THE GENUS OF THE GENERA REVEALING THE UNIQUE ATTRIBUTES OF COMMON TREE GENERA

Goals: Review Common Genera with a spot light on unique attributes

- Traditional Uses
- Ecosystem Relationships
- Unique attributes

Genera and species that will be highlighted

- Populus tremuloides
- Quercus (a look at the white vs the red/black oak groups)
- Pinus flexilis
- Gleditsia
- Taxus canadensis

Influences and appreciation

- Plant Migration
- Mutualism
- Cooperation
- Communication
- Survival Techniques
- Relationships with other species
- Native Trees
- Reading

Populus tremuloides
Populus is Latin for 'The people'

- Largest geographical range of any tree in North America Why

- **Cloned communities**
- **Fire dependant species**
- **Photosynthesis capabilities in bark**
- **Extracellular freezing**
- **Petiole orientation**
- **Vibrant fall colour**

Populus tremuloides Geographical Range (diversity)


PHILLIP COLLA

Populus tremuloides ethnobotany

- fever-reducer,
- pain-relief, fevers,
- anorexia,
- anti-inflammatory,
- arthritis,
- rheumatic pain.

- salicin and populin

Poplar tremuloides uses

- The wood is used for various types of boards, such as particleboard, waferboard, oriented strandboard and for pulp. The fibers of the bark can be used to make a fine paper product

Populus tremuloides Clonal communities (how to tell them apart)

Populus tremuloides Colonization

- Seed has very short span of viability but millions are produced, requires correct conditions to be successful

‘ open soil and no competitions’

Populus tremuloides Colonization

- Aspen form individual patches comprised of numerous stems, termed ramets
- Advantage of Asexual Reproduction
  - Share resources in tough times
  - Can expand territory if ground conditions are not suitable from seed
  - Fast recovery

Populus tremuloides Colonization

- Sharing resources

- Times of drought
- Nutritional needs
- Storage of photosynthates

Pando clone

- 106 acres of area in Utah, USA
- 47, 000 trees all sharing the same root
- very old
- Weight 6 million kgs
- Most massive organism on the planet

Populus tremuloides Colonization

- Can expand territory if ground conditions are not suitable for seed germination

Populus tremuloides Colonization

- Fast recovery

- Avalanche
- Mudslides
- Forest Fire
- Deforestation

Populus tremuloides
Fire dependant species

- Attributes of fire dependant species

- - highly flammable wood
- - burns quickly and hot

- - thin bark

- - produces lots of seed

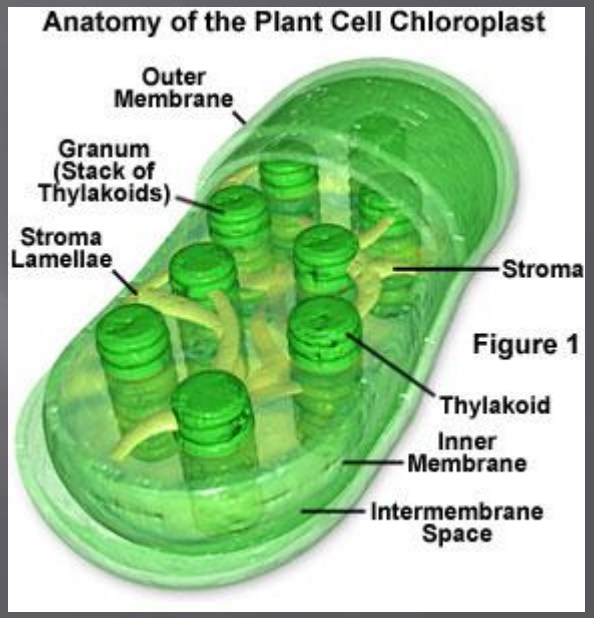
Populus tremuloides
Fire dependant species

Populus tremuloides Photosynthetic Bark

- Very unique attribute
- Assists in ability to produce photosynthates during the entire year
- Allows it to be very successful in early spring and late fall when temperatures are not too cold, extends season

