# UNDERSTANDING FARM WOODLANDS

Just as agricultural yields are affected by field and crop variables, site and species characteristics will have a dramatic impact on the growth and yield of your woodlot. By knowing these characteristics and how they interact to affect tree growth, you can tailor your management activities to help maximize benefits and offset potential problems. This chapter deals with some of these essential characteristics.

We'll begin with a single woodland tree:

- its life cycle
- key features of and stages in its development
- what it requires to grow well in a woodland.

Then we'll step back to look at the woodland as a whole:

- its life cycle
- its function as an ecosystem
- what affects its health
- different types of woodlands.

**Whether trees or field crops, plant growth is influenced by a variety of interrelated factors.**

## THE LIFE CYCLE OF A TREE

As with all plants, trees grow, reproduce and die. Familiarity with an individual tree's life cycle forms a good foundation for understanding how trees and forests grow and change with time, and how best to manage them.

**Soft Maple (Red, Silver), Basswood (pictured) and many other hardwoods can regenerate following harvest by stem-sprouts or coppice. New shoots can mature into a clump of trees using the rooting system of the original parent tree. Coppice can be managed as a quick way to regenerate desirable species.**

**Some trees such as this Poplar variety mature in 25 years or less.**

## LIFE CYCLE STAGES OF A TREE

| INITIATION | GROWTH | MATURITY | DECLINE |
|---|---|---|---|
| • Trees can grow from:<br>○ seeds, nuts<br>○ vegetative reproduction<br>○ coppice – from stumps, e.g., Basswood, most hardwoods<br>○ root suckering, e.g., Poplar, Beech and Sumac<br>○ layering – branches rooting and forming new trees, e.g., White Cedar, Black Spruce. | • Once established, a tree will grow rapidly:<br>○ if growth needs are met (light, water, nutrients)<br>○ when there's more height and root growth than diameter growth.<br>• Fast-growing trees can quickly dominate surroundings.<br>• Shade-tolerant trees often survive until growth conditions improve. | • Space, light and moisture will affect tree growth in mature stage.<br>• Trees survive best if they reach the upper canopy (overstory).<br>• Potential for diameter growth is greatest in this stage.<br>• Mature trees will produce seed. | • Trees usually begin to decline long before they die.<br>• Stress by insects, disease, weather, human disturbance and inter-tree competition causes trees to lose vigour and their health to decline.<br>• Stress factors make trees more vulnerable to other causes of decline.<br>• With decline comes decay caused by fungal infections, which reduce tree quality and value, but increase habitat potential for wildlife, e.g., for cavity-dwellers. |

## LIFE CYCLE

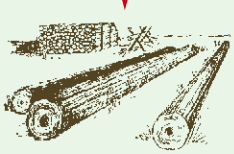
Germinating acorn.

A tree's potential lifespan varies by species. Most trees do not live to their potential.

Mature and declining trees can reproduce.

Almost all of a tree's energy is put into vegetative growth.

Dead and declining trees provide wildlife habitat.

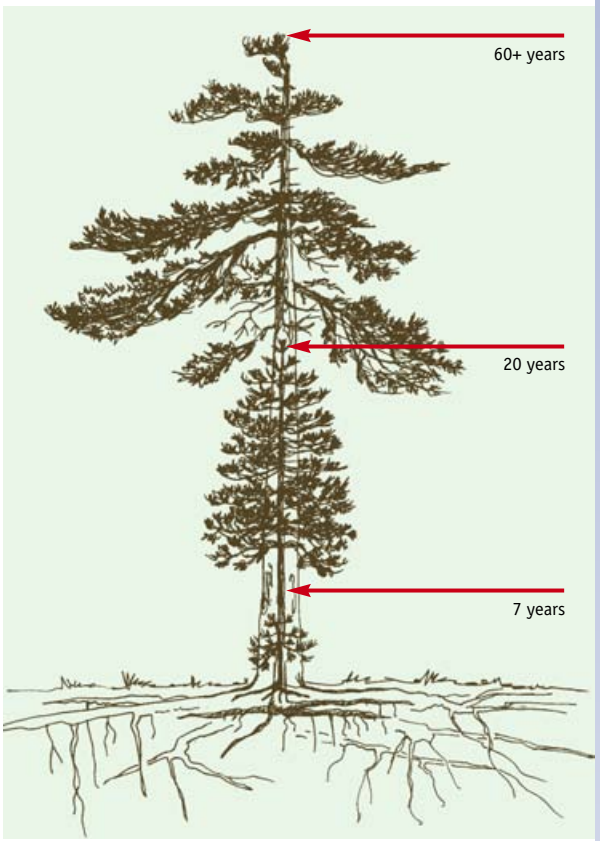


Harvesting can improve forest health by freeing up space for the remaining trees.

## TREE GROWTH

Like annual agricultural crops, trees become established and grow. Both convert light energy into chemical energy through photosynthesis. Both use this energy to send down roots and increase green (vegetative) growth.

This is where the similarities end. Unlike annual agricultural crops, trees are perennials and diversify their growth efforts to roots, buds, stems, branches and diameter growth.

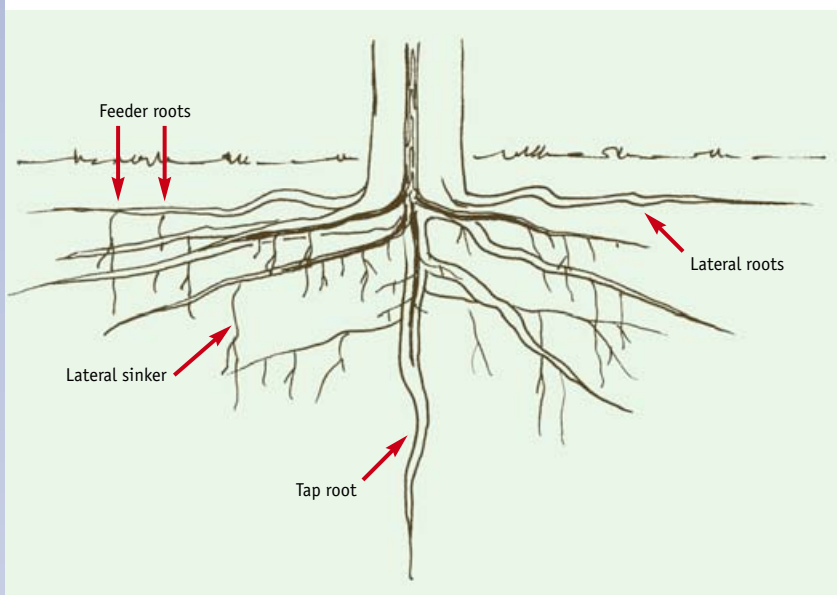



**Each year, a tree will grow both above and below the ground. Above-ground growth includes stem height and diameter, leaves and seeds; below-ground growth includes root length and diameter growth. All growth occurs in specialized tissues called meristems, which have the ability to divide and make new cells. Meristem tissues are concentrated at branch and root tips as well as in a thin layer of cells called the *cambium*, which is found just beneath the bark.**

## HEIGHT GROWTH

**Many trees, like this White Spruce, tend to have a *dominant* leader that releases hormones to suppress the growth of lateral branches near it. This is known as apical dominance. Apical dominance is the characteristic that contributes to height growth. Conifers tend to exhibit more apical dominance than hardwoods. This gives their characteristic pyramidal shape. Some hardwoods, like Maple and Oak, will have stronger apical dominance when they are young than when they are mature.**

## ROOT GROWTH AND DEVELOPMENT




**Roots provide two basic functions for the tree. They absorb and transport water and nutrients from the soil, and provide support for the above-ground portion of the tree. Roots will grow wherever environmental conditions are favourable, which in most cases is in the uppermost metre – although the major portion of a tree's root system is in the top few centimetres of soil.**

**There are two basic types of roots. Woody roots are large lateral roots that form near the base of root and stem. They support and anchor the tree.**

**Non-woody (feeder) roots are found mostly in the upper few centimetres of the soil and are used for absorption. In some species like Ash, they may have extensions called root hairs to increase the absorptive capacity of the tree. Many roots have mychorrizae (fungi) associated with them.**

## BUDS AND BRANCHES

**Height and branch growth generally begins as soon as a tree comes out of dormancy in the spring. Warmer temperature and longer days trigger bud opening and cell division, and growth in the branch just below the buds. Some buds will grow to form new lateral branches, others into leaves, and still others into flowers.**

## CROWN DEVELOPMENT

In forest conditions, inter-tree competition forces trees to grow taller, straighter and carry smaller crowns. In open-grown conditions, although the diameter growth is greater, trees tend to branch out, often do not grow straight, and have large crowns.

**The best logs are defect-free cylinders of wood. Woodland conditions are significant determinants in log quality.**

**One of the key goals of intensive forest management for valuable wood products is to manage the space between trees (and as a result, crown size) so as to strike a balance between maximum diameter growth, merchantable height and timber quality.**

## DIAMETER GROWTH

**Diameter growth is directly related to tree spacing and available light. The diameter growth (annual growth rings) of two 70-year-old Red Pine trees is contrasted in this picture. The one on the left shows evidence of tight spacing during establishment (small dark centre at right), and improved spacing (by thinning) and light conditions for most of its life (shown by white wood and large rings).**

**The tree on the right was subjected to high-density conditions (large dark centre) until the woodlot was thinned. Note how the lighter-coloured growth rings increase in width after the woodlot was thinned.**

The *cambium* is a thin layer of living cells between the wood of a tree and its bark. Each year these cells divide and increase the diameter of the trunk and branches by adding a new layer of wood to the tree. Tree diameter growth is greatest when there is adequate space, a well-positioned and well-formed crown, and no site limitations.

## TREE GROWTH REQUIREMENTS

*Silvics* is a word that describes the growth requirements and characteristics of a tree species in terms of its capacity to reproduce, establish, and develop. Silvics also indicates the potential of the species to react and adapt to forest disturbance and timber management activities.

Understanding silvics simplifies the prediction of species' performance to forest management practices. There are four key growth requirements that help to explain why species grow under certain conditions and why they are commonly found together on the same site. These are:

- light
- moisture
- nutrients
- soil/seedbed.

## SPECIES LIGHT REQUIREMENTS (SHADE TOLERANCE)

Trees require light for survival, growth and reproduction. Species such as Sugar Maple, Hemlock and Balsam Fir will survive and grow under the shade of existing trees. These trees are tolerant of shade and have adapted to regenerating in the understory of an existing forest.

