This document is intended to provide information about the many things that can be seen by walking the nature trail from the museum to the oxbow on the Raquette River. It is intended to provide content information (not technique) for those museum volunteers who would like to become nature interpreters. It may also be of interest to anyone who would like to learn more about the natural history of the Adirondacks.

Overlook at the Oxbow

There is far more material presented here than an interpreter would be expected to cover in a single walk. In fact there is far too much to hold the attention of most groups. The sequence of material follows the trail to the river. Each major section is a stop along the trail. Two stops: “Mosses” and “The River” have multiple major points within the section. Bracken fern is added to the “White Birch” stop for convenience.

This training material is in a Microsoft Word (.doc) format so you can save the file (about 3.8 MB) and work off-line.

- In conjunction with the outlines provided by the staff naturalists, extract material which is of interest to you and make your own version(s) and add your own “talking points”.

- The URLs imbedded in this text can be used to access additional information from supplemental web sites. Also see “Suggested Reading Material” at the end of the document for some great source material.

. (Technical note: If the pictures do not fill quickly, do a “print preview” (the icon next to print) and then “close” the preview.)
Since the origin of life, 3.5 billion years ago, there has been a war of survival. Those organisms, whose minute changes over long periods of time have resulted in successful adaptations to a changing environment, have survived. So too have those whose modifications have resulted in a competitive advantage. Many species have not survived.

About 360 million years ago, giant ferns and club moss dominated the swamps. We will see some of their much smaller modern day descendents.

On this particular battlefield, we will examine some of the successful species. We will discuss how various propagation methods have enhanced their ability to survive. We will even see some plants that wage chemical warfare and even enslavement by a lowly fungus.

Here, in the Adirondacks the current battle of succession has been going on for about 10,000-14,000 years. The glacier had wiped the slate clean.

There are four major factors that have determined what we will see on our walk thru this battlefield:

1. Geology
2. Climate
3. Opportunity
4. Human impact
• Geology

  o The ice age began about 1.6 million years ago. Glaciers covered much of northern North America. The latest, the Laurentide glaciation, began shaping mountains and valleys of the Adirondack region about 500,000 years ago and scrubbed the Adirondack landscape bare. About 22,000 years ago, as the climate began to warm, the glacier reached it’s maximum and soon began to recede, exiting the Adirondacks about 10,000 - 14,000 years ago.

  o It left behind clay, sand, gravel and rocks. These are the base materials that have formed the thin Adirondack soils. Over time, some of the rocks and underlying bedrock have been weathered producing the acidic soil we see today.

• Climate

  o The climate in Tupper Lake is fairly severe. It is USDA zone 3 which means that the coldest (not average) winter temperature will probably range between -40 F and -30 F. It is colder at higher elevations since temperatures drop about three degrees per 1,000 feet of elevation increase. The summits of some of the high peaks have alpine flora. (See alpine exhibit in the museum.)

  o As a result of the cold, we will not see some of the less hardy trees common south of here. We have no oaks, no tulip trees, and no hickories. However we do have yellow birch, red and black spruce and balsam which do not grow well down-state except at higher elevations.

• Opportunity

  o As the glacier receded, those species which were already nearby were the most likely to repopulate the area. For the first couple of thousand years, it may have looked like present day tundra. Early pioneers such as lichens and moss began soil building; sedges and dwarf shrubs came next. Spruce, tamarack and balsam followed soon after. Alders with their nitrogen-fixing root nodules helped enrich the soil. Aspens, birch and finally pines came in their time. Maples were even later.
- Many cold-climate plants common to the northwest did/do not inhabit the Adirondacks because they were/are isolated by the Great Plains.

- Humans have had a major impact on this current battlefield.

- The old stand forests were logged starting in the mid 1800’s thru the early 1900’s. Pines and spruce, which could be floated down the rivers, were harvested first. Hemlocks were cut for the tannin in their bark to support the hide-tanning industry. Then, after networks of logging railroads were built, the hard woods were logged.

