Native Tree Species in Eastern Ontario and Limitations of Current Planting Practices

Owen J. Clarkin
Citizens' Enviromnetal Stewardship Association – East of Ottawa (CESA-EO)
October 18, 2013

Premise:

The pre-settlement forest cover of Eastern Ontario was composed of a large mix of native species, as is documented in the historical record and can even be directly seen today in uncommon legacy woodlots.

Human disturbance has greatly decreased tree diversity throughout our landscape. Clearcutting and converting the land from forest to another use is the most obvious example. Subtle changes are common as well: such as the conversion of mixed climax forest into "Sugarbush", with a selection for Sugar Maple at the expense of the other climax forest species.

Another factor in this problem is current tree planting practices, which appear to arbitrarily "restore" a fraction of the native species, and also introduce a great number of non-native species, while essentially ignoring the rest of the natives. Over time, especially considering that our dwindling legacy woodlots continue to suffer from extensive clearing, this practice can only serve to decrease the diversity and health of the trees in our forests. Additionally, some non-native species are still being used in large-scale planting and are frequently more common in the landscape than other closely-related native species.

Disease and pests are another major factor: globalization and horticulture have introduced many invasive afflictions to our native trees and we will need to consciously search out and breed individual trees with resistance to restore such currently declining species. Planting them now must be part of the recovery plan, to ensure their populations remain large and genetically diverse enough to be viable.

Early successional species generally have benefited from the constant human disturbance, and often have great dispersal abilities. Many of these which are not commonly planted are doing fine due to the disturbed landscape: classic examples are Eastern Red Cedar (Juniperus virginiana) and Black Cherry (Prunus serotina) which were badly exploited but have recovered due to preferring open situations and having seeds being spread far and wide by birds. Trees tending toward climax forest growth have conversely been impacted severely and are not adapted for long-distance seed dispersal; they are not usually able to colonize isolated woodlots in which they were extirpated and will need to be consciously replanted.

Paradoxically, many of the species which are currently uncommon and little-planted are very useful for human use and are low in population due to historical "overharvesting". They must be restored: planting practices must not arbitrarily leave any species decimated by human activity neglected. We hope that our full native spectrum of tree species will be planted in their appropriate habitats with the sincere aim of ecological restoration: the right tree in the right place. The time is now.

The purpose of this document is to raise awareness of native species which are mostly ignored in planting efforts, and need conscious human help for restoration. We do not suggest that native species already receiving attention (e.g. Eastern White Pine) are "overplanted"; in general we need more trees, and native ones especially.

Trees currently neglected and of high priority for increased planting are listed below.
We consider the influence only of "full-sized" trees for simplicity, although there are numerous smaller trees and shrubs with similar needs:

Pitch Pine (Pinus rigida): Native to Eastern Ontario Very useful tree for poor soils but can grow well virtually anywhere: dry, wet (swamp edge), or mesic. This is a southern tree species which can be expected to flourish with continued global warming.

Red Spruce (Picea rubens): Native. The story of this tree is tragic: it is a climax species which was dramatically "overharvested" for valuable wood and not replanted due to species confusion with other spruces and allegedly slow regrowth (historically Norway and White Spruce used for replanting, Blue and Serbian Spruce arbitrarily used for lawns). Red Spruce is a southern/eastern tree which grows well on damp riparian or dry upland soils and can be expected to perform relatively well for a spruce with continued global warming...fine legacy examples can be found in Ottawa's Greenbelt and widely scattered throughout Eastern Ontario. White Spruce, which is a native but mostly northern Boreal species, died extensively in the heat wave/drought last summer: it may be time to plant at least a mix of spruces including Red Spruce for its tolerance of heat and drought.

Eastern Hemlock (Tsuga canadensis): Native. Suffers from the usual climax forest species problem, which is: it has been extirpated from many of the younger forests and needs to be reintroduced via replanting. "Overharvested" by the 19th-century tanbark industry. This species is also threatened by the non-native invasive insect Hemlock Woolly Adelgid and, faced with this threat, needs a large viable population. A species well-adapted to riparian planting.

Butternut (Juglans cinerea): Native. Common and historically planted for tasty walnut fruit. Now endangered due to disease (non-native Butternut Canker) and should be planted to increase population of blight-resistant trees in landscape via natural selection of resistant individuals. Unfortunately, the current trend is to plant the related non-native Japanese Heartnut (J. ailantifolia) or the hybrid of both species known as Buartnut (J. x bixbyi) which may over time result in hybridization introgression loss of Butternut as a distinct species (see similar problem with Slippery Elm). Butternut grows well along rivers/streams.

