



Butternut Tree

**ONTARIO
SPECIES
AT RISK**

A large, low-angle photograph of a Butternut Tree trunk and canopy. The trunk is thick and textured, with a large branch extending to the right. The canopy is dense with green leaves.

**A Landowner's
Resource Guide**



Healthy butternut

Greg Bales

Male flowers flush first. Female flowers flush with the leaves. Though on the same tree, they have evolved to mature

at different times, which reduces inbreeding. Female flowers are wind pollinated, and nuts develop and mature over the summer. They usually drop after leaf fall with the 1st heavy frost.



Greg Bales

Female Flowers



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Butternut seed



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Butternut seed shell with husk removed

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Male flower catkin

The Butternut Tree (White Walnut)

Butternut, *Juglans cinerea* L. is a member of the walnut family and is native to, and widespread in eastern Canada. It grows in southern Ontario and Quebec, as well as New Brunswick. It is a small to medium-sized deciduous tree.

The species is relatively short lived, rarely living longer than 75 to 100 years. Butternut is intolerant of shade, meaning it does not grow or reproduce under a forest canopy. It can be found scattered individually or in small groups within mixed hardwood stands, along fence lines or in open fields. Butternut is commonly associated with other tree species such as basswood, black cherry, beech, black walnut, elm, hickory, oak, red maple, sugar maple, white ash, and yellow birch. Butternut produces an edible and nutritious nut which is an important food source for birds, squirrels, and other small mammals. First Nation people used the nut oil for cooking, hair dressing, leather-making and polishing tools. Carvers and wood workers value the wood for its softness, colour, and varied texture. Commercial and hobby nut producers value its nuts and its contribution to breeding northern hardy nut trees.



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Identification of Butternut

In an open-grown situation butternut trees have a short trunk with a broad, open, spreading crown. In the forest, butternut have taller, less branchy trunks with smaller, more compact crowns. The smaller branches in the crown tend to bend downwards and then turn up at the ends to grow in the light. Shaded branches in the inner and lower crown naturally die back.

The buds are blunt, tan-coloured and hairy. There can be two buds above each leaf scar. The buds are arranged alternately along the twig. There is a large, long terminal bud at the end of the twig.

The bark is grey and smooth on immature trees. On older individuals, the bark becomes separated by narrow, dark fissures into wide, irregular, flat topped, intersecting ridges.

Leaves are compound. They are about 25 to 40 cm in length and are composed of 11 to 17 leaflets arranged along a central stalk. The individual leaflets are stalkless. Their undersurface is densely hairy. Compared to many native species their leaves flush late in the spring and turn yellow and drop early in the fall.

One key to differentiating butternut from black walnut is to observe the terminal leaflet. In butternut this leaflet is present and of similar size to the next closest leaflet. In walnut the terminal leaflet is underdeveloped or missing altogether.

Male and female flowers occur on the same tree but have evolved to mature at different times, which reduces inbreeding. Male flowers flush first before the leaves. Female flowers flush with the leaves. Female flowers are wind pollinated, and nuts develop and mature over the summer. They usually drop after leaf fall with the first heavy frost.

Butternut vs. Black Walnut

Butternut:

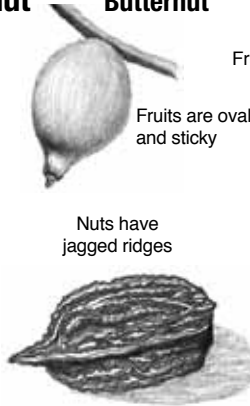
Terminal bud long, buds very fuzzy.
 Leaf scar straight across with hairy fringe.
 Pith dark brown.



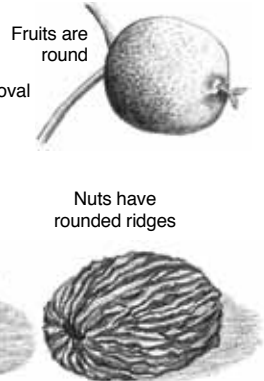
Black Walnut:

Terminal bud is as broad as it is long, slightly fuzzy.
 Leaf scar has no hairy fringe and is deeply notched.
 Pith light brown.

