THE ACADIAN FOREST

A guide to being in and understanding the forest

Blomidon Naturalists Society

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First Edition

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INTRODUCTION

It is well-established that being in nature is healthy for humans both physically and mentally. Even the colour green has a calming effect on humans. Studies have found that when shown pictures of various landscapes, the savannah produces the strongest positive effect. That may be no wonder, as for 99% of our evolution, we lived on the savannah. However, we clearly also have an affinity for trees. What young child does not like to climb in trees? Indeed, climbing alone can be a passionate activity. On children's playgrounds, the structures meant for climbing invariably have kids clambering on them.

When I was a child, my favourite pastime with my younger brother was climbing in the large beech trees that grew on the property. One day my brother fell out of a tree and broke his arm. My parents took him to the hospital to have the arm set in a cast. When he got home, he and I were out climbing again, him using just one arm, to the horror of my parents.

Our closest relative is the chimpanzee, and we share a common ancestor. That ancestor lived in the jungle on the African continent. Climate changed, becoming dry, and the jungle started to diminish in extent and the savannah slowly formed. Our immediate ancestors moved onto the savannah and having an upright posture and being bipedal was an evolutionary advantage. Ancestors of the chimpanzee stayed in the jungle and continued to live in the trees. The affinity of young children for climbing trees may be a trait from those early evolutionary times.

Humans left Africa at least twice in our evolution and spread out across the globe, settling everywhere except for Antarctica. Humans could eventually be found in every habitat on earth, from the fidget arctic to the hot tropics. Many groups settled in forests

but did not start to live in the trees again. We have not lost our affinity to savannah landscapes, but nor do I believe we have lost a connection to forests. Forests offer protection, food, material for constructing shelters, protection from the elements, and physical and psychological health.

Our modern society sees forests as a wood fibre resource, and we seem intent on turning forests into tree farms for our economic benefit. Forests, however, are so much more. They sustain a vast biodiversity, produce oxygen, purify the atmosphere, and store carbon. We are also beginning to understand that forests are not just collections of trees and various other organisms. Forests are complex ecosystems where the multiple organisms interconnect through a web of exchange we are just beginning to understand.

The more we can learn about forests, their intricacies, their impact on our overall health, and how to appreciate them, the better.

WHY ANOTHER BOOK ABOUT FORESTS?

Books about ecosystems tend to focus on the parts. What is the structure, what are the species within the system, how do they interact and compete, and what functions does the ecosystem serve, often in terms of human benefit? Though this book may cover some of these topics, it is much more about how humans need to connect with forests. What are the ways of being in and realizing a connection to forests? Throughout this book there are personal stories of relationships with forests with suggestions and ideas on how readers can develop connections. Thus, we hope that this book will inspire you to rediscover forests.

PART 1: PERSONAL STORIES

MY INTEREST IN NATURE

Riley Scanlan

It is not surprising to me that my favourite memories of nature do not involve a science lecture or biology field trip. As with many people fascinated with the outdoors, I realized how special a connection to nature can be at a young age. Every summer, my parents would send my siblings and I off to overnight summer camp. What I'm sure started as a vacation for my parents, quickly became the highlight of my year.

I was fortunate to go to a canoe tripping camp and spent many nights and weeks paddling from campsite to campsite around Ontario and Quebec. Some canoe trips were four days total, and the longest was 27 days. These were very special circumstances. As a child, camp was the only time of year that I could go weeks without adult supervision - *awesome!* While I saw my counselors as "old", in reality they were but a few years ahead of me. The environment this created was one of independence, creativity and freedom. Each camper had to pull their own weight but was also involved in some of the decision making - exciting for a young kid. *What's for dinner tonight?* Well, you're making it, so you pick! *What campsite should we stay at tomorrow?* Depends how hard you paddle!

What I think is most special, however, are the relationships that developed in these spaces. This includes relationships with other people, myself and my surroundings. The friends I made while 13 years old at camp are still some of my closest and will likely continue to be for my entire life. One camp friend I have not seen for 7 years, but we still send letters back and forth every few weeks. I look forward to the day we can reunite and I'm sure we'll pick up right where we left off. I also learned a lot about myself during these extended periods outdoors. Turns out, my body and mind are capable of quite a lot. And in turn, they really don't need too much to thrive: adequate food, water, shelter and friends. Finally, the relationship that took me a while to understand as special, is that between nature and I. I learned that you do not need to know the latin names of trees, birds, insects, etc. to appreciate how incredible they are. Canoeing along the edge of a river, I was grateful for the shade of overhanging trees. One time, a dragonfly sat on my shoulder for about an hour, while I canoed down the river and even through some small rapids. I immediately felt peace, knowing my dragonfly friend would protect me from mosquitoes. After weeks of drinking only water, spruce tea was a delicious addition to breakfast.

Though I did not know to name it at the time, I realize now that on these canoe trips I was seeing myself as a part of the forest and aquatic ecosystems around me. It was not lost on me that any garbage left behind or tree sapling stomped, had a permanent effect. In addition, I knew we had little control over our surroundings. During my 27 day canoe trip, it rained nearly every single day and there was not a thing we could do to stop that, so we sang songs and enjoyed (nearly) every minute, despite the circumstances. The forest and my group were intertwined in a messy relationship, each impacting and benefiting from each other. The dragonfly got a free ride downstream while I had my own personal mosquito-defender.

I remember one of my counsellors mentioned they studied environmental science in university. My eyes lit up as I thought, *Wow you can actually study and pursue a career in the environment? Sweet!* So, while I was lucky to have spent a lot of time in nature as a child, my interest became more formalized as I learned about ecology, carbon cycles, forest succession and so on. It turns out I was not the only one grateful for tree shade along the riverbank, but in fact river ecosystems rely on the cooler temperatures and nutrients from fallen leaves and branches of overhanging trees.

My science lectures and biology field trips indeed furthered my amazement for the outdoors, but it certainly did not start there. Anyone wanting to learn more about the environment will be hard pressed to stay engaged if starting with an introduction to soil

characteristics. Human powered trips, such as paddling, walking or hiking, allow one to slow down and pay attention to the environment around them. The trees, flowers, and insects themselves have a lot to teach us if we are willing to listen. I believe this should be the first lesson in environmental science.

MY CONNECTION TO FORESTS

Soren Bondrup-Nielsen

My earliest memory is of forests. I grew up in an old house right next to a state forest in Denmark, and the property the house was on had an abundance of trees. My brother and I would play under the trees, climb the trees, build huts using branches from the trees, and swing from branches and yell out like we were Tarzan. As children, we had the freedom to roam as we pleased as long as we didn't break one cardinal rule – to be back home at a specified time.

Over time, my sojourns into the forest expanded. When I was 11, I got a horse and began exploring the forest on horseback. If I came upon a deer, it would not bolt. I was not seen as a human mounted on a horse, and the deer would merely look and then continue feeding. My brother and I were given sleeping bags, and we would sleep outdoors. All our spare time, whether with each other or with friends were spent outdoors and mainly in the forest. Forests became a place that nourished our souls.

When I was 13, we immigrated to Canada. After a year in Toronto, we moved to a property on the Oak Ridges Moraine, and again forests were nearby. I continued to be drawn into the forest by some invisible force. I was not necessarily interested in knowing the various species of trees, birds, insects and plants I encountered. It was more that I just felt comfortable and safe within the forest. I felt I belonged.

In my middle teens, I began to go canoeing first in Algonquin Provincial Park and then in the Temagami region. This I did with a good friend and often my brother. We would be gone for up to a month, often in August. We loved the adventure, the solitude, the

camaraderie, sleeping under the stars, eating blueberries and catching fish we fried over the open fire. These trips were not to learn the ecology of the lakes and forests or learn the names of things. These were trips to be in nature. It was only later in my life, when I started university, that I began to study nature and eventually to teach about nature.

PART 2: ECOLOGY OF THE ACADIAN FOREST

WHAT IS A FOREST.

by Soren Bondrup-Nielsen

I can imagine that if you ask most people to describe a forest, they will mention trees. Similarly, if you ask, what is a pond, they will maybe say a body of water, maybe with aquatic vegetation around the edge For a grassland they will say grass and a desert maybe sand and cacti. We primarily see what gives these ecosystems their overall appearance or structure. But these ecosystems are so much more. They cannot exist if it was not for the multitude of organisms within them, most of which we may never see or cannot see with the naked eye.

