The forests of southern Ontario¹

by Ken A. Elliott, R.P.F.²

Introduction

The forest ecosystems that exist in southern Ontario today are the result of many biological, environmental and human influences. The range of most species is determined by local climate, disturbance, topography, soil conditions, and competition. Humans, especially since the beginning of European settlement, have changed the character and distribution of southern Ontario forests through land clearing for agriculture, logging, and urban development.

This paper presents a brief overview of some of these important historical influences and their impacts on forests, briefly outlines the six major forest types in southern Ontario, and summarizes some of the pertinent movements and programs that address forest conservation concerns.

Some Historical Influences

Pre-European First Nation Forest Use

Prior to European settlement the First Nations people used the forests as a primary source of food and shelter. They used fire to improve forest conditions for hunting and to retain small clearings for farming (Lambert 1967, Riley and Mohr 1994). These fires, as well as lightning ignitions, had an important influence on the distribution and composition of the historical forests of southern Ontario.

Timber Extraction Begins

Although Europeans began traveling through the forests of southern Ontario in the 1600s, the systematic clearing of land for timber extraction did not occur until the nineteenth century (Lambert 1967). Large-scale logging was first done to satisfy the needs of both the British and French navies (Ontario Royal Commission on Forestry 1947). Initial cutting (1776 to 1836) focused on giant oaks for masts, spars, and hulls. During the Napoleonic wars, preferential tariffs encouraged the cutting and squaring of large red and white pine for export to the United Kingdom (Lambert 1967). In the 1850s changes to the British trade policy and the signing of a treaty between Canada and the United States greatly increased the export of pine sawlogs to the U.S.

European Settlement and Land Clearing for Agriculture

Settlement and land clearing began in the 1780s with land grants to the United Empire Loyalists. This led to a steady progressive partitioning of the lands by the end of the century. Clearing occurred more slowly, despite the requirement that 5 acres and the road right-of-way had to be cleared within three years in order to gain full title to land granted by the Crown (Lambert 1967). Although the Deputy Surveyor was instructed to reserve

suitable navy timber for the Crown, in southern Ontario this directive was mostly ignored in favour of getting the land into the hands of settlers. Most settlers saw these forests as having little value and as obstacles to their farming efforts (Ontario Royal Commission on Forestry 1947). Fire was also used by settlers to clear land and widespread forest fires often burned considerable areas of slash and the understories of "high-graded" stands.

Logging Booms and Economic Trends

High-grading harvests that removed mainly the biggest and best trees occurred frequently. In the early 1800s the Europeans cut red and white oak and pine mostly for the naval industry. Later that century the Americans imported high quality Canadian hardwoods and pine sawlogs. There was also a hemlock removal phase, when the bark was used extensively for the tanning industry. Demands of the two world wars put further pressure on the forests. Today, market driven exploitation continues. For example, recent (1995 to 1997) high prices for maple have spurred the harvesting of many hardwood forest stands in southern Ontario.

Cutting for Charcoal Era

In the 1940s severe cutting of forests (e.g., clearcutting) occurred in response to the needs of the charcoal industry. Although some of these sites were destined for conversion to agriculture some were left to regenerate as even-aged forests, often dominated by less shade-tolerant species.

Climatic Events

Climatic events, especially when combined with human activities, can have detrimental effects on land. For example, land that was cleared of forests in the 1800s and then farmed intensively until nutrient depletion of the soil occurred, were particularly hard hit by depression-era droughts that left many of them severely gullied by erosion, with little or no topsoil and vegetation. On a smaller scale, other climatic events such as wind and ice storms, floods, tornadoes, and severe winters have also affected the distribution, structure, and composition of many forest stands in southern Ontario.

Forest Diseases

Two major introduced diseases have caused devastation to specific forest tree species. Chestnut blight (*Cryphonectria parasitica*) arrived in southwestern Ontario in the early 1920s and within 50 years had virtually eliminated American chestnut from the province. This provincially rare species was once a relatively common tree on drier, sandy sites of the Deciduous Forest Region.

Dutch elm disease (*Ceratocystis ulmi*) also arrived in the 1920s and subsequently killed a significant portion of the elm

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²Carolinian Forestry Specialist, Ontario Ministry of Natural Resources, South Central Sciences Section, 659 Exeter Road, London, ON N6E 1L3 E-mail: elliotk@gov.on.ca

populations in Ontario. However, some resistant trees remained and many young trees have regenerated. Unfortunately, when the young trees reach a diameter of 10 to 15 cm many of them become infected and die. So it appears that the forest composition has been altered for the long term.