**Shade tolerance refers to a plant's ability to survive and grow in the shade of another tree. Shade tolerance is a major driving force behind forest *succession*.**

Shade-tolerant species can survive this way for decades, growing relatively slowly in height and diameter until the existing canopy is opened up. They are often able to capitalize on the increased light levels and grow more vigorously. However, sometimes shade-tolerant trees can lose their ability to respond to improved growing conditions if they have survived under a heavy canopy for an extended period. Other species like Aspen and Birch require full sunlight and will not survive long in the shade.

| SHADE-TOLERANT SPECIES (CLIMAX SPECIES) | MID-TOLERANT SPECIES | INTOLERANT SPECIES (PIONEER SPECIES) |
|---|---|---|
| Hemlock, Beech, Ironwood, Sugar Maple, Balsam Fir | White Ash, White Spruce, Red Oak, White Oak, White Pine, Basswood, White Elm, Silver Maple, Red Maple | Aspen, Red Pine, Jack Pine, White Birch, Black Locust, Tamarack, Eastern Red Cedar, Black Cherry |
| **CAROLINIAN SPECIES** | | |
| American Chestnut, Black Gum, Big Shellbark Hickory, Black Maple, Blue Ash, Ohio Buckeye | Black Oak, Common Hackberry, Cucumber Tree, Blue Ash, Ohio Buckeye, Chinquapin Oak | Common Hop Tree, Dwarf Chinquapin Oak, Dwarf Hackberry, Honey Locust, Kentucky Coffee Tree, Northern Pin Oak |

**Balsam Fir is a shade-tolerant species that can survive as a sapling in the understory of a forest for decades. If the canopy is opened up through logging or other disturbance, the sapling is ready to capitalize on the increase in light thanks to a well-established root system.**

**Some tree species display different levels of shade tolerance throughout their life span. The slow-growing Eastern White Cedar requires full sunlight when it's young.**

## MOISTURE REQUIREMENTS

All plants require moisture for their day-to-day biological functioning, and trees are no exception. A tree draws in water through its roots where it's transported up through the stem and branches, and out to the leaves. In some cases, a tree's root system may extend well beyond its crown – sometimes as far as four to seven times the drip line perimeter of the tree crown as measured on the ground.

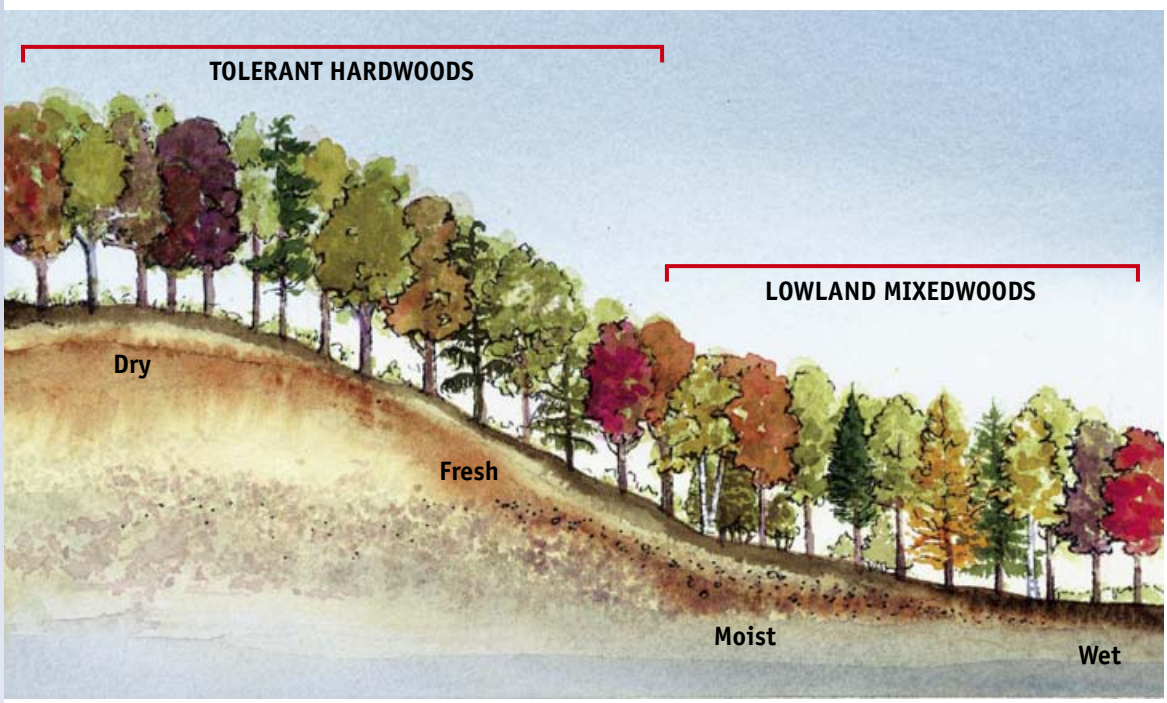
Some of the moisture in the leaf is used for photosynthesis, although the vast majority is lost through the process of evapotranspiration.

The availability of water throughout the growing season is classified using the concept of soil *moisture regime.* There are four moisture regimes. Some species are adapted to only one, while others are adapted to all. The chart below summarizes the most common species by moisture regime. **Bolded** species in this chart refer to species that prefer that moisture regime.

**MOISTURE REQUIREMENTS OF SELECTED TREE SPECIES**

| MOISTURE REGIME | DESCRIPTION | COMMON SPECIES |
|---|---|---|
| 1. DRY | • soil drains rapidly<br>• no standing water | • **Jack Pine, Red Pine, White Oak,** Hemlock, Red Oak, White Pine, Red Maple, White Ash, White Birch, White Elm, Black Cherry, White Cedar |
| 2. FRESH | • soil is well-drained<br>• moisture capacity ideal for tree growth | • **Basswood, Beech, Butternut, Sugar Maple, White Pine,** Hemlock, Red Oak, Red Maple, White Ash, Ironwood, White Birch, White Elm, Largetooth Aspen, Black Cherry, White Cedar, White Birch, White Spruce |
| 3. MOIST | • standing water seasonally present<br>• soils imperfectly drained | • **Balsam Fir, Green Ash, Bitternut Hickory, Black Walnut, Bur Oak, Trembling Aspen,** Red Maple, Silver Maple, White Ash, White Birch, White Elm, Black Cherry, White Cedar, Ironwood, White Spruce, Tamarack |
| 4. WET | • standing water usually present<br>• poorly drained organic soils | • **Willow, Alder, Black Ash, Tamarack,** White Cedar, Balsam Fir, Green Ash, Red Maple |

***Species composition* will change with slope position based on species' moisture requirements. Towards the top of the slope, species such as Sugar Maple, Beech and Hemlock will grow on "fresh" sites. Towards the bottom, species such as Red Maple, Balsam Fir, and Tamarack will grow on "moist" sites.**



## NUTRIENT REQUIREMENTS

Trees need nutrients to grow. Most trees can grow on a range of sites. Soil nutrient availability is related to a number of factors, including:

### soil texture

- ▸ clay soils: tend to be more fertile
- ▸ loamy soils: intermediate in fertility
- ▸ sandy soils: tend to be less fertile

### soil pH

- ▸ most trees prefer a pH in the range of 5.5–7.5
- ▸ when the pH of a soil is above (more alkaline) or below (more acidic) this range, some nutrients may become unavailable to the plant.

**Red Pine does not do well on high lime soils. *Carbonates* within 50 cm (20 in.) of the soil surface can eventually kill Red Pine and may impact the growth of White Pine, White Spruce and Norway Spruce.**

| SOIL TYPE | POTENTIALLY LIMITING NUTRIENT* |
|---|---|
| HIGH pH (ALKALINE) | Boron, calcium, copper, iron, manganese, phosphorous, zinc |
| LOW pH (ACID) | Boron, calcium, molybdenum, phosphorous, potassium |

* when amount of available nutrient is insufficient for optimal growth

For more information about soil pH and woodlands, see *Establishing Tree Cover,* the second title in this two-volume series.

## SEEDBED REQUIREMENTS

Many trees have specific requirements for the type of seedbed needed for germination and survival. Seed characteristics vary widely from species to species.

Small seeds can penetrate thick sod. For example, White Elm and White Pine will often germinate in abandoned agricultural land, whereas the spinning action of Maple seeds helps them penetrate thick layers of leaf litter. Oak are partially dependent on wildlife to spread and bury their acorns.

**Yellow Birch is a prolific seed producer – but few of these seeds germinate or survive. Yellow Birch seeds require exposed mineral soil or humus as well as the right amount of light and moisture to germinate and survive. Sometimes the only suitable sites are decaying stumps or mossy logs.**

**Tree roots can exert extreme forces to penetrate fissures and crevices on shallow to bedrock soils.**

## WOODLAND GROWTH – FOREST DYNAMICS AND CHANGE

A forest is an interconnected association of trees, plants, wetlands, insects, diseases and wildlife. Each forest is also in a constant state of change as the individual components in it grow, reproduce and eventually die. The mechanism that drives this change is a dynamic one based on a number of factors summarized in the next chart.

**CATALYSTS FOR CHANGE IN FORESTS**

| FACTOR | EXPLANATION | EXAMPLES |
|---|---|---|
| SILVICS AND SITE CONDITIONS | • Species-specific growth requirements | • Upland trees intolerant of high water tables |
| FOREST GROWTH AND DYNAMICS | • Competition for space, light, soil rooting volume, moisture and nutrients as trees grow | • Woodland trees that out-compete their neighbours grow quicker and live longer |
| NATURAL FORCES | • Natural factors that affect tree growth, reproduction and mortality | • Wind, fire, insects, and disease<br>• Ice accumulations |
| HUMAN IMPACTS | • Past land use and management practices | • Grazing, clear-cutting vs. carefully planned harvests |

## WOODLAND GROWTH AND TREE CROWN FORM

Crown form or shape is important because it influences the amount and quality of the wood produced. Crown form may also vary depending on where the tree is growing. Open-grown trees often have a crown that is too large and branchy to produce valuable saw logs (although large crowns are indicators of relatively high sap sugar content for maple syrup). Forest-grown trees in *stands* that are quite dense often have small crowns that can't support good growth. As a result these trees tend to be less vigorous, growing more slowly in diameter. Smaller, narrower crowns often result in permanently stunted trees that won't respond well, even if nearby trees are removed and exposure to sunlight is increased.

**Tree grown in forest.**

**Tree grown in open field.**

**Widely spaced trees growing in open fields are not affected by competition from neighbours. As a result, they tend to grow to a shape that is characteristic of the species. Generally, the open-grown White Pine tends to hang onto most of its branches. The form of the forest-grown White Pine is quite different. Competition from other trees shades out the lower branches as the tree grows in height. With proper management, the mature, forest-grown White Pine has a long, straight, relatively branch-free trunk that's often more valuable than the open-grown tree.**


**Crown position and size are important because trees with larger crowns tend to support higher levels of wood production. The crown position of a forest-grown tree can be classified into one of five general types.**

**1 = DOMINANT: A tree with a crown that is above the surrounding tree crowns and able to receive full sunlight. These trees are larger than the average trees in the stand and have well-developed crowns.**

**2 = CO-DOMINANT: Trees with crowns in the upper canopy and at the same level as one or more of the adjacent trees. These trees receive sun from above and usually have medium-sized crowns.**

**3 = INTERMEDIATE TREES: Trees receiving little direct light from above or from the sides; usually with small, crowded crowns that are most often below the canopy formed by co-dominant trees.**

