Fundy Model Forest

~Partners in Sustainability~

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The Fundy Model Forest…
…Partners in Sustainability

"The Fundy Model Forest (FMF) is a partnership of 38 organizations that are promoting sustainable forest management practices in the Acadian Forest region."

Atlantic Society of Fish and Wildlife Biologists
Canadian Institute of Forestry
Canadian Forest Service
City of Moncton
Conservation Council of New Brunswick
Fisheries and Oceans Canada
Indian and Northern Affairs Canada
Eel Ground First Nation
Elgin Eco Association
Elmhurst Outdoors
Environment Canada
Fawcett Lumber Company
Fundy Environmental Action Group
Fundy National Park
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New Brunswick Federation of Woodlot Owners
NB Premier's Round Table on the Environment & Economy
New Brunswick School District 2
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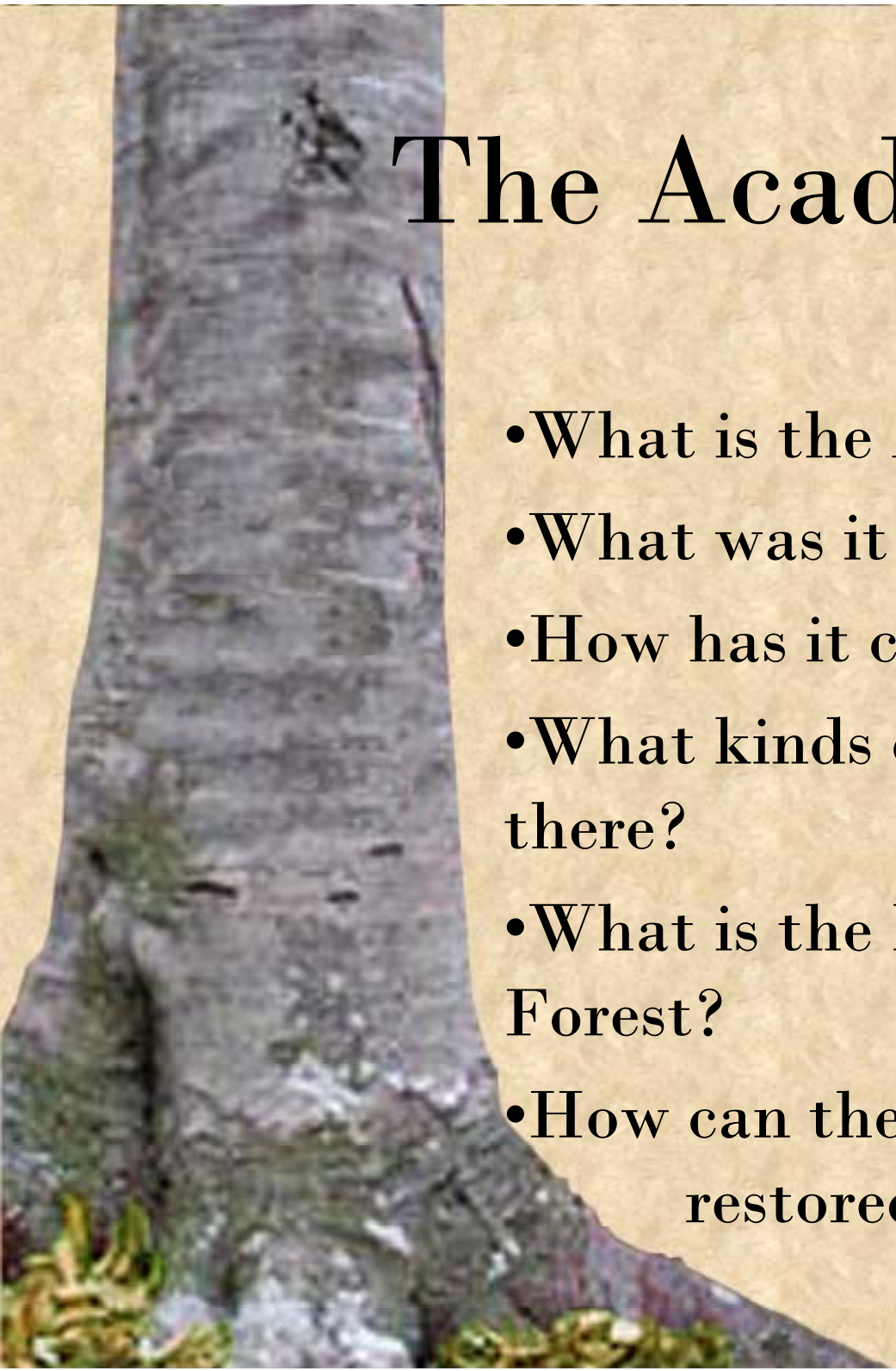
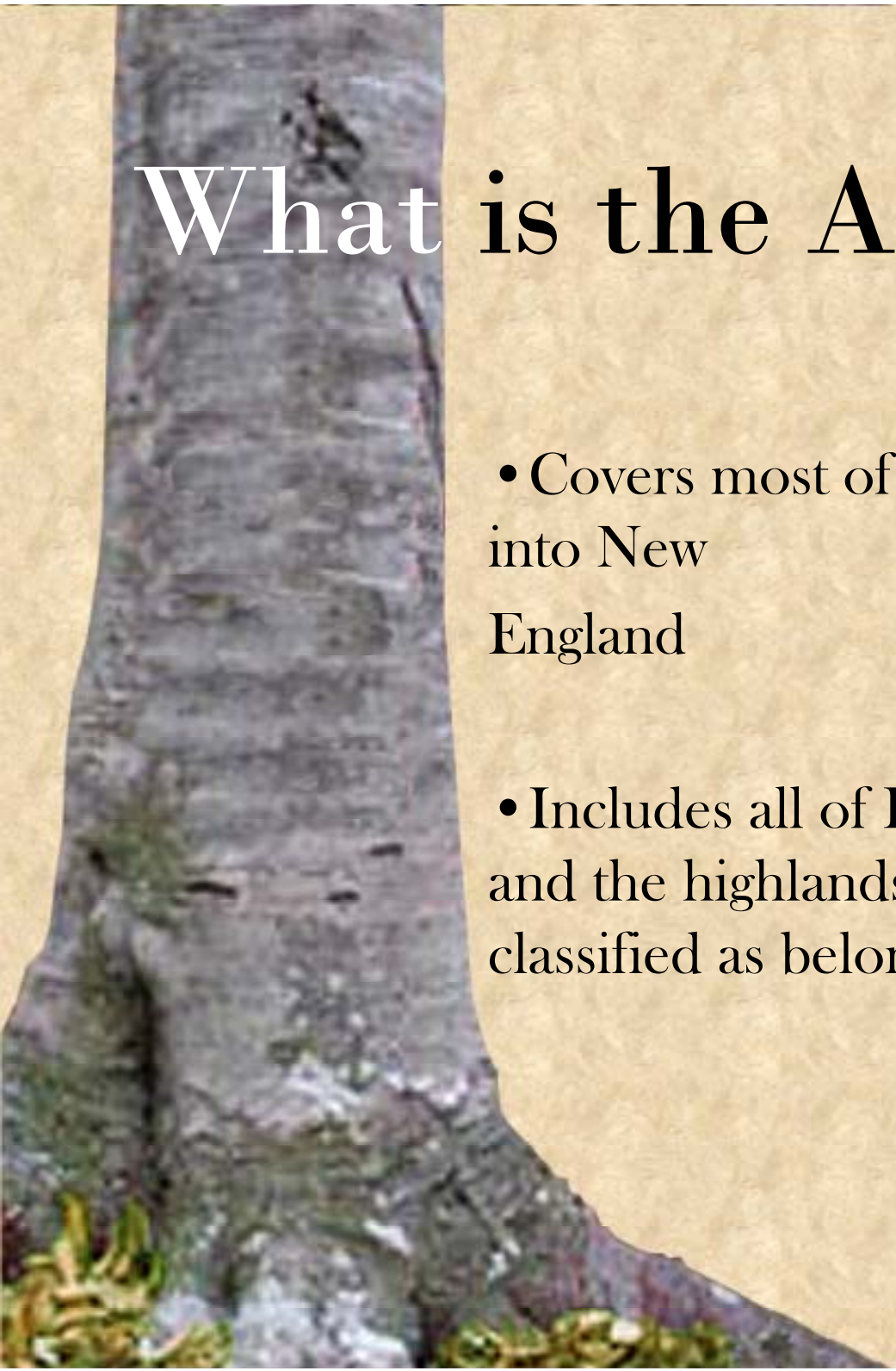
Nova Forest Alliance
Petitcodiac Sportsman's Club
Red Bank First Nation
Remsoft Inc.
Southern New Brunswick Wood Cooperative Limited
Sussex and District Chamber of Commerce
Sussex Fish and Game Association
Town of Sussex
Université de Moncton
University of NB, Fredericton - Faculty of Forestry
University of NB - Saint John Campus
Village of Petitcodiac
Washademoak Environmentalists



The Acadian Forest

- What is the Acadian Forest?
- What was it like before settlement?
- How has it changed, and why?
- What kinds of Acadian Forest are there?
- What is the Importance of the Acadian Forest?
- How can the Acadian Forest be restored?