Butternut canker (*Sirococcus clavigignenti-juglandacearum*) is another disease that could be as devastating because it appears to be progressing at a fairly rapid rate through the butternut population of the province. Also very recent evidence seems to indicate that flowering dogwood is being affected by anthracnose (*Discula destructiva*).

Urbanization

Another historical influence on the forests of southern Ontario that continues today is urbanization. The pace of urbanization has continued to increase since the 1800s. Two major urbanizing trends are putting pressure on the forests of southern Ontario. One is the expansion and sprawl of cities, towns, villages and the associated infrastructures (e.g., roads, sewers, hydro lines, gas lines) that support them. The other is a trend towards rural living, resulting in the construction of rural subdivisions and individual houses in woodlots severed from farmlands.

Urbanization represents a particularly insidious threat to the natural landscape because it often permanently converts it to pavement, buildings, and other anthropogenic features, and does not permit transition back to natural conditions. It also has negative impacts on adjacent or incorporated natural areas including the impairment of ecological functions; simplification of ecosystems; forest fragmentation; introduction of invasive, non-native species; increased nest predation by wildlife and domestic animals such as cats; and loss of wildlife habitat and rare and sensitive species.

Poor Forest Management Practices

Interpretations of what constitutes poor forest management practices vary considerably. However forestry and resource management professionals generally agree that such practices have occurred widely since European settlement and continue to cause significant problems across the province. Two general causes are frequently cited. First, a trend in the land turnover rate of about eight to 12 years leads some selling landowners to harvest their woodlot without concern for its future or new landowners may harvest a woodlot to recover some of their purchase costs. Second many landowners elect to reap maximum return from their woodlots over the short-term rather than spread economic return out over time. Most of these woodlots are usually "high-graded," with the removal of the largest, highest quality trees or species and often omission or deferment of necessary stand improvement practices. Unfortunately, all too often, these causes work together to undermine the ecological health of many woodlots in Ontario.

Although there has been increased use of forest management plans on private property, most harvests still occur without the guidance of a management plan or silvicultural prescription. In addition to this problem, poor markets for low quality and small diameter wood have made it difficult for conscientious forest managers to accomplish all their silvicultural goals when a forest harvesting operation is conducted.

There is a lack of forest management research pertaining to southern Ontario to support the development of guidelines and standards based on local research findings. Most of the current guidelines are based on American and central Ontario research

modified by limited local knowledge and experience. Present legislation, bylaws and guidelines would be much better if they could be based on current local information.

Some Historical Forest Conservation Measures Government Forestry and Extension Services

The Government of Ontario began assisting private landowners and municipalities around 1905. In the early years the emphasis was on the reforestation and restoration of the numerous unstable, eroded blow sand areas that were exposed during the rapid agricultural expansion of the late 1800s. The Government of Ontario established a successful partnership known as the Agreement Forest Program, in several counties where these fragile lands existed. These lands were leased to the government to manage for "forestry purposes." The program was later expanded to include agreements between the Ontario government and counties, regional municipalities, townships, Conservation Authorities, the Government of Canada, and one private corporation. At the height of the program almost 107 000 hectares were under this agreement (Borczon 1982).

The Ontario government also developed and established the infrastructure and technology for seed collection and cleaning, seedling production nurseries, distribution, and tree planting (Zavitz 1959). Since 1905, government tree nurseries have provided seedlings to private landowners at subsidized prices.

In the 1950s and 1960s, trained government staff were hired to provide extension services to private landowners who intended to conduct forestry operations such as tree planting or woodlot management on their properties. With the introduction of the *Woodlands Improvement Act* in 1967 these services became more available under both formal agreements and less formal extension programs. The formal agreements were primarily designed to plant trees with the landowner paying for the trees (at a subsidized rate) and the government covering all the other management costs. Free government extension services included field consultation, tree marking, and assistance in marketing forest products.

At the peak of the government extension services period (1977 to 1987) approximately 22 million trees were being planted annually on private lands (Staley 1987). Also, approximately 9000 field inspections were being made annually and an annual average of 400 000 cubic meters of timber were marked. During the quarter century since the introduction of the *Woodlands Improvement Act* there has been a remarkable amount of private land restored to forest and a considerable number (probably around 10%) of private woodlands have obtained forest management advice.