- Forest fires were prevalent in the late 1800’s and early 1900’s. Sparks from logging trains ignited the dry brush left from logging and many thousands of acres were burned. This provided for a whole new wave of plant and animal succession.
The museum site is on an old farm abandoned in 1961 and sold to the Town of Altamont, now Tupper Lake. Thirty-one acres were later “sold” to the Museum for $1.00. Here, the fields were grazed by dairy cattle. Pigs were raised on the island at the oxbow. Potatoes and silage crops were grown in the sandy soil, further depleting the thin topsoil of nutrients.

First step will be at a quaking aspen grove. This scruffy-looking tree is truly remarkable!
(Note: this is a big one! There is a whole lot of interesting material about this seemingly innocuous little tree. Pick and choose what you find of interest. More information can be found in the following reading material (see “Suggested Reading Material”) and web sites.)

“Field Notes…” pp. 40, 41, 79, 80
“Nature of …” pp 201, 202, 331, 332
“Ecology of Eastern…” p. 127

http://bss.sfsu.edu/geog/bholzman/courses/Fall99Projects/aspen.htm
http://www.nps.gov/brca/naturescience/quakingaspen.htm
http://en.wikipedia.org/wiki/Largest_organism

Leaf flutter: http://www.springerlink.com/content/v1m12242p3833162/
Lots of information: http://plants.usda.gov/plantguide/doc/cs_potr5.doc

• This “scruffy” looking little tree is really the king of all trees.

• It has many names:
  o Quaking aspen
  o Trembling aspen
  o Popple
- Aspen poplar
- *Populus tremuloides*
- Noisy tree

- And many “mosts.”
  - Most genetic variation.
  - Most aged (some clones are over 10,000 years old)
  - Most mass of any single organism, weighing in at about 6,000 tons.
  - Most widespread distribution of any North American tree. Mexico, 35 US States and all but one Canadian Province.

- An interesting reproductive approach.
  - Though it produces lots of tiny wind blown seeds (3 million per pound), they have a low probability of germination. They need to fall on recently disturbed ground at just the right time and under the right conditions.
  - To make it even harder to reproduce sexually, male and female flowers are on different trees: a condition called dieocious, meaning two households.
  - Adventitious shoots arise from roots and populate open areas quickly. No need to wait 10-15 years to come of seed-bearing age.
  - Thus, most “groves” of quaking aspens are clones. What we see then are multiple stems of the same tree. Students at the University of Colorado measured a large clone and determined it to be about 6000 tons. They named it Pando (“I spread” in Latin).

- Short of massive fires, or glaciers, a clone lives on even though individual stems may die. So, the clones are very old and even though there is little sexual reproduction, great genetic variability occurs because of the long time-dimensions and wide distribution.
Quaking aspen is a very fast growing, and therefore “soft” tree (about 60% of the density of oak, maple). In order to support fast growth, it has some unique adaptations.

- One is that wind across the flat leaf-petiole (leaf stem) causes the leaf to quake or tremble. It is thought:
  - That this flutter motion cuts down on wind turbulence and thus allows greater absorption of CO2 into the leaf: A necessary ingredient for photosynthesis.
  - Also that this motion allows more sunlight to reach lower leaves.
  - Thirdly, by breaking up the wind flow there is less likely to be wind damage to the branches.

- Another unusual adaptation is the smooth green or light-colored bark which can photosynthesize on warm days even after the leaves have been shed. As much as 10% of annual carbohydrate production can occur in this manner.

Quaking aspens are an important food source for many birds and animals. The bark is the number one desired food of beavers. Roughed grouse eat the buds; moose eat the leaves, as do deer if they are hungry enough. Snowshoe hare browse on young shoots.
• In order to keep from being eaten alive completely, quaking aspen wage chemical warfare on their consumers. When broken or crushed, leaves emit a combination of chemicals which are mildly toxic to some browsers.