Ecosystems are collections of species where those species largely depend on each other in order to co-exist. Different sets of species create different types of ecosystems, which require energy from the sun to exist. In a forest, the trees, shrubs and other plants capture energy from the sun through photosynthesis. This energy, together with nutrients in the

soil taken up by roots, allows for the growth and reproduction of the various species of vegetation. The trees and plants are a source of energy for the organisms we classify as herbivores, such as deer, rodents, hares, and many insects. Insects are a critical herbivore in a forest ecosystem. Most of these insects are harmless, but we humans tend only to be concerned with the ones that annoy us or cause what we consider the destruction of the trees. The herbivores in the forest are a source of nutrition for predators. Many birds and bats, and shrews in a forest are predators of insects. These predators are prey by yet other predators such as hawks and weasels. The key to a healthy ecosystem is this balanced transfer of energy from the sun to plants, herbivores and predators.

Ultimately the trees, the insects, the birds and other organisms die. An array of organisms we call decomposers such as fungi, saproxylic beetles, carrion beetles and various soil invertebrates obtain their energy from breaking down plant and animal matter. Decomposition ensures nutrients are recycled back into the soil, where they are again available to trees and plants. The energy needed by plants and animals to grow, move, maintain metabolism and reproduce cannot be recycled but is slowly dissipated as heat. The laws of thermodynamics tell us that the transfer of energy along the food chain from plants to herbivores to predators is not one hundred percent efficient, and some is lost as heat. Thus, ecosystem scientists refer to this as the flow of energy through the system but the nutrients, the chemical constituents are recycled over and over again. Without this process, the forest, any ecosystem, could not exist.

When I was younger, my wife and I bought a farm and started to raise sheep. We did not allow the sheep to pasture on about five acres of grassland that we harvested for hay to feed the sheep during winter. After about three or four years of harvesting hay, the grass did not grow very well. We probably only got about a fifth of the volume of hay we had initially taken off the field. Because we removed the grass and left none to decompose, the soil became depleted of nutrients, and the grass grew poorly. We felt silly thinking that we could keep haying the field without returning the nutrients. Once we spread the winter manure from the sheep back on the field, the hay crop recovered. Thus, the cycling of nutrients is essential for maintaining a healthy ecosystem.

A forest works the same; if you keep removing the trees, the soil loses its fertility. In Europe, where intensive forestry has taken place over several hundred years, the lesson has been the same; when you keep removing trees from an area, eventually, tree growth is stunted. And remember, the forest that we see is much more than solely trees. The cycling of nutrients through the multitude of organisms, many that we don’t see or can’t see, is essential for the cycling of nutrients within ecosystem.

Humans tend to see a forest as a source of wood to be harvested. We burn wood for heat, and we convert tree trunks into lumber for all kinds of uses, from buildings and furniture to musical instruments and much more. We primarily see nature as a warehouse of resources for our exclusive benefit. Maybe we should see nature as supplying us with precious gifts to be treasured, used sustainably, and not to be taken for granted.

THE ACADIAN FOREST

by Riley Scanlan

We live within a region where the forest is classified as the Acadian Forest. However, this does not mean the forest cover is uniform. It can vary dramatically across a landscape from mixed forests to areas of single species of trees to forests of young trees and forests of large old trees.

The mix of tree species in a given area is influenced by various factors, including climate, soil, rainfall, time, geography, and random events such as storms. Small scale differences can affect which species will grow or dominate, such as slope, exposure, and depth and moisture of the soil. The natural history of various species of trees, such as seed size, growth rate, and longevity, will affect the structure of forests. Finally, disturbance factors such as storms, insect outbreaks and fire will also impact forest structure. These are natural factors. However, human factors include planting exotic species, tree harvesting, and silvicultural practices such as tree planting and the use of herbicides. Thus, interpreting forest structure across a landscape is not easy.

Even if all the climatic, soil, and environmental conditions were the same, the natural history characteristics of different species of trees such as seed size, dispersal, growth rate, age at maturity and shade tolerance would create other forest structures over time. Trees that produce tiny seeds that are easily wind-dispersed can reach areas sooner than trees with large seeds that are not readily dispersed. Seeds of the broad-leafed trees have seed coats that protect them from fungal attack. On the other hand, the seeds of evergreens, the gymnosperms, do not have seed coats. Thus, deciduous tree seeds will survive on the ground for a long time, unlike evergreen seeds that do not last long. Shade tolerant trees such as hemlocks and red spruce will grow under a canopy in the shade, while shade-intolerant species such poplars and white birch require plenty of sun exposure. Trees that mature and reproduce at an early age, such as balsam fir, can spread through an area quickly, while trees that develop late such as hemlock and oak will not be able to spread as quickly. Thus, tree characteristics affect the overall structure of a forest. After a large-scale disturbance, the forest that recovers will be dominated by shade-intolerant species with good seed dispersal. However, over time shade-tolerant long-lived species such as hemlock, red spruce, sugar maple and yellow birch may begin to dominate.

There is a lot of variation within a forest across a landscape. Foresters classify areas of uniform forest cover, at a scale up to a few hectares, as forest stands. At a large scale, such as several hundred square kilometres, the variation of stands becomes a mosaic that appears uniform. The region that is called the Acadian Forest is such an area that shares characteristics that makes it different from adjacent areas. The Acadian Forest Region is bounded to the south by the North-eastern Hardwood Forests and the north by the Boreal Forest.

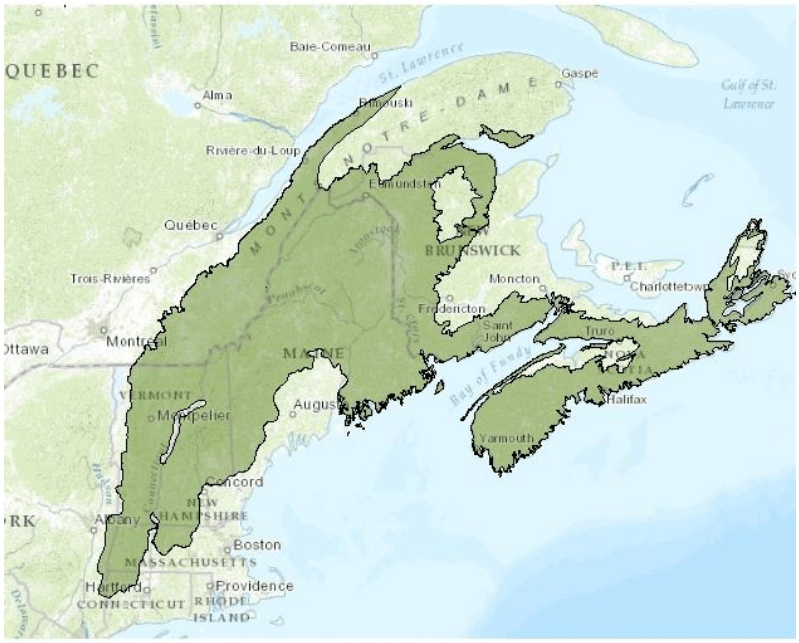
You can see now that it is not easy to define a forest. However, by understanding the combination of factors that influence the growth, recovery and continuation of a forest, one can notice similarities and differences in various stands, forests and entire regions. There is much still to be learned about the Acadian Forest and its diversity. However, what is certain is that without the abundance of organisms at every level (the plants, the insects, the decomposers), our forests would not be able to provide us such incredible gifts as the clean air, water and wonder that it brings.

THE ACADIAN FOREST REGION

Riley Scanlan

The Acadian Forest Region (AFR) spans across the Maritime provinces, part of Quebec's Gaspé Peninsula and extends into Maine and Northern New England. The geographic extent of the Wabanaki Confederacy, which includes the Mi'kmaq, Maliseet (Wolastoqey), Passamaquoddy (Peskotomahkati) and Penobscot nations, aligns with that of the AFR. The Acadian Forest is therefore also referred to as the Wabanaki Forest.