**4 = SUPPRESSED: Trees with crowns that are below the adjacent trees and receive no direct sunlight.**

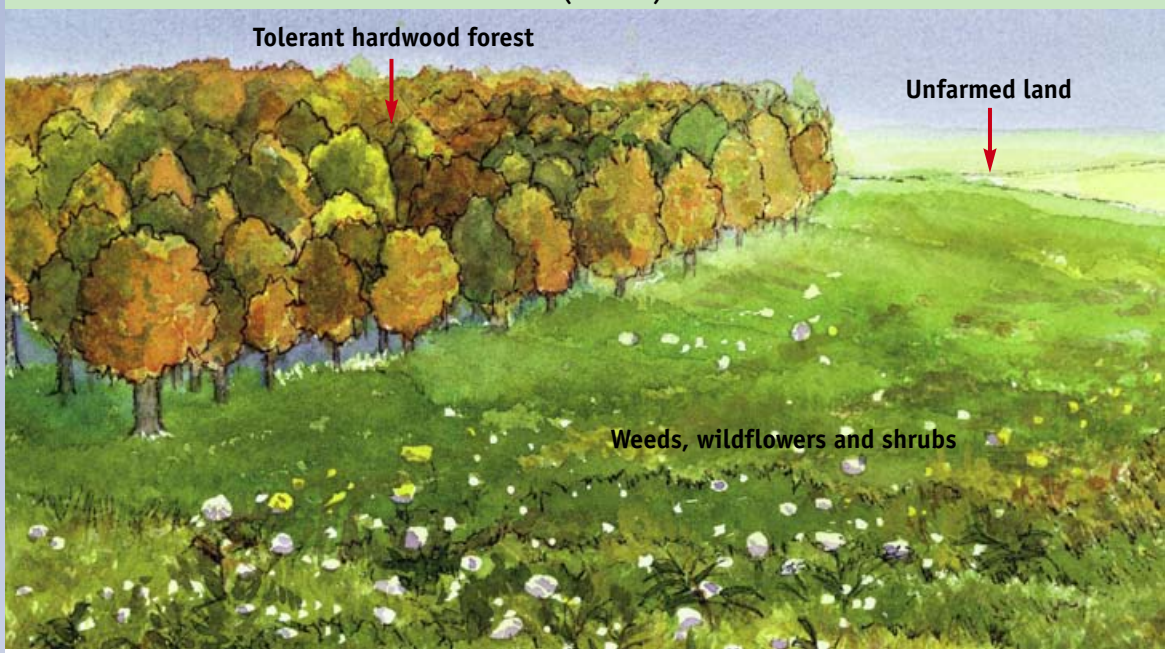
**5 = UNDERSTORY: Young trees, shrubs and other plants growing beneath the tall, mature trees in a timber stand.**

Forest management practices are designed to mimic the natural processes of change within a forest. By understanding what's happening now and what will happen in the future, you can make informed management decisions that will help you achieve your objectives for your woodlot.

## SUCCESSION – A NATURAL PROCESS

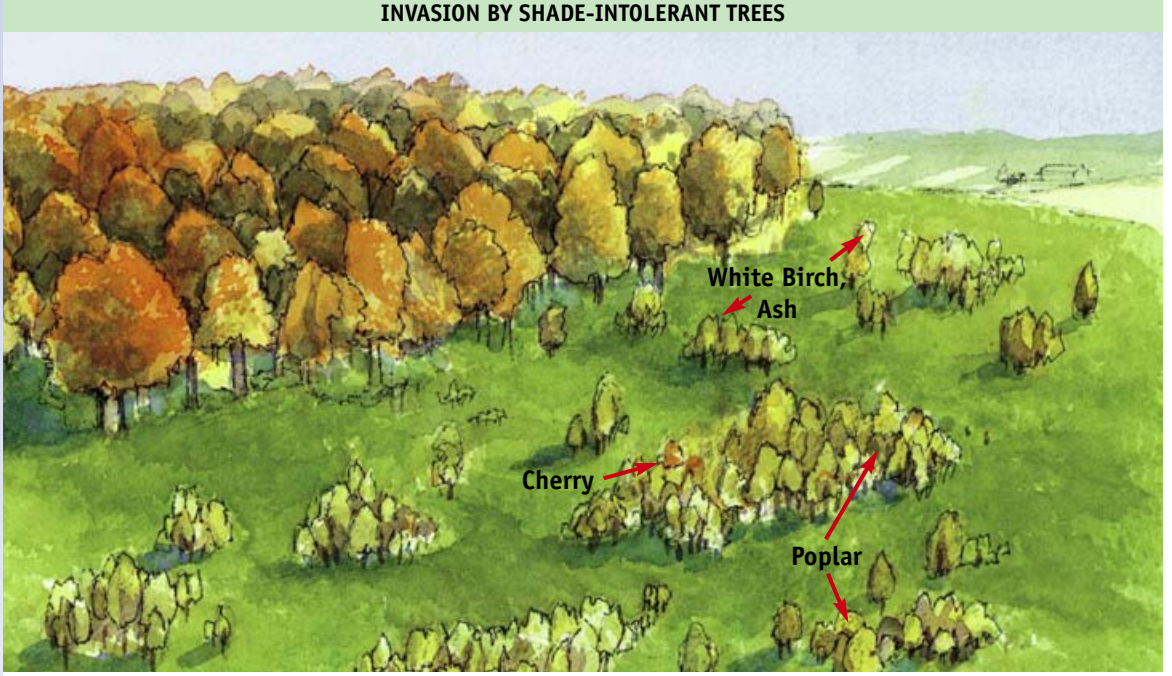
*Succession* is a natural and gradual process where existing plant species give way to new ones. Over many decades, a field that isn't cropped will convert to a forested state as sun-loving (shade-intolerant) pioneer tree species seed into the open area. Eventually, these trees will also be replaced by more shade-tolerant species capable of establishing themselves in the understory.

## UNFARMED (FALLOW) LAND




At first, unfarmed or fallow land is colonized by weeds, herbs, forbs, grasses and shrubs that specialize in finding disturbed areas and reproducing rapidly. Eventually perennial plants such as grasses and wildflowers will move in and replace the original weedy species.

## INVASION BY SHADE-INTOLERANT TREES

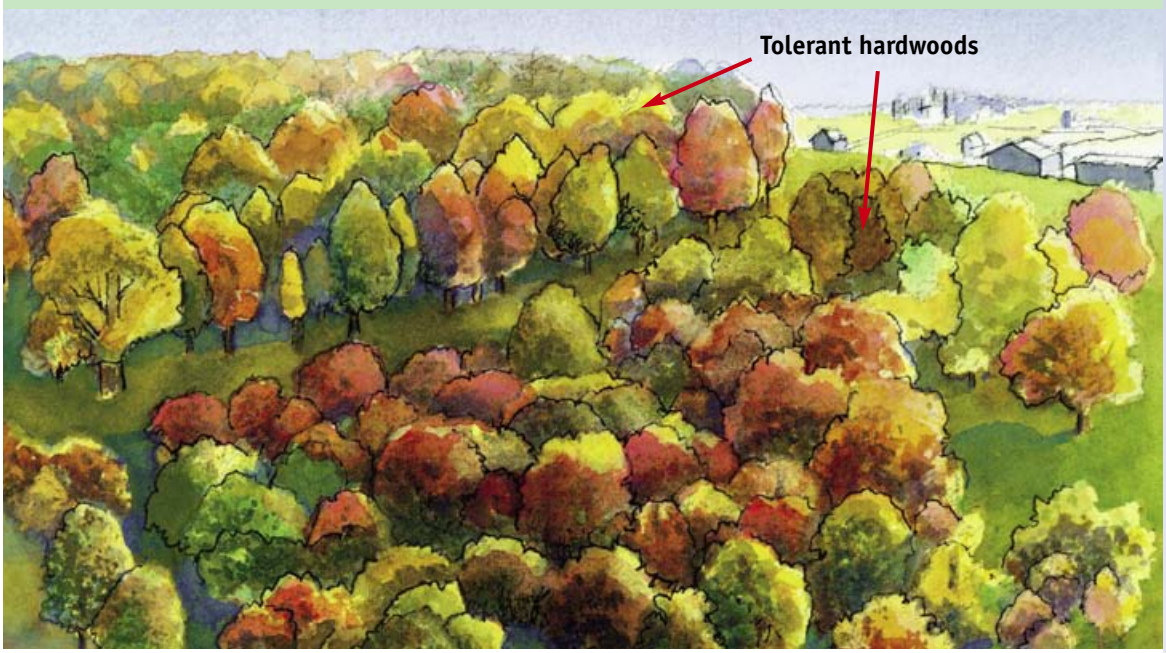



Over time, shade-intolerant pioneer species like White Birch, Ash, Poplar and Cherry will become established throughout the field. These fast-growing trees (pioneer species) are well-adapted to open sites and quickly grow to dominate the site. Maple as well as other shade-tolerant species are often not able to survive in open areas where grasses and other vegetation can out-compete them for nutrients, and especially moisture. Because most pioneer species are adapted to surviving on drier soil conditions, they are often better able to bear the heavy competition of the open field.

**TRANSITION STAGE**


**Eventually the pioneer species will dominate the open site, creating shade on the forest floor that prevents them from reproducing. The closed canopy creates a favourable environment for more shade-tolerant species such as Sugar Maple and Red Maple that begin to become established in the understory.**

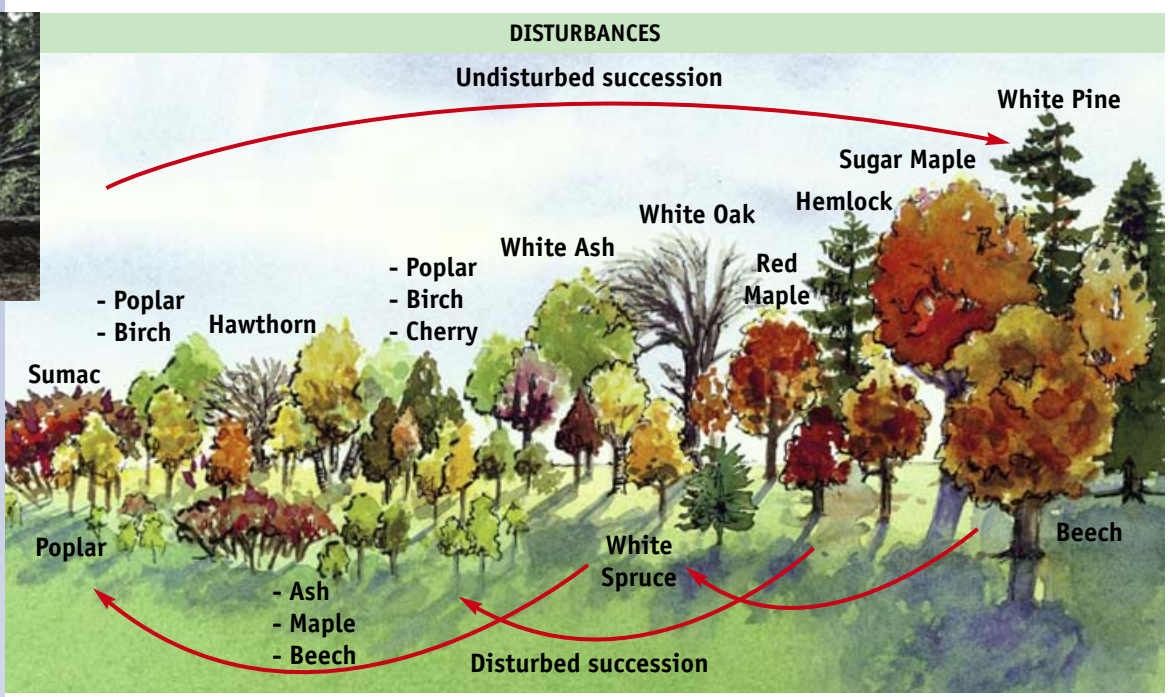
**CLIMAX FOREST STAGE**




**Over time, the short-lived pioneer species die or are harvested, and the forest changes to one dominated by tolerant (climax) species.**

## DISTURBANCE

Were it not for disturbance, forest succession would follow a gradual and predictable course of events. Disturbance is a much more abrupt and random process of change that occurs as a result of insect infestation, disease, weather-related events and human intervention. Forest disturbance can adjust the course of succession by altering the structure or composition of a forest stand.