• When snowshoe hare cycles reach their peak, their heavy browsing of new stems triggers the tree to generate a toxic cocktail which is distributed in new shoots. This is so toxic that some hares die of starvation thus contributing to the population cycle.

  So, this is indeed a remarkable tree!

  Next stop, a shrub with "delicious" fruit; another way to solve the "reproduce or perish as a species" puzzle.
Wild Raisin or Withered
(Viburnum cassinoides)

Adaptation: Careful packaging of seeds in a tasty fruit.

- Note stages of ripeness (white, pink, blue, and shriveled) all present at the same time. Staggered ripening helps assure seed dispersal over a longer portion of the growing season.

- Bird and animal consumption assures dispersal of seed.

- Dispersal helps assure non-competition with “parent” plant.

Next stop is a grove of alien pine trees. How old are they? Where did they come from?
**Scotch or Scots Pine**

*(Pinus sylvestris)*

Native red pines (*Pinus resinosa*) also have two needles per bundle. Needles are dark green, more rounded in cross section, longer, brittle and sharp-pointed.

- The Scotch pine is an alien species imported from Scotland in early 1900’s for reforestation. It has not done as well as expected as a timber tree. But in general it has done well, like so many alien species because it has no natural
enemies.

- Pines are conifers. Conifer means cone bearing. They do not have flowers but have instead, a male pollen-bearing cone and a female, or ovulate, cone. What we generally recognize as a pine cone is the ovulate cone. They are separate but on the same tree, making these trees monoecious, or “having one household”.

- Male cones are lower on the tree, or sometimes lower on a branch, which lessens the chance of self-pollination, thus assuring greater genetic variability. Pollinated in the spring, it takes some cones until two years from the following fall to shed mature seeds.

- Heavy seeds have long term viability and can penetrate field grasses. About 30,000 to 60,000 seeds per pound (depending on species, compared with millions in aspen, birch).

“Whorls” tell the age of pines, spruce, and balsams. But not of hemlocks, tamaracks and cedars.

(See video in museum by Professor Kudish)

- Q: How old are the trees in the grove?

A: Count the whorls starting from the base of the tree. (You’ll have to look
closely for stubs of branches). About two-thirds of the way to the top, where it becomes difficult to see the whorls, stop and add 50% to your total. This is a rough estimate of age.

- Q: How did they get here? (Recall that the farm was abandoned and sold to the town over 45 years ago).

A: Check to see if they are in rows. If so, they may have been planted as Christmas trees. Another hypothesis is that they may have spread from Sunmount. In 1923/24 Sunmount was established as a VA TB sanatorium. Many conifers were planted, including scotch pines, balsam, Norway spruce as it was thought that their fragrance helped TB patients. Notice the many mature Scotch pines on the school grounds and along Hosley Avenue. Could they have spread from there? The real answer is that we don’t know for sure and that is true of a lot of assumptions we make about succession. There are many things we can only deduce.

*Let’s turn now to an “old field” habitat and see what’s going on there.*
This “Old field” is characterized by grasses, small woody shrubs such as spireas, black chokeberry (*Photinia melanocarpa*), and dewberry (*Rubus spp.*). Perennial flowers are characterized by St. Johnswort (*Hypericum spp.*) in summer and asters (*Aster spp.*) and goldenrod (*Solidago spp.*) in the fall.

These will give way to sun loving pines whose heavy seeds can penetrate the turf and will shade out the current plants. In fact some small Scotch pines are already here. Note new trees coming up. This is a typical progression from old field to native white and red pines, or in this case, Scotch pine.
Goldenrods and asters wage chemical warfare called allelopathy. This allows them to dominate a field for some time.

Allelopathy is the inhibition of one species of plant (or fungus) by chemicals produced by another.

Across the trail is a recent blowdown.
"Blowdown" or "Windfall"


(View Dr. Canham’s video in the museum)

- On July 29, 2006, between 5:30 and 5:45, a strong wind passed through this area doing considerable damage four miles northwest on Big Wolf. Here it was but a whisper of that wind, yet enough to break and topple some trees.