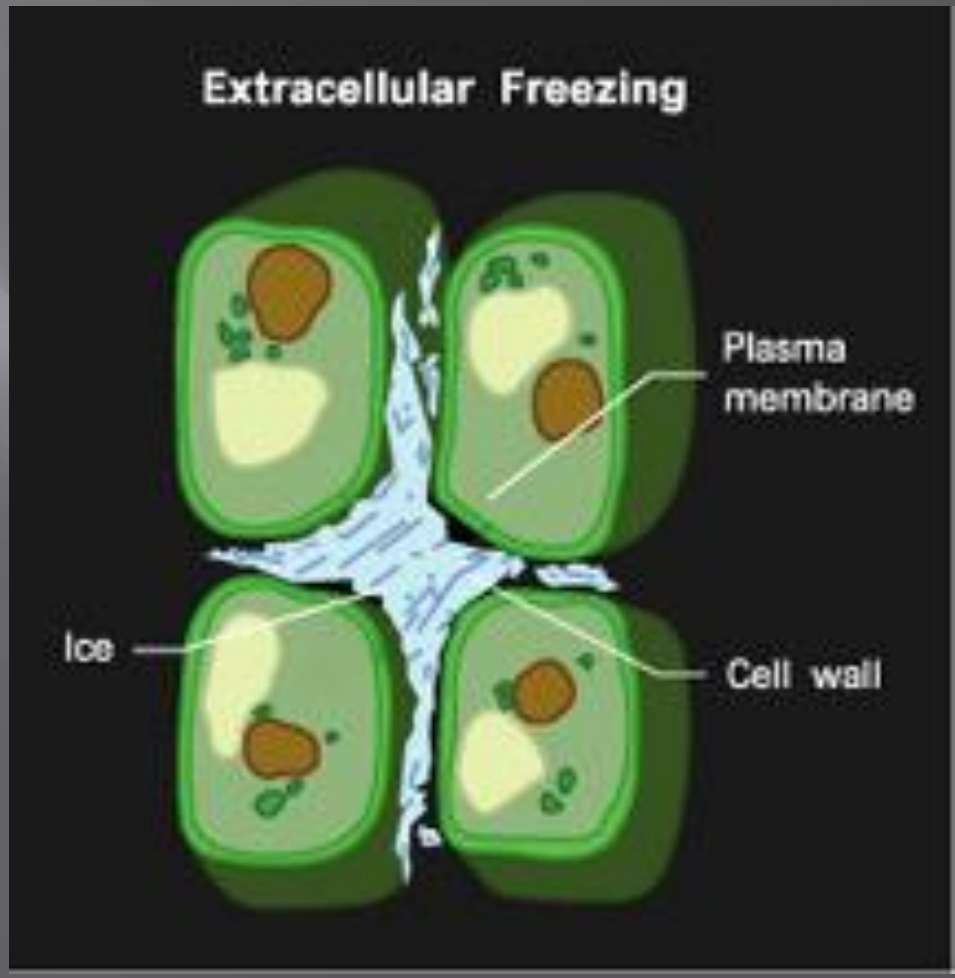
Populus tremuloides Photosynthetic Bark

- **The Mechanism For Corticular Photosynthesis**
- **Bark tissue contains photosynthetic organelles called choroenchymes**
- **The bark of young Aspens contains up to 42% of the total tree chlorophyll- (Kharouk, 1995)**
- **10-15% of total photosynthesis is corticular in mid summer, but larger during times where leaf contributions are reduced-winter (Aschen, 2001)**



Populus tremuloides Extracellular freezing

- Tree tolerant of very cold temperatures are divided into two groups: Hardy trees and very hardy
- Hardy trees can survive temperature above – 40 C, very hardy trees survive temps below – 40 C
- Other genera that exhibit this feature: alders , birch, willows, jack pine, larch, balsam fir, black and white spruce



Populus tremuloides
Extracellular freezing

Populus tremuloides petiole orientation

- The petiole of the leaf is perpendicular to the orientation of the leaf
- What is the advantage of having this feature
- Some other poplars also share this feature some do not.

Populus tremuloides

- This leaf is positioned in such a way that it results in a reduction of the rate of water loss through transpiration and it allows each leaf to move with more flexibility in a windy environment reducing damage

Populus tremuloides Vibrant fall colour

- Vibrant yellow fall colour
- Studies have shown that poplars with strong fall colour have reduced amount of overwintering eggs of aphids, species with stronger yellow fall colour were less prone to egg lay

The Genus Quercus

- This large group of trees in the Fagaceae family is divided into two main groups:

- **white oak group:**
- - rounded lobes
- - fruit ripens in one year
- -lower tannin content
- - tighter vascular system
- - involucre fringed cap
- - wood that is stronger and denser , when used for barrels it can hold liquids

The Genus Quercus

- This large group of trees in the Fagaceae family is divided into two main groups:

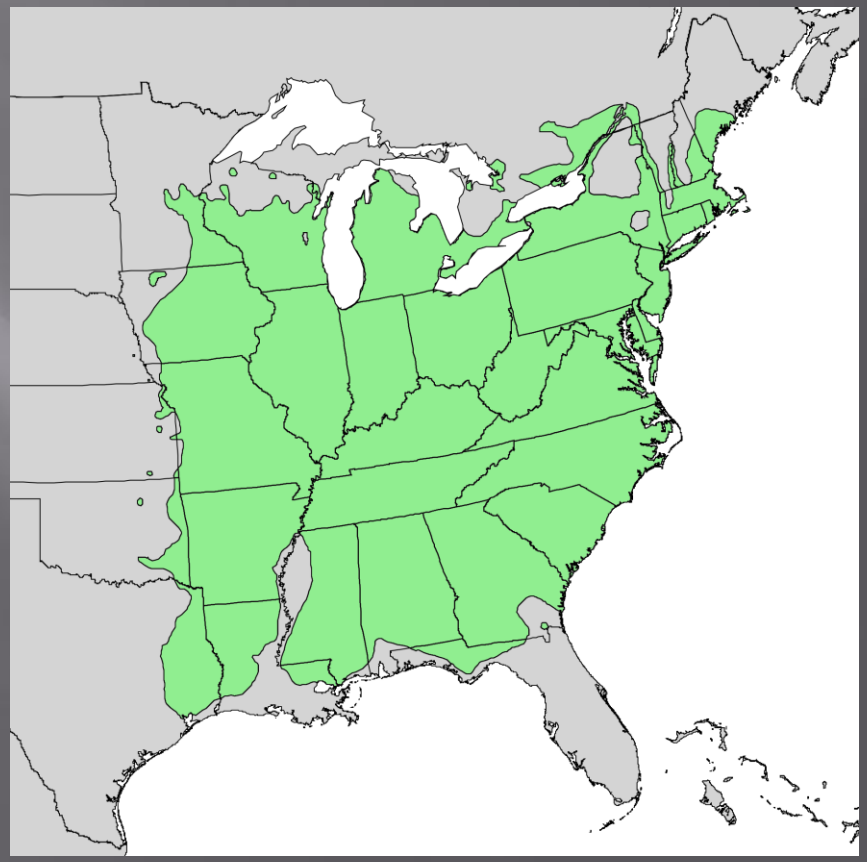
- Red/Black oak group:
- - pointed lobes
- - fruit ripens in two year
- -higher tannin content
- - more open vessels
- - involucre cap less fringed
- - wood when used for barrels cannot hold liquids

Quercus
Name derived from the Latin name of oaks 'Quercus'

Tree of worldly significance and can be found in many varied climates and ecosystems, most are well suited for dry climate zones

The Genus Quercus geographical range

- Most oaks that are native to the eastern part of North America have a similar range
- General introduction to its uses



The Genus Quercus Unique Attributes

- Fire dependant species
- Fire resistant bark
- Quick rate of growth of saplings
- Long vascular system
- Strong orientation of branches
- Excurrent tendancies
- Strong compartmentalizer
- Orientation of leaf on hot days

The Genus Quercus
Additional topics

- Relationship between oaks and other species
- Design of the acorn
- Masting as means of squirrel control

Quercus
Fire dependant species

- Oaks rely on a fire frequency of approx 5-10 yrs,
- Replenished nutrients
- Reduced competition
- Stimulated young oaks that grow quickly

Quercus
Fire dependant species

There is renewed regeneration of many species following a "normal burn"

These fires burn quickly as they pass underneath the oaks

Trees are designed for this

Quercus
Fire dependant species

- The oaks are designed for this type of environment and have many unique attributes

- Bark
- Leaves
- Tap root
- Regeneration of young saplings

Quercus
Fire resistant bark, leaves that curl

Oak leaves are thick, they resist decay, this provides a good fuel source for fire dependant species

Quercus
Fire resistant bark

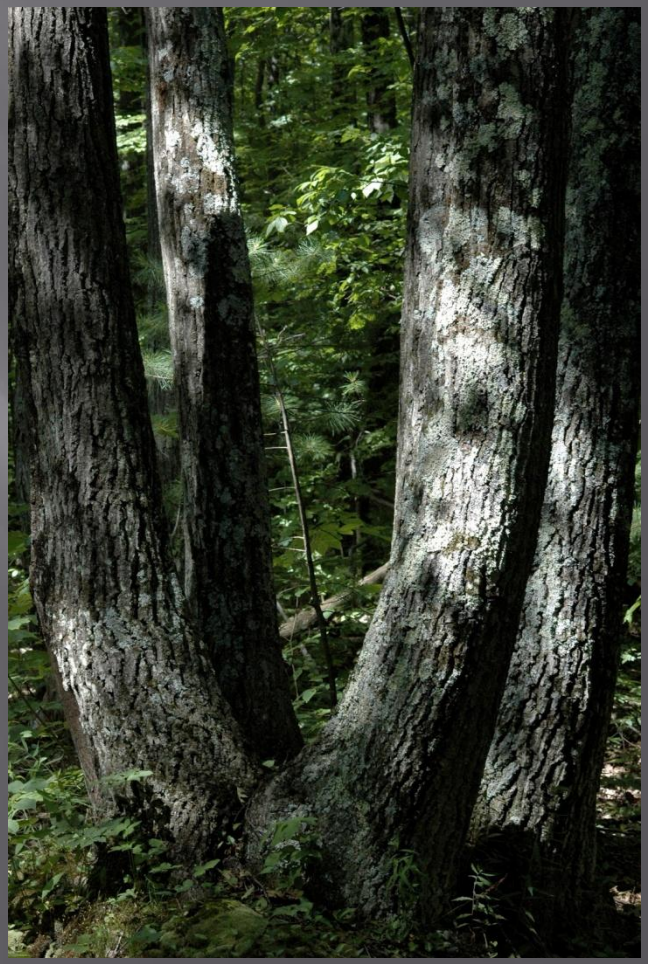
- **Young trees do not have bark that is thick enough to survive fire, this takes approx 10 years to develop which may be within or outside of the frequency of fire (fire cycle)**