**Major disturbances such as significant changes in the water table, wind, fire, insect/disease infestation, heavy harvests and ice damage will have a dramatic impact on the long-term development of a forest stand. Significant crown damage opens the stand up and changes the amount of light hitting the forest floor. In turn, the increased light levels have an impact on what type of species can and can't regenerate underneath.**

***Even-aged*** **conifer plantations are an excellent way to allow shade-tolerant hardwood forests to become established in the understory. Over time as the conifers are removed through thinning, the hardwoods will grow to eventually dominate the site.**

**Similar to natural disturbances in a stand, harvesting trees can promote favourable regeneration. Removing individual trees or small groups of trees in a hardwood stand favours the regeneration of shade-tolerant species.**

**This canopy gap is large, favouring the regeneration of mid-tolerant species like Oak and White Pine.**

## WOODLANDS AS ECOSYSTEMS

Woodland ecosystems have two main components:

- physical – geological materials, soil, water table, slope, aspect, climate
- biological – tree vegetation, non-tree vegetation, microbes, insects, birds, mammals.

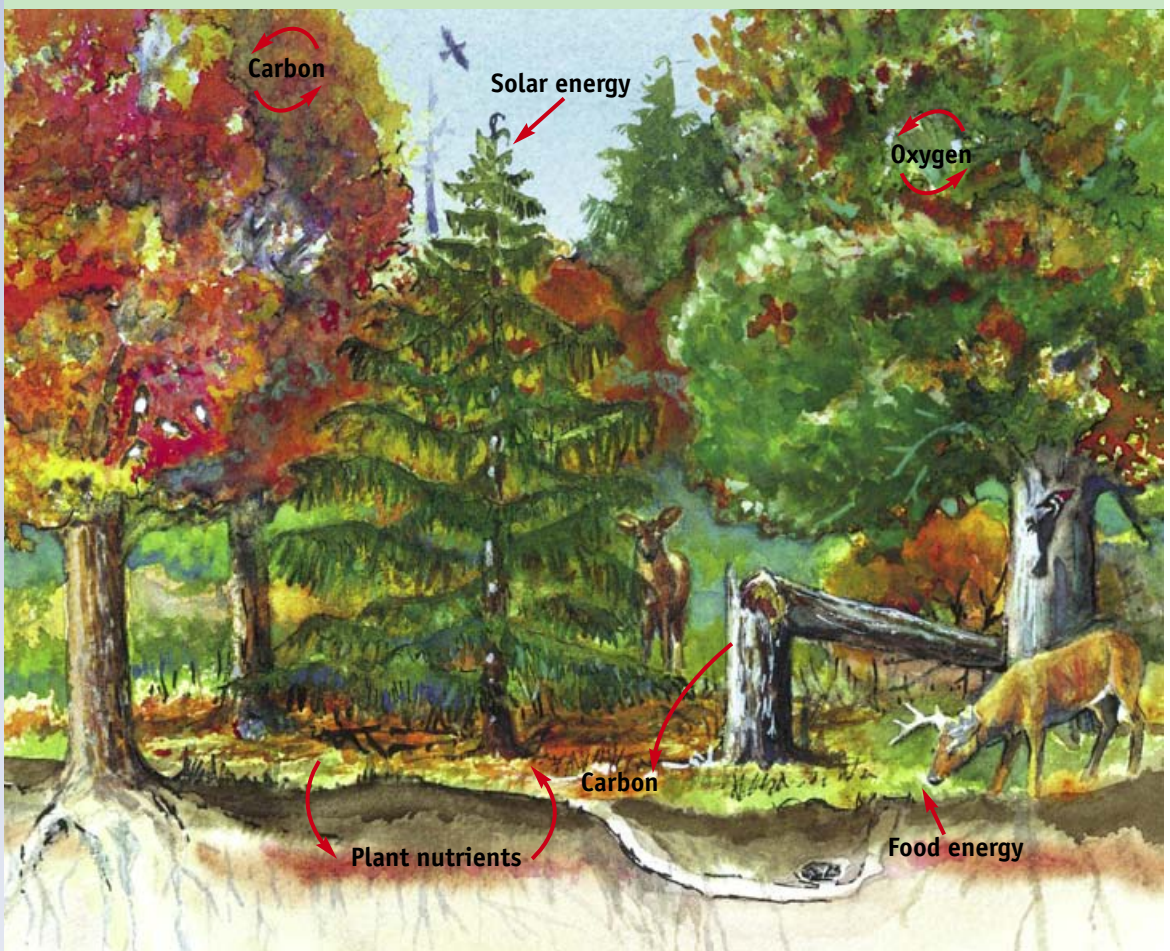
Woodland ecosystems are constantly cycling nutrients, organic matter and energy. For example, energy from the sun is transformed into plant materials. Plants feed animals. Microbes return plant and animal debris to the soil, which feeds the plants. Any severe disturbance of one key component (e.g., forest fire on forest vegetation) could have a profound impact on the ecosystem.

**Woodland ecosystems include geological materials, soil, understory vegetation, seedlings, saplings and canopy trees – plus all the microbes, insects and other fauna that live within these layers of soil and vegetation.**

**The aftermath of a forest fire has significant implications for all life forms in a forest ecosystem.**

Understanding woodland ecosystems helps to predict the impact and outcome of planned woodland management practices. For example, a harvest of an upland Ash-Hickory stand where more than one-third of the trees is removed may have minimal long-term impact on the woodland. However, a similar management practice in a lowland mixedwood may lead to higher water tables and excessive windthrow damage, and change the stand's species composition.

**UPLAND HARDWOOD-HEMLOCK ECOSYSTEM**



Woodland ecosystems are constantly changing and reacting to stress and disturbances. However, many woodland ecosystems eventually reach a steady state, where the forest composition remains similar for a manageable length of time. In these ecosystems, a particular community of forest vegetation and forest fauna will be commonly found in a specific and somewhat narrow range of site conditions. For example, tolerant hardwood ecosystems are normally found on well-drained loam soils, and lowland mixedwoods are found on poorly drained, coarse-textured to loamy soils.

**1. Shagbark Hickory**
**2. Trilliums**
**3. Red Osier Dogwood**
**4. Swamp White Oak**
**5. Cardinal Flower**

**A. Red-bellied Woodpecker**
**B. Karner Blue Butterfly**
**C. Indigo Bunting**
**D. Wild Turkey**
**E. Prothonatory Warbler**

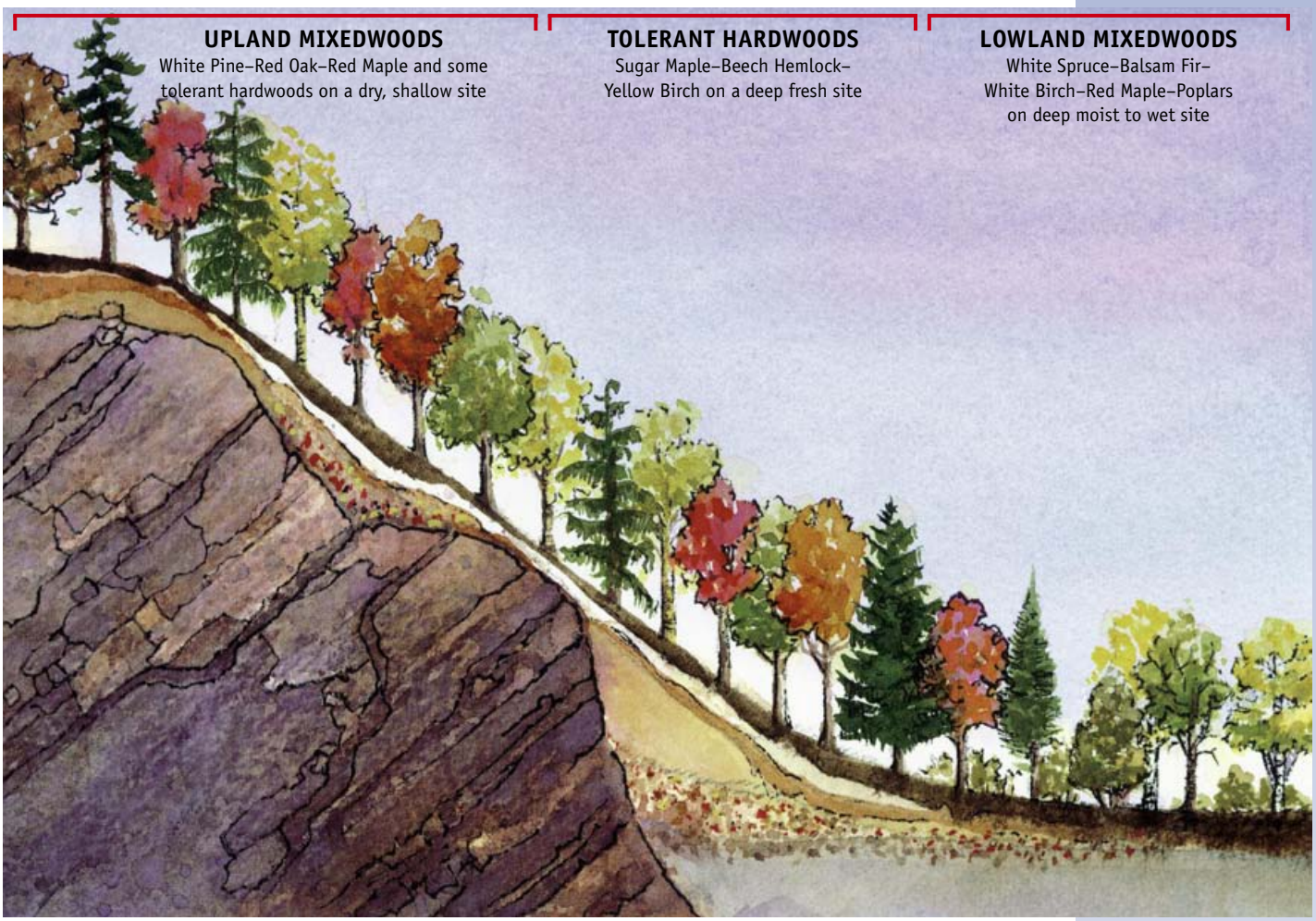
**F. Red-shouldered Hawk**
**G. Flying Squirrel**
**H. Opossum**