- Effects of disturbance: Sun-light and bare soil open the area for a new succession. The tiny seeds of sun-loving plants can now germinate. Some of these seeds may have lain dormant in the soil for many years! Notice that there is little plant growth under the dense canopy of the pine grove, but it is more than likely that that soil is rich in seeds which have not yet germinated.

- On July 15, 1995, a major linear windstorm flattened much of the Five Ponds Wilderness. Initially, the windstorm was called a microburst, a name that has lingered on. Technically however, the storm was a derecho. The previous large blowdown in the area had been in 1950.

  - The result has been a major change of vegetation: Old growth pines had covered the eskers (glacial ridges). Red maple and yellow birches are now abundant. Blackberries flourish in the sun. Some pioneers, such as pin cherry, aspen and
white birch, are not as evident as might have been expected.

- Pin cherry, though short lived, has seeds which remain viable for many years just waiting, again, for their turn in the sun. The light aspen and birch seeds are carried long distances by the wind.

- The forest is DYNAMIC! Succession is ongoing.

- Other severe weather events shape the forest.

The ice storm of 1998

- Ice storms

- Torrential rains and landslides

- Forest fires

- Droughts

Next we'll look at some mosses and some mosses that are not mosses.
"Mosses"

Not all mosses are mosses

Reindeer "Moss"

Hair-cap Moss

Club "Moss"
**Reindeer “moss”** *(Cladonia spp.)*

http://www.rook.org/earl/bwca/nature/moss/cladonia.html

- Very primitive organism classified as a fungus rather than a plant, it is really two (or sometimes three) organisms in one. Fungus (the mycobiont) and green algae and/or cyanobacteria (the photobiont) in a symbiotic relationship called mutualism. They help each other out.

- Like an Apartment house, the fungus provides the structure and the utilities. The photobiont, through photosynthesis, provides carbohydrates as “rent”. (As a point of interest there is some disagreement about this symbiotic relationship. At the macro level it seems clearly mutualistic. However at the cellular level it becomes apparent that the fungus “controls” the photobiont cell with hyphae (filaments) encircling and penetrating the cell. This would be a parasitic relationship. Maybe a prison rather than an apartment house is a more appropriate analogy. Is this perhaps a form of enslavement?)

- Lichens have no roots or vascular (plumbing) system. They only need rain water and air-borne dust; therefore they can be very early pioneers in the battles of succession. They secrete chemicals that break down rocks, thus contributing to chemical weathering and soil-making.

- Crisp and brittle when dry, spongy when damp, lichens adjust very quickly to
drying out. They shut down photosynthesis much like “true” moss.

- Ubiquitous, they are found in tundra, desert, and temperate rain forests. On rocks, ground, trees, stumps, gravestones, buildings; even submerged in salt water. Some lichens appear to have been painted on rocks and trees.

![Crustose lichen](image)

- Reproduction is mostly vegetative (non-sexual) by fragmentation. Small pieces broken off are wind or animal transported. Also by specialized structures called soridia. These special structures contain a tiny filament (hyphae) from the fungus wrapped around the photobiont cell. This assures that both components will be transported to their new environment. Rare sexually, by spore.

- Major food source for caribou; rich in carbohydrate. Thus the common name of reindeer moss. Early pioneers they breakdown rock and build soil. Important as source of food, medicine and indicators of pollution.
Hair-cap Moss is a True Moss (Polytrichum spp.)

http://www.bio.umass.edu/biology/conn.river/mosses.html  
http://149.152.32.5/Plant_Biology/moss.html  
http://www.adknature.org/training/Files/Moss1_files/frame.htm

- Also primitive but has own chlorophyll, no roots, no true vascular system so can grow many places. But, without a vascular system, destined to remain height challenged.

- Compare characteristics of birch tree leaf and moss single-cell thick leaf. Waxy cuticle of birch leaf keeps leaf from drying out. The moss leaf absorbs water from rain and dew but dries out in bright sunshine.

