Quercus ellipsoidalis E.J. Hill on Rims of Kettle Bogs in Ontario

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Abstract:

Hill's oak, *Quercus ellipsoidalis*, an occupier of a major and extensive disjunction in southwestern Ontario, grows on drier sites of glacial drift. It also grows on kettle bog rims and should be looked for on that very restricted habitat in its U.S.A. range where bogs occur, ie. north of the Wisconsin terminal moraine. Scarlet oak *Q. coccinea*, new for Canada, is mentioned in passing.

Hill's oak is a medium-sized, mid-continent red oak of North America. It occupies the interface between the tall grass prairie and the deciduous forest. It is closely related to its sister clade, the Appalachian scarlet oak *Q. coccinea*. Some say it is the same species, being merely the midwestern expression of its eastern sister. Whatever truth prevails, they are closely allied and have recently evolved from a common ancestor. With experience in the subtle and not so subtle differences they can be distinguished. They both occupy the most xeric habitats in their mostly allopatric ranges. They are both minor species in the great assemblage of American oaks.

To horticulturalists, the pair are a great gift with their small size (for an oak), tight upright-oblong crowns, cold tolerance, ability to withstand heat and drought, but best of all, their superb, consistent autumnal coloration in the red, scarlet, maroon and purple spectrum. Hill's oak is superior to scarlet for horticultural purposes, since the twigs, leaves and buds are smaller and the tree presents a daintier, more delicate aspect. Some individuals are akin to *Q. georgiana* in that respect.

In southern Ontario, Hill's oak currently occupies all or part of ten contiguous counties, cities, or regional municipalities. The range must have been more widespread during the postglacial hypsothermal, otherwise how did this disjunct population get here? The author has been studying this Ontario population for 45 years, and feels that Hill's oak is entitled to a specific name of its own, compared with scarlet oak. It certainly occupies an intermediate position in every respect. However, the author is a lumper, not a splitter. The main Hill's oak population occurs in Minnesota, Wisconsin, and northern Iowa, with disjunctions in Michigan and in northern Illinois, Indiana, and Ohio. It is definitely a tree of oak savannah and long grass prairie.

In Ontario's Brant County, it is arguably the most common of the three native red oaks in that jurisdiction; this could be considered the centre of its Ontario, and therefore Canadian, distribution (the author has not mentioned a second population along the Minnesota border - far from the one under discussion). In Brant County, it is currently genetically swamping its congeners red oak, *Q. rubra*, and black oak, *Q. velutina*, producing some interesting, but confusing to the neophyte, hybrids. These

hybrids, or their progeny, should be able to occupy progressively less xeric habitats than the dominant parent, therefore eventually producing a new entity capable of occupying more mesic habitats than Hill's oak presently does. Near Dunnville, in Haldimand County, in the Niagara peninsula between lakes Erie and Ontario, Hill's oak grows within one km. of the native Pin oak, *Q. palustris*. There is no hybridization occurring between these two, allopatric by virtue of being occupiers of the driest and wettest habitats for their genus, in Canada. Another wetland species, Shumard oak, *Q. shumardii*, does not hybridize with Hill's oak at a location slightly north, in the town of Grimsby, Region of Niagara.

Ontario is blessed with a nearly full complement of the pin/Shumard complex, lacking only the gulf coastal plain *Q. nuttallii*. Until recently, few realized that Hill's and Shumard's oaks were even in this province, and fewer still realized that these oaks would turn out to be more widespread than pin oak, long known to occur here.

Recently, the author discovered a few individuals of scarlet oak, *Q. coccinea*, near the Niagara River. He has studied this species throughout its North American range for forty-seven years, and feels confident in stating its presence in Ontario; however, this is not the forum or the time for this discussion. To put an old plagiarized myth to rest, in all those years, the author has only seen one individual with apical acorn rings! Most, however, have longitudal striping, as do many species.