**CAROLINIAN FOREST ECOSYSTEM**

## LOWLAND HARDWOOD (SWAMP) ECOSYSTEM


1. Silver Maple
2. Green Ash
3. Skunk Cabbage
4. Cinnamon Fern

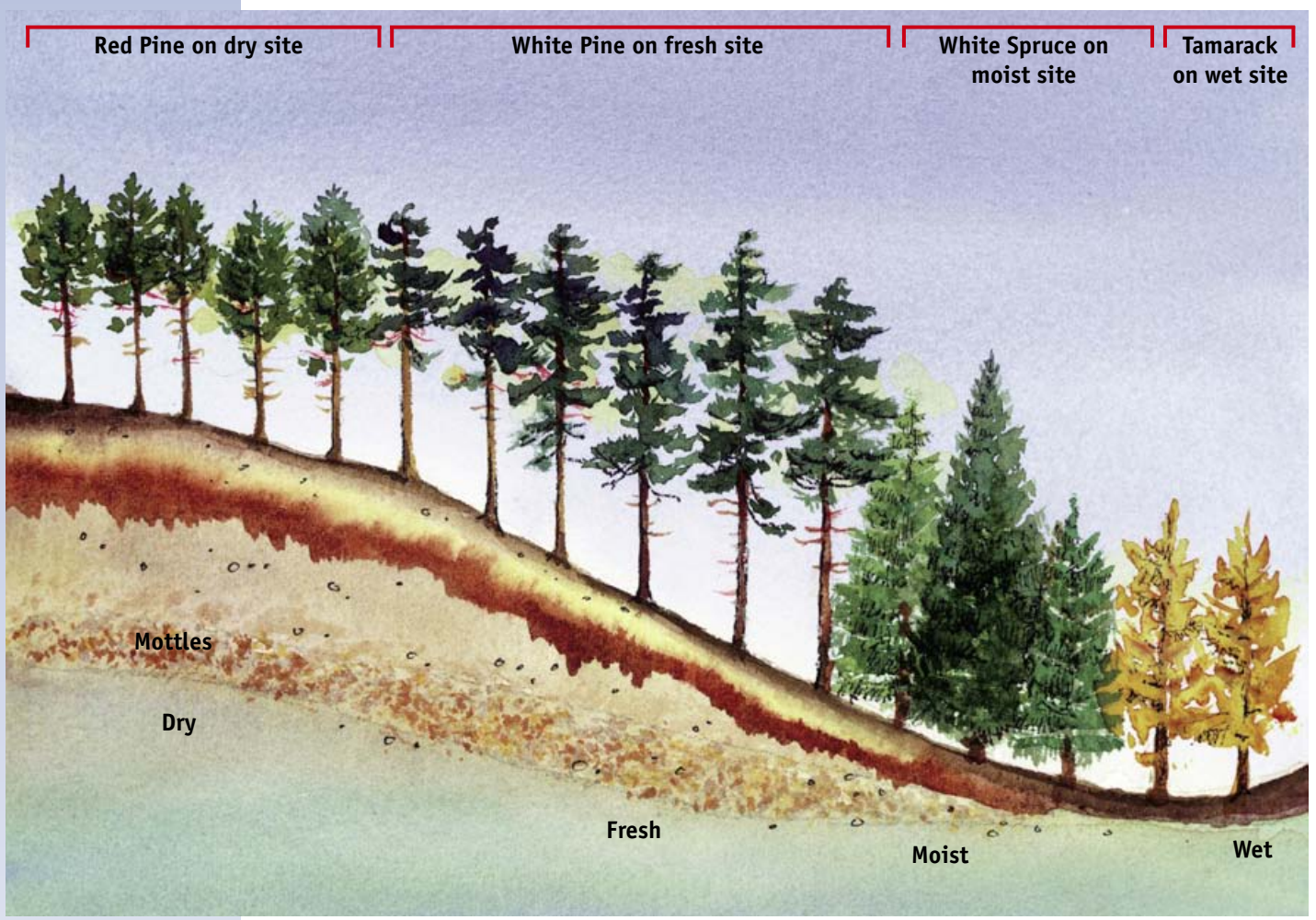
A. Midland Painted Turtle
B. Blue-spotted Salamander
C. Red-spotted Newt
D. Wood Ducks
E. Red-shouldered Hawk
F. Pileated Woodpecker



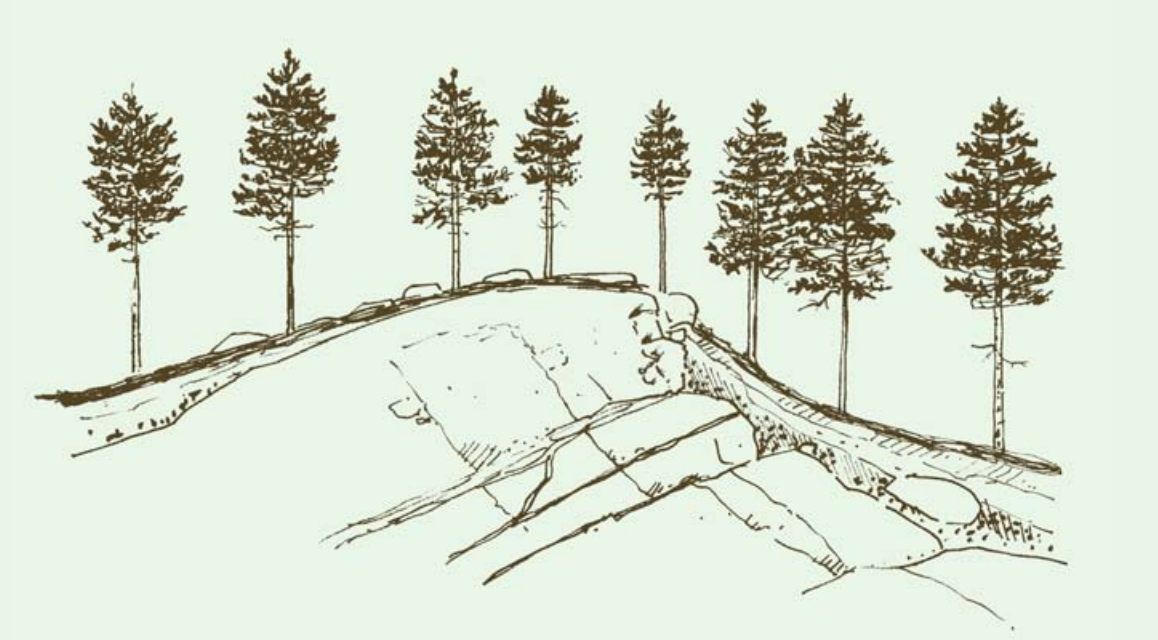

**There are at least three distinctly different ecosystems depicted in this illustration: the Pine-Oak mixedwoods on the dry, shallow to bedrock site at the top of the slope; the tolerant hardwoods in the fresh, mid-slope position; and, the lowland mixedwoods in the moist-wet, lower slope position. For forest management planning, these ecosystems should be treated differently.**

## SITE CONSIDERATIONS

Whether you're establishing a new forest or managing an existing one, it is important to understand the soil and site characteristics that influence tree growth and survival. Soil and site characteristics influence the commercial potential of the stand. They dictate what will grow well on the site.




**The healthy and fast-growing trees in this mixed conifer plantation have been matched properly to existing site conditions. Trees not planted on the right site (off-site plantings) will not thrive.**



**This illustration shows how soil depth can influence tree height. A stand of Red Pine tends to grow to the same height unless the trees are affected by poorer site conditions. In this case, the trees growing on the shallower soils (poorer site) are noticeably shorter than those on the deeper soils.**

## BIOLOGICAL COMPONENT

### BIODIVERSITY

Biological diversity or biodiversity refers to the variety of life, expressed as a measure of the variety and genetic diversity within ecosystems. It refers to the total number of different "types" of living organisms.

The loss of biological diversity is a growing global concern. In Canada, more than 200 species are considered threatened or endangered and many more are of provincial or local conservation concern.

Biodiversity sustains life on Earth and has a direct impact on the health of Ontarians. Ontario is helping protect our natural heritage of plants, animals, and ecosystems with its Biodiversity Strategy.

To some, conserving biological diversity and conducting a profitable forest harvesting operation have been considered incompatible activities. However, over the last few decades our understanding of the ecological processes that promote the maintenance of biological diversity has improved. By promoting some of the features listed in the following sequence of photographs, you can help reduce any negative impacts that forestry and agricultural operations have on these ecological processes.

**Biodiversity is the variety of life at all levels, from the smallest insect to the largest forest.**

**Old-growth forests are biologically diverse. Old-growth forests have multi-layered canopies (including super-canopied trees) and a high degree of tree species diversity (including mid-tolerant). They have an abundance of large-diameter, living and dead trees, cavity trees, and downed, woody debris.**

**OLD-GROWTH FOREST**

**Uprooted trees create small pits and mounds that provide habitat for plants as well as vital breeding locations for amphibians in the early spring.**

**Deadwood on the forest floor plays an important ecological role by providing food and habitat for numerous species.**

**Large trees that extend well above the forest canopy provide roosting habitat for several species of birds and mammals.**

**Large trees provide important cavity nesting sites for birds and other wildlife.**

## INVASIVE SPECIES THREATEN BIODIVERSITY

Non-native or introduced species can pose a significant threat to ecosystem function and biodiversity. There are a number of terms often used interchangeably to describe introduced species, including exotic, alien, and invasive.

*Invasive species* pose a significant threat to the biological diversity of an area. They have the ability to:

- flourish – they have few predators, produce large numbers of offspring and can survive over a broad range of habitat types
- dominate an ecosystem – they push out native plants and animals and prevent the establishment of desirable species.

It is estimated that Canada's list of invasive species includes:

- one-quarter of the 5,000 plant species
- 180 forest insect pests
- hundreds of other insect species
- an undetermined number of fish, molluscs, mammals, and diseases.

**The Emerald Ash Borer is killing Ash trees in parts of southwestern Ontario. Well-adapted to Ontario's climate, it poses a serious threat to North American forests.**

**European Buckthorn was imported as a landscape shrub from Europe in the late 19th century and has since spread to much of southern Ontario. It is an alternate host for the fungus that causes leaf and crown rusts on oats.**

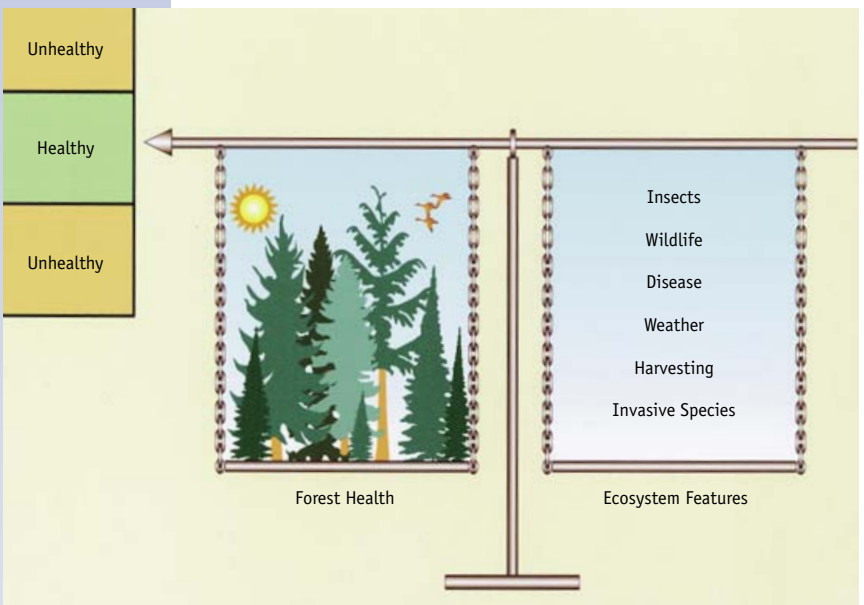
## FOREST HEALTH

Forest health is an important issue that should be considered when making management decisions about your woodlot. There are certain basic things that you need to consider to determine whether your woodlot is healthy. Ask yourself:

- is the forest growing well?
- are many of the trees declining or having insect or disease problems?
- has a recent drought left the forest more vulnerable to other problems?

A healthy forest ecosystem can be thought of as one with a natural balance of organisms, each with its own role to play in the maintenance of that ecosystem. Biological diversity, soil productivity, and natural disturbances are ecosystem features that, when in balance, help maintain forest health. It will be important to judge on an ongoing basis whether the health of the forest has changed over time.

