Brook
Dimmick Brook
Vandermark Creek
Laurel Brook
Deep Brook
Sawkill Creek
Sawkill Creek
Vantine Creek
Vandermark Creek
Sloat Brook
Sawkill Creek
Conifers: Pine and Hemlock > 50%
State Roads
200 Foot Stream Buffer
Sawkill and Vandermark Watersheds
0
1
2
3
4
5
6 Miles


Stream Buffer 200 Feet
Houses and Non-forested Land
3% of riparian buffer area is non-forested.
The riparian area includes 251 houses.
N
W
E
S
Houses
Non Forested
State Roads
200 Foot Stream Buffer
Sawkill and Vandermark Watersheds
0
1
2
3
4
5
6 Miles

other nearby blocks of forest. It is critically important that the connections between blocks of forest be protected in the next decade to sustain a healthy forest ecosystem with abundant wildlife.

2. The excessive deer population in this region has produced a collapsed forest understory. The loss of the forest understory ecosystem will continue to have cascading impacts on many species of wildlife and on the composition of the forest itself unless the deer are brought back into balance with their food supply. The most important forest management concern by far in this watershed is to restore the health of the forest understory by reducing the deer population.

3. Hemlock makes up a large portion of the riparian buffer zone along streams and wetlands in this watershed. Hemlocks are under attack from a serious infestation of the Asian woolly adelgid. This insect is likely to kill a majority of the hemlocks in the next decade. Unless deer populations are reduced or unless fences are built to help the regeneration of new forests, the loss of riparian forests is likely to have a severe impact to the esthetic and ecological values of the streams in the watershed.