Quercus
rate of sapling growth

- If a young oak does not survive the fire, the original young tree will often regenerate from the root system (tap root), fires burn quickly over the root zone and often roots remain in tact, these young seedling grow quickly after because of the larger root system feeding a young whip

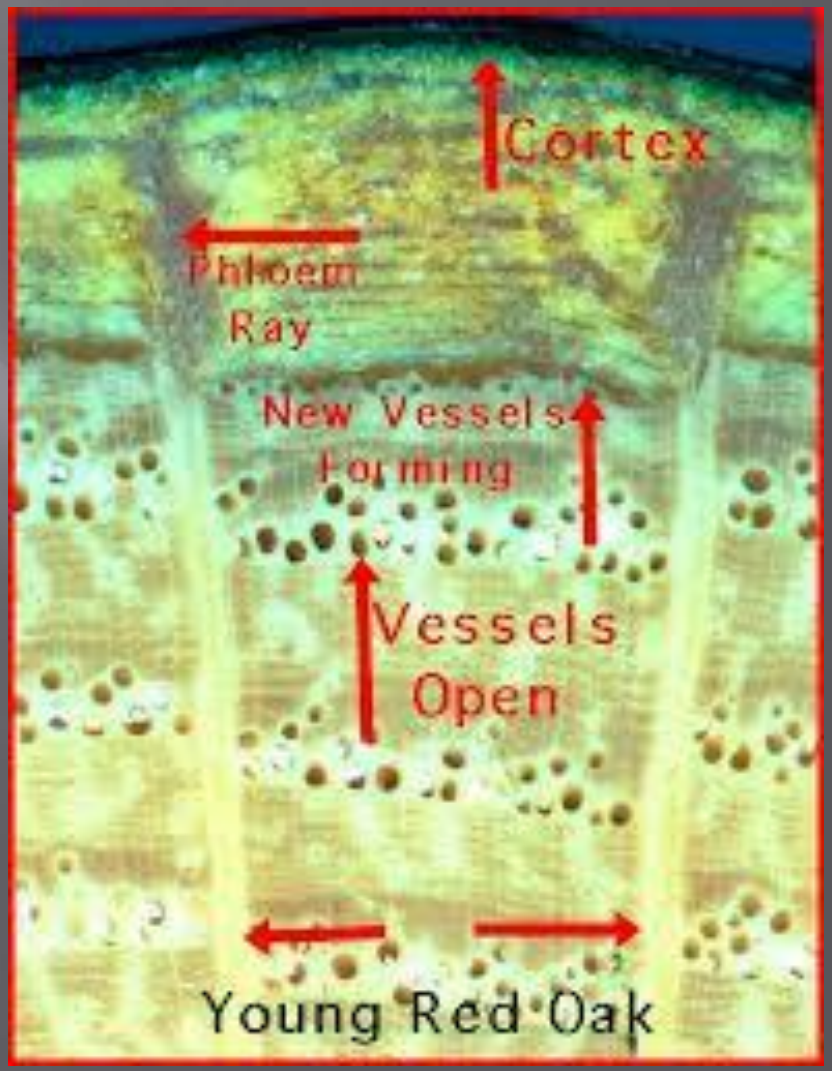
Quercus
rate of sapling growth

- **We often see oak trees in multi trunked groups**



Quercus long vascular system

- Oaks have a ring porous vascular system
- Efficient during times of stress
- Long vessels several feet long where one root is more or less feeding a section of branches



Quercus
long vascular system and leaves that turn during the day

- Very efficient in hot weather, many oaks have a whitish glaucous waxy bloom on the bottom side of leaves,
- During the heat of the day the back of the leaves turn towards the sun to reflect the heat, even if this exposes the stomata (they close during the day), this conserves water

Quercus
long vascular system and leaves that turn during the day

- Members of the white oak group do this more so than the red oak group members,
- to compensate red oak group members have a more waxy shiny surfaces

Quercus
waxy leaves of the red oak members

Quercus
excurrent , orientation of limbs

Quercus excurrent , orientation of limbs

- Branches that attach at 90 degrees have strong attachments which means they are very well secured into the trunk
- Branch collars can form properly allowing branches to reach out over the ground
- This gives the tree a competitive edge by shading out the competition

Quercus
Strong compartmentalization

- *Q. macrocarpa*
- *Q. robur*
- *Q. rubra* (regarded as medium by some)

- Good compartmentalization allows the trees to live for decades with less wood decay than species that do not callus properly