Worksheet #23 in the *Environmental Farm Plan Workbook* suggests several actions farmers should take to determine whether their woodlots are healthy or unhealthy.




**Woodland health is a balance of ecosystem features that include wildlife, trees, plants, insects, disease, and human activity – too many or too few of one particular feature can tip the balance and result in an unhealthy forest. If your forest is unhealthy, it may require corrective action or a change in your management plans to bring it back into balance.**

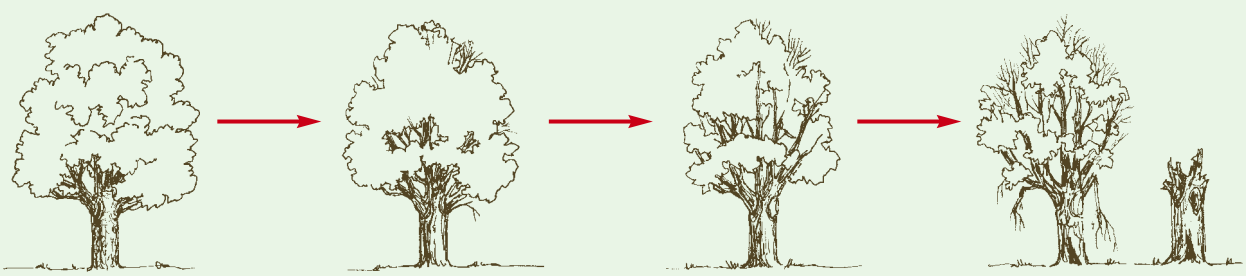
**One way to help maintain a healthy woodlot is to "scout it" three to four times a year to check for degradation, unauthorized use, forest pests or disease, and the presence of invasive species.**

## TREE STRESS

Trees are affected by stress. Stress weakens a tree, in turn making it more susceptible to the impacts of other living *(biotic)* and non-living *(abiotic)* stressors. Tree death seldom occurs by one stressor alone. Most trees are weakened by one stress, making them more susceptible to secondary stressors that may attack and kill the weakened tree.

**Forest Tent Caterpillars can completely defoliate a tree each spring for two or three years in a row. Many trees are adapted to this type of stress and will usually send out a new set of leaves, helping it complete its annual life cycle. However, if the tree is impacted by another stress like a summer drought or another type of insect, it may weaken, decline, and eventually die.**

**LIFE CYCLE**




**Trees seldom die quickly. Instead they tend to decline slowly over time, losing vigour until they are no longer able to sustain life. Decline is caused by stresses like insects, disease, and weather. In the early stages of decline, trees will often recover if the stress is reduced. If the decline is severe, however, a tree may not be able to recover even if the stress is alleviated.**

**Oak trees are susceptible to a wide number of insect and disease stressors including:**

- **defoliators – Forest Tent Caterpillar, Oakworm (several species), Gypsy Moth Caterpillar (pictured) (invasive) and Fall Cankerworm**
- **stem/wood insects – Carpenter Worm (borer), Carpenter Ant and Two-lined Chestnut Borer**
- **diseases – Armillaria Root Rot, Oak Wilt (not yet reported in Ontario), Sudden Oak Death (not yet reported in Ontario).**

**Repeated insect problems may weaken a tree, making it more susceptible to other stressors. Armillaria is currently the only significant disease affecting Oak in Ontario. However, Oak Wilt and Sudden Oak Death Syndrome are moving this way from the United States and represent a very serious threat to our Oak species.**

Insects and disease are not the only factors affecting forest health. Ice storms, wind damage, forest fire and human impacts from logging can have a dramatic effect on forest health.

**Weather-related events like drought, ice and windstorms can have a serious impact on forest health. Damage like this can take both forests and trees decades to recover from.**

## WOODLAND TYPES

Forest trees can grow in a variety of conditions and sites, and over a wide geographic area. Red Oak, for instance, can be found growing across southern Ontario and as far north as Temagami.

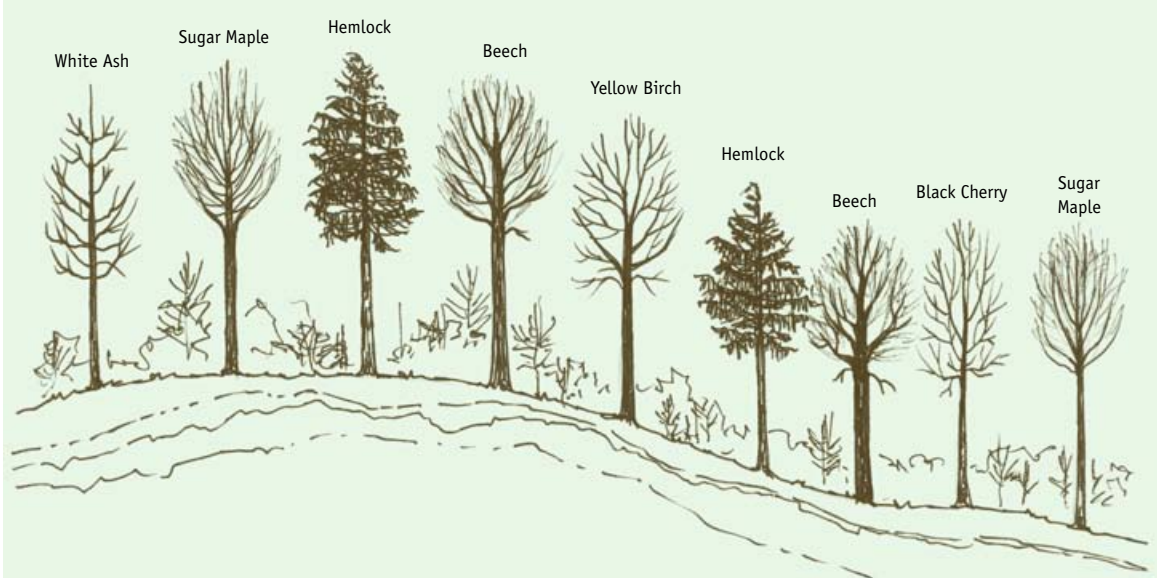
The presence and quality of any given tree species on a site depends on:

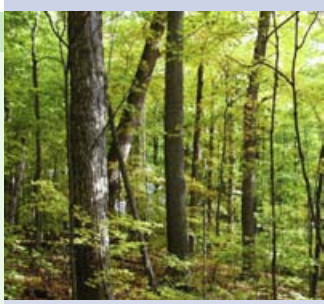
- soil and site conditions
- tolerance to overstory shade
- length of growing season
- disturbances, both natural and man-made
- competition from other trees and vegetation
- presence of a nearby seed source, if of seed origin.

Many tree species are commonly found together under similar circumstances. These associations of species that thrive under similar conditions are often called forest cover types or *working groups.*

For the purposes of this book, forest cover types have been simplified into six working groups based on common species, soil and site preferences, ecological adaptations and position in the landscape. These six types are listed in the first column of the chart on the next page. **Bolded** species in the table are those that dominate the working group. Other (non-bolded) species are commonly found in the working group but generally don't dominate it.

**TOLERANT HARDWOODS AND HEMLOCK**



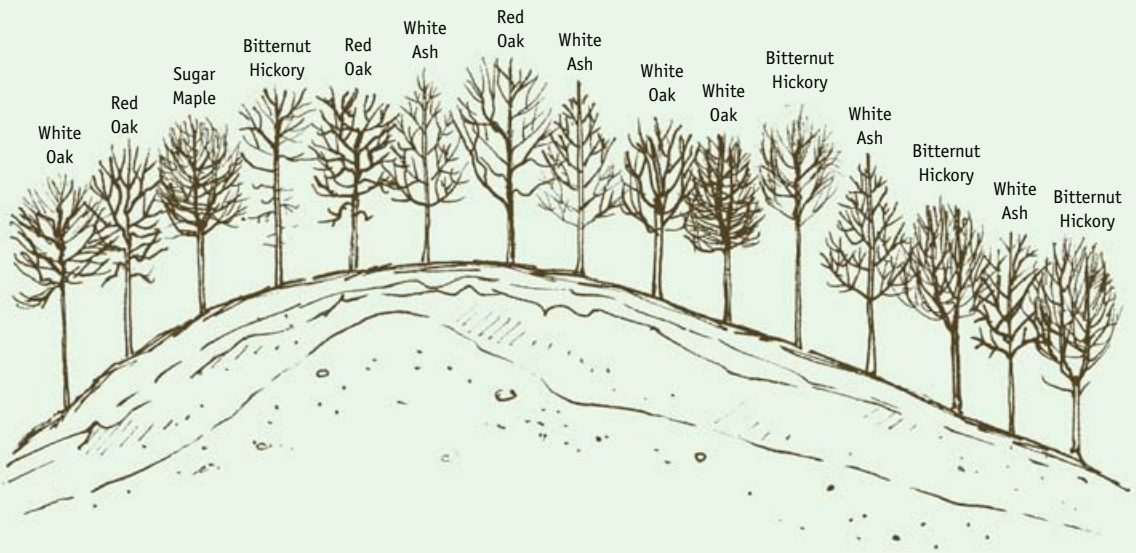
**Tolerant hardwoods consist mostly of Sugar Maple, Beech and Hemlock. They're usually found on well-drained soils throughout southern Ontario.**

**WOODLAND TYPES – KEY CHARACTERISTICS**

| WORKING GROUP | COMMON TREE SPECIES | CAROLINIAN ADDITIONS | TYPICAL SOIL AND SITE TYPE | TYPICAL LOCATIONS AND LANDFORMS | ECOLOGICAL ADAPTATION SYSTEMS | MOST SUITABLE MANAGEMENT |
|---|---|---|---|---|---|---|
| TOLERANT HARDWOODS AND HEMLOCK | • **Sugar Maple, Beech, Hemlock**<br>• White Ash, Black Cherry, Basswood, Yellow Birch, Hemlock | • Tulip Tree<br>• Sassafras<br>• Hackberry<br>• Sycamore | • dry to fresh moisture conditions (well-drained), shallow to deep soil<br>• well-drained sandy loams to clay loams | • moderately shallow to deep fertile soils on ground moraine drumlins and end moraines | • shade-tolerant | • single tree selection<br>• *group selection* |
| UPLAND MID-TOLERANT HARDWOODS | • **White Ash, Bitternut Hickory, Red Oak**<br>• White Oak, Green Ash | • Pignut Hickory<br>• Black Oak | • fresh to moist (well-drained to imperfectly drained) deep soils | • deep fertile ground moraines<br>• end moraines<br>• loess and lacustrine soils | • intermediate shade-tolerant | • modified shelterwood<br>• group selection |
| UPLAND MIXEDWOODS | • **White Pine, Red Oak, White Oak, Red Pine**<br>• Red Maple, White Ash, Sugar Maple | • Black Oak<br>• Chinquapin Oak<br>• Kentucky Coffee Tree | • dry to fresh moisture conditions<br>• shallow to very shallow soils with good drainage<br>• sandy sites | • Canadian Shield dry rock ridges<br>• top of bedrock-controlled drumlins<br>• sandy soils (dunes and beaches) | • adapted to fire and dry soil conditions | • uniform shelterwood |
| EARLY SUCCESSIONAL HARDWOODS | • **Trembling Aspen, Largetooth Aspen, White Birch**<br>• Black Cherry, Green Ash, White Pine | • Sassafras<br>• Tulip Tree | • most soil types | • most sites – less common on moist sites | • adapted to colonizing disturbed sites<br>• heavy production of light seeds | • modified clearcut |
| LOWLAND HARDWOODS | • **Red Maple, Silver Maple, Green Ash, Black Ash, Elms, Bur Oak**<br>• Yellow Birch, White Birch | • Hackberry<br>• Swamp White Oak<br>• Big Shellbark Hickory | • moist to wet soil conditions<br>• moist mineral soil<br>• organic soils<br>• poor drainage | • swamps<br>• moist soil around wetlands, lakes, outwash plains<br>• lacustrine plains | • tolerant of flooding | • group selection<br>• shelterwood<br>• single tree selection (upland) |
| CEDAR AND LOWLAND MIXEDWOODS | • **White Cedar**<br>• White Birch, Trembling Aspen, Balsam Poplar, White Spruce, Balsam Fir, Tamarack | | • very dry, shallow sites<br>• moist to wet soil conditions<br>• nutrient-poor sites | • shallow limestone plains<br>• high-lime soils<br>• swamps | • adapted to extremely dry and wet conditions | • shelterwood<br>• patch/strip<br>• clearcut |