Also, relatively well defined by the geographic distribution of the long-lived and shade-tolerant red spruce, the AFR is further characterized by a mixture of boreal and temperate conifers and hardwoods, by glacially-derived soils, by less common naturally-occurring fire events, and by relatively high average wind speeds. The final development stage of the Acadian Forest is called old growth. Within the AFR, old-growth species include sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), eastern hemlock (*Tsuga canadensis*), red spruce (*Picea rubens*), eastern white pine (*Pinus strobus*) and yellow birch (*Betula alleghaniensis*).



The Acadian Forest Region

Source: https://www.researchgate.net/publication/312551848_Modeling_and_Forecasting_the_Influence_of_Current_and_Future_Climate_on_Eastern_North_American_Spruce-Fir_Picea-Abies_Forests

Centuries of forest clearing for agriculture and forestry have left very little older Acadian Forests. Before European colonization, old-growth likely covered up to 50% of forest land in Nova Scotia. However, today it is estimated less than 0.9 percent of forest land outside of ecological preserves is old-growth, Acadian Forest. The remaining stands of old-growth Acadian Forest in Nova Scotia are likely to be found on steep slopes, where logging was difficult, and near waterways where regulations prohibit forestry activity within 20 metres of a watercourse. In addition, some protected areas in our province, such as Kejimkujik National Park and the Kentville Ravine, are home to beautiful, old Acadian Forests.

DISTURBANCE ECOLOGY OF THE ACADIAN FOREST

by Soren Bondrup-Nielsen

Disturbance is a significant factor shaping ecosystems. A disturbance is anything that, over a relatively short period, disrupts the structure of the system. A fire burning through a forest or a skunk digging up the forest floor to search for food is considered disturbance. These examples are very different in both extent and intensity, but never-the-less have impacts. The fire will potentially result in a new suite of tree species occupying the area. The digging by the skunk results in a small patch of exposed soil which may allow a dormant seed of a plant that requires an open place to germinate.

Disturbance has been studied extensively, whether in marine, aquatic, or terrestrial ecosystems. A central concept from these studies is the Intermediate Disturbance Hypothesis. It states that at intermediate disturbance, you find the most most number of species in an area. At low disturbance, competition among species is a driving factor resulting in few competitively dominant species. Contrary, at a high intensity of disturbance, again only a few species that can establish quickly and grow fast will dominate. No disturbance and major disturbances in ecosystems are relatively rare. Thus, most ecosystems are impacted by intermediate disturbances, which results in a relatively high level of diverse species co-existing.

The type of disturbance that impacts an ecosystem is a function of several potentially interacting factors such as time, climate, soil type, the nature of the species in an area, and human actions. There are critical climatic trends from the tropics to the arctic in the northern hemisphere, impacting the nature of disturbances. The tropics are warm and moist, whereas the arctic is cold and dry for the most part.

In the tropics, tree species diversity is high, and the decomposition of dead organic matter is rapid. Thus, soils are relatively nutrient-poor, as nutrients are taken up by plants as soon as they are available. The tropics also tend to be very humid. The rain that falls is largely generated by evaporation from the forest. For these reasons, when tropical forests are clear-cut they do not readily re-grow since the soil are nutrient poor and with lack of evaporation there is little moisture. In the tropics the disturbance tends to be single tree death. This opens a small patch where species that require more light than is available under the forest canopy, can grow.

The forests at the mid-latitudes, where it is relatively warm and moist during a relatively long growing period are dominated by a variety of hardwoods and conifers. These are classified as the Northern Hardwood Forest which include the Acadian Forest. The deposition rate of dead organic matter is about the same as the rate of decomposition;

thus, soils are fertile. The great variety of deciduous trees conserve energy during the non-growing season by converting chlorophyll in their leaves to nutrients turning the leaves bright fall colours. The nutrients are transported down into the roots at this time, where they are stored for the winter. The leaves drop to the forest floor and are slowly decomposed to form fertile soil. Stored nutrients in the roots are transported as sap up the tree to the branches and shoots where new leaves grow.

Fire and insect outbreaks are rare events in the Northern Hardwood Forest not extensively impacted by humans. The primary disturbance factor is wind, which, depending on intensity, can blow down single trees if the wind is moderate, groups of trees if intense or large swaths of trees when hurricanes blow through. The wind-caused disturbance results in what is called gap dynamics. Gap dynamics can maintain the overall structure of the forest for many hundreds of years. Old-growth forests covered half the Acadian Forest pre-European colonization; thus gap dynamics must have been the primary process of maintaining the forest.

The primary disturbance factor in the Boreal Forest is fire. The Boreal Forest is a wide belt of primarily spruce that encircles the northern hemisphere. The climate is cold and the growing period is short. The decomposition of dead organic matter such as trees and other vegetation is slow and there tends to be a buildup of organic matter on the forest floor depending on location the organic matter insulates and may result in the development of permafrost. Lightning is the disturbance which causes forest fires, which releases the nutrients and a new cycle of tree growth. The sequence is usually of poplar and birch, followed by fir and spruce. Over a large spatial and temporal scale, fire can be seen as an intermediate disturbance resulting in a mosaic of forest types across the landscape. Another significant disturbance is outbreaks of spruce budworm, which can kill trees when large areas are dominated by single species of old and often weak conifers. Trees in the Boreal Forest tend not to get very old.

OLD GROWTH FORESTS

Riley Scanlan

There are several reasons one might find themselves in a forest. I personally spend time in forests to find a moment of peace, for the quiet needed to think through an idea, for exercise, or to better connect with a friend. In most of these cases, only a small part of my brain is attending attention to my surroundings. However, I have noticed that in certain forest conditions I cannot help but be in complete awe and wonder of the stand around me. Such conditions, which I did not know to name until I studied environmental science, I now know to be old growth forests.

It's possible you too have had this experience, and perhaps you had the expertise to know what an old growth forest is. However, having studied these ecosystems in detail, my only conclusion is that there is still so much to learn. In fact, I would argue that as individuals, communities and entire societies, old growth forests provide countless lessons for life. Here I will provide an overview of what exactly an old growth forest is and how to know if you might be standing in one. I also hope to shed light on a few of those lessons that I have learned from these incredible ecosystems.

Forest Succession

As has been discussed, a forest is not one stagnant ecosystem but in fact will change slowly over time. After a wildfire blazes through an area (a rare event in he Acadian Forest), only a handful of plant species adapted to grow in such a barren environment will survive. Overtime, as those species grow, die and decompose, they will put nutrients back in the soil and grow roots to stabilize the earth. This creates a new habitat that other species are able to survive in. A forest will slowly form and eventually reach its final stage of development called 'old growth'. At this point, a forest will not change significantly unless there is another large scale disturbance, such as a major wind storm, fire, insect outbreak or human activity.

To better understand forest succession, imagine that the largest trees in a forest, with leaves and branches in the upper canopy, consist of poplar, white birch and balsam fir. However, the seedlings at the forest floor consist of entirely different species, such as eastern hemlock, sugar maple and American beech. It follows, then, that as the large canopy-dominant trees (poplar, white birch and balsam fir) die, they will be succeeded by the seedlings waiting patiently on the forest floor. This forest has not reached its final stage of development, as we can expect the species composition to change as trees die and others grow. If, however, you notice the canopy-dominant trees are the same species as those on the forest floor, we can assume the forest will not change drastically when one or a few trees die.

Commented [SBN1]: Black spruce seldome grows with poplarand white birch.

This state described is what we consider to be the last stage of succession, the climax stage or old growth. In the Acadian Forest Region, old growth stands will primarily consist of eastern hemlock, yellow birch, sugar maple, American beech, red spruce and white pine. These species are shade tolerant and can withstand living in the shady understory for long periods of time, waiting for a canopy-dominant tree to die and for sunlight to reach the forest floor.

Again, we must remember that no ecosystem is truly stagnant. An old growth stand may revert to an earlier succession stage if there is a storm or hurricane, or it is logged. Nature is constantly adapting to the changing environment.