Many dimensional parameters and fruit, bud, crown, and bark characteristics for the five species in the Shumard complex have been published elsewhere. The author has never seen a comparison of living leaves, useful for field work, in contrast to using dried specimens, where many features are lost. We repeat the axiom of oak study: use sun leaves from fruiting twigs. For a comparison of the four native Ontario oaks in this complex, see Table 1

Table 1: Shumard oak complex; living leaf rankings and habitat requirements:

Species	Habitat	Ventral Gloss	Ventral Abaxial Tufts	Dorsal Gloss	Leaf Size
scarlet oak *Q. coccinea*	xeric – all ages, shade intolerant (2)	1 shinier than dorsum	NIL	1 bright emerald Green	1(2)
Hill's oak *Q.ellipsoidalis*	xeric – all ages, shade intolerant (1)	2 shinier than dorsum	2	2 very dark green	3(4)
pin oak *Q. palustris*	wet feet shade tolerant (as a seedling)	4	3 minor (if at all)	3 yellow/green	4(3)
Shumard oak *Q. shumardii*	wet feet Shade tolerant (as a seedling)	3	1 major (rusty)	4 often opaque	2(1)

Southern Ontario contains three distinct substrate types, widely separated by time and erosion episodes. Lowest is the igneous and metamorphic basement, which also forms the basement of two thirds of North America. It is commonly known, where it is exposed across much of boreal and arctic Canada as the Canadian shield. It spans the inconceivable time span from three billion to one billion years ago. Lest a textbook purist-geologist attack this paper, the Grenville province portion of the shield, lying under that portion of southern Ontario concerning this article, is only

1.3 ~ 1.1 billion years old.

From one billion to 570 million years ago, there is a large gap in deposits known as the great unconformity. Much of the bedrock of southern Ontario has above it Paleozoic sedimentaries such as shales, siltstones, sandstones, limestones, and dolostones, ranging in age, from the bottom up, from 570 million to 350 million years old, or ordovician to devonian, inclusive.

The water of four of the five Great Lakes, flowing over a Sirlurian dolostone capstone, unto an Ordovician redstone shale (Queenston), softer, and therefore undermined, forms the world famous Niagara Falls. The feature over which it plunges,

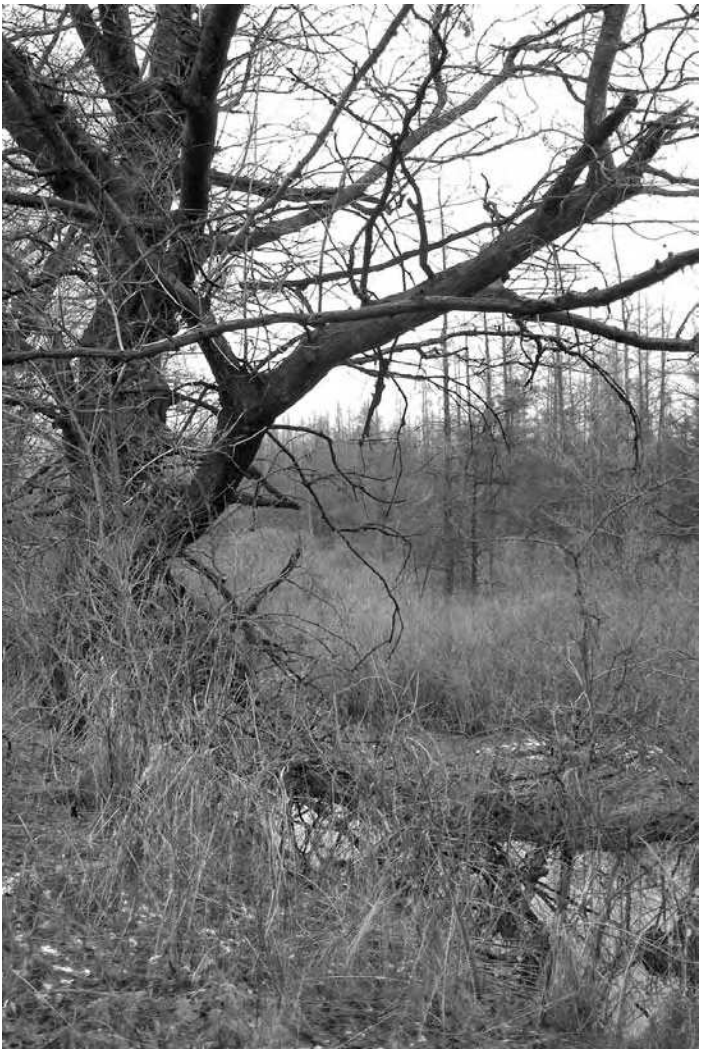

Fig 1. Hill's oak on bank.