Butternut



Black Walnut



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The nuts are pointed, about twice as long as they are broad and about 5-7 cm long. Nuts occur singly or in clusters of 2 to 5. The husk is yellow/green with dense, sticky hairs. *(Information on butternut from FGCA website: www.fgca.net)*

Butternut bark is ash-grey with flat topped ridges. →



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Butternut leaflets are opposite and almost stalkless.



Black walnut leaflets are alternately arranged and stalked. Terminal leaflet is underdeveloped or missing.

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Butternut & Black Walnut Bark Characteristics

Black walnut bark is dark brown with deep furrows. →



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Butternut Hybrids

Butternut is relatively easy to distinguish from most native species. But it can be difficult to tell it from black walnut or butternut hybrids and related exotic species. Butternut can hybridize with at least two exotic species. Hybrids of butternut and Persian or English walnut (*Juglans regia*) are known as *Juglans x quadrangulata*. They can form spontaneously but are uncommon, probably because *J. x quadrangulata* trees produce few fruit. *J. x bixbyi* is the hybrid of butternut and Japanese walnut (*J. ailantifolia*). Heartnuts are a horticultural variety of Japanese walnut. Japanese walnut was introduced into the U.S.A. about 1860 and widely planted since then.

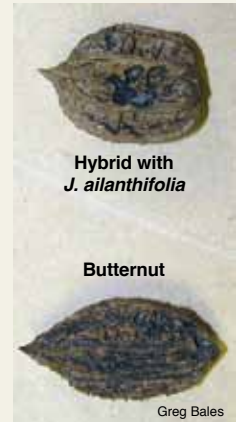
It blooms at about the same time as butternut, and the two species hybridize easily; the resulting buart (pronounced bew-art) hybrid bears nuts very similar to butternuts. Buartns are also known as buartnuts. Unlike most *Juglans* hybrids, buartns are highly fruitful and able to cross with other hybrids, both parental species, and may even self-pollinate, producing trees with confusing combinations of traits.

Over the past 70 years, many productive hybrids of unknown hybrid origin have been propagated and dispersed as butternuts, increasing the confusion. In some places, buart hybrids or their offspring are virtually the only “butternuts” to be found. The prevalence of buartnuts is well known among nut growers in eastern North America, but little recognized by siculturists, dendrologists and professional forest managers.

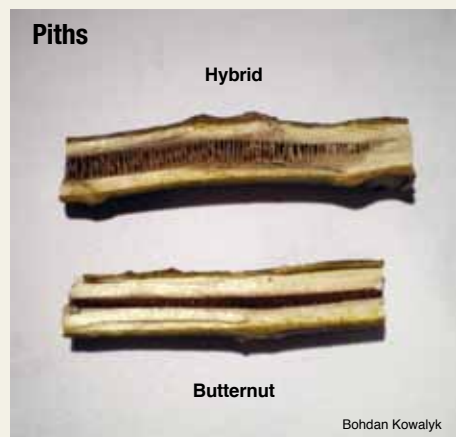
No single trait distinguishes butternut from hybrids. It is best to consider several traits before deciding. (*Hybrid butternut information from Hardwood Tree Improvement and Regeneration Center, Purdue University*)

Butternut hybrids characteristics to look for:

- very large diameter mature stem.
- bark that is less deeply ridged.
- little or no sign of butternut canker.
- widely chambered, light brown pith in 2 year old twigs.
- compound leaves longer than 60 cm, dark green.
- leaves stay green later in fall (October).
- mature male catkins longer than 15 cm.
- more than 8 female flowers along a stalk.
- husk that is heart shaped.
- frequent good seed crops, often annually.



We are now able to distinguish hybrids from pure butternuts with the development of DNA-based markers. To date DNA tests confirm most hybrids in southern Ontario are crosses with Japanese walnut (*J. ailanthifolia*). If the butternut has hybridized with another walnut species such as English walnut (*J. regia*) or black walnut (*J. nigra*, which is rare but can happen) we clearly see that the tree is a hybrid, but are not able to confirm whether it is with English or black walnuts.