Human societies must also continue to grow and evolve. In the same way a forest fire provides opportunities for new ecosystems to form, the COVID-19 pandemic can be seen as a chance to learn. Numerous issues, including the oppression of Black, Indigenous and People of Colour, barriers for people with disabilities, food insecurity and so many others, have been amplified by the COVID-19 pandemic. In the same way that after a wildfire, early succession species create a habitat necessary for other species to thrive, we must recover and continue to adapt by providing everyone an equitable and just life.

Commented [SBN2]: Interesting point but not for here, I don't think.

Tree Age

There are other ways to explain and understand old growth than simply by succession. The typical characteristic people assign to an old growth forest is that it must contain old trees. While the tree age of Acadian Forest species can reach over 400 years old, the forest itself may be thousands of years old.

Commented [SBN3]: This is an important point – I have dealt with this under Disturbance but you can expand on it here.

The most accurate measurement of tree age is to count its rings. Each year of growth can be seen in the cross section of a tree trunk. Rings can be counted on fallen, broken trees, on the stumps of cut trees or in a core taken from a tree by an increment borer.

Tree core taken from an Eastern hemlock. 106 rings indicate the tree is 106 years old. Notice the rings on the left are very close together, indicating slow growth in its early years likely due to being in a shady understory. Also, the centre of the tree can be seen at the far right.

Of course, one does not wish to cut down a tree they suspect to be old, only to find out they have killed a 250-year-old yellow birch. An increment borer is therefore very helpful. However, while boring into a tree is useful for research, it can still cause some harm to the tree and should only be used when absolutely necessary. There are, thankfully, ways to estimate the age of a tree without harming it.

A large tree trunk diameter is often attributed to old age, however it is not a very reliable metric for all species. Some trees, such as white pine, grow very quickly and may have a large trunk at only 50 to 80 years old. Hemlocks, on the other hand, are one of our shade tolerant species and will grow very slowly in the understory. An eastern hemlock may be the same age as a neighbouring white pine, but only a quarter of its size in diameter.

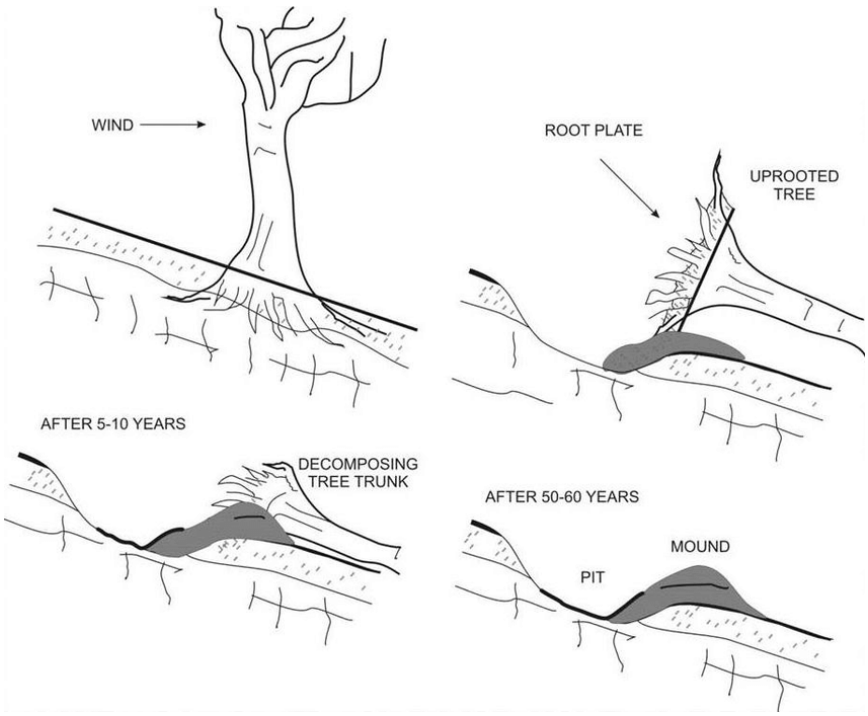
[would be cool to show a picture of both, with an estimate age for the smaller hemlock and larger white pine]

In addition, you will have to look at the growing conditions of a tree to better understand its age based on its size. If the tree has access to nutrient rich, deep soil, it will have no problem growing quickly. Therefore, a large tree here does not mean it is very old. However, if the tree in question is found on nutrient poor or loose soil, such as on a steep slope, then it will have to use much of its resources to just stay alive and be less able to grow rapidly. A large tree found in such conditions will likely have taken a long time to get to that size.

In addition, one relatively reliable sign of old age, particularly for eastern hemlocks, is the lack of branches close to the ground. If the lowest branches on a hemlock's tree's trunk are 6, 10 or even 15 feet high, you are likely staring at an old tree. This is because once a tree reaches the canopy, its lowest branches are not photosynthesizing nearly as much as its highest branches. Therefore, a tree will stop producing branches near the Earth and will rather focus its energy on growing taller and lengthening branches in the canopy. After a while, such a tree will have no branches close to the ground and we can presume it is quite old.

Pits and Mounds

Another attribute of an old growth forest is the presence of pits and mounds. Also referred to as pillows and cradles, these features indicate that the largest disturbance the forest in question has seen is only that of wind causing one or a few trees to fall down. When a large tree is tipped over by the wind, its roots and much of the soil beneath it is pulled up from the earth. After many decades, the roots decompose to form a higher elevation mound, and the Earth that was initially uprooted with the tree forms a low elevation pit.



Source

A forest that has numerous pits and mounds is indicative of low disturbance, meaning it has been able to grow for a long time and is likely old growth.

Canopy Structure

As humans age, we collect experiences, memories and knowledge. After so many years of living, older people seem to have learned how best to manage life. At least, as a twenty-something trying to navigate today's world, it sure seems that way. In fact, many cultures regard older generations with the highest respect and younger people are encouraged to listen and learn from them. I see old forests much the same, they are our ecological ancestors. Old growth forests have grown and developed through countless adversities and have collected an incredible amount of knowledge. We can see this in the canopy structure of an old forest.

The canopy consists of all the crowns of the various trees and shrubs in a forest. The tallest trees that reach the top of the canopy, as we discussed earlier, are canopy

dominant. However, each part of the canopy is important. The older a forest, the denser the canopy becomes. These old growth forests have learned to not let any amount of energy go to waste. The canopy dominant trees take up much of the sunlight, grow very large and create incredibly complex root structures that hold the soil in place. What sunlight these trees do not capture, is used by the middle layer; the trees waiting patiently in the understory for their shot at growing up into the canopy. Finally, any light that makes it through this middle layer is taken up by the shrubs and herbs at the forest floor, if indeed, there is enough light.

The forest floor under the closed canopy of old mature forests supports very little vegetation due to lack of light. There is no vegetation under a coniferous stand, while under deciduous trees such as maples, oaks and ash, there will be carpets of spring annuals that take advantage of the light in the spring before the trees leaf out. Once the leaves are out, there will be little light reaching the forest floor, allowing vegetation to grow.

It is indeed possible to measure the amount of light where you are standing using a light meter app of which there are a number. (we can link to some)

[Show pictures of light coming through a young vs old forest canopy.]

Old forests are relics of our natural history and there is an awful lot we can learn from these habitats. I am most interested in their ability to use every photon of energy to its fullest; nothing is wasted and nutrients are constantly recycled. The canopy is one example of a forest's ability to work efficiently, and we humans ought to take note.

Commented [SBN4]: I am not sure what you mean here.

Dead Trees

Another reason forests make great examples of efficient, zero-waste systems, is the importance and use of dead trees. When a large tree dies, not only does it provide an opportunity for younger trees to take up sunlight and continue the succession of the forest, it also creates a unique habitat for numerous creatures. Snags, or dead standing trees, become home to cavity nesting birds. Saproxylic beetles require dead and decaying wood to survive various stages of their life cycle.

Commented [SBN5]: More needed here – I will see what I can do.

These dead trees are eventually broken down by many decomposers and the nutrients are recycled through the ecosystem. When a forest contains numerous dead standing or fallen trees, it is likely that no human has interfered or removed any potential lumber or firewood. That said, if you see a stump and no sign of the rest of the tree, we can presume a person is responsible. Any forest that has fewer indications of human interference is more likely to be old growth.