By 1994, the government had eliminated private land extension services. By 1998, only one government nursery was still producing tree seedlings for private land and this nursery was privatized recently. The present approach to private land forestry encourages landowners to help themselves through education and planning. To assist landowners with this new approach, the government has established a network of stewardship coordinators, organized around municipal boundaries, with each coordinator being guided by a council of local residents representing landowner interests within the municipality.

Municipal Tree Bylaws

The predecessor to the *Trees Act* was introduced in the 1940s in response to extensive clear cutting that was occurring

due to a strong market for charcoal and firewood (Tree Bylaws Advisory Committee 1991). The legislation, which has been changed very little in the past 50 years, provides interested upper-tier municipalities with a way to pass bylaws designed to control the clearing of forests. In the past few decades the interpretation of the legislation has been stretched in an attempt to encourage proper forest management. The *Municipal Act* was recently amended to allow for the passing of tree protection bylaws in municipalities with at least 10 000 people.

Most municipalities have relied on an easily measured "diameter-limit" approach to restricting forest harvesting operations. Although this method of regulation does protect the young growing stock where appropriate quantities and quality of regeneration exist, in many forests this technique actually exacerbates previous problems resulting from past "high-grading" (i.e., taking the best and leaving the poorest timber) (Tree Bylaws Advisory Committee 1991). As well, the diameter-limit does not prevent "high-grading" and promotes a system of harvesting, which is unsustainable under many circumstances.

Some municipalities still do not have tree-cutting bylaws and others have found them to be difficult to enforce or incapable of protecting forest ecosystems. Forest clearing and poor forest management practices have continued in a relatively uncontrolled fashion across most of southern Ontario in large part because many municipalities have little or no confidence in the use of these bylaws and others do not believe their forests require this type of protection.

Forest Management Incentive Programs

In the early 1970s landowners expressed concerns about the taxation of forested properties. By 1976 a tax rebate program was established to compensate landowners for taxes paid on woodlots that qualified for the program and that were being conserved through their management practices. Although this program has gone through a few alterations and was canceled once by government, it currently exists as the Managed Forest Tax Incentive Program (MFTIP). Under this tax reduction program, landowners who manage their property under an approved management plan pay 25% of the land taxes on the portion of their property that qualifies as a "Managed Forest."

This incentive program, especially with the recent trend towards increased land taxes, is considered to be a constructive landowner-based approach to maintaining more forest cover on private land.

Development of Natural Area Protection in Ontario

Since the establishment of Algonquin Provincial Park in 1893, some effort has been directed at protecting significant natural areas within the provincial park system. In the late 1940s another program was developed, granting designated Conservation Authorities a mandate to control water flow within their watersheds in order to reduce flooding, erosion, and property damage. Collectively, these Conservation Authorities (CAs) became another conservation agency that purchased lands and established a system of conservation areas that protected natural ecosystems and provided recreational opportunities. Nature or ecological reserves funded by generous individuals and citizen groups such as the Federation of Ontario Naturalists have also contributed to the existing network of protected natural areas.

Over the past century, efforts by all these agencies have succeeded in placing a significant amount of forest land under some

form of protection. Also, new conservation agencies continue to be created (e.g., Land Trusts), reflecting an increased public awareness and appreciation for protected natural areas. Many municipalities now play an important role in the protection of natural areas because they have taken over the management of Agreement Forests from the Ontario Ministry of Natural Resources.

Increasing Conservation Ethic in the Public and Forest Landowner

Over the past century there has been a general increase in the public's concern for the environment. Examples include an increase in rural forest property ownership, and involvement with tree planting and other habitat restoration projects, as well as membership in conservation and naturalist groups. Even during relatively hard economic times, public interest in the conservation of natural areas, including woodlands, remains strong. As more of the natural landscape of southern Ontario is developed, public support for, and appreciation of, remaining natural areas can only grow stronger.

Increased Use of Written Forest Management Plans

Today, more forest stands in southern Ontario than ever before are managed under the direction of a written management plan. This success is mainly a result of the MFTIP management plan requirements. In order to qualify for the program, landowners must have an approved management plan for their woodlot. Although the proportion of woodlot owners who have become involved with this newer program is still quite low, these landowners tend to be concerned about the overall importance of their woodlots, maintaining or encouraging healthy woodlots, and are interested in learning about what they should do to protect them for the future.

Changing Role of Ontario Government and Private Sector Forestry

As stated earlier, the Government of Ontario, through the Ontario Ministry of Natural Resources (OMNR), has moved away from an active role in forest management to one in which the OMNR provides policy direction, science and technology transfer, and advice through its staff and stewardship coordinators. As a result of this change in roles, private sector forestry consulting and field forestry services have developed considerably over the past few years.