Fig.2 Long view of a bog; oaks on far bank, spruce on the bog in middle ground, mixed ericads and miscellaneous species in front, with glimpse of *Thuja* in immediate foreground.

Fig 3. Hill's oak and bog; on right showing mostly *Larix*

a United Nations-designated World Heritage Site, known as the Niagara escarpment, is an 800 km long feature of southern Ontario, and can be seen from space. This escarpment can actually be traced from Iowa to New York in a great northward curving arc. It forms, to name a few, the Door peninsula of Wisconsin, Manitoulin Island, Ontario (the world's largest freshwater island, famed for its alvars), and the Bruce peninsula of Ontario, famous for the large diversity of temperate-latitude ferns, orchids, and endemic dicots. Do not forget Niagara Falls, over which flowed, before human intervention, 6,000m^3/sec. of water.

After another lengthy time period dubbed the "Big Gap" from 350 million years ago to 135,000 years ago, when there was only uplift and erosion in Ontario, glacial deposits began to be laid down and alternately scraped away. The most recent glaciation, known as the Wisconsin, began retreating (melting back) about 20,000 years ago. The resulting deposits form the third and uppermost layer of Ontario bedrock. It is composed of some stratified but mostly unconsolidated tills of sand, silt, clay, conglomerates, and erratic boulders. These often form recognizable structures such as drumlins, kames, eskers, and moraines. There are also many fluvial and lacustrine deposits including abandoned beaches, bars, outwash plains, and deltas. These may be variously sand, silt, clay, or cobbles.

Features that are common indicators of retreating continental glaciers are kettle bogs. These are formed when blocks of ice sever from the decaying ice. Subsequently they become buried by till, usually sand or gravel in an outwash plain. Insulated by their cover, they take longer to decay than exposed ice. When eventually they do melt, they result in a dimple in the landscape, usually pot- or kettle-shaped, hence the name. If they fill with ground water, and eventually vegetation, it is usually ericaceous and sphagnous, cooler and more acid than the surroundings. In southern Ontario, which at the time of European settlement in 1780-1820, the cover was 90% deciduous forest and10% long grass prairie/oak savannahs, the bogs contained boreal relict species, mostly ericads, *Larix* and some *Picea*. The ericads included such genera as *Andromeda, Chamaedaphne, Gaultheria* (2 sp.), *Gaylussacia, Kalmia, Ledum,* and *Vaccinium* (5 sp.). Other shrubs present might include *Cephalanthus, Cornus* (3 sp.), *Ilex, Nemopanthus, Pinus, Rosa, Rubus* (2 sp.), *Salix* (numerous sp.), *Spirea*, and *Thuja*. These bogs today often have Hill's oak growing on their banks. **Figures 1, 2** and **3** show such a bog in late winter.

There are several possibilities for the explanation of oaks near these bogs:

1) If a mature closed canopy forest had developed over centuries in the surrounding vicinity, the only place with full or at least half-sunlight for a medium-sized tree would be the bog bank. Individual crowns could reach over the open bog.

2) As senescent leaning trees toppled into the bog, they would create large sunny beds for seedling recruitment.

3) When the aboriginal people had used fire to clear the surrounding level area for agriculture, the bog bank might serve as a refugium.

4) Similarly, after European settlement, soil tillage would destroy seedling recruitment on the level grounds, but the bog bank would function as fence lines do today.

5) In a natural fire, prior to human interference, there would be enough moisture in the lower bog bank to allow more roots to survive and sucker than at the higher elevations.

6) With a greater accumulation of organic debris at the bottom of the bank and

in the presence of the peat and/or sphagnum itself, the pH would be lower there, than at the higher elevations, creating a more agreeable seedbed for an oak.
7) In a fairly level area, the top of the bank would represent the best drainage site for an obligate xeric species.

In Ontario today, urban expansion and suburban sprawl coupled with farm industrialization are threatening the rural landscape. Kettle bogs and their banks, themselves always rare and now endangered, may represent the last refuge of Hill's oak in Ontario.

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