Conclusion

Notes

Change

Us humans are not so adept to changes, yet we create it all around us. As societies, ideas or movements can spread like wildfire and create change on a massive scale. For example, the adoption of the steam engine in the 19th century allowed foresters to cut large tracts of land faster than ever before, but this was seen as a step forward. Yet, when the change is inflicted upon us, such as a pandemic, our globalized world is thrown into disrepair.

Globally, relatively stable habitats such as old growth forests, are having to adjust to climate change. Species we currently consider native to Nova Scotia will longer be able to survive in our climate, and will be replaced by a new group of trees. While modern climate change is caused by human activity and is far more rapid than any other change the planet has experienced in the last 10,000 years, change is naturally very common.

Human evolution

As civilizations evolved, humans became organized. Many nomadic cultures became settled agriculturalists. This allowed people to live in larger groups, which in turn meant that every individual did not need to know every skill necessary for survival. A few people would be responsible for hunting, some could specialize in medicine, while others made clothing, etc. This created an interdependence between people and with each generation, new lessons were learned and passed on.

This is parallel in the evolution of old growth forests. As the early succession species move in to an area, they

Interdependence

Each tree alters the habitat in some way. Early succession species are quick to utilize available resources. As these species take over, and some die, they put nutrients back in the soil and eventually create a shady understory required by other species. Traditional evolutionary theory assumes individuals that are able to grow, use resources and ultimately produce offspring will pass on their genetics. Eventually, the characteristics that do not aid in this pursuit of survival and reproduction, such as say, helping others without a gift in return, will be selected against.

Commented [SBN6]: I am not sure about this section. What was your intention.

The idea that each individual is competing for resources and seeks to serve only their own best interest is largely being challenged, and we can see this in old forest succession.

TREES OF THE ACADIAN FOREST

by Soren Bondrup-Nielsen

Pine

When I was a young teenager, there was a large stand of white pine not far from where I lived. I would often go there and just sit under one of the massive trees and feel the forest floor soft with its thick layer of rusty-red dead pine needles, breathe the air with its sweet redolence, and listen to the soothing muffled sound of the wind blowing through the tree-tops. White pine needles grow in bundles of five, and long, slender and soft. Entering this pine stand was like entering a different world. In the adjacent field, the wind would pull at me, there was no distinct odour as I inhaled, and the tall grass would pull at my feet as I walked. But entering the pine stand, all this would change. Sitting under one of the tall pines was calming.

Later, but still a teenager, I started to go canoeing in Ontario's Temagami region with my friend, Hap. Here we came across an old, dilapidated lumber camp that had been active in the early fifties. The tall white pines, so common in this area, had great commercial value. They were cut down in winter, mainly by teams of two lumberjacks alternately pulling and pushing a crosscut saw. Logs had been hauled to the shore of Diamond Lake by teams of horses and piled on the ice. In the spring, logs were floated to a sawmill in Temagami, where they were cut into lumber. At the time we canoed in that region, there were still clusters of tall mature pines along the shores. We often pitched out tents under these pines on the soft forest floor, and in late summer, could feast on blueberries growing nearby.

Later in my life, I moved to Nova Scotia. There are still some areas with massive pines, especially in the western half of the province, but it fades compared to the pine stands that grew here when Europeans colonized this area. Pines were coveted for their straight grain, even texture and light wood. Pine was used initially in home construction, but the British realized the value of pine for shipbuilding, especially as masts and spars. Wood was becoming scarce in Britain, and the building of naval ships was essential for dominance on the seas. Pine was harvested and shipped to England in massive quantities. White Pine became so valuable that to protect the resource, surveyors would cruise the

woods, and tall, straight pines were blazed with a Broad Arrow and were only to be exported to Britain.

White pine lumber, although it is soft, is a beautiful wood to work. It provides a prized interior finish to homes. Despite its softness, it is strong and durable; some people like the natural look of the pine and will only varnish or stain it, while others will like how well it takes paint.

There are two other native pines in Nova Scotia, red pine and jack pine. Both pines are scarce in the province. The needles of both pines occur in two's; the needles can be easily broken in half, unlike those of white pine. Red pine needles are straight and long as those of white pine, while jack pine needles are twisted and about one inch long. Red pine will grow tall and straight, and lumber from red pine is heavier and harder than white pine.

Eastern Hemlock

My first encounter with hemlock was not the tree itself but with lumber cut from hemlock. When I was fifteen, my family moved to a ten-acre property on the Oak Ridges Moraine in southern Ontario. On the property, there was an old post and beam building, somewhat rundown. It had been used for the storage of farm machinery. The building was about forty feet by fifteen feet in size. The beams were of white pine and in great shape, but the roof was collapsing, and only some of the boards were salvageable but not in good condition. I took the building apart. Labelled the beams and had them transported down a hill to where I would build a barn for a horse that I hoped to acquire. I made footings and then assembled the posts and beams into their original shape. This gave me a rectangular frame that had to be clad with boards. There was a lumber store in Schomberg not far away. When I told them of my project, they suggested using rough hemlock more because of my limited budget than the quality of the wood. Hemlock is tough and highly rot-resistant but brittle and splintery. As I began to plank the barn, I quickly realized that it was not that easy to drive nails in the planks, and some boards split when I drove in a nail. However, in the end, I did finish the barn in rough hemlock, and it looked good and functioned as a horse barn for many years.

When I moved to Nova Scotia, I came across several old-growth hemlock stands and quickly became enamoured by these massive ancient trees. To be in an old stand of hemlock was similar yet different to being in an old stand of White Pine. The air was primarily dry in the pine stand, but the atmosphere was moist in the hemlock stand. There was a distinct redolence, different from the pine stand but equally calming. And the sound of the wind blowing through the treetops was a different melody from that of the pine. Hemlock needles are dark and shiny green with two white lines below. The needles are attached to the branch on short tender stalks, which come off with the needles when you pull on them. The cones are small, about one centimetre, for such a large tree.

In the days of wooden culverts, hemlock was often used because of its rot resistance. On my farm where we raise a few sheep, and I used to have a horse, I use four by four hemlock for fence posts; they last a long time in the ground.

I supervised a student in the early nineties, doing his Masters of Biology in the Rossignol area of the province; he was surveying small mammals - mice, rodents, and shrews. There we several old-growth stands in the area. On a visit there in 1992, I came across a stand of hemlock that had been cut down. I wandered through the scattered stumps, feeling sorry for the majestic trees no longer providing a dense canopy that created the moist, cool micro-climate and did not let enough light through for there to be much vegetation growing on the forest floor. As I inspected the stumps, most had some centre rot, but I came across one stump that was solid right to the centre. I tried to count the growth rings; I could get to just over 250, but there were two areas where the rings were so tight that I could not distinguish them. This was in the very centre, and there was a band if tightly spaced rings about twenty centimetres from the centre.

I was intrigued by the story written in the growth rings, so I returned the following day with my chainsaw and cut a slap off the stump. I took it home and polished the surface so I could accurately count the rings. It turned out that this hemlock started its life in 1667. For 49 years, it hardly grew at all, only reaching a diameter of two and a half centimetres. For the next 28 years, it grew to a diameter of almost twenty centimetres, where for the first 8 years after being, what is called released, growth rings were almost 5 millimetres wide, after which it slowed down. Between 1744 and 1772, the tree only added one centimetre to its girth, after which it grew steadily for the next 220 years to a diameter of about 80 centimetres when it was cut down in 1992. This was not a large tree diameter-wise, but it was ancient – it was 325 years of age.

Hemlock is a shade-tolerant species, and I figured that this tree had started its life within a stand of mature hemlock where it had survived in the shade, growing hardly at all. This was a nice example of the strategy of the shade tolerant hemlock, waiting for a gap to open which results when a tree blows down or dies. This lets light down to the forest floor. These spindly but old hemlocks have grown very slowly but when light finally reaches them, they have an explosion of growth. The subsequent period of slow growth between 1744 and 1772 may have resulted from a dry or a cold period.