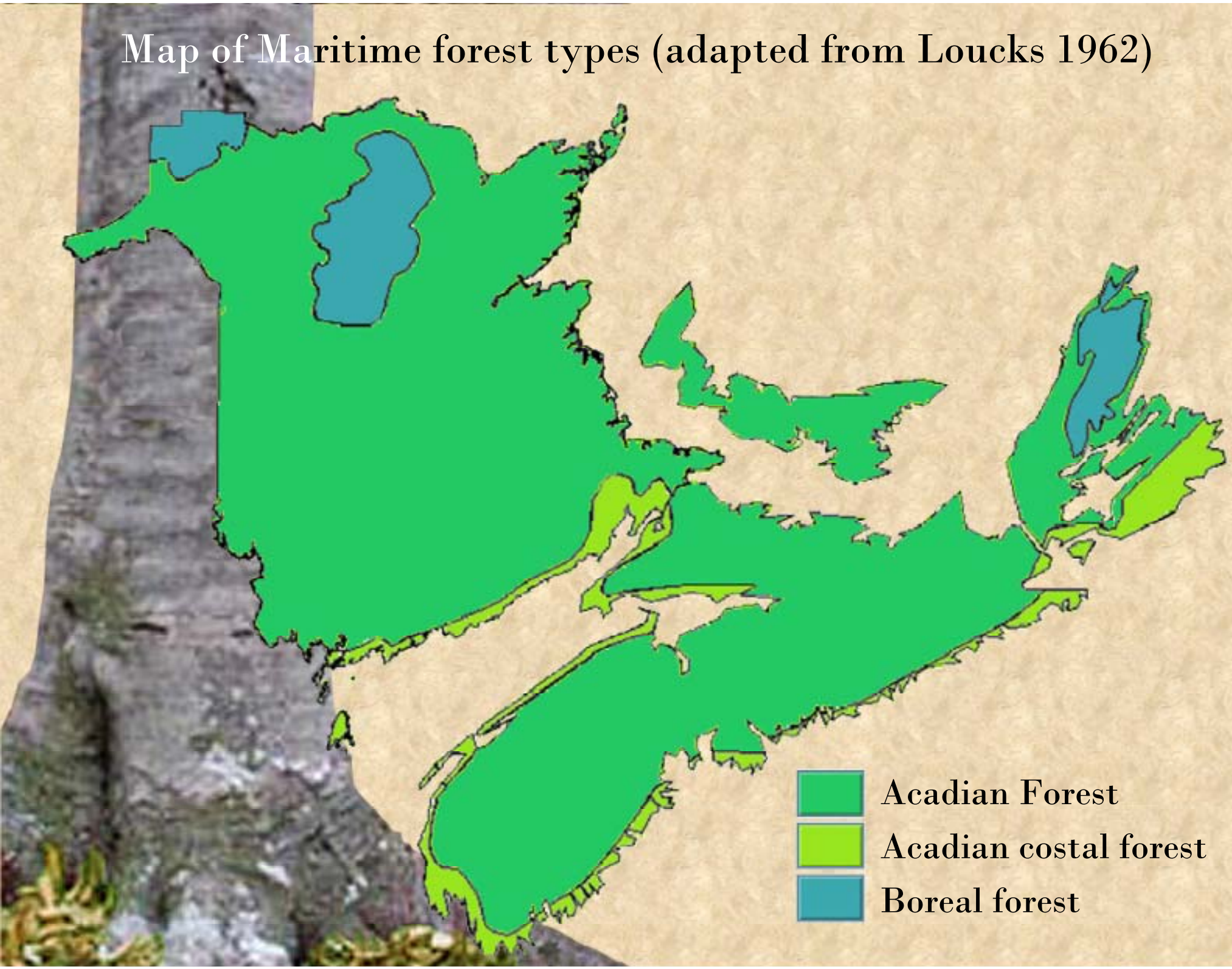


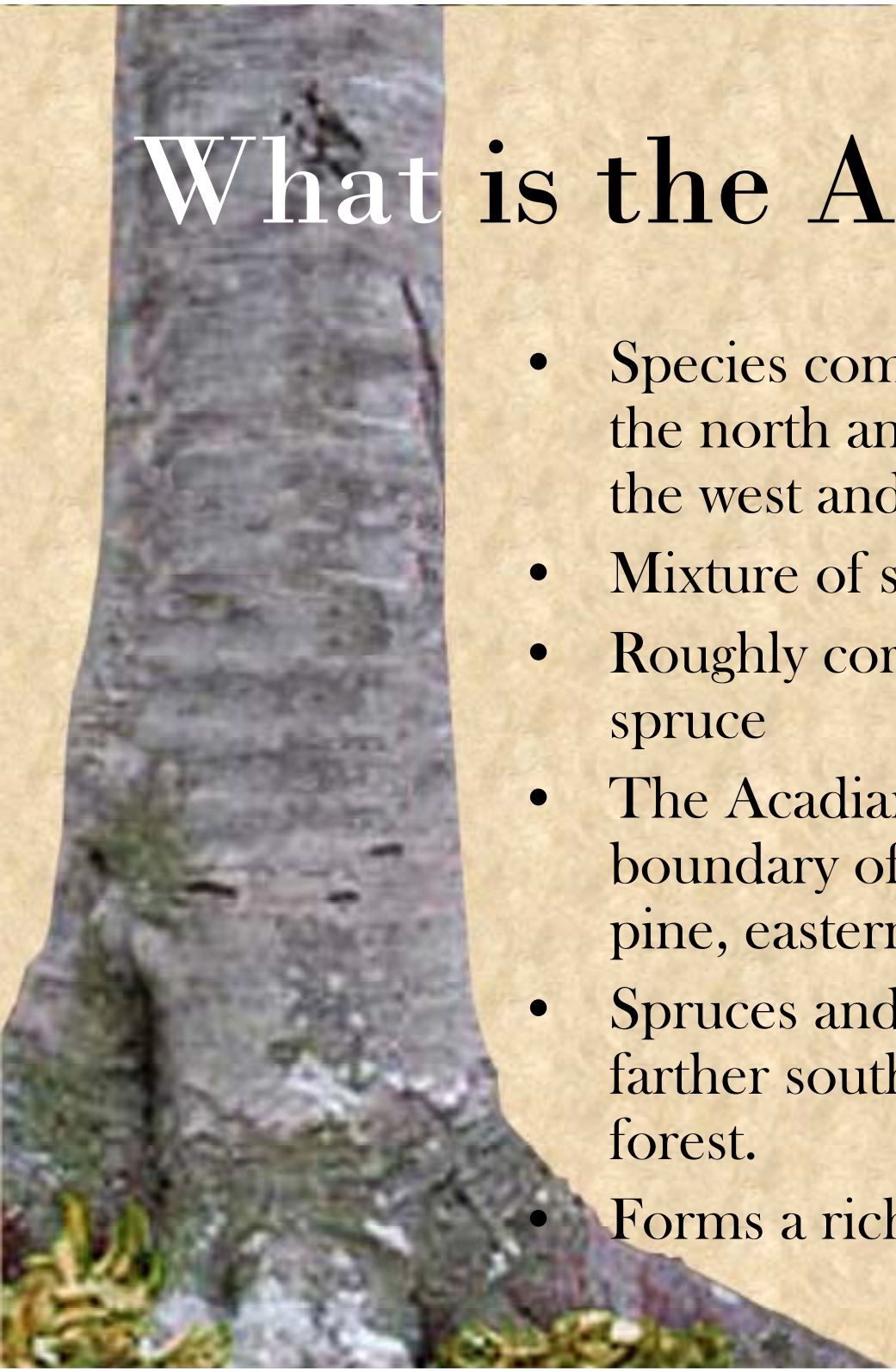
What is the Acadian Forest?

- Covers most of the Maritimes and extends south into New England

- Includes all of PEI, but parts of north-west NB and the highlands in Cape Breton are sometimes classified as belonging to the boreal forest.

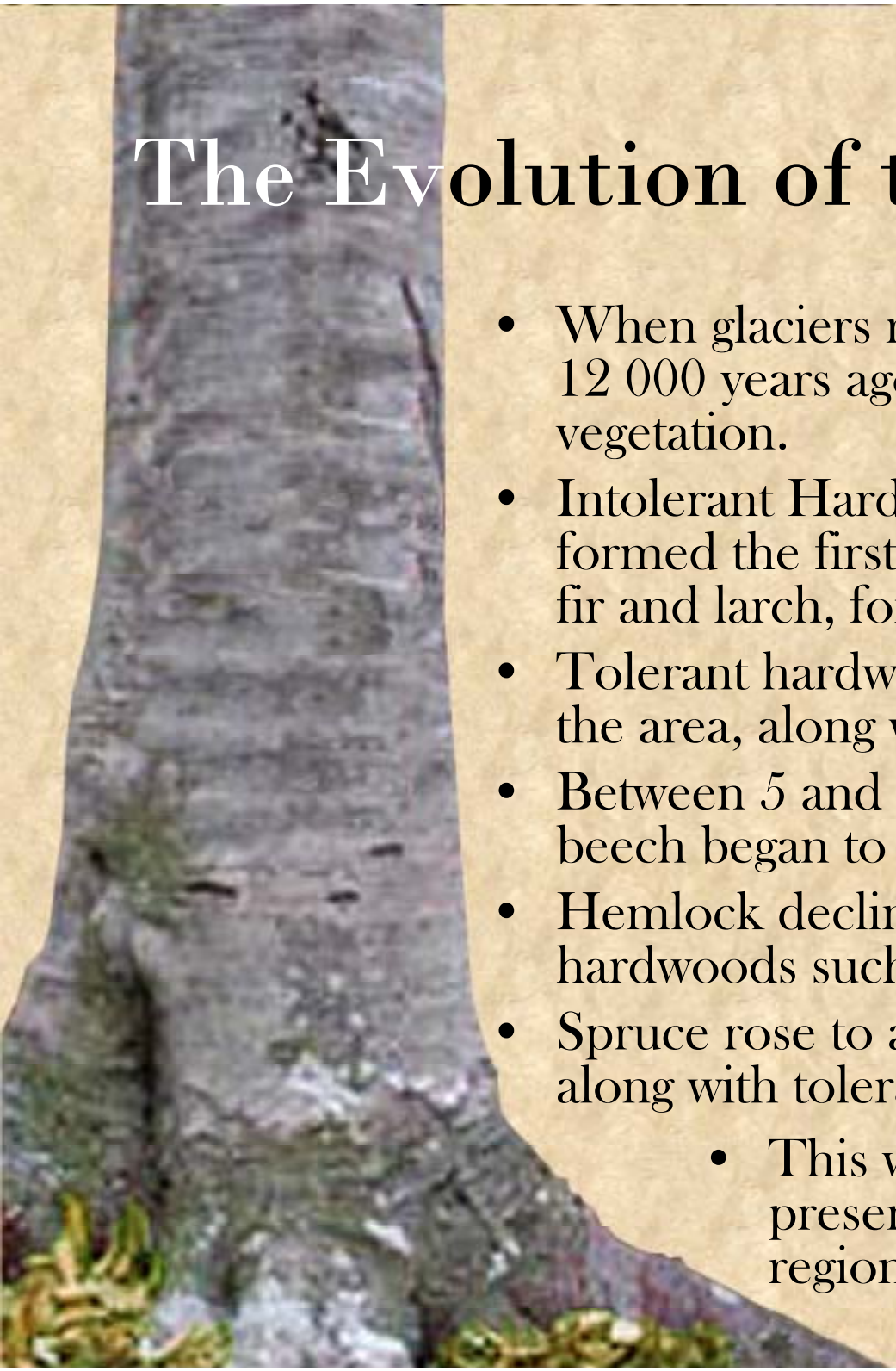
Map of Maritime forest types (adapted from Loucks 1962)