What is butternut canker?

The butternut tree is fast fading from our woodlands, field edges and backyards. The Butternut Canker fungus *Sirococcus clavigignenti-juglandacearum* is causing the butternut's decline. It can infect and kill healthy trees of any age and size. Currently, the butternut is listed as a Nationally Endangered Species by Environment Canada. In Ontario it is designated as an Endangered Species under the Provincial *Endangered Species Act*. Infection usually occurs through buds, insect wounds or other openings in the bark. The fungus kills the cambium in elongated patches called cankers. The cankers expand to encircle branches and stems and

cut off the flow of water and nutrients. As the disease progresses, branch dieback in the sunlit part of the crown becomes visible. As the cankers increase in number and size crown die-back accelerates. In early spring and summer, cankers may begin to exude a blackish fluid which dries to form sooty patches.



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← Butternut stem oozing black fluid from butternut canker sites within bark.

Bark on root flare of tree damaged by butternut canker.

↙ Butternut root flare oozing black fluid from butternut canker sites within bark.



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These first cankers occur in the uppermost branches making it difficult to spot from the ground. As a canker expands the bark begins to split and fall away to form an **open canker**. By the time sooty patches and open cankers are seen on the stem and root flares the crown is usually badly affected.

Butternut Canker Symptoms

- **Dying branches in sunlit portion of the crown.**
- **Spring, a thin black fluid oozes from cracks in bark.**
- **Summer, fall, and winter, black fluid dries to a sooty patch.**
- **Under the bark, cankers are sunken, elongated, diamond - shaped dark brown to black.**
- **Epicormic branches sprout below cankers.**



Dying branches in upper crown.

Epicormic branching sprouting along upper stem.



Canker forming below branch leaf scar.



Stem sprouts and epicormic shoots usually become infected and die rapidly. Nuts can carry the fungus and upon germination, seedlings may become infected and die quickly. Armillaria root rot often occurs with the canker and hastens butternut mortality. Beneath the bark, the fungus produces thick, black hyphal pegs or stromatal columns that cause the bark to blister and split open. Pycnidia develop amid the hyphal pegs, and conidiospores are released in gelatinous tendrils or creamy masses. Spores are scattered throughout the growing season by rain splash, wind, insects, and probably by birds, and rodents. Fruiting structures are more likely to develop on dead branches than on cankered areas of the stem, and rain splash and stem runoff spread spores lower on the tree. Rain splash and wind spread conidiospores up to about 45 meters, although longer distances are possible.

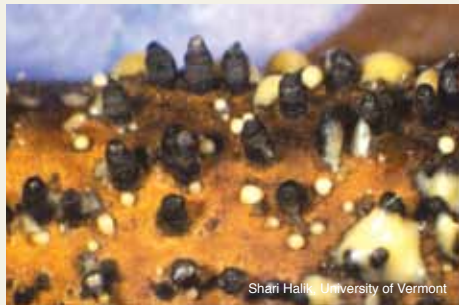
Since its discovery in 1967, the fungus has spread rapidly and efficiently throughout the range of butternut, raising questions about the mode of spread. Sticky conidiospores could adhere easily to the exoskeleton of winged insects and be transported long distances. From 1997 to 1999, researchers found at least 17 beetle species carrying canker fungus conidiospores in two sites in northern Vermont.



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← Armillaria, also known as shoestring root rot.

Black hyphal pegs that release conidiospores.



Shari Halik, University of Vermont

Conidiospores estimated per beetle ranged from 200 to 1.6 million. The most abundant species on freshly cut logs and branches of infected butternut were weevils and longhorned beetles. Beetles most commonly collected from live butternut crowns included the butternut curculio and a leaf beetle. The butternut curculio creates feeding and egg-laying wounds on live shoots. From 1997 to 1999, 6-11% of curculios examined carried conidiospores. Although the numbers they carried were relatively small, these spores are possibly sufficient to infect healthy or freshly wounded tissue of butternut. Curculio wounds may make suitable infection courts for conidiospores transported by rain splash or insects

A secondary fungus, *Melanconium oblongum* is often found fruiting on dead cankered butternut branches and is often confused with *S. clavignenti-juglandacearum*. Considered a weak parasite, this fungus invades weakened or dead tissue and causes what is referred to as Melanconis dieback.