Shagbark Hickory (Carya ovata): Native. Rare in the landscape near Russell, more common just to the south. May have been drastically "overharvested" for valuable wood (current question for research). This and the following Hickory are long-lived trees with strong and valuable wood, little impact from disease, and "southern" characteristics of heat and drought tolerance. The nuts of this species are edible. Hickories, like oaks, are often not considered easy for planting due to having large taproots, this problem has been solved with the introduction of narrow and deep pots for nursery growth. The taproot is really an advantage, providing resistance to windthrow and drought.

Bitternut Hickory (Carya cordiformis): Native. Fairly common in the landscape near Russell, but still hardly ever planted intentionally. A very useful tree which can thrive on wet ("swamp hickory") or dry sites, has southern characteristics of heat and drought tolerance. Strong wood,with beautiful bright yellow autumn leaves and winter buds.

Yellow Birch (Betula alleghaniensis): Native. Suffers from the usual climax forest tree problem, needs to be intentionally reintroduced to isolated areas from which it has been extirpated via human carelessness. Grows well along edges of swamps, or ravines.

Beech (Fagus grandifolia): Native. Suffers from the usual climax forest tree problem, needs to be intentionally reintroduced to isolated areas from which it has been extirpated. Beech has two additional challenges: 1. Introduced Beech Bark Disease is moving in from the east and a large population will be needed to produce disease resistant individuals via natural selection. 2. A major dispersal agent of Beech nuts, the Passenger Pigeon, has been extinct in the wild for over a century and it is possible this is limiting the dispersal of the species (White Oak/Bur Oak may also suffer from this problem).

White Oak (Quercus alba): Native. Similar situation to Shagbark Hickory; rare in the landscape near Russell, more common just to the south. May have been drastically "overharvested" for valuable wood (current question for research). A "southern" tree, which can be expected to perform well with continued global warming.

Swamp White Oak (Quercus bicolor): Native to Eastern Ontario. A swamp-adapted tree of southern disposition, can be considered for planting along with the already commonly planted Bur Oak (Quercus macrocarpa).

Elms: have suffered very badly by the invasive Dutch Elm Disease and are now being largely "forgotten" in the current era of the Emerald Ash Borer. This is tragic, as the situation for native elms has never been worse.

American Elm (Ulmus americana): Native. This species is amazingly still very common due to its inherent colonization abilities and youthful vigour. So for the present time, "planting" is not the concern here. However, rare large individuals which are exhibiting disease resistance should be intentionally propagated and crossed with other such individuals for eventual release back to the wild with genetic resistance. A good example of a large and presumably resistant specimen can be found at the intersection of Russell Road and Leitrim Road, west of Carlsbad Springs.

Rock Elm (Ulmus thomasii): Native. Presently uncommon to rare in the landscape. It is only a little exaggeration to call this tree the broadleaf "White Pine" of Southern Ontario. 19th-century logging records indicate it was cut very thoroughly for its uncommonly valuable wood; however, unlike White Pine it was not replanted due to alleged slow growth. The situation is so dire and the species so "forgotten", that in the current crop of reforestation documents this tree does not even elicit mention as a species for consideration of planting in Ontario, even though it badly needs human assistance and used to support a large part of the logging industry! A large one found by the present writer growing at the front entrance of local nursery was not even recognized by the owner! We apparently have some (hopefully curable) amnesia regarding the two presently uncommon elms. This tree is somewhat more resistant to Dutch Elm Disease than American Elm but does not have the colonization abilities for disturbed sites. There are widely scattered large survivors left (a huge one is in plain sight at the "Percival House" in downtown Merrickville) but they need a "dating service" with human help to breed with other resistant remaining Rock Elms. The species is rather shade tolerant and more of a climax-forest type tree than the other elms, and it is likely that the bulk of the remaining population exists as shade-tolerant understory root sprouts, where it is certainly usually confused with the far more common and similar-looking, but less shade-tolerant American Elm. Rock Elm is a very useful tree which convergently evolved with Bur Oak and therefore is similar to it: valuable wood, longevity (apart from Dutch Elm Disease), drought tolerance, heat tolerance, ability to grow on clay bottomlands and rocky uplands, etc. Grows well in riparian situations too! Needs help to increase its population and thereby have natural selection for disease resistance.