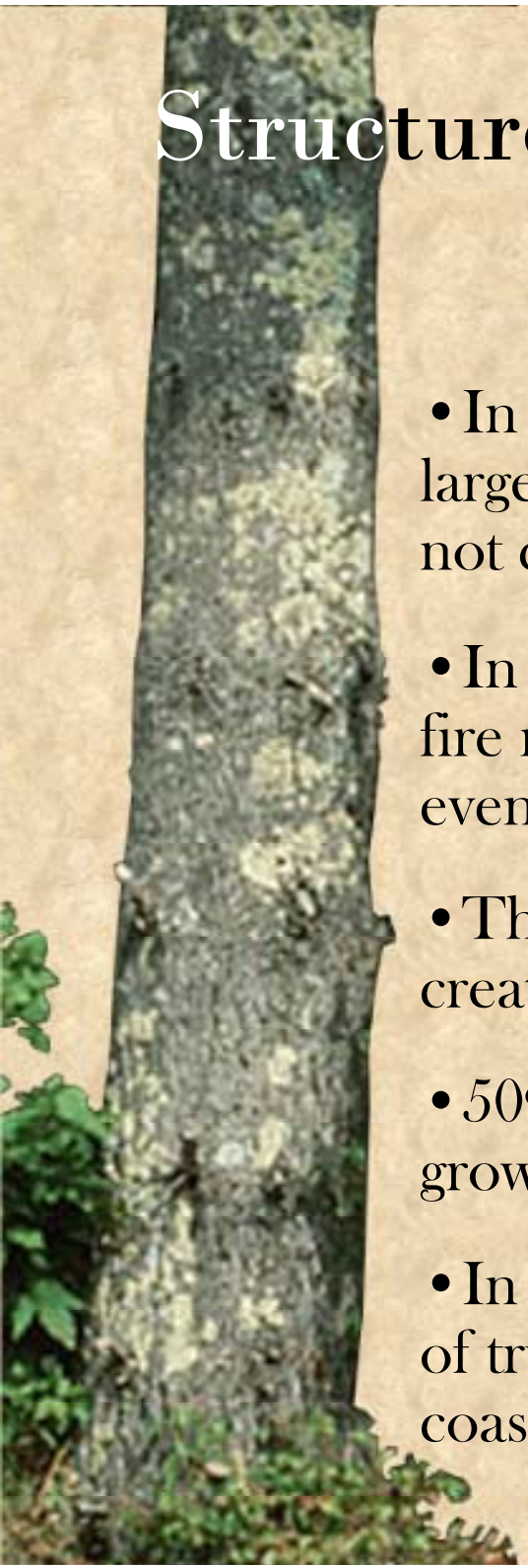
What is the Acadian Forest?

- Species come from both the boreal forest to the north and the deciduous forest types to the west and south.
- Mixture of soft and hardwood species
- Roughly corresponds to the range of red spruce
- The Acadian forest is the northern-most boundary of several species (red oak, red pine, eastern hemlock, beech, ashes)
- Spruces and balsam fir do not grow much farther south than the extent of the Acadian forest.
- Forms a rich, diverse, and unique ecosystem.



The Evolution of the Acadian Forest

- When glaciers receded from the Acadian forest region 12 000 years ago, it was first colonized by tundra vegetation.
- Intolerant Hardwoods such as poplar and birch formed the first forests, followed by spruce, and then fir and larch, forming a boreal-type forest.
- Tolerant hardwoods such as oak began to move into the area, along with pine.
- Between 5 and 6000 years ago eastern hemlock and beech began to dominate the region.
- Hemlock declined in abundance and was replaced by hardwoods such as beech, maples, and birch.
- Spruce rose to a prominent position again, dominating along with tolerant hardwoods.
    - This was the form the Acadian forest would present to the first Europeans to colonize the region.

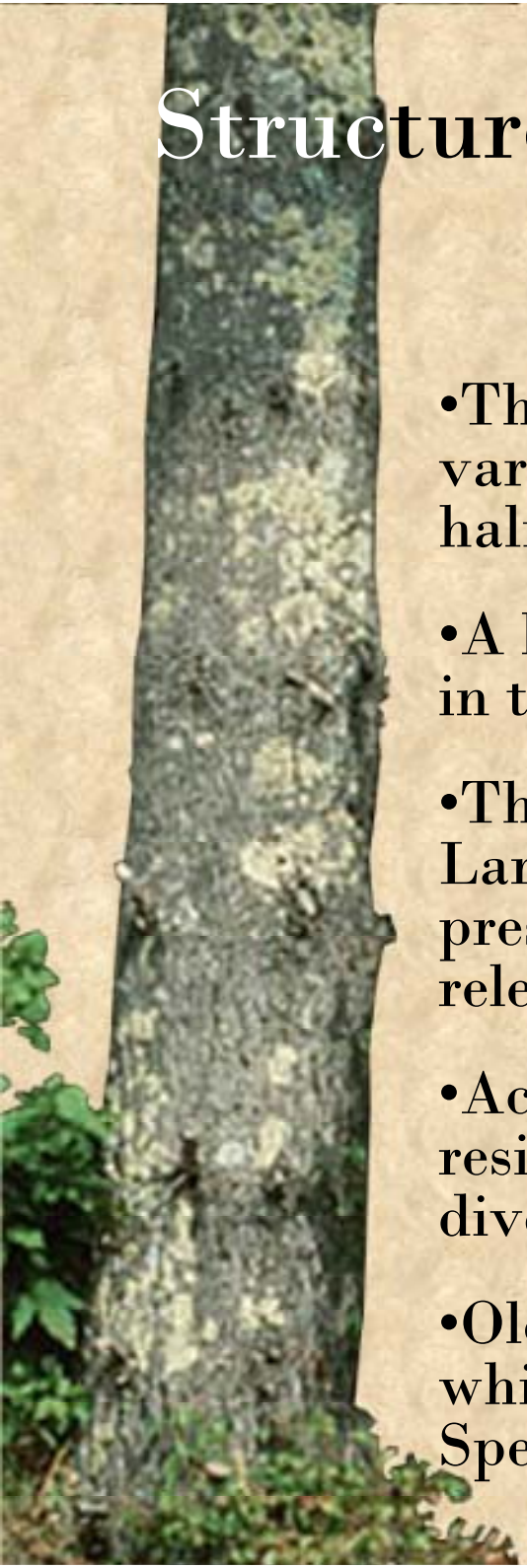


Structure and Age in the Pre-Settlement Acadian Forest

- In most parts of the Acadian forest, natural disasters such as large scale wind-throws, forest fires, or insect epidemics were not common occurrences.
- In forest types which were not susceptible to frequent fires, fire return times may have been between 800 to 1000 years, or even much more.
- This low rate of stand replacing disturbance would have created an Acadian forest composed of 80% mature stands.
- 50% or more of the Acadian forest may have been old growth.
- In some forest types, site factors would prevent the formation of true old growth forests, such as black spruce bogs or stunted coastal softwoods.

Structure and Age in the Pre-Settlement Acadian Forest

- 85% of the forested landmass would have been covered by shade tolerant species. In these forests, change would have been gradual, with individual trees or small groups of trees aging, and falling, creating small gaps in the forest canopy.
- New trees capitalizing on these forest gaps would tend to be shade tolerant species which had been growing slowly in suppression.
- **Stands would be uneven aged, and form a "shifting mosaic" where change would occur slowly, but overall stand composition would remain relatively unchanged.**
- **Small gaps would be sheltered from the wind, and much less susceptible to drying than large gaps.**
- **Many of the defining Acadian forest species regenerate best in these conditions.**



Structure and Age in the Pre-Settlement Acadian Forest

- The average age of the trees in an old growth stand would vary, but would tend to be from 100 to 150 years old – about half of the lifespan of its main species.

- A large degree of downed woody material would be present in these stands.

- This material would be in varying degrees of decomposition. Large, standing snags as well as large fallen logs would be present as wildlife habitat, water storage, and as slowly-released nutrient reservoirs.

- Acadian old growth stands tend to be stable, fire and wind resistant, disease resistant, and have a high degree of genetic diversity.

- Old growth forests possess unique structural characteristics which make them excellent habitat for a number of species. Species utilizing this habitat tend to be specialists.

Human Influence on the Acadian Forest:

Initial Harvesting

•400 years ago, the Acadian forest was little-altered by human activity.

•Would have appeared somewhat different from the forest around us today.

•Increased presence of long-lived, shade tolerant species. Decreased presence of short-lived, early succession, shade intolerant boreal species.

•Tolerant hardwood stands especially were more frequent.

•Commercial harvesting of pine and spruce in New Brunswick had already begun by 1700.

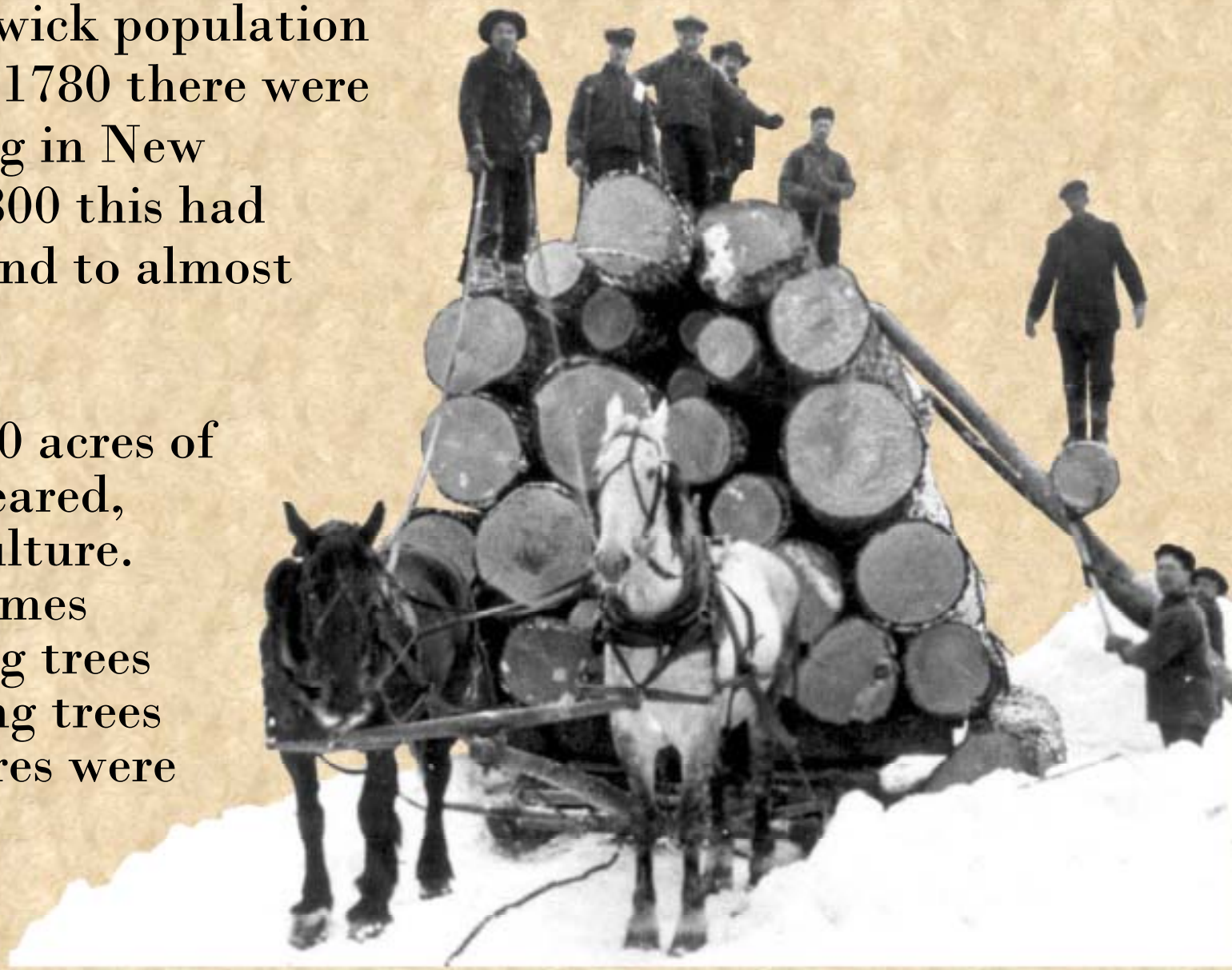
•Large white pine was harvested for masts, first for the French navy, then for the British. By 1811 little large white pine remained in the south of the province.