(Information about butternut canker disease and conidiospore formation from University of Vermont Forest Pathology; potential beetle vectors of Sirococcus clavignenti-juglandacearum on butternut. Halik, S. & Bergdahl, D.R. 2002, Plant Disease 86:521-527)

Butternut curculio larvae feeding on butternut kernel.



Madeline Danby

Butternut management

Natural selection eventually favours the strongest members of a population, but human activities, such as introduction of invasive species like the canker fungus and overharvesting, are creating undue pressures. Ontario is home to the northernmost populations of butternut, which are possibly unique, and therefore important to the evolutionary process and the recovery of this species. It is possible that one of these distinct populations holds the key to the survival of the species. The genes that contribute to canker tolerance or resistance, could be in your woodlot!

The foundation of recovery is conservation. But in the case of a disease threatened species conservation is not likely enough. Woodlot owners are encouraged to consider activities that increase the vigour of existing trees and increase natural regeneration or at least seed production, which will support planting programs. In this way we maintain the locally adapted gene pool and get a greater chance of finding genetic resistance to the canker.

Butternut is usually a very small component of Ontario woodlots. It is associated with many species, some of which may be better suited to the site or your objectives and may require different management strategies. The best strategy is to have an experienced forestry professional present options for butternut that are in balance with the factors of economic costs and benefits, forest health, wildlife habitat, and protection of biological diversity.



Wild ginseng growing at base of butternut

Greg Bales

Consider the following factors:

Site - butternut grows better on deep, fresh, limestone based soils.

Light - butternut is very intolerant of shade; its presence in a woodlot means some disturbance created the open conditions butternut requires to grow well.

Age - butternut is a short lived tree (100 yrs is very old). Many species such as maple, oak and pine live more than twice as long.

Health - butternut canker will kill most butternut. Consider whether you have vigorously surviving butternut that are worth managing. For example, older, heavily cankered butternut trees growing in a closed canopy with longer lived species on a dry site are under a lot of stress and unlikely to survive long or produce much seed, and any seedlings that germinate will be suppressed and not survive.



Butternut management scenarios - basic to complex:

- Conserve all butternut
- Monitor tree health, forecast and collect seed;
- Report information and seed to local Recovery Teams
- Assess vigour of butternut trees and remove trees that are shading the crown of vigorous butternut. The single tree selection system creates small gaps around the healthier trees of desired species to give them more light and encourage seed production. Poorly growing, diseased and damaged trees are removed (see page 17 re ESA process that has to be followed before any standing butternut trees can be removed).



Retainable tree crown before and after thinning.

- Create larger openings in the canopy to promote the germination and growth of the shade intolerant butternut seedlings. The group selection method removes selected groups of trees - the optimum opening for butternut is a diameter roughly equal to the height of the stand. This should only be considered where there are at least 10 vigorously-surviving mature, seed producing butternut trees per hectare, within 100 metres of each other, to promote pollen exchange. Butternut researchers suggest that harvests for butternut regeneration should consider first using the selection system followed several years later by a group shelterwood cut. There is some evidence that opening up the forest too quickly can actually stress the existing butternut trees.

- Plant locally adapted seed or seedlings in the gaps or other open areas. This can replace or augment poor natural regeneration due to infrequent flowering, seed crops aborted by droughts and seed predation by insects and other animals (Climate change effects that include early springs yet later frosts, severe wind storms, and droughts are affecting the flowering and seed set of many species).



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Another healthy butternut found.

Planting butternut

Butternut must be planted strategically, and with the understanding that the canker will kill many trees within the first 10 years, especially if they are stressed from poor planting and tending. Planting in a mix with other species of slower or similar growth rates will reduce the speed of infection and leave you with an overall planting if/when most of the butternut die.