Quercus Relationships between other species

- Oaks have several relationships with several other species

- Squirrels, chipmunks,
- Wasps, deer

Quercus Relationships between other species

Insect control

Tree migration and perpetuation


Cordilleran
Ice Sheet
Laurentide Ice Sheet

Quercus
Design of the acorn

- Think about the design of the acorn
- Review characteristics
  - White oak group
  - Fringed cap that often encloses nut
  - Not bitter tasting
  - Ripens in one year
  - Produces more fruit than other group

Quercus
Design of the acorn

- Red oak group

- Takes two years for fruit to ripen
- Produced less volume
- Very bitter tasting
- Cap is not as fringed and often does not cover as much of the nut itself

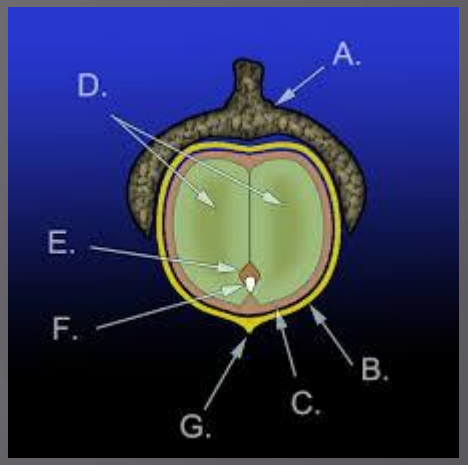
How does this relate to relationship with other animals

- White oak acorns, for instance, have evolved to have many acorns with more than one seed in them. A squirrel removes an embryo from one of the seeds and then buries the acorn, allowing another seed within that acorn to germinate instead.

- White oaks acorns which are preferred provide more fat to the squirrels, only a few a buried during lean acorn producing years but normally the squirrel does remove the nutritious embryo first

- Red oaks, meanwhile, have evolved a means of being partially eaten by a squirrel and yet still survive to become a sapling. The cotyledon, or future first leaves of the red oak embryo within the seed, contains preferentially higher amounts of tannins , the top of the acorn itself is less bitter and contains more lipids and sodium than the bottom. As a result, a gray squirrel begins eating the red oak acorn from the top, and often caches it partially eaten. The remaining seed survives to germinate.

Quercus
Design of the acorn



Quercus Masting

- A means of survival for the oak
- Every few years we have a bumper crop of seeds
- Trees over vast geographical areas will all exhibit the same seed sets as their relatives in other parts of the province
- Trees do release volatiles in the air to communicate with their partners in the wood lots
- Climate is also part of the process

Quercus masting

- Takes energy
- Less vigorous the year after masting takes place
- What is the benefit ?

Quercs masting

- What is the advantage of having a bumper crop every few years
- Squirrel and bird populations that rely on oaks are significantly tied into the aspect of masting

Masting what is the counter measure

- How do squirrels fight back

Many other species of trees exhibit masting

- Walnuts
- Maples
- Ash
- Hickory
- Wingnut
- Nyssa

Pinus flexilis limber pine

- This interesting surname, with variant spellings Pyne and Pinn, is of Anglo-Saxon and Old French origin, and derives from the Olde English pre 7th Century, or Old French "pin" meaning "pine" and was originally given as a topographical name to one resident who live near a conspicuous pine

The Genus Pinus flexilis

- Pinus flexilis produces pine nuts, a none winged seed that relies on birds and squirrels to move this seed from one location to another
- Clarks nutcracker and a ground squirrel do most of the work
- The preferred choice for this relationship is the Clarks Jay,
- The cone has features that allow the preferred “mover’ to dominate in this task

Clarks Nutcracker

- Adapted with specialized pouch that can hold several pine nuts
- Long distance flyer
- Store communal caches on windward side of mountain slopes
- Can find seeds all winter long, very good memory

Mountian squirrel

- Eats seeds from cone that drops to the ground
- Cone scales disintegrate very easily, easy for squirrel to get at pine nuts
- Not a lot of seeds moved or buried

