



Trees & Shrubs

for the Improvement and
Rehabilitation of
Pits and Quarries in Ontario





Ontario

Ministry of
Natural
Resources

Mineral
Resources
Branch

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Contents

Introduction	1	Planting Design	
Background		Landscaping	12
The Aggregate Industry	2	Screening	12
Pit and Quarry Rehabilitation	2	Rehabilitation	14
Vegetation of Ontario		Sources and Types of Nursery Stock	
Natural forest regions	6	Types of nursery stock	17
Current forests and woodlots	6	Nurseries	18
Ways of Using Trees and Shrubs		Planting and Maintenance Techniques	
Introduction	8	Time to plant	19
Uses for trees and shrubs	8	Care of trees before planting	19
Site Planning		Planting seedlings and transplants	19
Existing vegetation	9	Planting young trees	21
Planting ahead of time	9	Transplanting from the property	24
Progressive rehabilitation	10	Maintenance	26
Site Preparation		Criteria for Choosing Species	
Grading	10	Winter hardiness	27
Overburden and topsoil	11	Tolerance of soil conditions	27
Soil amendments	11	Tolerance of air conditions	28
		Purpose of planting	30
		Fifty Recommended Trees and Shrubs	
		Selection guide based on soil fertility and moisture	33
		Description of species	35

Description and Evaluation of Existing Plantings	
Study Objectives	56
Study Methods	56
Occurrence of Tree and Shrub Plantings	58
Planting and Maintenance Techniques	
Planting materials	59
Planting and maintenance procedures	59
Cost of plantings	59
Evaluation of Plantings	
Plant survival and growth	60
Screens	60
Rehabilitation plantings	60
Conclusions	61
Acknowledgements	62
Appendices	63
Selected References	69
Index to Recommended Species	70

List of maps	
1. Bedrock geology of southern Ontario	3
2. Major sand and gravel deposits of southern Ontario	4
3. Areas designated under The Pits and Quarries Control Act, 1971	5
4. Forest regions	7
5. Plant hardiness zones	29
6. Location of study sites	57
List of figures	
1. The most effective position for a complete screen is close to the viewer . . .	14
2. Combinations of trees and shrubs, alone or with an earth berm	15
3. Several rows of plants are more effective than single rows and close spacing more effective than wide spacing.	16
4. The wedge and slit methods of hand planting seedlings and transplants. .	20
5. Planting bare-root trees.	23
6. Root pruning one or two years before digging helps in transplanting trees from the wild.	25



Introduction

The last 10 years have seen great changes in our approach to managing our environment. While there is a continuing use of non-renewable resources, there is also a growing recognition that land disturbance and dereliction can and should be minimized, especially in regions where competition for land is great.

Extraction of aggregates may be considered an interim land use, in which environmental disturbance is minimized during extraction, and land continues to be useful once extraction is completed. There are several ways of achieving these goals, both in the design of the active operation, and in the rehabilitation of extracted land in order to restore it to its former use, or to an alternative use that is compatible with the surroundings.

The purpose of this report is to describe ways for using trees and shrubs for improvement and rehabilitation of pits and quarries in Ontario. Recommendations are partly based on first hand observations in southern Ontario, made during 1978 under a contract between the University of Guelph and the Ontario Ministry of Natural Resources (Mineral Resources Branch). A summary of the study is included on pages 56-61.

Background

The Aggregate Industry

The two main sources of mineral aggregate in Ontario are sedimentary bedrock which provides crushed stone, and glacially deposited material which provides sand, gravel and clay.

Palaeozoic sedimentary bedrock underlies much of southern Ontario and includes extensive deposits of limestone, dolomite, gypsum, and sandstone (Map 1). An important source is the Niagara Escarpment which stretches across southern Ontario from the Niagara River to the Bruce Peninsula, capped by a resistant Silurian dolomite.

Glacially derived material overlying the sedimentary bedrock in southern Ontario was formed in the late Wisconsinan phase of the Pleistocene glaciation, between 7,000 and 16,000 years ago. Deposits consist of outwash plains, outwash channels, kames, eskers and glacial lake deposits providing resources of sand, gravel and clay (Map 2).