Human Influence on the Acadian Forest:

The Emergence of Forestry as a Primary Industry

•The New Brunswick population grew quickly. In 1780 there were 4000 people living in New Brunswick. In 1800 this had risen to 25 000, and to almost 200 000 in 1850.

•By 1850, 640 000 acres of land had been cleared, mainly for agriculture. Land was sometimes cleared by cutting trees down, but girdling trees and controlled fires were also used.



Human Influence on the Acadian Forest:

The Emergence of Forestry as a Primary Industry

•1830 saw the introduction of steam powered sawmills, and the expansion of logging operations into more remote parts of the province.

•By 1850, most large white pine had been removed from within 5 km of any stream large enough to float timber down in the spring.

•Shipbuilding became an important industry, and ships constructed from pine and hardwood often set sail with loads of lumber.

•As pine became scarce, spruce was used more regularly.

•The bark of hemlock is rich in tannin, a substance used in tanning leather, and these trees were cut down in huge numbers to remove the bark. In many cases, the wood was not used, but rather left in the woods to rot.

Human Influence on the Acadian Forest:

Forestry's Effect on Waterways

- Brooks and streams are dependant on the forest for nutrients, protection from erosion, and shade.
- Mill damns were created, generally with no fish ladders. Mill waste was typically dumped directly into streams. Streams were manually straitened to facilitate log transport.
- Flood dams were build to help force logs downstream in spring floods. These log filled torrents were extremely damaging to waterways, scouring stream beds and eroding banks.
- The forests surrounding brooks filter sediment from runoff, and release rain water slowly into drainage basins, controlling floods. Early forestry did not protect these riparian zones.

Human Influence on the Acadian Forest:

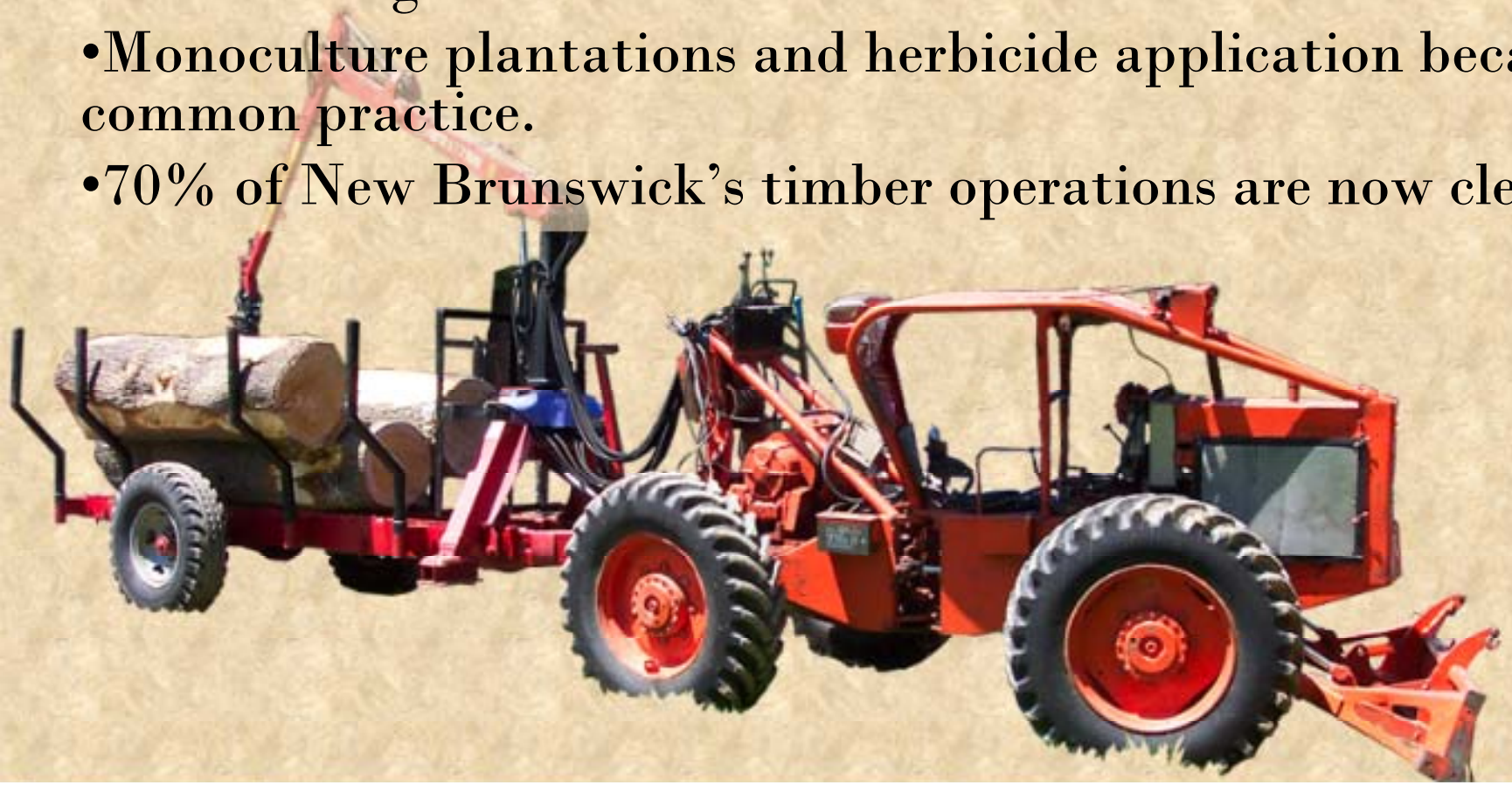
Forestry's Effect on Waterways

•The effects of these forestry practices, although no longer being carried out, have not reversed themselves. The effects of logging can still be seen in many rivers. Some species of fish have drastically reduced populations or are no longer found in some of the waterways they once inhabited.

Human Influence on the Acadian Forest:

Modern Forestry Emerges

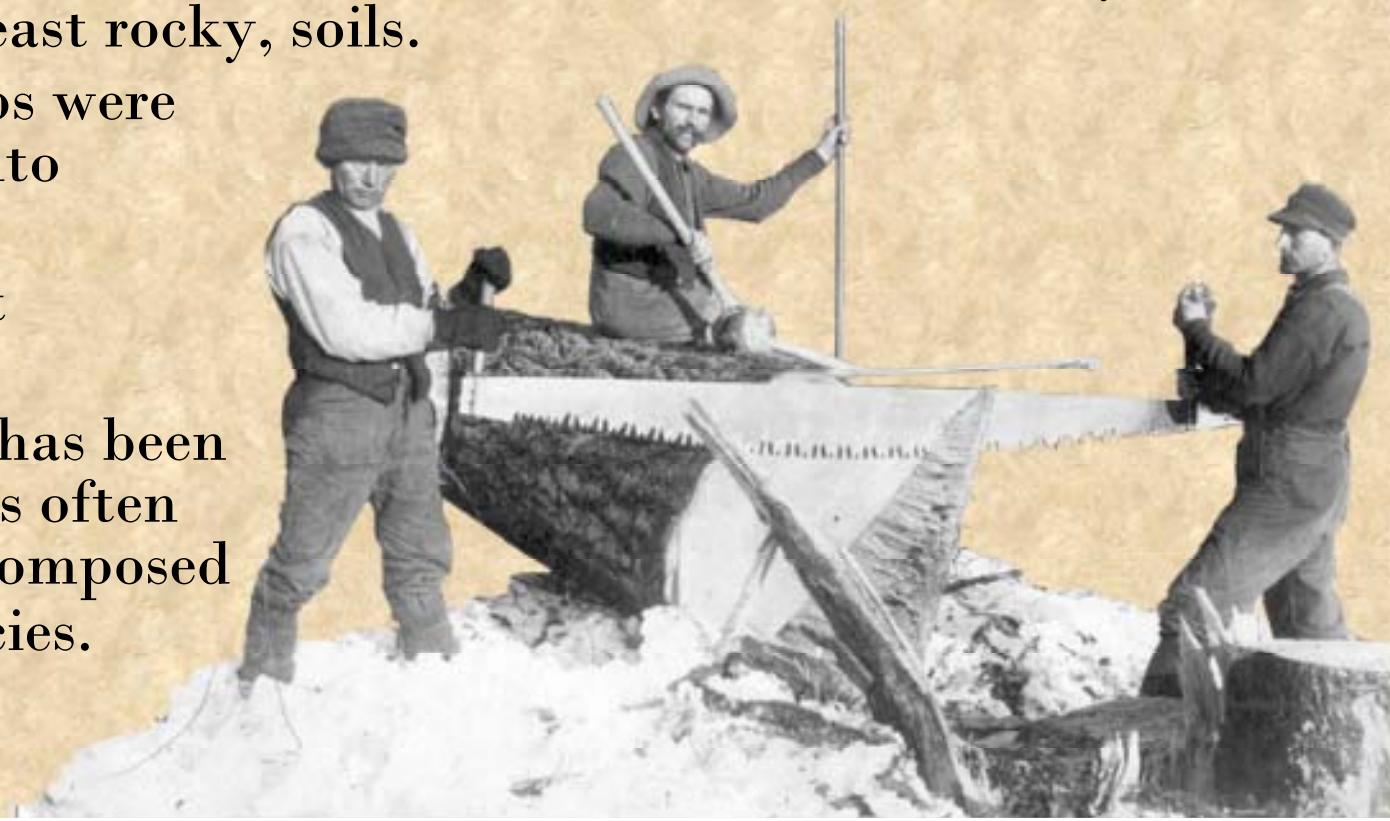
- The 1950s saw increased mechanization of timber harvesting. The first chainsaws were becoming practical, and heavy machinery was put to greater use in the forest.
- Clearcutting became the dominant form of timber harvest.
- Monoculture plantations and herbicide application became common practice.
- 70% of New Brunswick's timber operations are now clearcuts.