Pinus flexilis

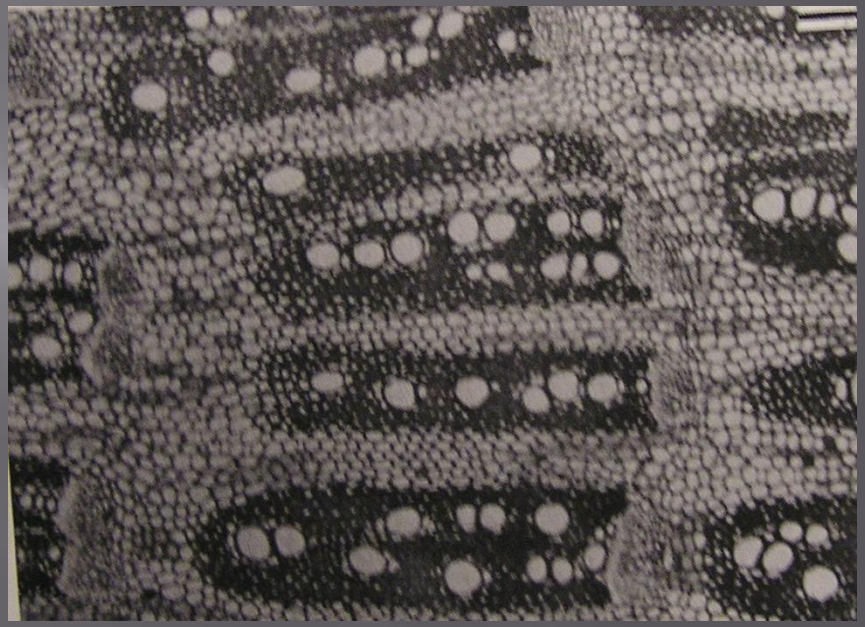
- Produces cones with a very heavy resin set that is not very palatable for squirrel
- Comes ripen over a long period of time which is beneficial to the survival of the pine tree

Asynchronous ripening

Pinus flexilis branching habits

- The collenchyma cells of plants usually have thickened walls which stiffen the leaves and stems (Freeman, 2002)

- Pinus flexilis has cell walls that are composed of thin-walled collenchyma cells (Carlquist, 2003)



Henry D. Thoreau
Faith in a Seed

- Tim Flannery
- The Eternal Frontier: An Ecological History of North America and Its People
- E C Pielou
- After the Ice Age: The Return of Life to Glaciated North America

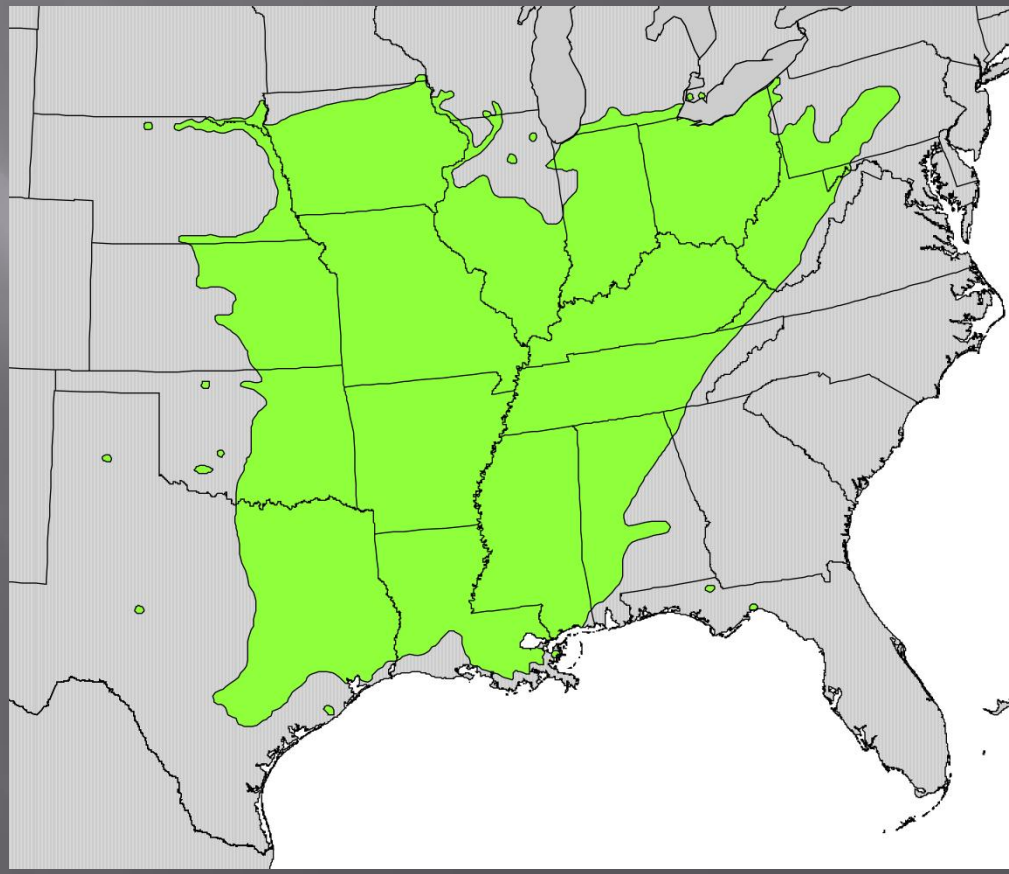
The Genus Gleditsia

- Attributes
- Thorns
- Sweet pulp in pod
- Drought tolerance

The Genus Gleditsia

The Genus Gleditsia geographical range and meaning of name

- Gleditsia, is a tribute to the German botanist Johann Gottlieb Gleditsch.
- triacanthos means
- Three horned



The Genus Gleditsia

- 12,000 - 15,000 years during the late Pleistocene, impressive megafauna ranged the land these large browsers included:

- Mastodon
- Jefferson Ground Sloth
- Stag Moose (*Cevalces scotti*).
- mammoths
- a horse (*Equs complicatus*) probably browsed some. Other browsers included a tapir, a large peccary, and Caribou.