Slippery Elm (Ulmus rubra): Native. Presently uncommon to rare in the Eastern Ontario landscape. This species suffers severe conservation issues, which are different from those of Rock Elm. It was and still is harvested extensively for the "medicinal" properties of its mucilaginous the inner bark. It is more Dutch Elm Disease resistant than the other two native Elms, but still is susceptible. Apart from logging, the major problem is one of hybridization with the non-native and sadly very common and invasive Siberian Elm (Ulmus pumila). They freely hybridize, with the hybrids even being more common in many areas than "pure" Slippery Elm. Slippery Elm is the more useful tree to humans and from at least this perspective must be conserved as a distinct species! Therefore, Slippery Elm needs to be planted intentionally to preserve it into the future as a distinct species. It grows well in many situations, including riparian zones.

Black Maple (Acer nigrum): Native. A "southern" tree which is closely-related to Sugar Maple. Uncommon at Russell: it becomes locally common and even dominant, replacing Sugar Maple,in areas toward Cornwall (e.g. Summerstown Forest). This species can be expected to grow better than Sugar Maple with continued global warming. It is adapted better to heat, drought, and damp heavy clay soils (similar to Rock Elm, Bur Oak). It merits consideration for planting along with Sugar Maple.

Basswood (Tilia americana): Native. This beautiful and useful species is actually rather common in the landscape. The issue is that for reasons unknown, the non-native Little-Leaf Linden (Tilia cordata) is almost exclusively the species planted in modern years: if this lamentable trend continues unabated it may threaten Basswood with hybridization loss of identity and/or displacement.

Ashes: Are currently suffering very badly due to the invasive Emerald Ash Borer (EAB) insect. The three native species are among the most common trees in the landscape (especially Red Ash) but their populations are currently collapsing with resultant immense ecological impact. They are presently common and in the near future will be uncommon, rare, or even extirpated if nothing is done. They will definitely need human help (breeding programs) if they are to avoid extinction. Research out of the epicentre near Detroit indicates that there are very rare survivors (less than 1 in 1000) of EAB from all three native species, and these individual trees probably have some resistance to the insect. In a few years we will need to find any survivors and breed for their resistance,similar to the American Chestnut recovery program, the rare survivors are too isolated to pollinate each other. White and Red Ash are similar-looking and easily confused; Black Ash is more distantly related and looks from a distance a bit like a walnut with "tropical"-looking larger leaves.

White Ash (Fraxinus americana): Native. This is the mature forest species of the three. It is a large tree with valuable wood. Just before EAB was accidentally imported, it was becoming a commonly planted ornamental tree. EAB attacks it after all of the Red Ash in an area are already declining or are killed.

Red Ash (Fraxinus pennsylvanica): Native. This is a very adaptable tree and extremely common in Eastern Ontario due to its colonizing abilities (similar to American Elm this way). Grows on bottomlands by preference, but also on virtually any site. In a local area, it is the first of the three species to die from EAB, apparently due to the insects preferring it as a host.

Black Ash (Fraxinus nigra): Native. This is mainly a swamp-habitat tree, and is locally abundant on wetlands.

References:

Example of 19th-century logging records, available for download online (there is a series of these): "Appendix to report of Fruit Growers' Association, FORESTRY. Report of Delegation, Appointed to Attend the: AMERICAN FORESTRY CONGRESS. Held at Cincinnati Ohio, April 25th to 29th, 1882 and subsequently at Montreal, Province of Quebec, August 21st to 23rd, 1882. Printed by Order of the Legislative Assembly. Toronto: Printed by C. Blackett Robinson, 5 Jordan Street, 1882."

Andrea C. Anulewicz et al. "Emerald Ash Borer (Agrilus planipennis) Density and Canopy Dieback in Three North American Ash Species." Arboriculture & Urban Forestry 33(5), 338–349, 2007.

Andrea C. Anulewicz et al. "Host Range of the Emerald Ash Borer (Agrilus planipennisFairmaire) (Coleoptera: Buprestidae) in North America: Results of Multiple-Choice Field Experiments." Environ Entomol. 37(1), 230-41, 2008.

Tannis Beardmore et al. "A survey of tree species of concern in Canada: the role for genetic conservation." The Forestry Chronicle, 82(3), 351-363, 2006.

Paul M. Catling "The Problem of Invading Alien Trees and Shrubs: Some Observations in Ontario and a Canadian Checklist." The Canadian Field-Naturalist, 111, 338-342, 1997.

