The Trees of Forest Lake Part 1

These articles has been written per the request of the Forest Lake Preservation Foundation which has a mandate to provide education to the residents of Forest Lake. I was delighted to have the opportunity to do this, as I had little knowledge of forests in general, and trees in particular. Much of the material in these articles was taken from A Sierra Club Naturalist's Guide to the North Woods, as well as Wisconsin's Natural Communities published by the University of Wisconsin Press.

After reading these articles I hope everyone will have an appreciation of how complex the ecological web of our forest actually is, and hopefully come away with a better appreciation for how unique our Forest Lake surroundings are.

When our family first looked at our property on Forest Lake before buying about 33 years ago, our real estate agent told us to watch how shaded the road became once we passed the public landing. It felt like we were in the deep woods when we drove through. He stated that the reason was that Forest Lake was never logged when intensive logging was happening elsewhere in the state. Therefore the canopy of trees was much fuller than around most lakes. Apparently Forest Lake was the home of a rather upscale resort, which catered to people from the Chicago and Milwaukee area. They would take a train north until they reached State Line (now known as Land O Lakes) and then went by dirt road to the resort. It featured fishing, hunting, gambling and other pastimes. Because the land around the lake was privately owned, it was never logged. Another example of an unclogged woods is the Sylvania Wilderness. A group of steel company executives bought the land before the lumber companies could get to it, and used it as a private retreat, so likewise this land was never logged.

While we might look at our Wisconsin forests as pristine, our forests are relatively new on an ecological time scale. Only 15,000 years ago 85% of the state was ice, and the remainder in the south was tundra (and I don't mean Lambeau Field). As the glaciers receded the forests began to grow and gradually evolved to the white pine forests and mixed hemlock/hardwood forests that we see surrounding our lake now.

It wasn't until the 1850's that the state was surveyed, which was largely to make for an orderly process of logging and land development. Was the forest pristine at that time? Actually no, as the land in Wisconsin was managed to some degree by indigenous tribes for thousands of years before the arrival of Europeans. In the southern part of Wisconsin the more agrarian natives burned the prairies and savannahs annually, to improve food production and facilitate hunting. In northern Wisconsin, the natives were more hunter gatherer types, but did regularly burn land for gardens, and particularly to improve blueberry grounds. Fire has an important role in determining the nature of a forest or prairie, so there was some degree of forest management for thousands of years.

To summarize this, the forest around our lake has been evolving and changing for thousands of years due to glaciers and indigenous peoples.

The king of the forest in the eastern half of the US is the white pine. Indigenous tribes used the white pine for many things. In times of winter famine they would eat the soft inner bark of tree. The word Adirondack means "tree eater" in Iroquois, and referred to the Algonquian tribe. The young staminate cones were used by the Ojibwe for a nutritious stew with meat. They would use the pitch or sap as an anti microbial salve to treat infections. The sap also was used to waterproof canoes.The needles of white pine have more vitamin C than most of the citrus fruits we eat. The white pine was known to the Iroquois as the "tree of peace". By legend a great leader united the 5 bands of the Iroquois (Mohawk, Oneida, Onondaga, Cayuga, and Seneca) into a peaceful confederation. He planted a white pine and they would have peace conferences

at the base of this tree. The white pine has needles in bunches of 5 which symbolized the 5 bands in the confederation, and the long life of the white pine symbolized that their peace would last long after their leaders were dead. Often weapons were buried at the base of the tree of peace after meetings of the 5 bands, to symbolize the Iroquois pact.

When Europeans first arrived at the New World they were astounded to see the virgin forests with massive white pines towering over the forest. About 85% of the hardwood forests had maple trees older than 150 years old. About 30% of the white pine forests had pines over 200 years old. To the Europeans who came to the new world it was their most valuable tree. Amazingly, the white pine was a very significant factor leading to the American Revolution.