Spruce

Red Spruce is the signatory tree of the Acadian Forest. Its distribution basically defines the extent of the Acadian Forest. I did not meet this tree until I moved to Nova Scotia. In the mid-1990's I conducted a study of saprozylic beetles in the province. Saproxylic beetles are beetles whose larvae live within deadwood. My students and I used flight intercept traps hung up in various stands throughout much of central Nova Scotia to catch flying adult beetles. One such area was the Abrahams Lake Nature Reserve, where there was a stand of old-growth red spruce. The red spruce trees were massive, measuring between 50 and 90 centimetres in girth and towered some 25 metres. Under these trees, there was a thick layer of moss cover with little ground vegetation. There were very few to no branched on the lower half of the trunks, which stood straight and clean.

In 2003, Hurricane Juan blew down thousands of trees in Nova Scotia. The downed trees were entangled like massive pick-up sticks. Many people were out salvaging wood which was painstaking work. A friend of mine was one of these, and I asked if I could buy a good solid large log of red spruce; he kindly gave me one. I had a fellow with a portable band saw cut me half-inch planks with the live edge from this log. I was in the process of building a 14-foot-long lab strake wooden boat. I wanted the boards for the planking. After cutting the planks to the proper shape, I steamed them in my homemade steamer and then bent them into position and clinkered them fast. The red spruce planks were ideal for the job and made for a beautiful finish. I still have that boat, and it rows well and is solid as can be.

Spruce - red, white and black, have square needles, and you can feel the four corners by rolling the needles between your thumb and forefinger. Needles are also stiff and sharply pointed. As such, they prick your hand when handled. Red and white spruce can be distinguished by their smell when you crush some needles. White Spruce smells like cat

pee and thus the other name, Cat spruce. Red Spruce, on the other hand, smells rather sweet when the needles are crushed. Red Spruce twigs make a lovely tea. Whenever I visit my friend Frank Meuse, we always have spruce tea. If we are walking through the woods, he will bring a pail, and when we are close to a small brook or stream, we stop to build a small fire. Frank fills the pail with water and hangs it over the fire. He then picks a few short twigs with new shoots of Red Spruce and puts them in the boiling water. We let it steep and then enjoy the refreshing taste of spruce tea.

White and Red Spruce are superficially similar but quite different. Apart from smelling different, the twigs of Red Spruce are covered by very fine hair, whereas the twigs of white spruce are almost glossy with no hairs. Further more, red spruce is a typical shade-tolerant old-growth species. White spruce is not shade tolerant and grows along the coast and readily invades abandoned fields. The trees will dominate and shade other vegetation leaving the ground bare of vegetation exposing the soil, which readily erodes. I have wandered through some white spruce stands on former old fields where the mass of roots was exposed, forming a tangled mess that was difficult to negotiate.

Spruce forms long, even-diameter roots just under the moss or loose soil, and one can easily pull these up, which can be as long as several metres. Years ago, on the shore of Lake Superior in northern Ontario, my brother and I attempted to build a birchbark canoe. We had consulted with an Ojibwa women who told us how to harvest and use the spruce roots. We were amazed at how easy it was to collect the roots and how long they were. We used the roots to tie the canoe ribs to the gunnels and were surprised at how tightly we could pull the roots and how strong they were. My brother and I built the frame first, and the Ojibwa women laughed at us as we were constructing the canoe backwards in a sense. We should have started with the bark and then fitted the ribs and gunnels afterwards. We never did get to the stage of wrapping the structure in birch bark.

Black spruce is the typical tree of the boreal forest. In Nova Scotia, it is not uncommon but mainly found growing in poorly drained soils along the Atlantic and Fundy shores. New trees will form by rooting their lower branches in wet moss.

Balsam Fir

I have spent many winter nights in my sleeping bag lying on a bed of balsam fir boughs arranged in a thick layer like feathers on a bird and been well insulated from the cold of the snow or bare ground. Balsam fir boughs are soft and fragrant and make for a perfect

mattress. When you layer, the boughs overlap them so that the thicker part of the branches are covered. Layered like that, you cannot feel the thicker part of the branches, and you have a springy mattress that you can sleep repeated on for days without compaction.

Balsam fir needles are flat, and the branches are flat, and each year a new whorl of branches are added to the growing tree. Thus, by counting the number of whorls, you can tell the age of the tree. Balsam fir is also nicely fragrant and, to me, has a calming effect. Especially in the winter when I have camped out, I cut down three or four small firs. The poles left after cutting the branches off I use to either support my wall tent or make a lean-to with which I cover with a tarp. Fir grows very fast and often in abundance, so I have never felt guilty relying on them for my comfort, knowing that new fir will soon grow where I cut them down.

When you handle fir, you can get quite sticky from the pitch in the bark. The bark of fir often has numerous blisters, and if you pop them, the sticky pitch flows out and will colour your skin black. The pitch, however, is clear and has the same refractive index as glass. Balsam fir pitch was used in earlier times as the material for mounting sliced sections of tissue under cover glass on glass slides for microscopy studies. It was called Canada Balsam.

When cut down, de-limed and de-barked, Balsam fir make nice straight even poles that are white and strong. I have built several beds, chairs and tables using the fir for legs, posts, and beams. They carve nicely, and furniture can be ornamented that way. Some years ago, I built a 19-foot catamaran, and I cut a fir down and used the trunk for a mast. It was firm and served this purpose exceptionally well.

Fir grows quite well in the shade of other trees but equally well in the open with much light. Fir stands can be quite dense and thus impenetrable. Fir is not long-lived. At 60 to 70 years, they reach old age and start to die. Fir is now a very abundant tree across Nova Scotia, but prior to European colonization, fir was not plentiful within the Acadian Forest.

Birch

The birches are named after the colour of their bark, white, grey and yellow. Further south in the North-eastern States, there is also a black birch, but it does not make it into Nova Scotia. The yellow birch will grow in old-growth forest, not abundantly but certainly there as it is moderately shade tolerant and can reach 250 years. White and grey birch are not shade tolerant and do not grow to be very old.

White birch is also known as canoe birch. The bark of the white birch is water-resistant and tough. It can be taken off in large sheets, and indigenous peoples from Ontario east used the bark to build their canoes and various containers. But it is probably the birch bark canoe that is best known. Canoes were the primary means of transportation on the numerous lakes and rivers. Canoes could be built in various sizes to accommodate just a single person out hunting or fishing to several people. The Mi'kmaq built large seagoing canoes and would paddle them from Newfoundland to Cape Breton.

Years ago, when my brother and I tried to build a birchbark canoe, we cut down a long slender white birch. We split the log and used a draw knife to make square gunnels and the keel. The birch wood was very nice to work; it was straight-grained and strong.

The papery outer layer of white birch makes for an excellent fire started having a high pitch content. When it burns, black smoke rises. Wet birch bark will ignite, and I have started more than one fire in the rain using birch bark. If you peel the white papery layer off a living birch tree, make sure only to use the bark that is already loose. Being too vigorous when peeling bark off a birch can harm the tree. Sometimes birch will have noggins growing on the trunk or large branches. I have cut these noggins of and carved bowls from them. Since the growth layers are bowl-shaped, it is easy to hollow out the noggins and make nice-looking, functional bowls or cups.

Years ago, I was contracted to carry out a year-long bird survey of Pukaskwa National Park. The contract started in late November, and the park had constructed an A-frame for us to live. It was heated with a Hudson Bay airtight stove, but parks personnel had not cut any firewood. Ben, a local Ojibwa, helped us cut a few dead spruce trees to be used as kindling and several large white birch trees. I was worried that the birch would not have any time to dry, although they were cut after leaf fall when much of the sap is withdrawn into the roots. Ben taught us how to build a fire, first getting a hotbed of coals using the

dry spruce wood and then adding the split birch logs, which burned nice and long and gave off lots of heat.

Maple

What is more iconic than maple; the leaf of sugar maple is prominent on the red and white Canadian flag. There are several maple trees, but the two main ones are sugar maple and red maple. Sugar maple is a shade-tolerant tree and is found in old-growth. Red maple is not shade-tolerant but colonized cleared areas and grows fast. Both trees produce a sap that can be evaporated to make maple syrup, but the sap of sugar maple has the highest sugar content.