Human Influence on the Acadian Forest:

Land Clearing

- By 1850, 640 000 acres of land had been cleared, mainly for agriculture. Land was sometimes cleared by cutting trees down, but girdling trees and controlled fires were also used.
- Land clearing or brush burning fires sometimes escaped, increasing fire frequency across the landscape.
- Tolerant hardwoods were most often cleared for farmland, as they most often grew on the best, least rocky, soils.
- Calcareous cedar swamps were drained and converted into farmland.
- Riparian zones were not maintained.
- Today, some farm land has been abandoned. This land has often returned to forest, now composed of early successional species.



Human Influence on the Acadian Forest:

Human Influence Through Introduced Pests

- Although disease is a natural part of the Acadian Forest, several foreign pest species have been introduced which face no predators or resistance.

- These species can be very destructive, both in an environmental sense and in an economic one. These pests have changed the forest, and are likely to continue to do so.

- Of the many pest species that have been introduced to the Acadian Forest, only a few of the most important ones are discussed here.

Human Influence on the Acadian Forest:

Human Influence Through Introduced Pests

Beech Bark Disease

- Actually a combination of beech scale (insect) and nectria (fungus)
- Introduced from Asia to Halifax in 1890.
- Spread across North America. Spread is still in progress today.
- Initially, 85% mortality
- Has not spread to some parts of Northern New Brunswick, where the cold prevents its survival.
- Not all infected trees die – some survive and produce more trees susceptible to infection.
- Even in infected areas, "clean" beech still persist – these trees are genetically resistant to infection. This may mean that in the future, beech bark disease will be largely overcome.
- Human intervention in forest stands may contribute to solving this problem. It has been suggested that if infected beech are girdled, then they will die without producing stump sprouts. This would eventually leave only resistant trees to pollinate each other and produce resistant offspring.

Human Influence on the Acadian Forest:

Human Influence Through Introduced Pests

Beech bark disease is easily recognizable in its advanced stage: it forms cankers on the normally smooth-skinned beech bark

Human Influence on the Acadian Forest:

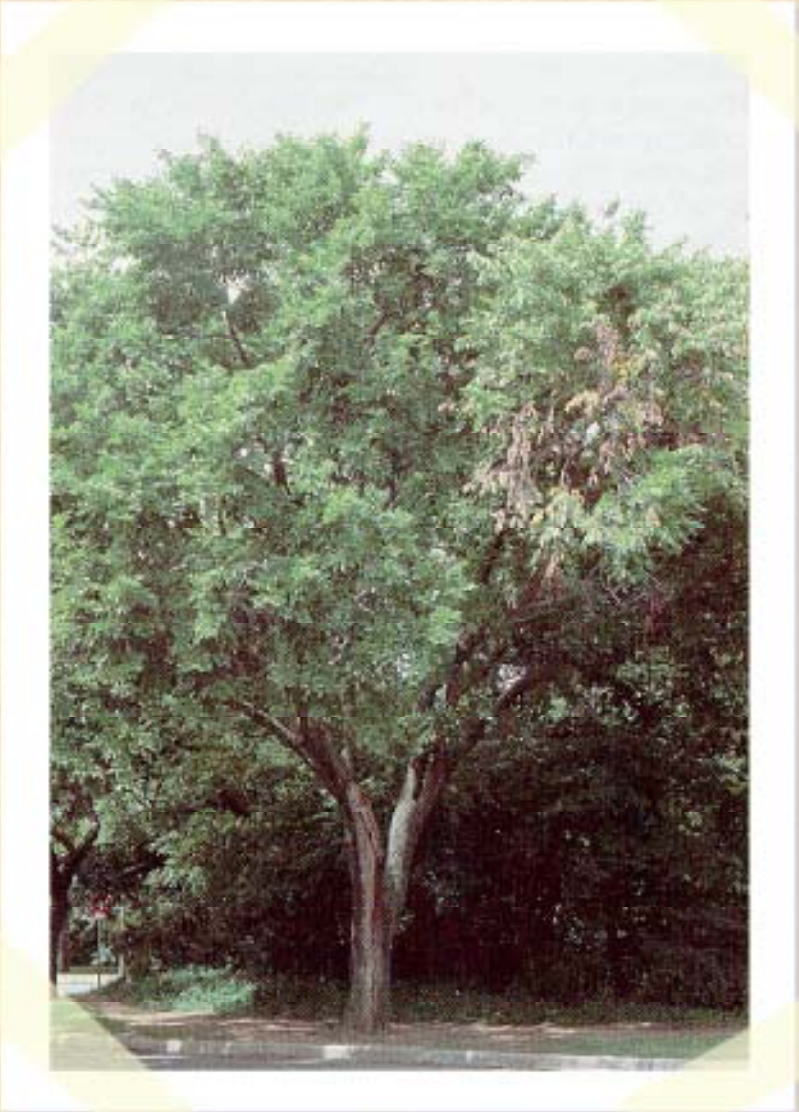
Human Influence Through Introduced Pests

Dutch Elm Disease

- Fungus, thought to have originated in Asia
- Traveled to Europe early in the 20th century, and was identified by 1920
- Traveled to North America by 1930 and began spreading across the continent.
- Entered New Brunswick in 1957, Nova Scotia in 1969, and PEI in 1979.
- Has killed over 40 million elms, especially white elm (American elm). Destruction was very visible, because white elm was a popular urban tree.
- Can be transmitted by elm bark beetle, or through root grafts 25 to 50 feet distant.
- A number of expensive or labor intensive measures can be taken to save urban trees, but these resources may not be available in a woodlot setting.
- Removal of dead or dying elms infected with Dutch elm disease can prevent its spread to nearby trees.

Human Influence on the Acadian Forest:

Human Influence Through Introduced Pests



•Certain herbicides can be used to kill infected trees, and cause the bark to dry out, making them less suitable locations for bark beetle reproduction. Research has shown this can be a very effective, cost effective, method if the disease is caught early. This is called the "trap tree" method, and can actually reduce bark beetle numbers significantly.

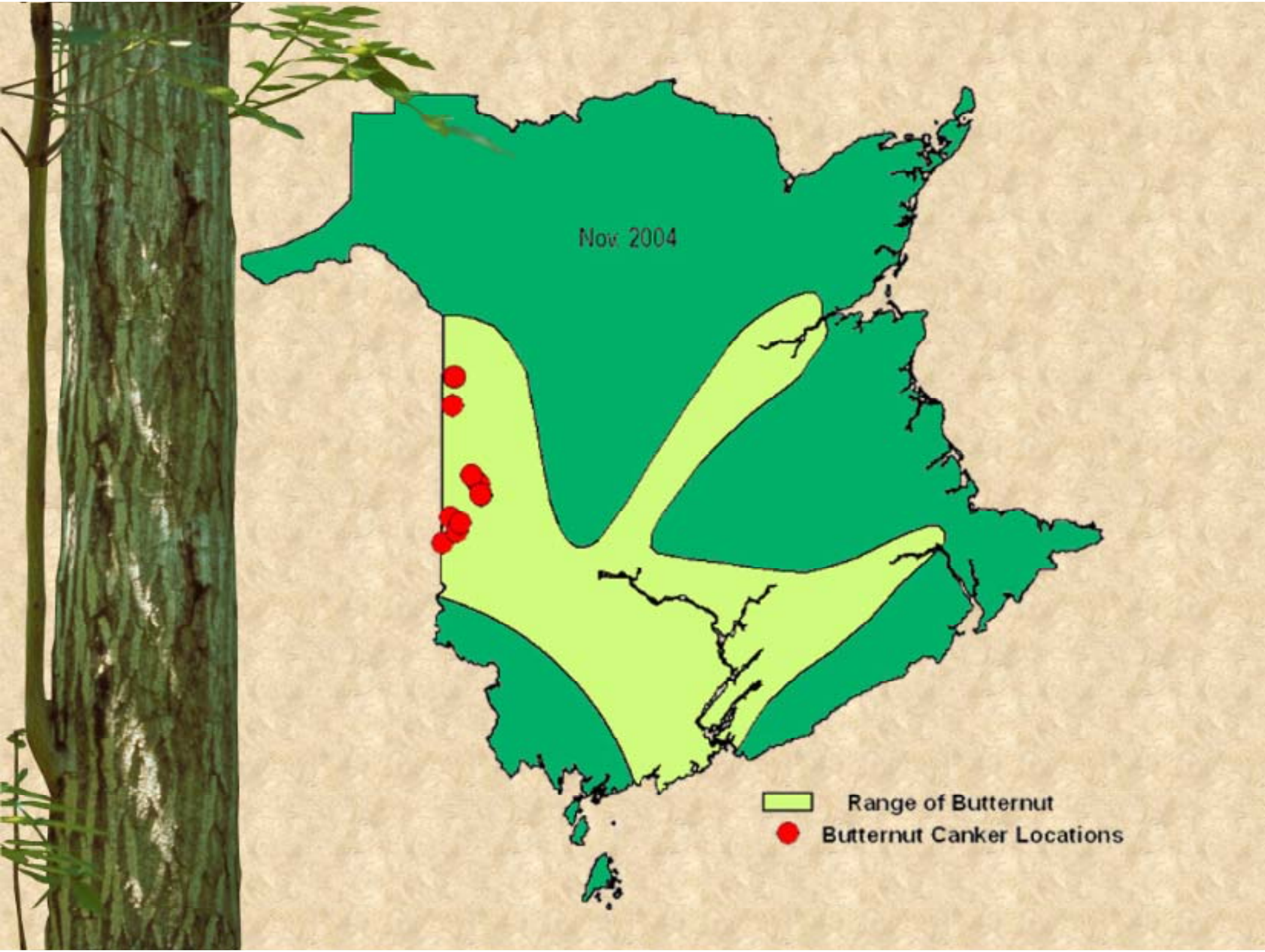
Sections of dead branches, or "flagging", are often the first sign of Dutch Elm infection

Human Influence on the Acadian Forest:

Human Influence Through Introduced Pests

Butternut Canker

- Fungus first reported in Wisconsin in 1967.
- This pathogen has probably been present for a longer period of time, and is believed to have been introduced, possibly from Europe.
- In some areas, canker has lead to 80% mortality in butternut.
- Reported in Quebec in 1990, Ontario in 1991, and New Brunswick in 1997.
- In New Brunswick, butternut is at the northern extent of its range, so it may be especially vulnerable. It is possible that butternut canker will extirpate butternut from this province.