To understand this we have to look back to the very first colonists in America. When they arrived in the New World, the massive white pine were hundreds of feet tall and perfectly straight. There was nothing like it in Europe. The wood was easy to work with, easy to cut, and could lie on the ground for a year and still be workable in a saw mill. The wood could float which made it easy to transport. In short it was ideal for a ship's main mast at a time when England's navy ruled the seas.

Because the Crown owned the woods of the new land, the largest white pines were declared the sole property of the king. The king's agents marked all the largest white pines with a slash mark, known as the "broad arrow". Initially all trees 24 inches or more in diameter were marked and belonged exclusively to the crown. Later the king revised the broad arrow to mark all white pines 12 inches or more in diameter. Not only were the colonists prohibited from possessing these large white pines, they also had to pay a tax on ANY small white pine they cut for themselves. In all about 4500 masts were sent to England from the colonies. The colonists were extremely unhappy about the lack of access to the best lumber for building and commerce. In1734 the kings men were assaulted and beaten by a crowd in New Hampshire, upset about the broad arrow law. This was known as the Mast Tree Riot. Again, in 1772 an angry mob beat and almost killed the king's sheriff inspecting sawmills for prohibited trees in the Pine Tree Riot. This underlying discontent likely fueled the Boston Tea Party in 1773. Indeed, the white pine was so central to the colonists' unhappiness, one of the initial Revolutionary War flags had a white pine as its emblem. The Connecticut Historical Society has stated that the Pine Tree Riot is not taught in schools in addition to the Boston Tea Party "because Boston had better historians". After the Revolutionary War the fledgling US then built its navy using white pine. The USS Constitution first used white pine for its main mast.

Once Wisconsin was surveyed and opened for logging, the lumber barons drastically altered the north woods. In the mid 1800's the surveys indicated 22 million acres of woods in Wisconsin. After the most intense logging there were only 13 million acres of woods, These woods were not the same as the originals. Most of the woods in Wisconsin were logged over at least once. After the intense logging there was only slash left on the ground, and the slash usually ended up burning in massive hot forest fires. Many times the fires were set on purpose to clear the land. Some of the fires were deadly. For example the Peshtigo fire burned through 8 counties and killed over 800 people. White pine (and red pine) need about 50 years to develop bark thick enough to withstand forest fires and there were no longer any of these trees left before the fires (many areas of the state were left with no white pine greater than 3 inches in diameter). Although the mixed hardwood/hemlocks regenerated slowly there were no remaining pines thick enough to withstand the fires and re-seed the forest. Instead aspen and white birch dominated (they have suckers underground which will sprout after a fire clears the land). After time the mixed hardwoods then replaced the aspen and birch.The type of forests in Wisconsin changed dramatically.

Fortunately, we still have white pines around Forest Lake, as well as the mixed hardwoods that were harvested by the barons elsewhere. These are very important parts of the ecosystem

around Forest Lake. White pines can grow to be 500 to 800 years old. I have a picture of a newspaper article from I believe the 1930's which states that there was a white pine on Pine Island (the one with the eagle nest) which was at that time the largest white pine in the state. I have only been on Pine Island once (in the middle of winter so as not to disturb the eagles) and I can see no trace of it. I was told by John Schneck, a long time lake resident now deceased, that during World War 2, a tornado hit one of the islands and leveled the trees. Perhaps the white pine was a casualty.

The white pine is a very interesting tree. It is the most shade tolerant of our local pines, so can grow slowly in the understory of a fairly dense woods. When young it grows slowly, but It is subject to browsing by deer when young, and may not survive, Once it reaches about 20 years it can grow quite rapidly, sometimes 10-15 feet per year. Ultimately it can become the tallest tree in the woods. This is when the white pine becomes the favored nesting site of the bald eagle. Because it is the tallest tree in the woods, it is often subject to lightning strikes, which makes it ideal for the eagles. The lightning thins out the branches in the top of the tree. This makes it the best spot for eagle nests, high enough to see any potential predators in the vicinity, and with enough clearance for young eagles learning to fly. In the 33 years we have owned the islands, the eagles have changed their nesting site 3 times. Each time they have picked a white pine which overlooks all the other trees. This is no accident. At night when there are eaglets in the nest the eagles never roost in the tree with the nest. I used to think that this was because the babies would bother them all night screaming for food. Now however, I wonder if it is because most lightning strikes occur at night and a lower tree is therefore a safer spot at night. When I have been fishing in Canada too far north for any pine trees, I have seen that the eagles nest is the tallest maple in the forest. I have the suspicion that if we did not have any tall white pine on Forest the eagles would likely move to another lake that had tall white pines.