Gleditsia

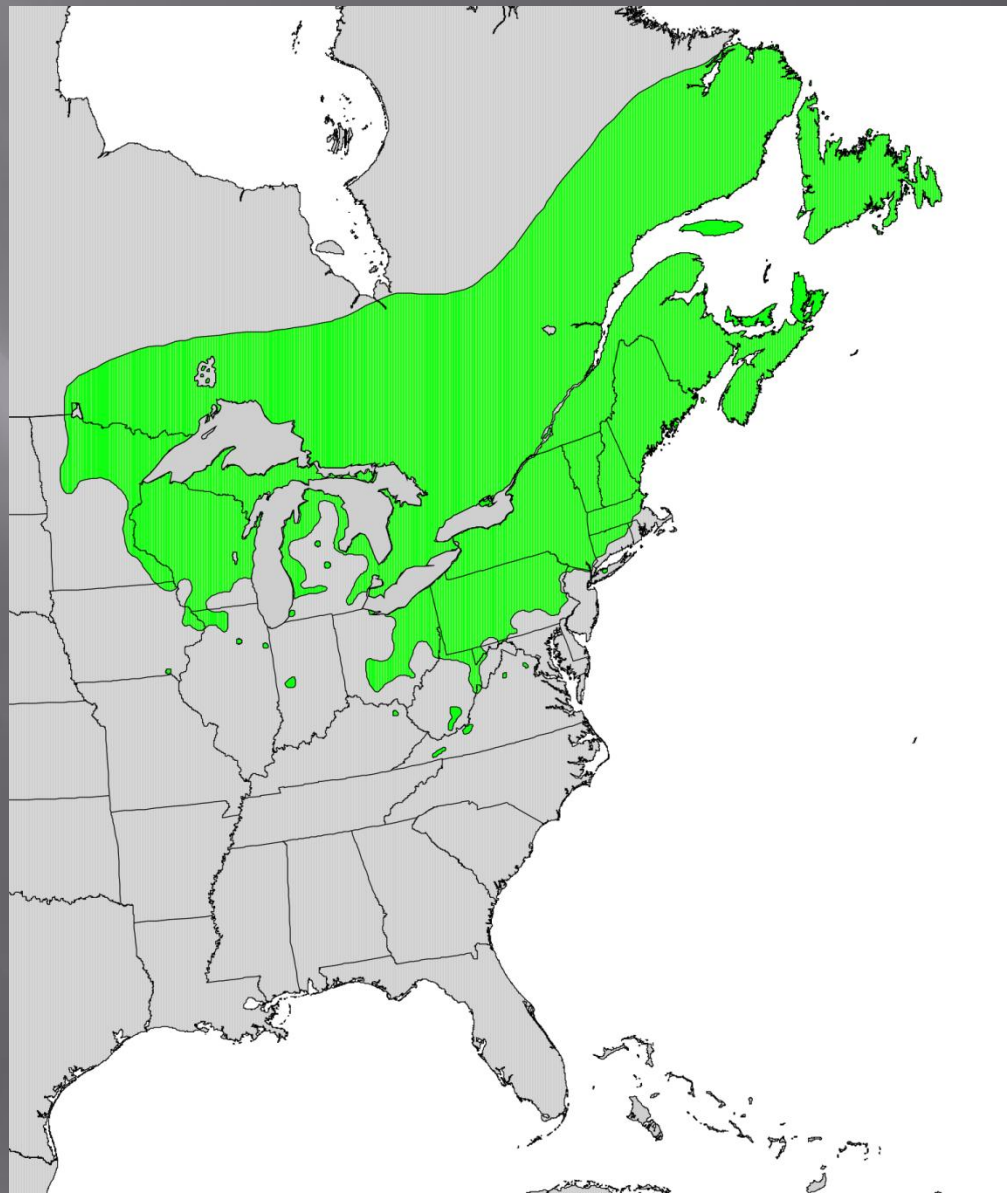
- The seeds were dispersed by grazing animals, which ate the pod pulp and excreted the seeds in droppings; the animal's digestive system assisted in breaking down the hard seed coat, making germination easier. In addition, the seeds were released in the host's manure, providing fertilizer for them. Honey locust seed pods ripen in late spring and germinate rapidly when temperatures are warm enough

Gleditsia

- Why do Gleditsia have small bi pinnate leaves on summer growth
- This is a more drought tolerant feature
- Native range starts in the mid west states, tall grass prairie and grass savannah

Taxus canadensis

- Latin name is derived from the Latin word yew
- Ethnobotany : all parts of the plant are mildly toxic except aril uses include:
- Relief of rheumatism.
- taking the tea after childbirth.
- alleviate pain following childbirth.