When I was a teenager and lived with my parents on the Oak Ridges Moraine in Ontario, close by, there was a large stand of mature sugar maple. During our time in Highschool, each March break, my brother and I would tap maple trees in this stand and make maple syrup. We had a great time. We tapped maybe up to 20 trees in the wood lot. We had a large cast-iron cauldron that we hung from a log supported in the crook of branches of two small maple trees, and we collected dead branches and trunks of small-diameter trees for firewood. We would keep the fire going under the cauldron all day, evaporating the sap. We faithfully collected the sap during the week of tapping trees and kept the fire going except at night. We brought the sap home at the end of the week, which was now fairly thick but not quite a syrup and finished it off on the kitchen stove. The week-long work in the woods would produce two to three gallons of syrup which we poured on just about any food we could. It was delicious and especially so since we had made it ourselves.

Some years ago, I bought about half a dozen eight-foot logs from a guy who would cut the logs and split them for firewood. He does this on a commercial basis, and he had piles and piles of logs. I picked out logs of maple and ash that looked like they would produce nice straight-grained lumber. I took the logs to a friend of mine with a portable band saw and had him cut one inch and half-inch planks. I brought the planks home and painted the ends of the boards with oil-based paint that I had on my paint shelf in the barn. I then piled and stickered the planks in the basement so that air could circulate around the planks. I left them for two years before I retrieved the boards and brought them up to my workshop. The planks were now dry and ready for use in projects. The maple boards finish very nicely.

Poplar

In the Acadian Forest of Nova Scotia, there are three species of poplar or aspen – trembling aspen, large-toothed aspen and balsam poplar. The latter tree is not that common. The other two poplars are well named. Trembling aspen has leaves that tremble in the wind. The leaf stem or petiole is flattened vertically, which causes the leaves to move back and forth, forming a figure-eight pattern that gives a trembling or rustling sound. On a windy day, you know from the sound if you are in a trembling aspen stand. Trembling aspen is the first tree to leaf out in the spring. Large-toothed aspen is also well named as the leaves have characteristically large tooth-like structures around the edge. Large toothed aspen leaves are somewhat velvety, and although the leaf petiole is similarly flattened, it is thick, and the leaves do not tremble in the wind like the leaves of trembling aspen. Large-toothed aspen is one of the later trees to leaf out in the spring.

The poplars are early succession trees and do not do well in the shade. The poplars can reach a height of up to 25 metres, but they will usually die at 60 to 70 years of age. The poplars produce tiny seeds with silky structures, which means the seeds can be blown a long distance before falling to the ground. Poplars and especially trembling asper are excellent colonizers and are among the first trees to colonize disturbed areas, such as clear cuts.

I learned the lesson that poplar wood rots quickly a long time ago as a teenager. The farmer on the opposite side of the road from my parents had a grove of tall, straight aspen. I needed to build a fence for my horse, so I asked the farmer if I could cut some of the aspen down. He permitted me, and I cut several aspens, peeled them and cut them into fence post lengths. Although I painted the bottom with a water-resistant stain, the fence posts started to break off at ground level after only one year. I had been so please with myself, having obtained all the posts for free, but the year after, I realized that I had only made double the work for myself.

Lumber is sawn from poplar, and I have used boards cut from poplar for my fences. If the wood stays dry, it becomes tough and will last for a long time. Should a board become covered with grass and exposed to moisture, it will rot quite fast. In older days, poplar lumber was used in horse barns for building the stalls. Horses inside for periods get bored and start to thew the wood in their stalls called cribbing. Poplar wood must be unpleasant to horses because they do not crib the poplar boards.

Cherry

There are several species of cherry in the Acadian Forest. Pin and chokecherry are shrubs and will colonize large gaps in the forest. Birds such as robins, starlings and cedar waxwings eat the cherries and then later defecate somewhere, expelling the pits. Cherry seeds will last a long time in the soil, fifty years or more but will not germinate until there is an opening and the sun heats the earth.

Black cherry is a long-lived tree that can be up to almost 20 metres in height and reach 150 to 200 years. The wood is dark reddish-brown, is very hard and has a pleasing grain. It finishes beautifully. I have a tall, straight black cherry growing in my wood lot. Some years ago, I took one of my students for a walk in the wood lot, and when we came to the black cherry, he told me a way to recognize black cherry, even in the pitch dark, by feeling the bark. I felt the bark, and he asked me how it felt. I said something about being quite flaky. He responded by saying, “think of corn flakes.” True enough, the bark surface looks like someone had glued cornflakes to the trunk. Later I took some young kids on a nature hike, and we came across a black cherry. I asked the kids to feel the bark and tell me what they sensed. They said rough, and I responded, “does it not feel like cornflakes?” The kids looked at me with blank stares. They did not know cornflakes – I was stunned. How could you be a kid and never have tasted cornflakes?

Black cherry makes beautiful hardwood lumber. When my friend was salvaging trees after hurricane Juan I asked if he came across a black cherry if I could buy a log. Again, he gave me a log. I had the log milled on a portable band saw and used the cherry boards for gunnels for the wooden lab strake rowboat that I built. It turned out beautifully and gave a nice, finished look to my boat.

White Elm

As a teenager in the sixties in southern Ontario, I witnessed the death of thousands of tall, beautiful vase-shaped elms due to Dutch elm disease. Beetles would infest trees with the fungus, which over a few years killed the trees. Naked trunks of former giants dotted the landscape. Over time the smaller branches would break off, and finally, the trunk would collapse to the ground. The dead trees were a hazard, and dead elm in towns and along roads was cut down to prevent potential disaster when they would come down.

There was a small pond in a forest of spruce, fir and small maple trees, not far from my parent's house. On the shore of this pond, I built a wigwam. I cut down several maple saplings. Then I traced out a circle on the ground about ten feet in diameter. I pushed the thick end of the saplings into the ground, spaced two feet apart around the circle, bent the saplings, and tied the ends together to form a dome. With all the elm bark that had come off the dead elm trees, I selected big sheets and used these to cover the dome. By overlapping the bark sheets, the wigwam was watertight. In the centre of the dome, I left an opening about a foot and a half square. In the wigwam's centre, I had a fire pit, and the smoke from the fire escaped through the opening in the dome. When there was no fire, I had a piece of elm bark that I used to cover the space and tied it down. I spent many a night in the wigwam and especially enjoyed the heat from the fire during winter nights.

When I moved to Nova Scotia in 1989, I was delighted to see majestic white elm trees along roads, in front of houses in the country and along streets in towns. It was like being transported back in time. However, for a second time, I was to witness the demise of these beautiful trees. The same fungus carried by the same beetle arrived in Nova Scotia, and during the late nineties, elms began to die én masse. Pia and I had bought an old farmhouse on ten hectares of land to raise a few sheep. In front of the house towards the road, there were three massive elm trees. They stood firm even in the strongest wind. In the summer, they provided a welcome shade. On a branch, maybe four metres off the ground, I hung a swing, and my kids loved being pushed by me. In 1997 we were gone for a year, and when we returned, the biggest of the elms was showing significant signs of the Dutch elm disease. Over the next few years, all three elms died, as did nearly all the elms in the province. It was a sad sight.

Interestingly, up the road at the next house from us, there is a massive elm that, for some reason, is still alive, and every summer has a lush green canopy. I am noticing now, almost twenty years later, that young elms are growing in ditches and along the edge of a

wet area on the property. Maybe some of these will be resistant to the disease, and in two hundred years or more, there will be massive elm trees again.

Elm makes excellent lumber, and a neighbour took some of the elm logs and had boards cut. I received some of the boards, and when I built my lapstrake rowboat, I used the elm boards for the transom, keel, ribs and seats for the boat. Elmwood is strong and finished very nicely.

Ash

There are two species of ash in Nova Scotia, white and black. It is interesting how so many species of trees are named after a colour, primarily black and white. White ash can grow in the shade of other trees as a young tree but less so when it gets older. Ash has compound leaves and is the last tree to leaf out in the spring and the first to drop its leaves in the fall. White ash is scattered throughout Nova Scotia but is most common in the central part; it prefers deep moist soil on lower slopes and along streams. It is always found growing with other species such as beech, birch, maple, and hemlock.