When logging in Wisconsin was intense, the pure white pine forest was initially logged exclusively. The logs were felled in winter usually with 2 person saws known as "misery whips", and then floated to the sawmills in the spring and summer. After the pure white pine stands were gone, then the white pines were selectively harvested from the hardwood forests. The remaining hardwoods were not logged until the big white pines were almost all harvested from the mixed forests. There was no thought of replanting white pine in those days. While we might look at the lumber barons as rapacious or greedy, they looked at things very differently. They were supplying the lumber for a growing nation, and were clearing the ground for settlement. The common saying was "the plow follows the axe". Unfortunately for many new Wisconsin farmers, the soil in northern Wisconsin was not conducive to successful farming.

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After the white pines were all logged, the loggers turned to the hemlock trees. (The hemlock in the north woods is unrelated to the poison that killed Socrates). The hemlocks were prized for the tannins in the bark which was essential for tanning leather. In general hemlock depends on wetter soil, so they often concentrated around lakes. It was difficult to get hemlock to market however, as hemlock sinks instead of floating. In addition a hemlock that is felled is quickly stripped of its bark by deer. Fortunately there were not a lot of deer in the northern forests at that time because of the nature of the forests. Ultimately deer have become vastly more plentiful in the north woods since logging, as deer are "forest edge" animals and don't do well in uninterrupted tracts of forests. By logging the forests and making roads to remove the deer the loggers made northern Wisconsin into prime deer territory. Unfortunately for todays forests, there are few if any young hemlocks. I have looked carefully for young hemlock around my property and have not found any. This is apparently because the plentiful deer love to eat young hemlock, and young hemlock do not survive the browsing like maples do. I am hopeful that with the reintroduction of wolves into the north woods that the hemlock might make a recovery. In Yellowstone, several tree species have recovered after the introduction of wolves, as deer will not usually browse in an area that has high wolf risk, and there are now tracts of new native trees in those areas that haven't been seen in decades. Hemlock seeds germinate best on the stumps of dead trees, or "tip-up" mounds from wind-downed trees. Hemlocks are blown over more easily than our other trees because they have shallow root systems.

Ultimately white and red pine started being replanted because it was such a valuable resource. However, in the early 1900's the white pine was under attack from another foe, a fungus which caused white pine blister disease. It was imported from Asia, and reportedly was killing large numbers of young white pine. Ultimately it was determined that the fungus needed an intermediate host before it could infect a white pine and that host in the north woods was either currant or gooseberry. At one point the lumber companies that owned large tracts of land sent workers into the woods to eliminate all the currant or gooseberry bushes. It was also determined that the lower branches were most susceptible to "catching" this fungus so trees were rapidly pruned as they grew. Because the fungus prefers moist air, the white pines growing on higher more airy ground were less susceptible. While some white pines continue to be affected, the blister rust is not as great a threat as for example the Dutch Elm disease was to elms. There are some white pines around Forest Lake which have the blister rust, but they seem to be tolerating it well.

Unfortunately the existence of white pine blister rust in the north woods resulted in replanting of many more red pines than white pine. Often plantings would consist of only one type of tree. The chances of disease in that type of planting makes the strategy of "putting all your eggs in one basket" a risky one.