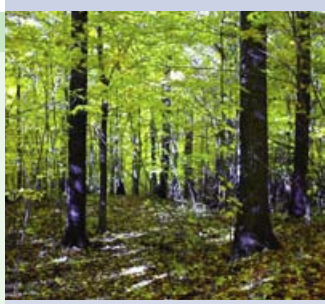
Adapted from *Silvicultural Guide to Managing Southern Ontario Forests,* Ontario Ministry of Natural Resources

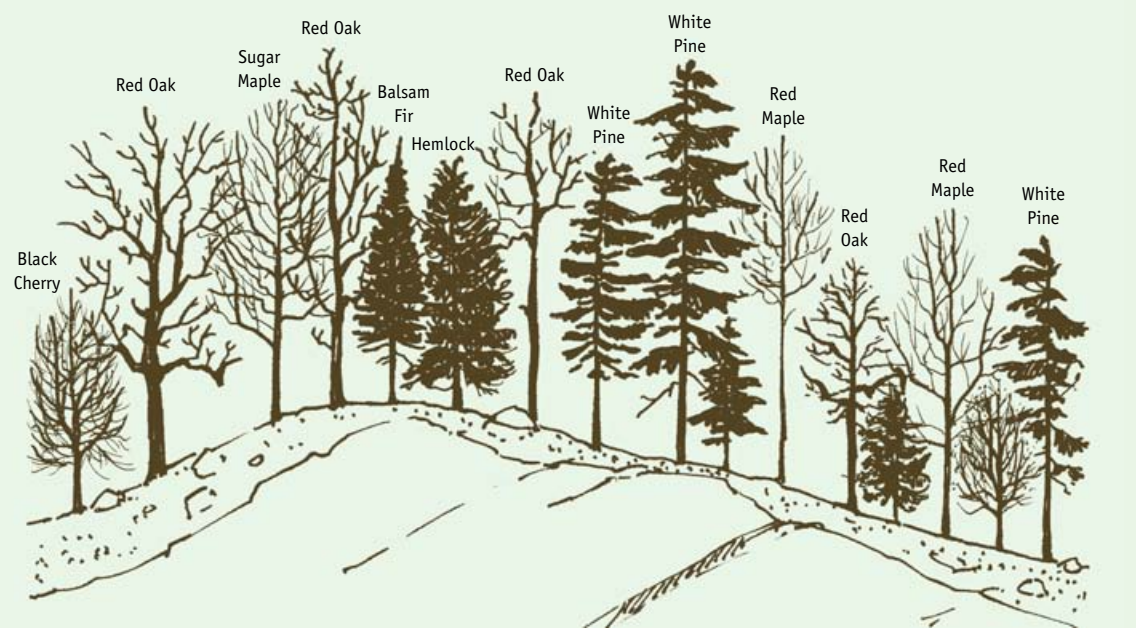
## UPLAND MID-TOLERANT HARDWOODS




**The most common trees in upland mid-tolerant hardwood forests are Oak, Ash and Hickory. Most stands are found on fresh to moist deep soils.**

## UPLAND MIXEDWOODS

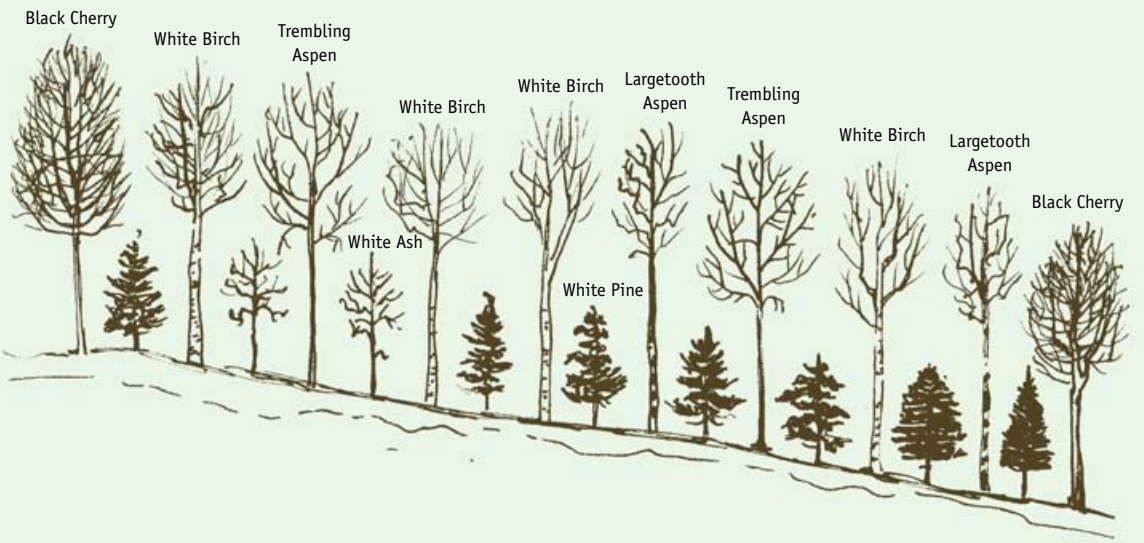





**Pine and Oak dominate the upland mixedwoods working group. These forests are usually found on dry to fresh shallow sites in central and eastern Ontario.**

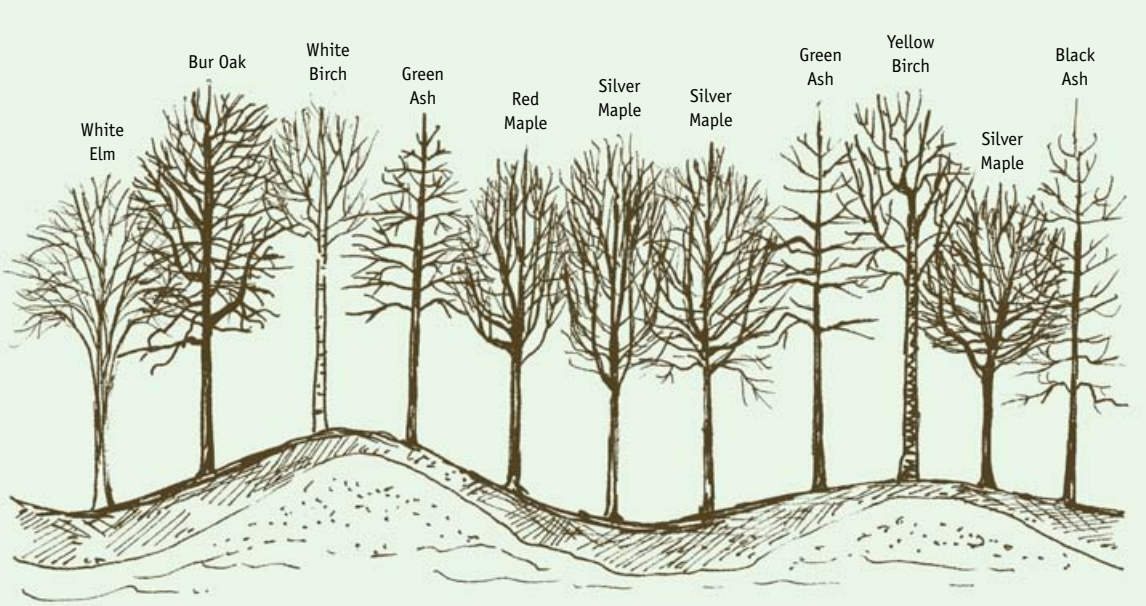
**Your woodland may have a number of species from other working groups. For example, in some woodlands, groups of early successional species such as White Birch and Trembling Aspen can be found growing with tolerant hardwood species.**

## EARLY SUCCESSIONAL HARDWOODS



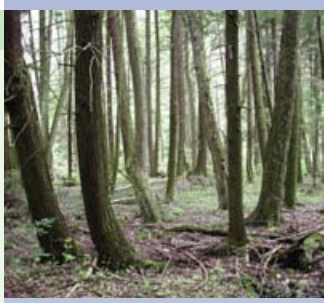

**Poplar species and White Birch with a conifer or hardwood understory typify this working group, which grows on a wide range of sites and is most common in eastern Ontario.**