Taxus canadensis

- Native yew
- Unique amongst Taxus in that it is monoecious
- Self pollinates
- Layers profusely
- Asynchronous ripening of fruit
- Poisonous seed

Taxus canadensis

This plant is monoecious, because it grows communally, it often self pollinates, because of this the fruit set and the viable seed count is quite low for this species as compared to other Taxus species

Taxus canadensis

Other species of yews are dioecious and seldom self pollinate

Taxus canadensis

With a lower seed count, it uses layering to propagate itself over several acres

Taxus canadensis

- Normally the plant prefers moist conditions and is very shade tolerant normally found under climax forest trees like hemlock

Taxus canadensis

The fleshy part of the aril is not toxic

Birds who consume the aril also consume the hard seed which is poisonous

Seed is not harmed in the digestive tract,

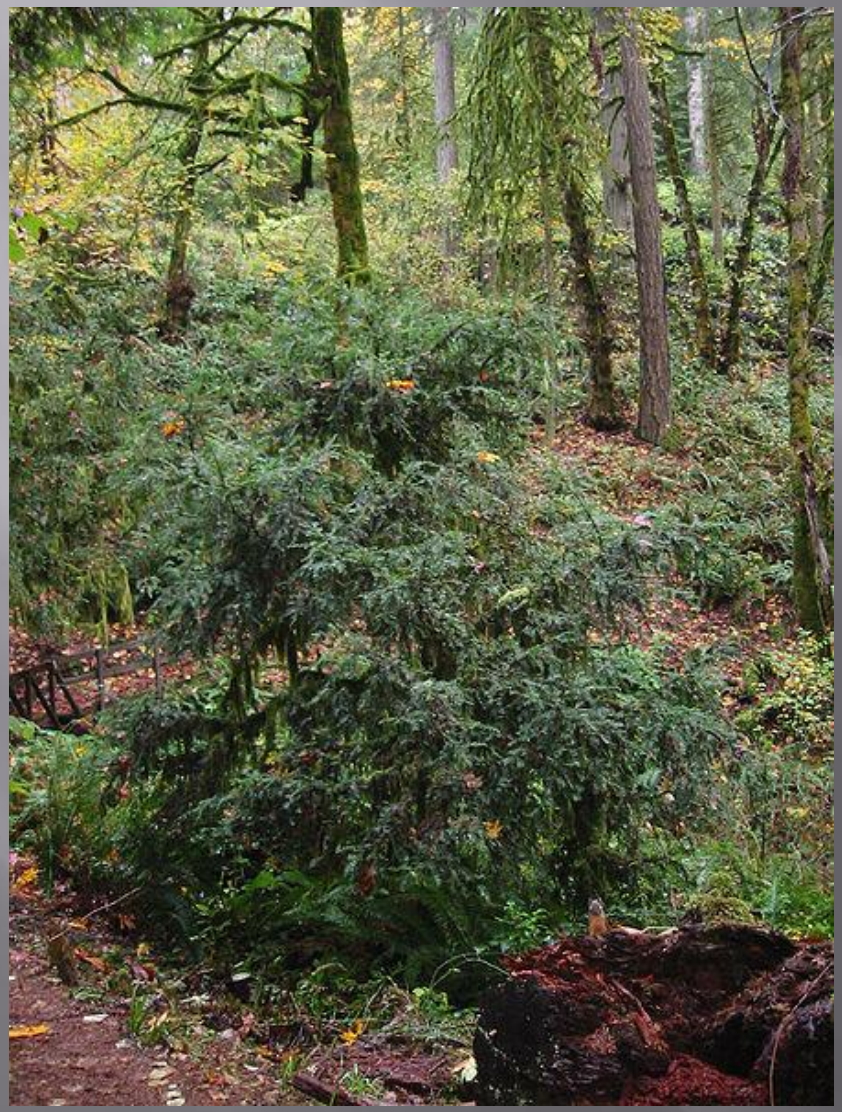
Birds roost in the cover of hemlock and seed is released

Acid in digestive system scarifies the seed,

Taxus canadensis

- Asynchronous ripening of fruit helps plant perpetuate especially due to the lower fruit set as compared to other species of Taxus,

Taxus canadensis



- This species is a favourite food of both moose and deer especially in winter, these animals often yard in the same protected environment as the Yews prefer, a poisonous seed is very beneficial in this situation.

Conclusion
Always ask the question why, there is usually an interesting story

- Why do birch trees have triangular leaves
- Why do birch trees which like to grow in full sun have leaves of a very similar size unlike more shade tolerant species
- Why to birch trees have white peeling bark

- Why to some trees have red fall colour which takes energy to produce

- Why does the sycamore tree have thin exfoliating bark
- Each of these have answers that make each tree adaptable to their native environment

Platanus occidentalis Thanks you for attending today's talk