Red pines often coexist in the north woods with white pine. The red pine also can live to 500 years old. The red pine does not grow as tall as the white pine. It is easy to age a red pine early in its life. Each year the tree adds a new layer of limbs and you can count each level as 1 year. As the tree ages, however, the lower limbs are lost and then determining age is more difficult. In general the red pine prefers a sandier soil and the white pine prefers a slightly richer soil, but these 2 types of pine coexist throughout our forest. As a red pine ages it's bark tends to a slightly reddish color. It is easy to distinguish a red from a white pine. The red pine has needles in "bunches" of 2, while the white pine needles grow in groups of 5. Red pines are self pollinating, and have male and female cones. A typical red pine will produce a good seed crop about once every 3-7 years. The seeds are dispersed in the wind, but not as far as white pine seeds. Some fires will produce a seedbed that favors the regeneration of red pine. The best seed production comes from the oldest trees (50 years old and greater). Because the red pine

tends to be disease resistant, lumber and paper company re-planting of some woods sometimes occurred exclusively with red pine saplings. As these red pine stands mature, the shade from the thick tree canopy tends to eliminate most of the understory plants and trees, and this leads to poor plant and animal biodiversity. This approach may produce some economic gain, but may be associated with increased risk of disease etc.

The most common type of woods in the north of Wisconsin is the mixed hardwood. In our area this includes mixtures of hemlock, some white pine, red pine, sugar maple, basswood, and yellow birch. There are also less common trees including red oak, jack pine and black ash. Many times the lower areas, which are wetter, favor the pines, hemlock and black ash, while the hardwoods like maple predominate on the higher elevations. In the fall you can appreciate this pattern around Forest Lake as the trees change color.

Sugar maple is a very hardy tree, and the saplings tolerate significant shade in the understory of the forest. They also survive browsing by deer, and you can often see dense fields of first year maple saplings in the understory of our forest. 200 year old trees are common, and some live to 400 years old. As opposed to the soil of pine forests which is acidic and not very fertile (due to the layer of pine needles on the ground) the soil in a hardwood forest is much richer as the maple leaves add calcium potassium and magnesium to the soil. The sugar maple leaf is able to carry out photosynthesis even with minimal sunlight. This gives it an advantage over almost all the other young trees in the understory of the forest.

Basswood trees can be found around Forest lake and often form a ring-like pattern. The seeds germinate best on the bark of downed trees. Once a basswood tree is growing well, sprouts will grow out from the root system and form a sometimes perfect circle of new saplings around the center trunk. When the central tree dies, a perfect circle of basswood trees remain.

The yellow birch is unusual for a birch in that it is very slow growing. There was a live specimen just 100 yards from the landing on the right, which was felt to have been over 250 years old. Unfortunately it died several years ago and I don't know if there are others around the lake. There is a tract of land owned by the Nature Conservancy on the Palmer/Tenderfoot Lake system with multiple very old yellow birch which is accessible by boat or canoe.

The red oak is a very interesting tree as it propagates with acorns. These acorns are eaten and buried by squirrels and chipmunks. But the acorns are spread much further by birds. Woodpeckers will drop them around the tree (and eat them) but blue jays are known to transport acorns up to several miles and bury/hide them. In addition to being propagated by mammals and birds, the oak also has a propagation strategy similar to the mayfly. About every 5 years in some forests, the oaks will have a massive crop of acorns compared to the preceding 4 years. This strategy ensures that every 5 years there will be surplus of acorns and increased propagation that year. Because this is not a yearly phenomenon the populations of animals that eat acorns will not rise accordingly.

Jack pines are very present in the woods, but only certain areas. The jack pine is designed to thrive on areas that burn about every 5-10 years. The small cones on jack pine may remain on the tree for as many as 25 years. The seeds are sealed inside the cone with a wax. When a fire provides enough heat the seeds are released from the cones and the jack pine seeds become an early colonizer of the burned area. The jack pine does not do well in shade, but in a burned area it will grow quickly in the full sun. If there is not a fire within the next 10 years, however, the jack pine will do poorly as it becomes shaded by taller trees. and the lack of sun dooms the jack pine. I believe there are some jack pines along the bike trail that runs along Hwy B.