Current Forest Conditions

After approximately 200 years of human alteration of the southern Ontario landscape, the existing structure, composition, and function of forests in this part of the province, especially south and east of the Canadian Shield, have changed dramatically. For example, much of this region was almost completely covered by forest and disturbance to it was mostly natural (e.g., fires, windstorms) with occasional small wildfires that were deliberately set by First Nations peoples for hunting and agricultural purposes. Today, forest cover is as low as 2 or 3 % in some parts of southern Ontario and agricultural and urban-based land uses predominate over much of the region.

Forest Cover

In some areas close to the Canadian Shield and on the Niagara Escarpment forest cover levels have increased since

they were originally cleared. However most of these forests are small and fragmented.

Forest cover levels tend to increase as one moves east and north from Windsor, where Essex and Kent Counties in the extreme west of southern Ontario have forest cover levels of less than 5%. The Greater Toronto Area (GTA) has an average forest cover percentage of 18 to 20%. The municipalities east of the GTA have forest covers in the 20 to 40% range and those to the north (i.e., Peterborough, Victoria, and Hastings Counties) have more than 40% forest cover.

Three corridors consisting of higher forest cover can be clearly seen on the map of existing forest cover in southern Ontario (see page 839): the Bruce Peninsula from Tobermory to Long Point, the Oak Ridges Moraine, and the Frontenac Axis in the area of the Thousand Islands.

Forest Composition

It is likely that the present forest overstorey species composition is quite similar to pre-European settlement forest but in different proportions. Due to extensive cutting, grazing, and burning that accompanied early settlement and agricultural development, the forests that remained would have regenerated to a greater number of species with shade intolerance or mid-tolerance. These forests that regenerated in the late 1800s and early 1900s are now the mature forests of southern Ontario and likely contain a higher proportion of oak, ash, cherry, hickory, basswood, and many of the Carolinian species in the overstorey than they would have contained in presettlement times.

Due to succession and a generally more passive approach to forest management (e.g., removal of dead trees, single-tree selection system silvicultural prescriptions, and/or no cutting) the intolerant and mid-tolerant species are declining from the overstorey and generally receive insufficient sunlight to regenerate in the understorey. They are being replaced by the tolerant species such as sugar maple, beech, hemlock and red maple that are regenerating in the understorey.

As well, past land clearing and forest management practices have left almost no "old-growth forests." Today, very few forests that have never been harvested exist. In some cases, forests that have remained protected for the past century or more have taken on many characteristics of old forests but are still young in comparison to many of the forests that early European settlers would have encountered.

Also, in some areas forest composition has been drastically changed because of dramatic declines of some species, such as American chestnut and white elm, due to disease. The recent butternut canker epidemic may also cause a significant reduction in the butternut population. Historically, vigorous harvesting practices in combination with more exacting regeneration requirements have reduced the occurrence of natural white pine and hemlock.

More recent trends have also had an effect on certain species. During the 1900s the proportion of beech increased in many farm woodlots because it is shade-tolerant, it had no commercial value and it was generally left standing during harvesting operations. The amount of ironwood, a shade-tolerant understorey tree, also often increased in grazed woodlots because cattle did not eat it and it also had no commercial value. In the 1970s, in woodlots that received tree marking and other government services, both beech and ironwood were often entirely removed, providing another example of the enormous influence

humans have had on the composition and structure of the forests of southern Ontario.

Forest Types of Southern Ontario

The species composition of the forests of southern Ontario varies considerably due to latitude, natural disturbances, local climatic and site conditions such as underlying bedrock and soils, the nature of competing vegetation, and the history of prior forest management and land use. Different systems have been developed to classify these general forest types. In southern Ontario a first approximation of an Ecological Land Classification system (ELC) has recently been developed by the Southcentral Sciences Section, OMNR (Lee *et al.* 1998). This classification system consists of over 80 descriptions of wetland and terrestrial forest vegetation types.

Traditionally the forestry community and ecologists have used less specific classifications for forests. Most of the forests in southern Ontario can be placed into one of the following six general forest types:

1. Upland tolerant hardwoods

This forest type is usually dominated by one or more of the following species: sugar maple, beech, hemlock, red oak, white ash, red maple, and black cherry. Common associates on many sites include ironwood, basswood, bitternut hickory, white pine, white birch, yellow birch, and butternut.