Black ash is a tree of open wet areas, and in Nova Scotia, it is endangered. Black ash is intolerant of shade and is slow-growing, while white ash is fast-growing. Both ashes have distinct growth rings that separate easily and, as such, are highly thought after for basket making. My friend, Frank Meuse, weaves all kinds of beautiful baskets using white ash, although if black ash was readily available, I am sure he would rather use these for basket making. Because of the slow growth of black ash, you can get more delicate strips of wood for weaving.

Ash is also very bendable and makes good tool handles, snowshoe and tennis-racket frames and furniture. Unfortunately, with the arrival in Nova Scotia of the emerald ash borer, a native beetle to Southeast Asia, ash trees are a doomed species. This beetle species lays its eggs on ash, and the larvae burrow under the bark and in a short time kills the tree. There are no native enemies of the emerald ash borer, and ash has no defence against the larvae, so the trees have no chance to resist this invasive species.

When we bought our property in 1994, there were a few ash trees in the wood lot, but I found no young shoots. The woodlot was there, and I believe because the ground was

quite wet and could not be farmed. I surmised that maybe ash seeds were not germinating because of the high moisture content of the soil. In early 2000 ditches were dug along the edges of the wood lot by the adjacent farmers to drain their fields. The adjacent ditches benefitted my wood lot in that it became drier, and then I noticed that young white ash started to germinate and grow. I am not sure if this was a coincidence or not, but there are now many ash trees growing in the wood lot.

The ash boards that I had cut at the same time as the maple boards I have given to my son, and he has made some beautiful shelves from them. The sand and varnish very nicely.

Beech

Spending my pre-teenage years in Denmark growing up next to a forest, beech was the most typical tree in the deciduous forest. Trees growing together had straight trunks with no branches below the crown. They had been planted and were harvested for lumber for furniture making. There was a factory close to where I grew up, and they made beech tables, chairs and more. A beech tree growing by itself and not shaded had massive branches and made for a great climbing tree.

When I moved to Nova Scotia, I came across beech trees again, now the North American species instead of the European species. But these beech trees were sick. I did not see big trees, and nearly all the trees had gnarled puckered bark. In North America, the invasive beech scale insect, introduced from Europe, feeds on the bark and makes cracks that native canker fungi can invade, interfering with the vascular tissue. The tree does not get huge and dies. Very few beech trees evade the scale insect and the fungus.

Beech, being shade tolerant, used to be a dominant tree of the Acadian Forest. It was found in well-drained soil growing with sugar maple and yellow birch and hemlock, red spruce, and white pine. Infested beech trees do reproduce, and young beech can be found in many places. Characteristically, young beech trees do not drop their leaves in the fall, but they do turn yellow and young beech with yellow leaves stand out like lanterns.

Maybe someday in the future, a beech tree resistant to the scale insect will have reproduced and spread across the landscape, and beech will once again be a dominant tree of the Acadian forest.

Oak

The red oak is native to the Acadian forest, unlike the English oak, which was introduced. English oak grows most frequently along roads and in towns. Occasionally English oak will have spread into forests, most typically forest patches near human settlement.

Red oak is a light-loving, fast-growing tree on poor soil where you can find it with white birch, aspen and red maple. On such poor soils, it does not get very tall. On better ground, it will grow to a large size together with typically old-growth species. Young oak will keep its leaves over-winter, similar to beech trees. Oak reproduces via highly nutritious acorns. Acorns are bitter to us but are a delicacy to squirrels, deer and mice, and black bears.

Red oak has open pores, which means that you cannot make watertight barrels from the wood. Nor were red oak boards used in shipbuilding because of the porosity of the wood. Red oak is used for flooring and interior finish. It is strong wood and finishes nicely.

PART 3: GETTING OUTSIDE, INTO A FOREST

WAYS OF BEING IN A FOREST.

by Soren Bondrup-Nielsen

To “not see the forest for the trees” implies getting lost in the details of a situation and not understanding the broader issue. When applied to a natural forest, it refers to focusing on the individual plants and animals around you but not comprehending the forest as a whole ecosystem of interacting parts. Now, more than ever, researchers are beginning to understand the meaning of the interconnections within ecosystems.

One such interconnection is between trees and fungi; trees communicate underground via the network of fungal hyphae sharing nutrients. In addition, trees release air-born chemicals to communicate with each other to attract or repel insects collectively. Chemicals released by trees also impact the atmosphere within the forest, which has a positive emotional effect, certainly on humans and now promoted as “forest bathing”; indeed, it may equally impact other species.

Furthermore, all the various animal and plant species are essential for maintaining the forest ecosystem. The traditional view that an ecosystem is no more than separate individuals competing for existence is a narrow perspective and not the only way to view a forest. The idea of the interconnections among all species and individuals constituting a forest gives a more holistic understanding of the forest.

When we humans evolved, we left the forest and entered the savannah. Our survival depended on our upright posture walking on two legs, freeing our hands to become dexterous tools, and subsequently, our brains enlarged. However, we did and still do, depending on resources from forests. Various foods, building materials, and firewood come from forests. In addition, forests create oxygen and control global water and carbon cycles, which, in a real way, allow us to breathe and survive on this planet. We humans seem to be losing sight of our role in that system and should try to practice ways of being in or being a part of a forest. However, I think that a sense of being part of a forest is still with us. Though we inherently like open spaces, we still feel a sense of connection with forests. Thus, being in a forest – enjoying it, feeling a sense of peace, being part of it, feeling protected – can be achieved in different ways.

Years ago, I spent three late winters, spring and early summers studying the Boreal Owl. The first year I travelled by skis and snowshoes when there was snow on the ground and later walking or travelling by bicycle. I was immersed in my study area. I encountered all manner of life and sounds within the forest, from the wind playing music as it wafted through the branches of the different species of trees to owls swooping down to catch unsuspecting voles on the ground. Moving through the forest under my power and exposed to the elements, I could witness and be part of the forest. In the second and third year, I acquired a car as I felt I needed to get around quickly and efficiently. It did not take me long to realize that I was cut off from the experience of being in the forest by being enclosed within metal and glass. Sure, I would drive to a spot and get out and do the things one does when studying some aspect of a forest, but I forgot to be in the forest. As a career ecologist, this has haunted me. When you study some part of ecology, you tend not to “see the forest for the trees.” So, the challenge becomes to find a harmonious existence between the two ways of being in the forest – being focused on a narrow objective and being open to the whole of the forest.

There is nothing wrong with driving along a road through a forest; the scenery can be spectacular. However, it does not allow one to experience the forest as an interconnected living system. I would argue that travelling through a forest by any motorized means cuts one off from fully experiencing the forest.

If you go for a walk through a forest, there can be several different experiences. You may walk with a friend and be in deep conversation, and essentially miss out on your surroundings. Or you may be so preoccupied within your mind that you also miss being in the forest. Again, there is nothing wrong with this – the discussion with your friend is valuable, or your solitary introspection may solve some serious issues. Doing this within a forest may be just the right place. These ways of being in a forest are beneficial, but you will not feel like you are a part of your surroundings.

You may walk through the forest and be intensely on the lookout for various species of organisms, whether just birds or plants or any species you encounter. I will argue that this is a way of "seeing the trees and not the forest." When I focus on the details or individual parts of something, I tend not to see the whole. And this is true of forests.

When I walk through a forest, I will often practice not focusing on anything specific but try to take in the forest by using all my senses. This can be accomplished by feeling the ground under my feet with each step, being aware of the sounds I hear, the smells I perceive, what I see, and the feeling when I touch a branch or a tree trunk. When we walk through a forest, many organisms become silent and hide as we represent potential predators. Sometimes I will sit still for a long time under a tree and let the forest come alive. By sitting still, we become invisible. Sitting still, I have had birds land on me, and voles sit on my boots and preen.

There are many ways of experiencing a forest. None is right or wrong, but to always experience a forest only one way limits the potential of being in, and indeed, being a part of the complex, interconnected ecosystem that is a forest.

HOW TO UNDERSTAND THE FOREST.

Here we can suggest things that people can do if they are interested in trying to "understand" the forest.