Aspen is another tree that survives fire well, as it has extensive sucker systems underground and they begin growing new trees shortly after a fire. Many areas of burned forest begin as either jack pine or aspen forests. Because new growth of a second generation of these sun loving trees don't survive in the understory, they are eventually replaced by the slower growing pines and hardwoods.

Black ash trees prefer wet soil, and can usually be seen growing in depressions. Ash is being rapidly destroyed in the US by the emerald ash borer. I spoke recently to a local forester who told me that the ash borer hasn't made it to the woods around us yet. I suspect that ultimately the ash tree in the US may go the way of the elm tree.

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Ultimately forests change. The usual evolution of an undisturbed woods is from pine woods to mixed hardwoods and hemlock. Because of changes in weather and other factors in the local history of a woods, there is much variation.

Every forest in the north woods is not the same. Depending on soil type, moisture levels, sun exposure will affect the composition of the forest trees. There are other factors at play as well. These include disease, insects, fires, and blowdowns. Before Europeans arrived all of these factors were at play. The ecology of the forest is so complicated and intertwined, each of these factors involve plants and animals that exploit these forest changes. For example, some beetles prefer to lay their eggs on burned trees and brush. Some insects have infra red sensors that will detect fires far distances away and allow them to reach the burnt woods before competitors. There is a beetle which has been observed to have traveled 60 miles to reach the site of a burn. There are over 40 species of insects that lay their eggs on burned wood. These grubs in turn become food for many of the animals in the woods, even including the black bear. There are some plants which specialize in growing in areas that have been burned, like fireweed. After a fire, white pine seeds will be spread throughout the forest by wind if any of the largest pines that are resistant to fire are still present in the woods. If there are no white pine seeds then plants that have suckers underground like aspen and birch will grow first and dominate because the suckers are spared from the heat of the fire. Blow downs are actually fairly common. For example on July 4, 1997 a wind storm swept Wisconsin and leveled 844,000 acres of Wisconsin forests. That is not a typo. While we were taught about “succession of the woods” in school, multiple random scenarios can drastically change the composition of forests.

It is hard to manage the forests of Wisconsin in a completely natural way. For example, clearly fires were a random factor throughout the history of the woods. While it would be nice to have intermittent fires, safety and economic damage are of paramount concern and fire suppression will always be a factor in management. There is some trend of for nights in the north woods to be warmer than in the past, and cool nighttime temperatures are a major factor in controlling fires. This increased risk of fires getting out of control will be a consideration in the future. Controlled burns will be prescribed at times (frequently used in forest sanctuaries in Florida) but it will be dependent on humidity, wind conditions, and temperature and always carries some risk. Probably the best way to avoid diseases that damage the woods is to make sure the trees are diverse, in addition to careful surveillance of imported plants for new diseases.

Ultimately, there is a tremendous interdependence on plants, insects, and other animals in the forest. For example we have the large, beautiful pileated woodpeckers which only exist in “old” forests with standing dead trees, as this is where they feed.Over 80 species of birds in Wisconsin use tree cavities for nesting. After the glaciers receded, there were no longer earthworms in Wisconsin. The north woods then evolved without any worms. The lack of worms allowed leaf litter to build up on the forest floor, and this litter and the associated fungi below it became integral to the health of our native tree species. When Europeans arrived, they brought various types of worms and worm “eggs” in the roots of their plants. While Canadian and European crawlers may be helpful in composting, they inhibit the growth and propagation of native trees and plants of the north woods. These invasive worms consume the leaf litter, changing the soil of the north woods to favor invasive species instead of our own natives. The worsening of soil quality in areas with non-native earthworms is probably related to “forest decline syndrome” This is why I never dump my excess fishing worms into the forest or lake to be extra careful. Always dispose of unused worms in the garbage. There are many species of

land snails and tree snails which are vital to successful brooding of birds in the north woods. Remember how we almost lost the eagles in Wisconsin due to weak eggs from DDT? Birds need calcium for a strong eggshell. Female forest birds seek out and consume land and tree snails immediately before nesting for the calcium, which improves the thickness of their egg shells. Habitats with few land snails have fewer productive broods of birds due to the lack of calcium. Old forests with downed trees tend to have significantly more snails and are expected to have healthier bird communities.