Things to consider before planting butternut:

1. Ask your supplier to ensure the seed or seedlings are from native, locally adapted butternut trees.
2. Plant in an open area with limestone-based, deep fresh soil.
3. In the first 5 years at least, be prepared to water, remove competing vegetation and protect from animals (especially white-tailed deer). Butternut has an aggressive root system that does not like transplanting. But if the tree top dies back, they often resprout.



Planted butternut seedling.

Butternut recovery program

Several organizations are working together on butternut recovery. They include the Forest Gene Conservation Association, the Rideau Valley Conservation Authority, and several local Ontario Stewardship councils. The Ontario program is part of a larger recovery effort across north eastern and north central North America to try and save this endangered tree species.

The involvement of private landowners and community forest managers is essential to butternut recovery. Together we can locate and assess mature, healthy butternut, forecast and collect seed, and determine where to undertake strategic thinnings. Butternut seedlings can be provided for planting and monitoring in appropriate locations throughout southern Ontario. When you report butternut trees that appear to be resistant to the canker we can act quickly to graft and plant them in local butternut archives. (see www.fgca.net for information on archives).

Endangered Species Act 2007 and Butternut Do's and Don'ts

- A person can cut down a butternut tree that was planted/cultivated or is confirmed to be a butternut hybrid.
- A person can prune a butternut tree i.e. remove a hazard branch, if an expert determines it will not harm the tree.
- An unhealthy or dead butternut tree can only be cut down if it is assessed as “non-retainable” by a Ministry of Natural Resources (OMNR) - designated Butternut Health Assessor (BHA).
- Butternut wood from ‘assessed non-retainable’ trees may be bought or sold or used in any manner.
- If a person wishes to cut down a healthy or “retainable” butternut tree of any size (as assessed by a BHA), then a permit under the *Endangered Species Act* is required, and activities such as planting replacement butternut trees must occur.

Visit www.ontario.ca/speciesatrisk or MNR at 1-800-667-1940 and ask for your local Species-at-Risk Biologist to learn more about how the *Endangered Species Act* affects butternut and you.

Also ask for information on local Recovery Programs that can help you assess and manage your butternut.

Will there be any butternut for the next generation to see? →

Looking for those few remaining healthy butternut trees.



Greg Bales



Greg Bales

Butternut Recovery Program: Private Woodland Owner's View:

Forest health and pending threats to one's woodland are a constant thought and worry. My hundred acres is mostly Red Oak, but there are other hardwoods and pine, and my favourite, the butternut. When the biggest and oldest died and fell down, I figured that was natural - trees do that, and people too! But news of the dreaded Canker got me to check and see that it was hitting the younger specimens too.

My regular contact with the Stewardship Co-ordinators of North and South Simcoe put me in contact with a diligent MNR Technician, hired to co-ordinate butternut recovery. Madelaine Danby kept me in the picture, seeking permission to search for healthy trees, for a "nut" year (no luck there yet) and for samples for DNA tests. Then Madelaine marked 4 of my best trees to aid the foresters who did a selection cut around each tree so they can reach into the sky without competition.

It has been most interesting and I have been contacted regularly to assist or witness the action. The next activity late this winter is collecting scions from the upper crown of the best tree. A professional arborist will use throw ropes to access the scions which will be grafted onto walnut root stock. All we can do now is hope that we see this species recover from its endangered status.

Jim Laking - Adjala-Tosorontio
Twp - 17th SR and 2nd Line.



Butternut Recovery

Healthy trees growing among heavily diseased trees that are reported by concerned landowners will be cloned by grafting and then planted in Butternut Archives. These grafts will be managed for seed production and disease resistance screening and breeding.



Healthy tree



Graft in pot



Butternut archive

Many people in Ontario are working together to conserve and recover butternut. The lessons we learn and the capacity we build will help us address other species that become vulnerable from the effects of land development, exotic species, and climate change. Landowners play the most important role in species recovery simply by conserving these species on their land. If you are interested in learning what more you can do to help the recovery effort please contact the Forest Gene Conservation Association

Contact Barb Boysen

Forest Gene Conservation Association

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Email: barb.boysen@ontario.ca, Website: www.fgca.net



Assistance for this project was provided by the Ontario Ministry of Natural Resources and Environment Canada

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