David Euler (ed.), Algonquin Park: The Human Impact. Algonquin Eco Watch, 2009.
Discusses the human impact on Ontario populations of Red Spruce, Hemlock, et al.

John Laird Farrar, Trees in Canada. Canadian Forest Service and Fitzhenry & Whiteside, 1995.

Alain Franc et al. "Substantive Element: Maintaining Forest Cover to Meet Present and Future Needs." IUFRO Occasional Paper 15, Part 1, 11-14.

Kathleen S. Knight et al. "Factors affecting the survival of ash (Fraxinus spp.) trees infested by emerald ash borer (Agrilus planipennis)" Biological Invasions, 15(2) 371-383, 2013.

Gerald N. Lanier et al., "Dutch Elm Disease and Elm Yellows in Central New York." Plant Disease 72(3), 189-194, 1988.

Alex Mosseler "Canada's Forest Genetic Resources." Petawawa National Forestry Institute, Information Report PI-X-121, Canadian Forest Service, 1995.

Alex Mosseler and WW Bowers. "Criteria and Indicators of Sustainable Forest Management: From Concept to Reality." IUFRO News, 27(3), 9-11, 1998.

Alex Mosseler "Minimum Viable Population Size and the Conservation of Forest Genetic Resources." Chapter 13 in S. Puri (Ed.) Tree Improvement: Applied Research and Technology Transfer. Science Publishers, Inc. USA, 191-205, 1998.

Alex Mosseler and OP Rajora. "Monitoring population viability in declining tree species using indicators of genetic diversity and reproductive success." *Environmental forest science*. Springer Netherlands, 333-343, 1998.

Alex Mosseler et al. "Indicators of population viability in red spruce, Picea rubens. 1. Reproductive

traits and fecundity." Canadian Journal of Botany, 78, 928-940, 2000.

Alex Mosseler et al. "Overview of old-growth forests in Canada from a science perspective." Environmental Reviews, 11, S1-S7, 2003.

Alex Mosseler et al. "Old-growth forests of the Acadian Forest Region." Environmental Reviews, 11, S47-S77, 2003.

Alex Mosseler et al. "Old-growth red spruce forests as reservoirs of genetic diversity and reproductive fitness." Theoretical and Applied Genetics, 106, 931-937, 2003.
Lisa M. O'Connell et al. "Impacts of forest fragmentation on the reproductive success of white spruce (Picea glauca)." Canadian Journal of Botany, 84, 956-965.

Ran Nathan et al., "Spread of North American wind-dispersed trees in future environments." Ecology Letters, 14(3), 211-219, 2011.

Neil Pederson, "External Characteristics of Old Trees in the Eastern Deciduous Forest." Natural Areas Journal, 30, 396-407, 2010.

Danijela Puric-Mladenovic et al. "An analysis of the vulnerabilities of Terrestrial Ecosystems and Vegetation Cover to climate change in the Lake Simcoe watershed."

Om P. Rajora et al. "Indicators of population viability in red spruce, Picea rubens. 2. Genetic diversity, population structure, and mating behaviour." Canadian Journal of Botany, 78, 941-956, 2000.

Om P. Rajora et al. "Mating system and reproductive fitness traits of eastern white pine (Pinus strobus) in large, central versus small, isolated, marginal populations." Canadian Journal of Botany, 80, 1173-1184, 2002.

Eric J. Rebek et al. "Interspecific Variation in Resistance to Emerald Ash Borer (Coleoptera: Buprestidae) Among North American and Asian Ash (Fraxinus spp.)," Environmental Entomology 37(1), 242-246. 2008.

Rudy J. Scheffer et al. "Biological Control of Dutch Elm Disease." Plant Disease 92(2), 192-200, 2008.

Sara R. Tanis and Deborah G. McCullough, "Differential persistence of blue ash and white ash following emerald ash borer invasion." Canadian Journal of Forest Research, 42(8), 1542-1550, 2012.

JG Whitehill et al., "Interspecific Comparison of Constitutive Ash Phloem Phenolic Chemistry Reveals Compounds Unique to Manchurian Ash, a Species Resistant to Emerald Ash Borer." Journal of Chemical Ecology, 38(5), 499-511, 2012.

Juan E. Zalapa et al. "Patterns of Hybridization and Introgression Between Invasive Ulmus pumila (Ulmaceae) and Native U. rubra." American Journal of Botany, 96(6), 1116-1128, 2009.