In Germany many of the forests were planted after WW2 with Norway spruce and Scotch pines almost exclusively. I believe that much of the reforestation was meant to provide reparations for the war. Unfortunately in the last 3 years, Germany has had successive droughts affecting their forests, weakening the trees. This weakening has left them susceptible to insects and the forests have been decimated by a beatle. There is great devastation in one of the most heavily forested countries in Europe. The Germans who were famed for “scientific forestry” are unlikely to ever again plant monocultures of 1 tree to create forests. In Land O Lakes, you can see areas (for example along the bike path to LOL) where red pines were planted almost exclusively, sometimes by work crews during the Great Depression. There is now a great debate in Germany about how to replant their forests. Considerations include risk of disease, drought, and increasing temperatures. I believe they will never again risk planting woods without significant diversity.

Because of the complexity of all of these interactions you can see that diversity in our forests should be beneficial for our ecosystems and uniformity would be less beneficial, leading to more fragility of the ecosystem. Our forests serve many purposes, including economic, environmental, hunting, fishing and esthetic. There is tremendous pressure to produce wood and paper products from our woods. Because of the economics of lumber and paper, many forests are managed for fast growing trees like aspen and birch. Because of the pressure from hunters many woods are managed for aspen, to support deer and grouse. Because of the pressure from environmentalists some woods are preserved from logging. Because of the dangers of fire many forests which would be most likely to burn beneficially are managed to suppress fire. Clearly to my way of thinking there is no single best way to manage our forests. Everybody has a stake in how we manage our woods.

The North Woods is an important asset to all Wisconsin residents. It provides economic benefits to all of us including wood and paper products, hunting and fishing, preservation of biodiversity, and helps protect against climate warming. The North Woods faces incredible pressure in all directions, and I am not able to render an opinion on how best to manage it to maximum benefit.

There is a massive study planned in the Elliott State Forest in Oregon that will try to answer some important forest management questions. The advisory board for this experiment includes loggers, hunters, environmentalists, and indigenous people. It will involve about 84,000 acres of forest, which will be divided up into multiple management strategies ranging from clear cutting, selective logging, no logging, and multiple combinations of strategies. They will monitor carbon accumulation, stream health, insect bird and fish diversity, as well as economic benefits. Of note, this will be very costly, as since 1930 the Elliott State Forest is legally obliged to generate revenue for Oregon public schools through logging. The total cost will be over 200 million dollars, but it is the best chance I believe to answer many questions about the best ways to manage the forests.Unfortunately answers will likely be decades in the making.

Clearly, we have a unique forest around our lake. Its never been logged, and is filled with many species of very old and majestic trees. This old forest supports some amazing specimens of animals and birds. In it's entirety the plants, birds, insects mammals and trees are all quite interconnected. We are only beginning to appreciate the complicated symbiosis between the various species we see every day at the lake. Some benefits are obvious, like the calling loons and the trees older than our country. Some are less obvious like the capture of CO2 and natural cooling the forest provides to our properties in the summer. I appreciate being able to write this article, as I have learned a tremendous amount. I have also learned that I am just scratching the surface of what I should know about our forest. I hope there was new information in this article for you. After writing this I appreciate our trees more than ever here on Forest Lake. We truly live in the middle of a magnificent old forest. I hope you feel the same. If you have questions or comments please email me at gastrodocman@gmail.com. If I can't answer your question I will try to find answers. Mark Dreyer