- “Clump” format helps to avoid drying out.

- Reproduce by spores and budding.
Club "moss" is a Lycopod

A typical habitat

- More advanced plant than true moss, club mosses have true roots, a vascular system, and complex leaves. During the Carboniferous period 362 MYA, ancestors of present day club mosses were large tree-like plants which dominated the vast swamps.

- Reproduce by spores (rarely), but more often by modified underground stems called rhizomes and by above ground runners (or stolons). Runners enable the plant to extend across bedrock or other inhospitable area. Some
species also develop viable bulblets in leaf axils (the juncture of a leaf and stem).

- Create a slightly shaded micro environment thus other plant seeds can germinate. Thus enabling further succession.

- Spores were used in early flash photography and for coating medicines.

Demand to an Adirondack birch tree and a lesson on deer fly survival

(Point out various lycopods along next section of trail as well as big, healthy beds of true moss. There is also a red pine about 12’ high on right-hand side of trail if you want to point it out. Cut a bracken fern along way to birch station. Also pick up some pebbles for “film” test at oxbow)
White/Paper/Canoe Birch
(Betula papyrifera)

http://plants.usda.gov/java/profile?symbol=BEPA
hort.ufl.edu/trees/BETPAPA.pdf

- Three widely distributed birches in NW Adirondacks: white, grey, yellow.

- To confuse the issue, this is a birch with three common names: white, paper, canoe.

Paper birch leaves: Compare to gray birch’s long pointed apex.

Note peeling bark. Gray birch does not peel.

- Early Americans made canoes from canoe birch bark plus resin from spruce and balsam.

- Birch seeds are tiny (1.4 million per pound), and have very brief viability. Because of this they propagate best in recently burned or disturbed areas, where they can easily reach the soil.

- Point out leaf shape and peeling bark.

(Pick a leaf to compare with gray birch at the next stop.)
**Order of the Bracken**

- Bracken fern is one of three ferns in NY not protected by law.

- They can be very useful if you have forgotten your hat during deerfly season.

- Cut a frond about six inches below first fork, invert, and place on your head, long frond to the back. Deerflies will seek highest spot and buzz the stem rather than your ears.

![Bracken Fern](image)

*Bracken Fern (Pteridium aquilinum)*

Next step we’ll compare the canoe birch with its very similar sister where you will become one of few who can tell the two birches apart.
**Gray Birch**

*(Betula populifolia)*

hort.ufl.edu/trees/BETPOPA.pdf
http://plants.usda.gov/java/profile?symbol=BEPO

- Note the long tapering leaf apex. Compare with white birch leaf from last station
- No peeling bark

*Watch the forest canopy as we move on down the trail. Notice the change in temperature. Keep your eyes peeled for a HUGE rock.*
• Note change in canopy, conifers, and northeast facing slope, cooler.

• Point out large hemlock with low branches which must have developed in an open field when young. Compare to newer trees.

• Comment on glacier’s force to move such a large boulder. This boulder is called a glacial erratic.

• Don’t dance with a glacier! Think of half gallon juice containers with “tent” tops removed (~4” x 4” x 8”) and stacked on top of each other to a height of 5,000 feet. It would take 7,500 of them. At 4 # each, that’s about 30,000 # or 15 tons! Adjusted to psi (divide by 16), it would be about 1,875 psi. Compare that to a 200 # man standing on the ball of one foot exerting about 12 psi. How would you like 5,000 ft. of ice to step on your toe? (This is for easy math. As you know water expands when frozen so that equal volume of ice weighs about 9% less than water. However, this is compensated for because using 4x4x8 overstates a half gallon by about 10%, and water really weighs 8.345# per gallon. So it’s about a wash. This is too picky but you may have a physicist ask pointed questions about the math. The point is that the glacier exerted great downward pressure, and this translated into lateral pressure capable of transporting this glacial erratic.)

• Note lichens and moss on the big erratic. They facilitate both chemical and physical weathering.
- Rock will ultimately be broken down by weathering and erosion and transported to lakes and oceans where the cycle will begin again.