Nov 2004
Range of Butternut
Butternut Canker Locations

Human Influence on the Acadian Forest:

Human Influence Through Introduced Pests

Black, elongated, seeping cankers are typical of this fungal infection

Human Influence on the Acadian Forest:

Human Influence Through Introduced Pests

Eventually, canker girdles the tree, killing it

Human Influence on the Acadian Forest:

Human Influence Through Introduced Pests

Hemlock Woolly Adelgid

- Aphid-like insect which originated in Asia
- Introduced to North America in 1924. Feeds on eastern and Carolinian hemlock.
- Spread across much of Eastern US, as far north as southern Main.
- Research indicates it is probably able to over-winter in southern New Brunswick. It is possible that HWA may also over-winter in central New Brunswick, in a range closely corresponding to the range of the eastern hemlock.
- No reported infestations in New Brunswick to date.
- Virginia, New Jersey, and Connecticut are among the harder hit areas. Infested stands average 42% mortality, with some stands loosing as many as 90% of their hemlock. If this pest becomes established in New Brunswick it may pose a very serious threat to the hemlock growing here.

Human Influence on the Acadian Forest:

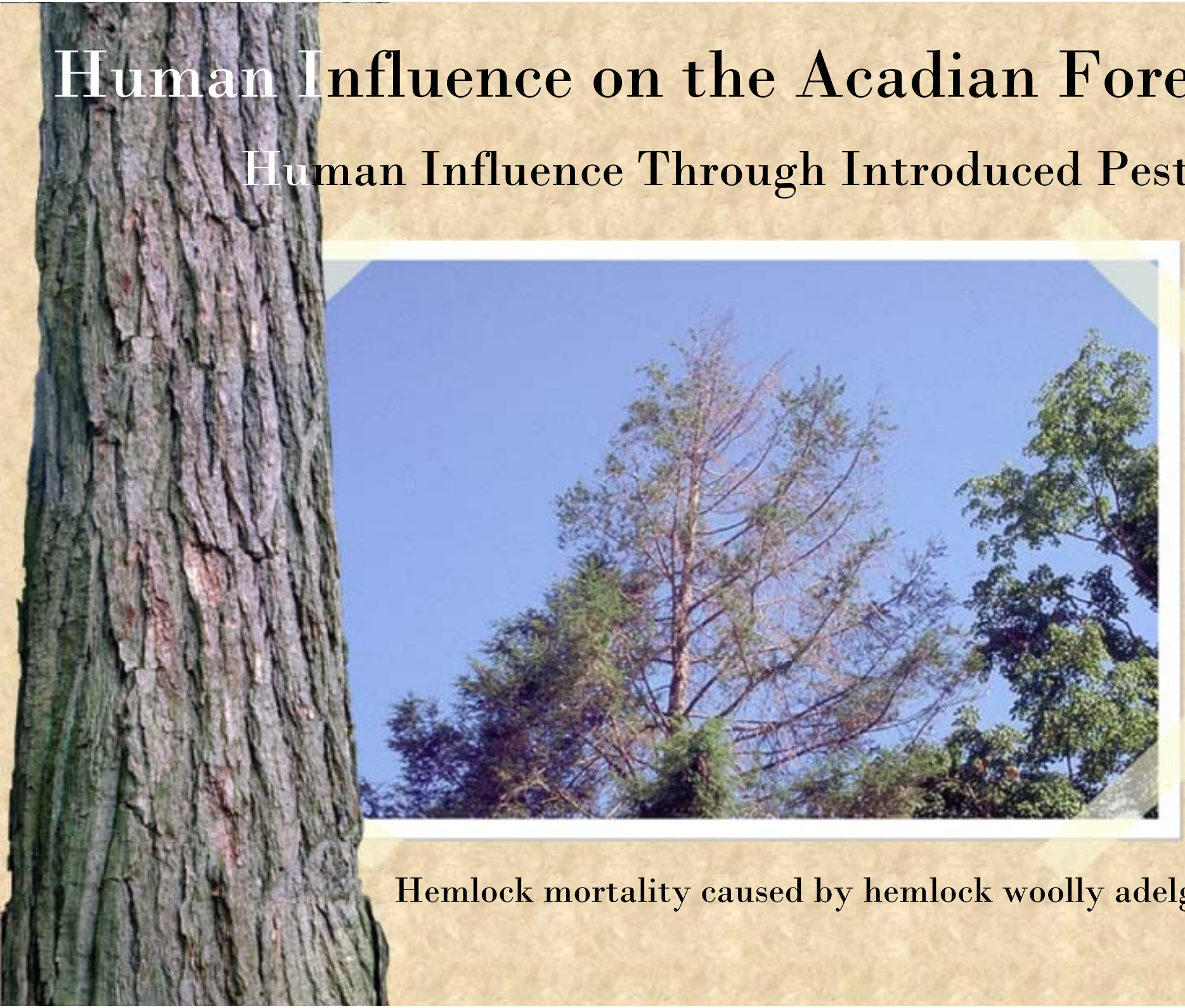
Human Influence Through Introduced Pests

•Currently, a predator species (*Laricobius nigrinus*) has been released into adelgid-infested hemlock stands in several regions. Tentatively, the effect of this has been very positive.

White, cottony deposits along twigs and graying, dying needles indicate the presence of this species.

Human Influence on the Acadian Forest:

Human Influence Through Introduced Pests



Hemlock mortality caused by hemlock woolly adelgid.

Acadian Forest Types

- The Acadian forest takes a number of forms, depending on climate, elevation, proximity to the coast, and soil type and drainage.
- Various systems have been developed to classify the different types of Acadian forest. The one offered here is taken from "The Acadian forest: Historical condition and human impacts" (Loo & Ives: 2003, 468)
- Identifies 9 distinct forest communities forming the Acadian forest.

Acadian Forest Types

1. Rich tolerant hardwood: type 1

- **Upland: Species -** dominated by sugar maple, beech, yellow birch, white ash, and iron wood. some basswood, butternut, and eastern hemlock may also be present.
- **Location** – warm. well-drained, deep soil. Mainly located in western New Brunswick.

- **Associated Flora** – bloodroot, Dutchman's breeches, wild leek.
- Normally, openings in this kind of forest occur through the fall of individual trees or cohorts. High-grading, as well as clearing for agriculture and urban development, have affected this forest type.

Acadian Forest Types

1. Rich tolerant hardwood: type 2

- **Bottomland: Species** – dominated by red maple, white elm, and basswood. Some silver maple, bur oak, balsam poplar, and sugar maple.
- **Location** – warm, with periodic flooding.
- **Associated Flora –** ostrich fern, nodding trillium
- Normally, openings in this kind of forest occur through the fall of individual trees or cohorts. Some habitat has been lost because of flooding caused by hydroelectric projects.

Acadian Forest Types

2. Ridge-top hardwood

- **Species –** dominated by sugar maple, beech, and yellow birch. Some white ash and ironwood also present.
- **Location –** Cool, with rocky, well drained soil.
- **Associated Flora –** Red trillium, rose twisted stalk, Indian cucumber, and trout lily.

➢Normally, openings in this kind of forest occur through the fall of individual trees or cohorts, although occasional stand replacing fires can occur. Agricultural clearing, high grading, and conversion to tree plantations have all affected this forest type. This forest type is often found in the uplands of northwestern and central New Brunswick, as well as Albert County in the Fundy highlands.

Acadian Forest Types

3. Upland Mixedwood

- **Species** – dominated by sugar maple, yellow birch, red spruce, and beech. Some balsam fir, white pine, eastern hemlock, and eastern white cedar.
- **Location** - Ranges from cool to warm, and from moderately to well drained. Somewhat rich.
- **Associated Flora** - Clintonia, star flower, bunchberry, and Indian cucumber root.
- Normally, openings in this kind of forest occur through the fall of individual trees or cohorts. Many of these forests have been cleared for agriculture, converted to plantations, high graded, clearcut, or had their softwood component removed. These forests were once much more frequent across southwestern and northern New Brunswick.

Acadian Forest Types

4. Mixedwood fire types

- **Species –** May be dominated by jack pine, trembling aspen, and black spruce or by white pine, red oak and red pine on well drained sites. Balsam fir, white birch, and grey birch may also be present.
- **Location –** Cool to cold areas with soils which may be poorly or well drained.
- **Associated Flora –** Bracken fern, lambkill, bunchberry, and velvet-leaf blueberry.
- Openings in this kind of forest can occur through the fall of cohorts or individual trees, but regular fire is also a natural part of this habitat. Clearcutting, clearing, and removal of pine component have all affected this forest. Human alteration of the frequency and occurrence of fire has also had an effect. These forests occur across the province, but dominate the eastern lowlands.

Acadian Forest Types

5. Wet calcareous mixedwood

- **Species –** Dominated by eastern cedar, black ash, and red maple, with some black spruce present.

- **Location –** Warm areas with moderately rich, poorly drained organic soils. This forest type occurs on alkaline sites.
- **Associated Flora –** Calypso orchid, yellow lady's slipper, marsh fern, royal fern, and wood anemone.
- Normally, openings in this kind of forest occur through the fall of cohorts or individual trees. Draining and clearing, clearcutting and site conversion, and heavy harvesting of eastern cedar and black ash, have all affected these sites. The alkaline sites occupied by these forests are spread across the province, and are home to many rare plant species, especially orchids.