2. Upland oaks

The upland oaks include red oak, white oak, bur oak, and black oak. The most common upland oak forests on sites in southern Ontario are dominated by red oak, but other oak species more typical of the northeastern United States may also occur (e.g., white oak, occasionally bur oak). Other significant species in these forests include white pine, sugar maple, bitternut hickory, red maple, white birch, largetooth aspen, trembling aspen and red cedar. Other less common associates include other hickories, black cherry, sassafras, white ash, beech, and chinquapin oak.

3. Lowland hardwoods

In general, the dominant tree species in the lowland hardwood forests are silver maple, red maple, green (red) ash, black ash, white elm, hemlock, and yellow birch. Other common associates include: trembling aspen, balsam poplar, basswood, white birch, white cedar, balsam fir, red elm, black maple, butternut, white pine, white ash, sugar maple, largetooth aspen, and bur oak.

Carolinian species may also be found in lowland hardwood forests and floodplain areas in southwestern Ontario. These species include hackberry, swamp white oak, Shumard oak, pin oak, black walnut, honey locust, sycamore, and black willow.

4. Lowland conifers

This forest type is commonly dominated by eastern white cedar. These sites also often include balsam fir, white birch, hemlock, tamarack, white spruce, trembling aspen, and largetooth aspen.

5. Carolinian Hardwoods

The Carolinian Hardwoods forest type is characterised by a unique group of tree species found mainly in the south-

western part of southern Ontario. Due to range limitations of these species (they are at the northern limits of their range) and the fragmented nature of the forests in this part of the province, Carolinian hardwoods are encountered as small, scattered populations that are often mixed with more common species that comprise the other forest types described above. Therefore, this forest type is more broadly defined and the management objectives for it focus more on the perpetuation of these provincially uncommon species.

Carolinian forest patches contain some representation of any of the following species: black walnut, hackberry, pignut hickory, shellbark hickory, black gum, tulip tree, sycamore, sassafras, cucumber tree, blue ash, chinquapin oak, dwarf chinquapin oak, Hill's oak, honey locust, hop tree, Kentucky coffee-tree, Ohio buckeye, pin oak, pawpaw, pumpkin ash, red mulberry, swamp white oak, or American chestnut. Stands with a large diversity and/or density of these species are provincially significant.

6. Plantations

These are predominantly coniferous woodlands that have been established through planting. Hardwood plantations or combinations of both conifers and hardwoods are also found. Plantations have often been used to restore forest cover to lands unsuited or unwanted for agriculture, as well as to cover unstable soils. Older, managed plantations (i.e., 40+ years) often contain regeneration from local natural seed sources.

Invasive Non-Native Species

Not all non-native plant species threaten the integrity of forest ecosystems. But some species are highly invasive and can quickly cover woodlands, out-competing native species for nutrients, water, light, and growing space. Tree species of most concern are Norway maple, Scots pine, and black locust. The most invasive shrubs include common and glossy buckthorns, several honeysuckles, barberry, and privet. Herbaceous species of greatest concern in forested areas include garlic mustard, Dame's rocket, and moneywort. Generally, these invading species more readily displace native species in more highly disturbed woodlands that are often found in close proximity to residential areas.

Biodiversity Implications

The generally small size and high degree of fragmentation of most woodlots in southern Ontario as well as the history of forest exploitation and other detrimental impacts of human activities on these ecosystems have led to the extirpation of numerous plant and animals species. As these impacts have persisted and even spread, local populations of other wildlife species such as area-dependent birds have continued to decline and genetic

impoverishment of species growing at the geographical limit of their ranges has become more severe. Forest ecosystem structure, composition, and function in these forests are no longer comparable to the few remaining undisturbed, unfragmented, more natural forests. Today, most forests of southern Ontario have lower native diversity, at the landscape, species, and genetic level. The structural and age diversity of these forests have generally been simplified.

Conclusions

Although southern Ontario forests are somewhat degraded when compared to the forests that most likely existed prior to European settlement, there are numerous opportunities to improve them. Forestry professionals now know more about forest conservation and restoration and emphasize sustainable forest management using performance standards that are designed to ensure natural and healthy forest ecosystems. Also, planners and resource managers are beginning to regard forests within the larger, landscape context, as well as the local site-specific perspective to identify significant natural core areas for watershed protection and maintenance and enhancement of municipal forest cover levels.

Individual property management, legislation, policies, and guidelines for sustainable ecosystem-based management need to be considered in the context of the larger landscape scale and should be based on the most current scientific knowledge, including research from southern Ontario forests as well as other areas.

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