The rock cycle

Watch for a light grey-barked tree with dying branches
Beech and Beech Bark Disease (BBD)
(Fagus grandifolia)

http://www.michigansaf.org/ForestInfo/Health/BBdisease.htm
ADK forest pests:  http://www.apa.state.ny.us/Research/ADK_Forest_Pest_Chart.htm

Scale insects with white waxy covering on a beech tree
(Be careful not to confuse scale with white crustose lichen)

- BBD is caused by two organisms: a scale insect closely related to aphids and a
  fungus which subsequently invades the hole made by the scale insect.

- The scale is an alien, introduced into North America about 1890. No checks and
  balances on alien species. No resistance by beech trees. None of these scale insects
  are male, reproduction is parthenogenetic. Adults do not fly or the disease would
  have spread much faster.

- The scale penetrates the bark with her stylus (modified mouth part) to feed on sap.
  Subsequently, spores from one of two Nectria fungi (one of which is an alien) invade
  the hole and kill the “inner bark” (actually the phloem). The cankers caused
  by Nectria can eventually kill the tree by girdling it, killing all of the phloem
  in a continuous ring around the tree, preventing any carbohydrates from
  making it down to the root system for storage.

- Third important hardwood tree lost in recent time. American chestnut and
  American elm have succumbed to disease from alien fungi. There is concern about
the hemlock wooly adelgid, another alien from Asia, which is a serious threat to hemlocks. It has already made it into Massachusetts and into the Hudson Valley.

Just down the hill we will see a nursery for small seedlings.
This is an old hemlock. See the “open field” branching.

Notice the pileated wood pecker holes and their characteristic shape. We can deduce that the tree must have been decaying before it fell since the holes are oblong in orientation with the tree trunk.

The woodpecker was probably after carpenter ants that were eating the damp dead wood. Bacteria in the gut of the ants enable them to digest the cellulose in the wood. Like the lichen, this is another case of mutualism. Both the ant and the bacteria benefit from the relationship.

After the log fell, fungus, bacteria and other decay organisms continued to break down the wood. The tannin in the hemlock has slowed this process.

Mosses have begun to grow on the log and have provided a nursery for the “sister” trees: hemlock and yellow birch.

When the nurse log finally collapses to the ground, the sister trees will send roots down around the trunk. After the log completely decays, the trees will be left looking like they are on stilts.

Next stop is the third species of birch tree.
Yellow Birch
(Betula alleghaniensis)

http://plants.usda.gov/java/profile?symbol=BEAL2

Distinctive bark of Yellow Birch

- Important timber tree of the Northern hardwood forest.
- Three to four foot diameter and up to 100 ft high.
- Used for furniture, cabinets, flooring.
- Point out moss all around the base of the tree, thus dispelling the “moss-on-north-side” myth.
- Bark makes great tinder for starting a fire.

Next stop: the Raquette River. Notice the abrupt change of habitat.
At the River
Pickerelweed and Water Lilies

(Pontederia cordata and Nymphaea odorata)
Arrowhead
(Sagittaria spp.)

Wetland Environment

- Previous discussions have been about adaptations in generally similar habitats. Many adaptations are required for survival in wet area.

- Submerged aquatic plants need to obtain CO2 and O2 from the water, and must be able to cope with varying water levels. Water lilies have adapted to the problem by floating their leaves on long stems that can adjust to varying water level. Unlike terrestrial plants, they have their stomata (pores) on the top surface of the leaf for gas exchange. Floating flowers enable insect pollination. Another interesting adaptation is found in wild celery (Vallisneria americana). Male and female flowers are on different stems with the female flower growing up to the surface. The male flower is lower on the stalk and when it matures, it breaks loose, floats to the surface and pollinates the female. Fertilization causes the stem to corkscrew thus shortening it and transporting the ovule nearer the bottom where it has a better opportunity to germinate on the bottom of the water body.