Acadian Forest Types

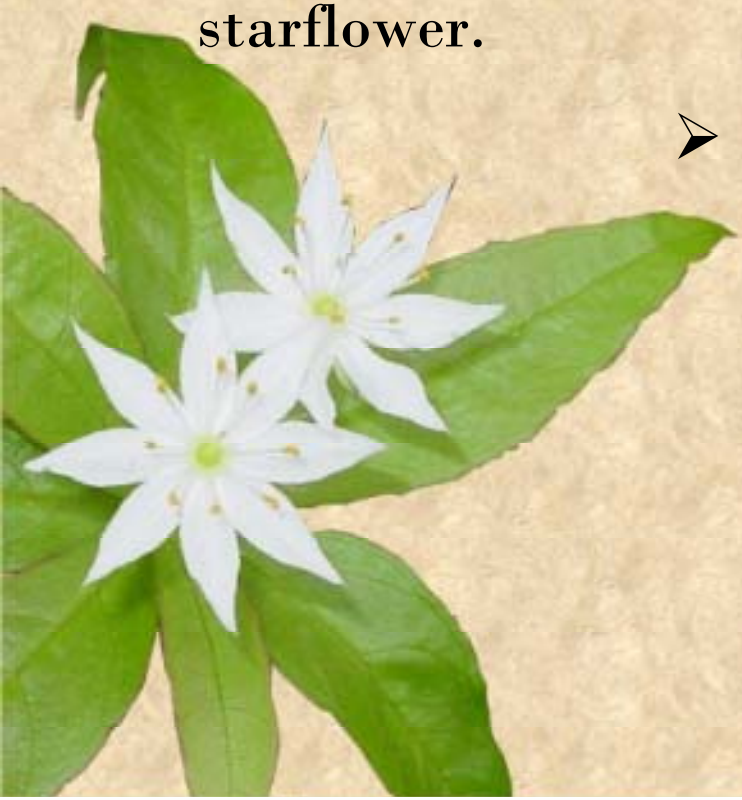
6. Wet acid peat softwood

- **Species –** Dominated by black spruce and eastern larch with some red maple and balsam fir.
- **Location –** These cool to cold sites have poor, acidic organic soils.
- **Associated Flora –** A variety of sphagnum species are present, including rhodora, lambkill, and Labrador tea.
- Despite the wet nature of these sites, stand replacing fires are a natural part of these environments. Blowdowns are also a natural method gap creation in these forests. Clearcutting and peat harvesting are the most prevalent human influence on these forests.

Acadian Forest Types

7. Costal softwood

- **Species –** Dominated by either red spruce or white spruce and balsam fire, along with some white birch, red maple, black spruce, and white pine.
- **Location –** Cool areas with well drained rocky soils
- **Associated Flora –** Schreber's moss, bunchberry, twinflower, starflower.



- Wind, ice, and salt spray can cause cohort or single tree mortality in these forests. Costal softwoods are also subject to periodic spruce budworm attacks. Clearing for settlement and agriculture, along with clearcutting and acid rain have all influenced these forests. These forests are considered part of the Acadian forest, but are somewhat boreal in nature. They are found anywhere along New Brunswick's coast or islands.

Acadian Forest Types

8. Highland softwood

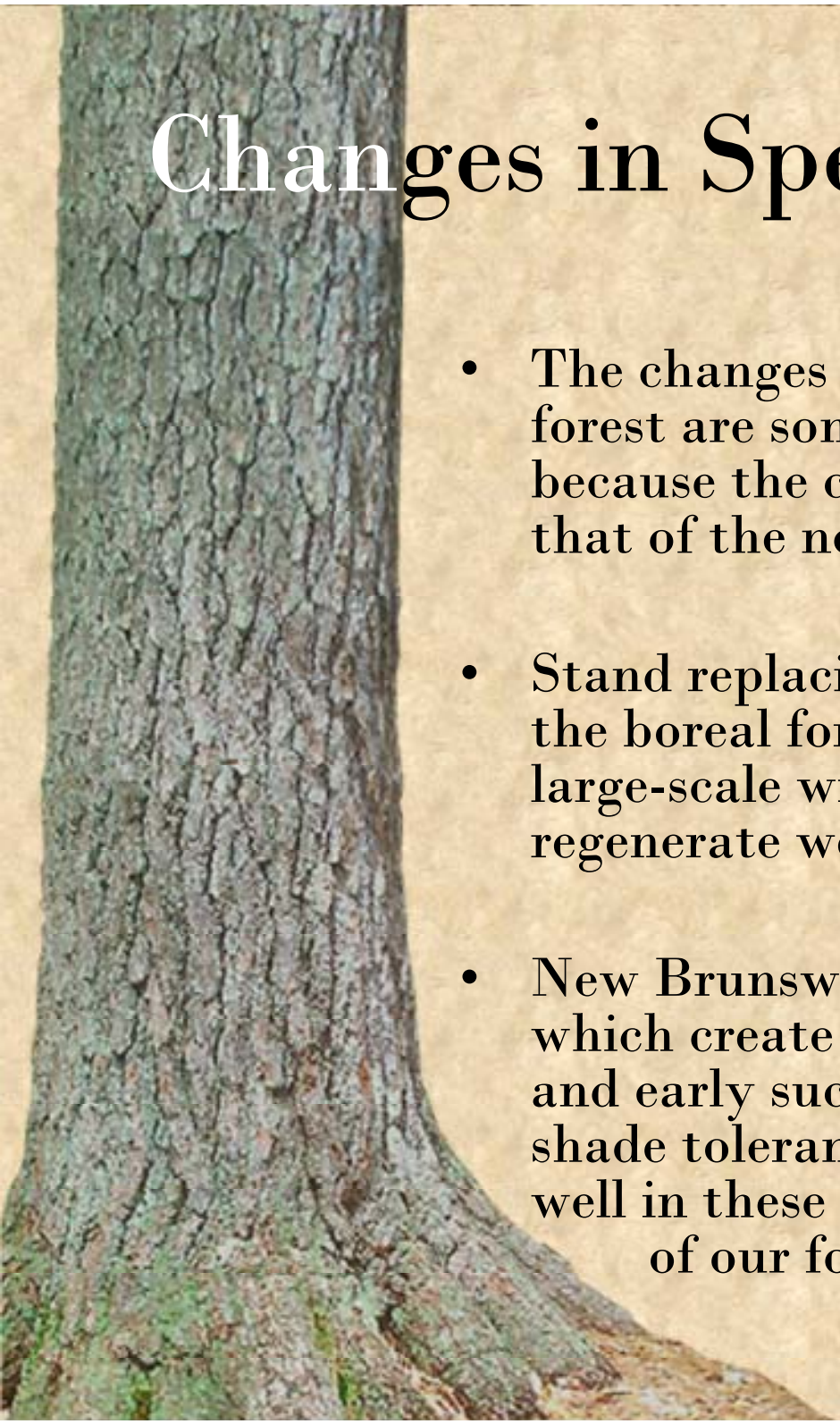
- **Species –** Dominated by balsam fir, black spruce, and white spruce with some white birch also present.
- **Location -** Cold areas with moderately poor soils

- **Associated Flora -** Schreber's moss, bunchberry, twinflower, wild lily of the valley, and wood fern.
- Stand replacing fires and blowdowns, along with budworm attacks, mean that large areas of this forest are replaced to form natural even aged stands. Fire suppression, budworm spraying, high grading and clearcutting have all had an impact on these stands. These forests grow in north-central New Brunswick in the Appalachians, where they receive the provinces highest levels of precipitation. Some forest classifications do not include these areas as part of the Acadian forest, but rather see them as a southern extension of the boreal forest in the Maritimes.

Acadian Forest Types

9. Tolerant softwood

- **Species –** Dominated by red spruce, white pine, and eastern hemlock, with some sugar maple, beech, yellow birch, balsam fir, black spruce, white spruce, eastern larch, and eastern cedar all potentially present.
- **Location –** Cool to warm sites with imperfectly drained or well drained soil.
- **Associated Flora –** Pink pyrola, moccasin flower, creeping snowberry, Schreber's moss, and partridge berry.
- Normally, openings in this kind of forest occur through the fall of cohorts or individual trees, as well as small scale fires. These forests have been affected by high grading, removal of certain species, clearcutting, and agricultural clearing. These forests are most common in eastern New Brunswick.



Changes in Species Composition

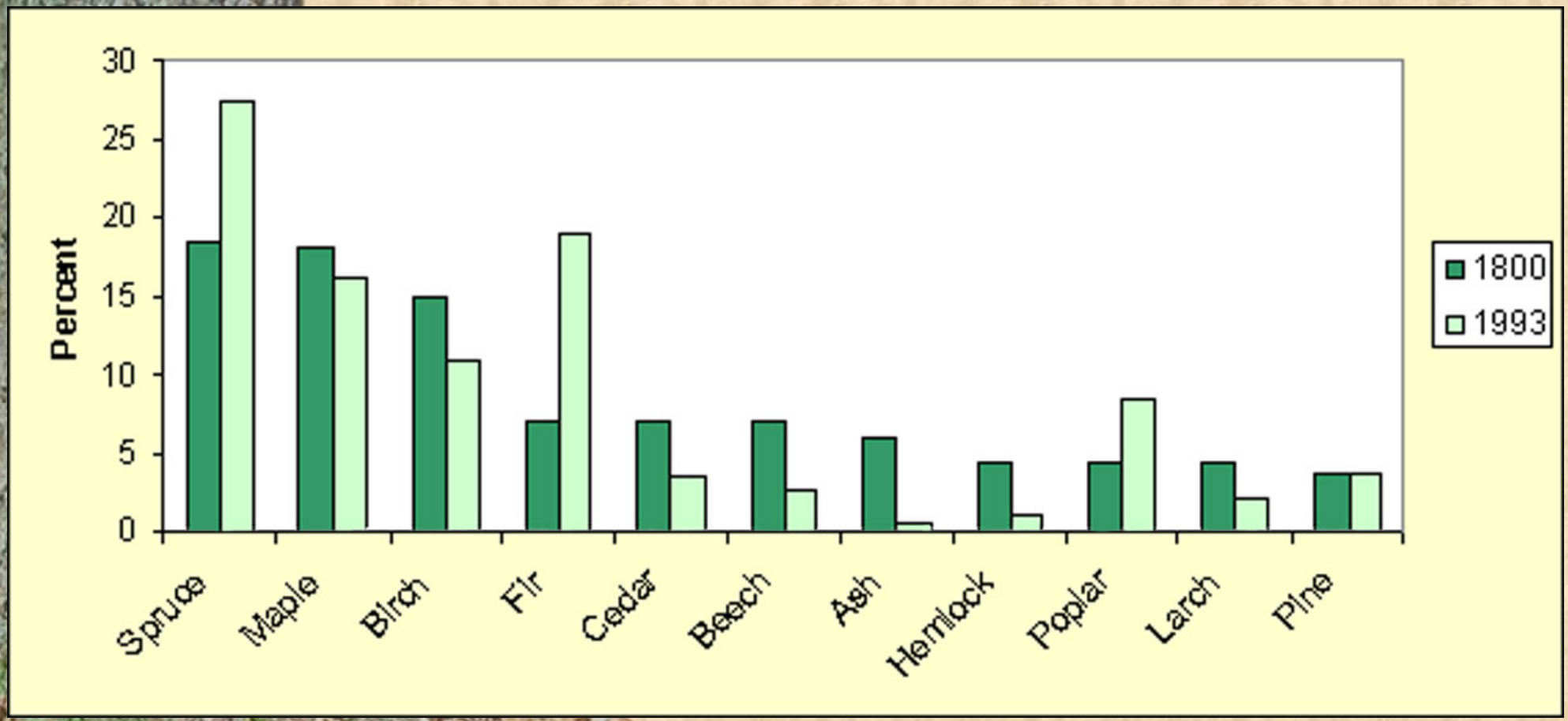
- The changes that have taken place in the Acadian forest are sometimes described as “borealization”, because the character of the forest is moving closer to that of the northern boreal forest.