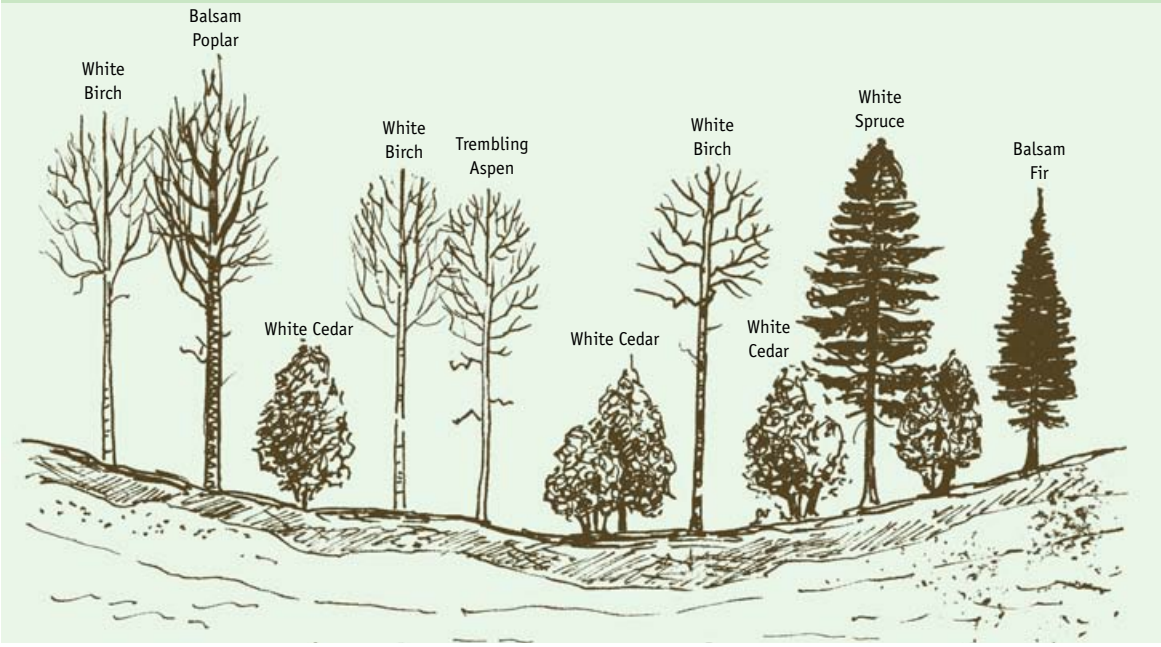
## LOWLAND HARDWOODS




**Lowland hardwoods consist mostly of Ash, Maple and Birch species that prefer moist to wet sites.**

## LOWLAND MIXEDWOODS





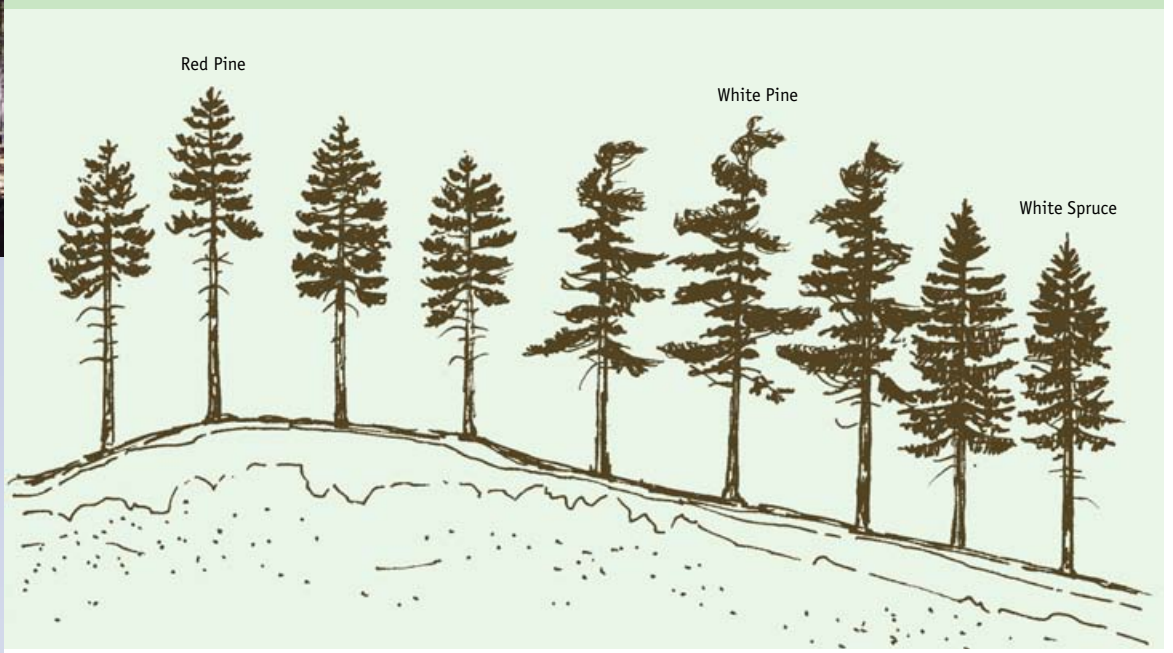

**Lowland mixedwoods are found on cool moist to wet sites and consist of conifers (Cedar, Spruce, Fir and Tamarack) as well as hardwoods (Birch, Poplar and Ash).**

## PLANTATION TYPES

Most established plantations found in Ontario are made up of:

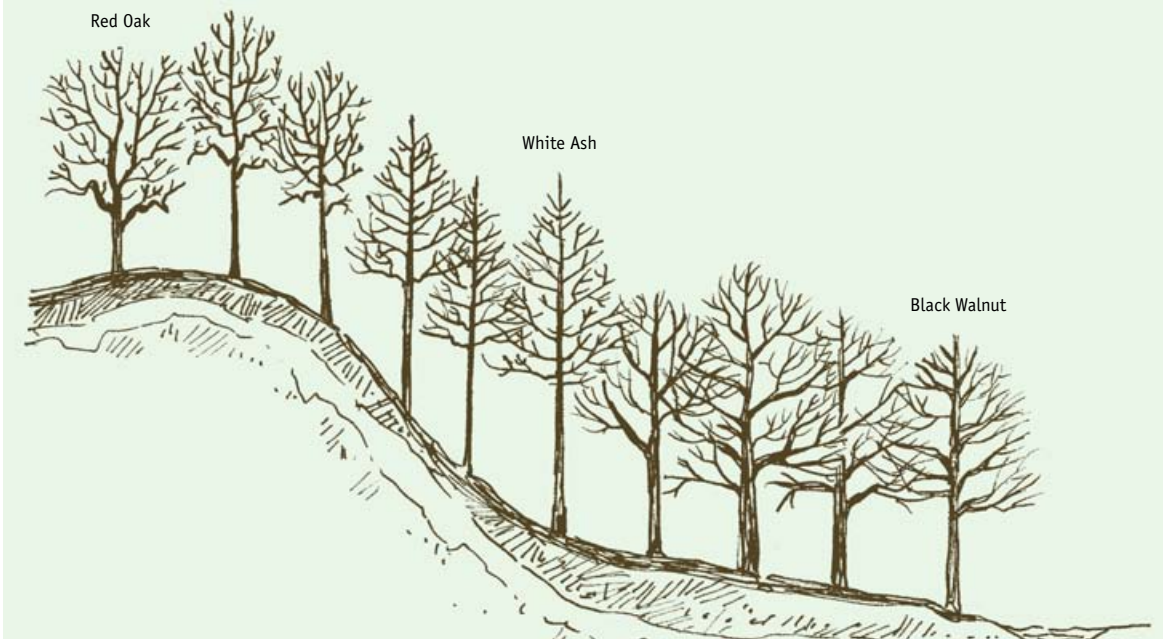
- ▶ conifers – single or multiple species
- ▶ hardwoods – single or multiple species
- ▶ mixedwoods – a mix of conifer and hardwoods and in some cases, shrubs
- ▶ specialty plantations – fibre, *biomass*, Maple, orchards, Christmas trees

**CONIFER PLANTATION SPECIES**



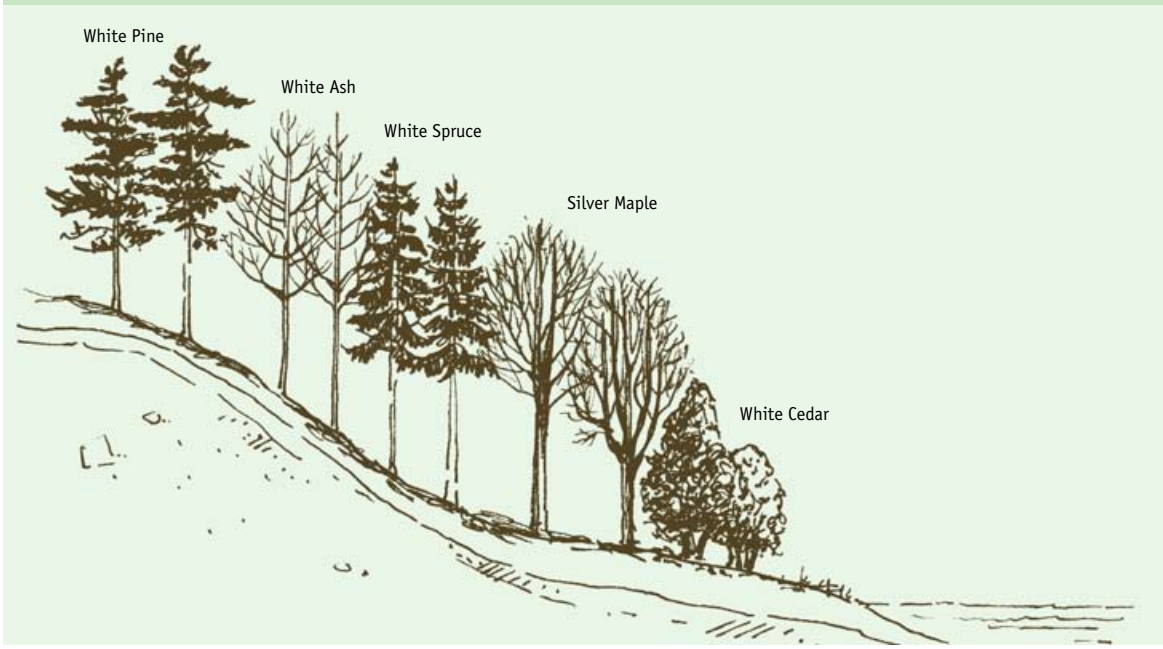

**Pine, Spruce and other conifer species are normally found as single-species or mixed conifer plantations.**

## HARDWOOD PLANTATION



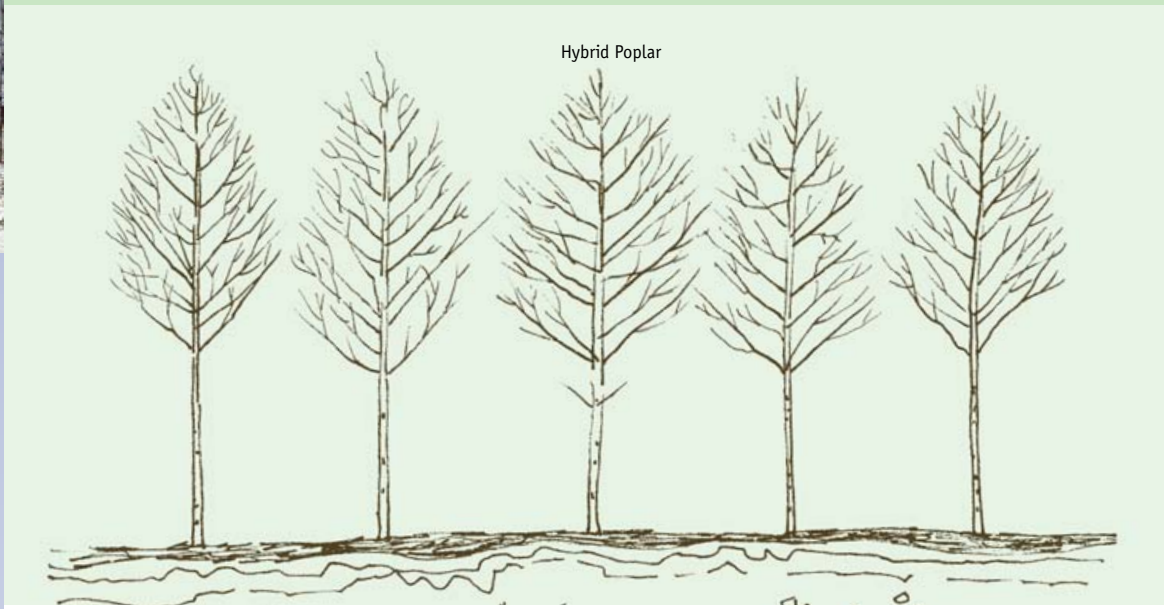

**Plantations of valuable hardwoods can be found on deep, well-drained sites.**

## MIXEDWOOD PLANTATION




**Mixedwood plantations are found on conservation lands in southern Ontario.**

## SPECIALTY PLANTATION




**Specialty plantations are stands established for a specialized purpose such as pulpwood, biomass for energy, or maple sap for syrup production.**


**A Maple plantation adjoins a natural sugar bush. Maple plantations that have been established to produce large volumes of sweet sap are called Maple orchards in Ontario.**