- Wet waterside plants such as silver maple, willow and tag alder must be able to withstand flooding.
**Organic Decay**

- The film often found on the quiet surface water is a result of organic decay yielding “film,” CO2, methane, ammonia. Oil slicks look somewhat similar.

- The “pebble test” can differentiate between the two. Throw a pebble into the film. If it is oil, ripples of color will radiate outward from the pebble in concentric circles; if decay, this will not happen.

**Water Cycle and Clean Power**

- Nine miles downriver, in Piercefield, is the first of 19 hydro power plants on the Raquette River.

- Brookfield Power, a very generous donor to the museum, owns and operates 17 of these plants with a capacity of 181 megawatts. This is enough electricity to supply 135,750 homes.

- This clean, environmentally friendly power is generated by taking advantage of the approximately 1,400 foot drop from the oxbow to the St. Lawrence River as the Raquette cascades off the Adirondack Plateau.

- The water cycle is the engine. Water precipitated on to the Adirondacks, in its rush to the sea, provides the force that turns the turbines which generate the electricity.

**Oxbow**

- Point out island

- Describe oxbow development (see oxbow marsh exhibit in the museum)

- Why named

- Mile added to paddle.
• If clear day, point out Whiteface (28 mi), Sawtooth (15 mi), Seward's (12 mi)

Thanks for attending.
Sources

- Much of the material has been derived from web sites which are “.edu” or “.gov” and from the books in the suggested reading section below.

- Also from Biology of Plants, Raven et al; Ecology, Molles; Fieldbook of Natural History, Palmer; Living in the Environment, Miller; as well as personal observation.

- Though I have tried to be thorough regarding accuracy, you may find questionable items. If so, please bring them to my attention so that we can compare sources and arrive as best we can, at “scientific truth”. Also let me know about things that are not clear. luvsadk@aol.com

- In this regard, the comments on “succession” are most suspect as there seems to be little agreement among authors. This may be a reflection that succession depends on the circumstances and there is no single course. I’ve tried to tailor it to what I see on the site. Also, the “final” retreat of the glacier from the Adirondacks is cited anywhere from 5,000 to 18,000 years ago. I’ve used 10,000-14,000, but who’s counting?

- Also, editing help and comments from Tracy, and careful review and comments from volunteer Ed Hecklau.

From time to time, there may be modifications to the on-line document. Check this page for revision date and revision notes.

John Sayles

Revision: 06/01/08. Note on blowdown re “microburst”. Replaced stock images with actual trail images for: blowdown, erratic, nurse log. Modification to beech bark disease based on comments from Charley Canham.
Added a section on hydro power to “At the River”.
Added The Nature Handbook and After the Ice Age to suggested reading.
Suggested Reading Material

*Field Notes from the Northern Forest*, Curt Stager
  
  A fun read and lots of good stories to tell
  
  Chapters: Underground Connections, Plant Defenses, Mosses and Lichens, Conifers, Princess Pine

*Nature of North America*, David Rockwell
  
  Good background book on natural history

*Ecology of Eastern Forests*, Peterson Field Guide #37
  
  You have to sort out northern on your own but lots of info

*North Woods*, Peter J Marchand
  
  Good on succession and climate

  A lot of ADK coverage, interesting, not needed for walk. Chapters 2,3,4,12,13

*Pond and Brook, a Guide to Nature in Freshwater Environments*, Michael Caduto
  
  A lot of good information about wetlands

*Adirondack Wildguide*, Michael G. DiNunzio  
  A great overview of the Adirondacks.

*The Nature Handbook, a guide to observing the great outdoors*, Ernest H Williams

*After the Ice Age*, E. C. Pielou, Provides excellent insight into continental glaciers and succession.


Note: If people want, additional material can be added such as other trees and shrubs along trail and at overlooks:

Winterberry, white pine, blueberries, Indian pipe, red pine, mountain ash, willows, tag alder, buttonbush come to mind. Also ferns and mosses, maybe lichens.