- Stand replacing disturbances are more common in the boreal forest, caused by fire, spruce budworm, or large-scale wind throw. Consequently, boreal species regenerate well in large, exposed openings.

- New Brunswick’s timber harvests are 70% clearcuts, which create a good environment for many boreal and early successional species to reproduce. Many shade tolerant, long lived species do not regenerate well in these large gaps, and the species composition of our forests has changed accordingly.

Changes in Species Composition

- Several estimates have been done, attempting to quantify this change. The one offered here used witness trees recorded in land deeds, and was conducted in Kings County. By 1800, some white pine would have been harvested in this area, so pine is probably underrepresented.



Changes in Species Composition

- Other methods of reconstructing the pre-settlement forest confirm most of the general trends shown in the graph, with the exception of spruce - a genus some studies show has declined.

- Within the genera shown on the graph, there have also been significant changes. Red spruce has declined, while white spruce, which has colonized many abandoned farm properties, has become much more abundant. Sugar maple has decreased in frequency, while red maple has become a much more common species.

Wildlife in the Acadian Forest

- Several of the wildlife components of the Acadian Forest are missing. The woodland caribou, wolverine, and grey wolf are examples of Acadian forest species which are no longer present in New Brunswick. Other species, like the eastern cougar, are on the verge of extirpation, or like the sea mink have become extinct.

- There are a number of species which continue to be present in the province, but have been extirpated from certain portions of their natural range or have become rare, such as marten, peregrine falcon, spruce grouse, and northern leopard frog. The fisher has recently been successfully reintroduced to some regions where it had been extirpated.

Wildlife in the Acadian Forest

- New species have moved into the area. Before the settlement of New Brunswick, white tailed deer were relatively rare, and only present in the most southerly part of the province. Coyote have extended their range into the Maritimes as well.

- In the case of moose, the species is abundant but feeding patterns have most likely changed. This species no longer has any natural predators, although some mortality is now caused by the parasite brain worm carried by white tail deer, as well as by human hunting.

Wildlife in the Acadian Forest

- The feeding preferences of large herbivores for one species over another have been shown to have an important impact on forest development. The way in which the presence of large predators in an area can change herbivore feeding patterns has been shown to be equally important to species composition.

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Restoration

- Some of the changes that have taken place in the Acadian Forest cannot be undone. We cannot go back in time. Eliminating all forestry activity in the Acadian Forest region is also not possible. We can change some of the damaging trends that are present in our forests.

- We can move towards forest systems that are complex, rich, and diverse. To this end, we can use what we do know about the historical condition of our forests as a benchmark.

Restoration: Fragmentation

- Forest access roads can have a significant impact on forest ecosystems. Roads provide increased human access to an area, which can mean increased harvest through hunting, fishing, and trapping (the desirability of this depends on the nature of the site).
- Roads contribute to habitat fragmentation, and have provided corridors for the spread of invasive species. Some guidelines have been suggested to minimize the impact of roads on a forest ecosystem.
- Road networks should be kept at a minimum density. Road densities of under 0.58km/km2 are considered adequate for most wildlife, and this is sometimes used as a target in forest management aimed at preserving biodiversity.
- Roads should avoid crossing watercourses if at all possible. Cul-de-sacs are preferable to loops in most cases. In areas which do not presently require access for silviculture, landowners may consider the use of temporary barriers such as earth mounds and boulders.

Restoration: Watercourses

- Water course buffer zone guidelines for crown land currently mandate a 60m buffer. This is generally sufficient for most areas, but along watercourse with large slopes leading up to them, it may be preferable to measure the buffer zone 60m out from the point where the slope is less than 20%, rather than from the edge of the water.
- While some cutting can be allowed within buffer zones, it is preferable to abstain from any cutting within the 5m of forest closest to a watercourse
- In streams or brooks where damage has been done in the past, a number of methods can be used to restore the watercourse to a form which is more suitable as habitat for native fish. In some parts of the province there are organizations dedicated to waterway restoration which are able to provide information and expertise.

Restoration: Snags

- Forest structures found in mature and over-mature forest stands are important as habitat and food sources for many wildlife species. Some of these structures can be identified and preserved during harvesting
- Snags, especially large diameter ones which do not pose a threat to forest workers, should be left as habitat for wildlife. These standing dead trees are home for a number of species which live in cavities within them. Other species use these as a food source, often creating cavities for other animals in the process.
- Some forest management guidelines suggest 12 – 15 snags/h as an appropriate number, ideally with a diameter at breast height (DBH) of greater than 20cm.

Restoration: Snags

- Along with these snags, it is suggested that 10 – 12 hardwood trees/h, either living or partly dead, and with a DBH of at least 25cm, also be preserved. Ideally these trees would be poplar or beech, although maple or yellow birch are also useful to wildlife.

- Retaining these trees where ever possible as part of a small clump during harvest operations is highly beneficial to many species of wildlife.

Restoration: Downed Woody Material

- Downed woody material is also important to wildlife. Unfortunately, intensive forestry practices sometimes remove this component of forest structure.
- Tree limbs and tops should remain on the site. Ideally, some recommendations would like to see even the bark of harvested trees remain on the site, but this may not often be feasible.
- One report on New Brunswick forests suggested 200 pieces of downed woody material/h, with an average diameter of 10cm or more, would be a suitable minimum in softwood or mixed wood stands.

Restoration: Tree Species Composition

- Tree species that have had their presence in the Acadian forest significantly reduced by human activity should be given special consideration. In the southern regions of the province, this would include Easter White Cedar, Eastern Hemlock, Bur Oak, Red Oak, Basswood, Black Ash, Butternut, Ironwood and Black Cherry. Although province wide data on this subject is not complete, these species have often been significantly reduced from their pre-settlement levels.
- This trend can be reversed by limiting the harvest of these trees, as well as creating conditions which are favorable to their continued growth and reproduction.
- In forest types where gap replacement is the norm, efforts should be made to maintain stands as uneven aged, with 30% of the forest in the mature or over-mature stage of development.

Restoration: Tree Species Composition

- Gaps created by harvesting need to be kept small, to simulate the natural occurrence of gaps in these Acadian Forest types. Longer gaps may be possible, as long as they are relatively narrow, and oriented to minimize their exposure to prevailing winds. Smaller gaps will allow tolerant, exposure-sensitive species to regenerate. Ideally, new trees will be recruited from established suppressed trees.
- In areas where "borealization" has taken place, tolerant, exposure-sensitive Acadian species may be introduced by direct planting after a gap replacement harvesting. If the site is appropriate for these species, they may become established, and in future harvests may be able to act as a source of regeneration in future harvests.
- Some sites are especially sensitive, and may need to be protected from any kind of harvesting. Among these are many calcareous cedar swamps, which are home to a variety of rare or endangered plant species.


End

Fundy Model Forest Final Report
Acadian Forest Management and Restoration
INFOR Inc.
2007

This project is the result of a growing public interest in the 'Acadian forest', what it is, how it can be sustainably managed and restored in areas where forest cover type has been altered through human intervention. This workshop has been created for woodlot owners and the interested general public for the purpose of imparting the knowledge required for the implementation of sustainable management in an Acadian forest ecosystem. Topics covered range from definitions and descriptions of Acadian forest (including all of the debate and difficulties surrounding its categorization), through historical perspectives on its use and exploitation, ecology, and the current resurgence of interest in preserving remnant patches and restoring this forest type across its historical range. Subject headings covered by this workshop include:

- **What is the Acadian Forest?**
- **What was it like before settlement?**
- **How has it changed, and why?**
- **What kinds of Acadian Forest are there?**
- **What is the Importance of the Acadian Forest?**
- **Acadian Forest restoration?**

What is the Acadian forest?

This is a question that is still widely debated and not easily answered. The key features that define New Brunswick's forest as being 'Acadian' are discussed, beginning with its establishment and continual evolution since the last glaciation. Descriptions of individual species and contemporary species complexes are given along with the roles of site and climate in shaping the Acadian forest.

What was it like before settlement?

This topic delves into a description of New Brunswick's forests immediately before European's settlement. It gives a historical perspective on Acadian forest structure as seen by our ancestors, how it was used, and sets up the next topic, discussing how it has changed through human exploitation.

How has the Acadian forest changed?

This section discusses the history of forest use, the evolution of New Brunswick's forest industry from its early beginnings through to the development of the pulp and paper industry and on to the current state of our forest industry. It gives perspective on the progression of products extracted, methods of harvesting and the type of management used at various stages of the industry's development. This subject further discusses our

influence on the Acadian forest through the introduction of forest species and pests and the effects of fragmentation on species.

What kinds of Acadian forest are there?

Descriptions of 9 individual Acadian forest types found in New Brunswick. General descriptions of various forest types resulting from differing climate and site conditions. This section emphasizes the role of abiotic factors in determining forest types and the importance site plays in forest ecology. Included are descriptions of elevation, soil, moisture regime and associated species as well as general stand structure.

What is the Importance of the Acadian Forest?

Information is given concerning the ecological diversity of the Acadian forest and the importance it plays in hosting a diverse array of species and habitats.

Acadian Forest restoration?

In the face of non-native species, invasive species, human exploitation and changing climate conditions, this section discusses the question of Acadian forest restoration. Considering the nature and volume of changes that have taken place in the 400 years since Europeans first began to influence the Acadian forest, questions such as 'is the pre-European forest sustainable today?' must be asked when considering restoration. Should the restoration of pre-settlement forest be pursued, or is it more feasible to strive towards the development of healthy, diverse forests that thrive in today's environment. This is the approach taken in recommending strategies for Acadian forest management in this workshop. Implementing strategies that foster a diverse array of species and stand types, age stratification and habitat development are suggested as the best means of developing a healthy, sustainable and resilient forest with the greatest ability to weather disturbance.