As the most industrialized and populated province in Canada, Ontario has a high demand for mineral aggregates. In 1977 the total production was over 135 million tonnes, with 30% quarried from bedrock and the rest recovered from glacial deposits. The highest production areas are close to the main urban centres, such as Windsor, London, Kitchener, Toronto and Ottawa and there are currently about 1600 licensed operations ranging in size from a few hectares to several thousand hectares.

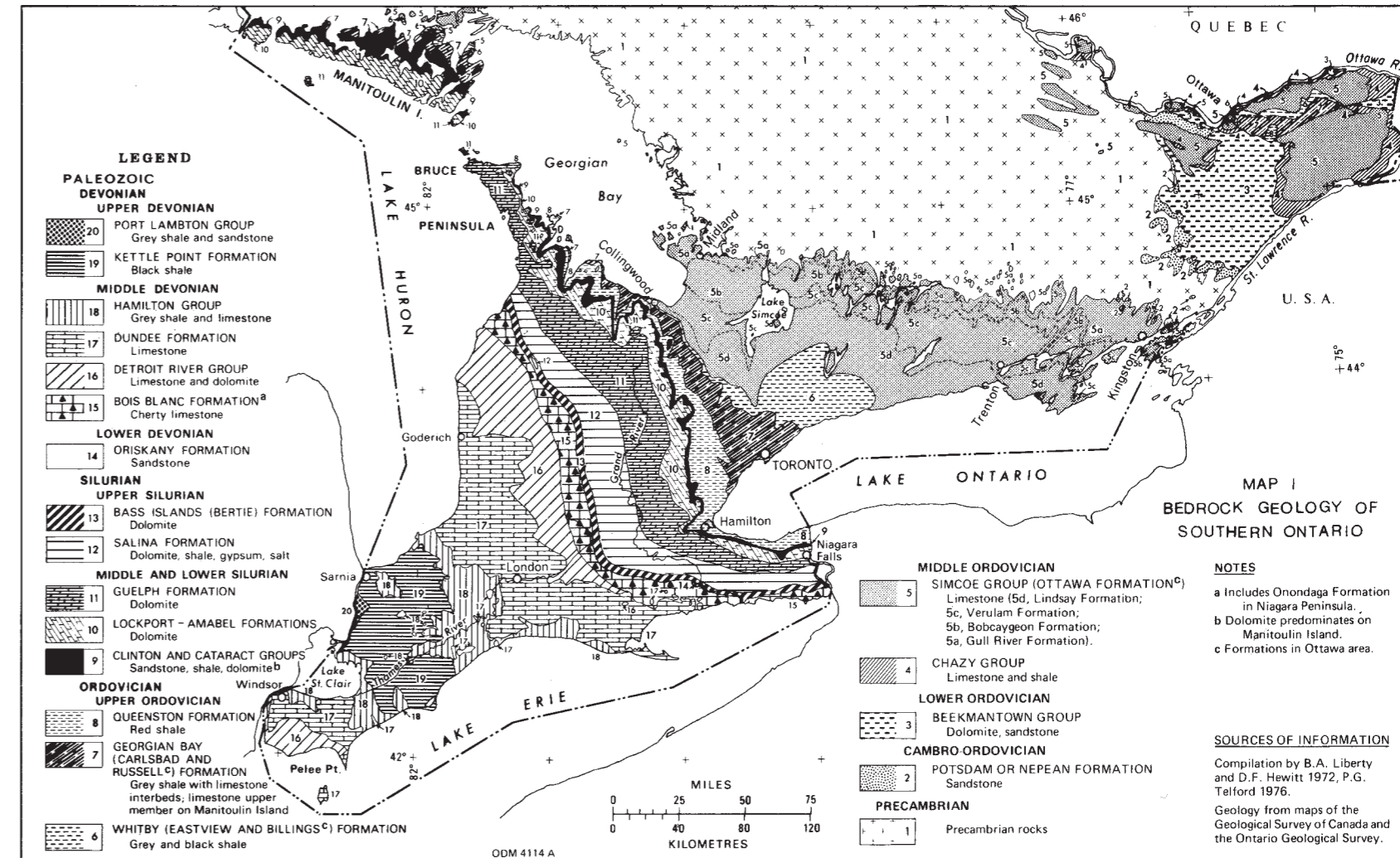
Pit and Quarry Rehabilitation

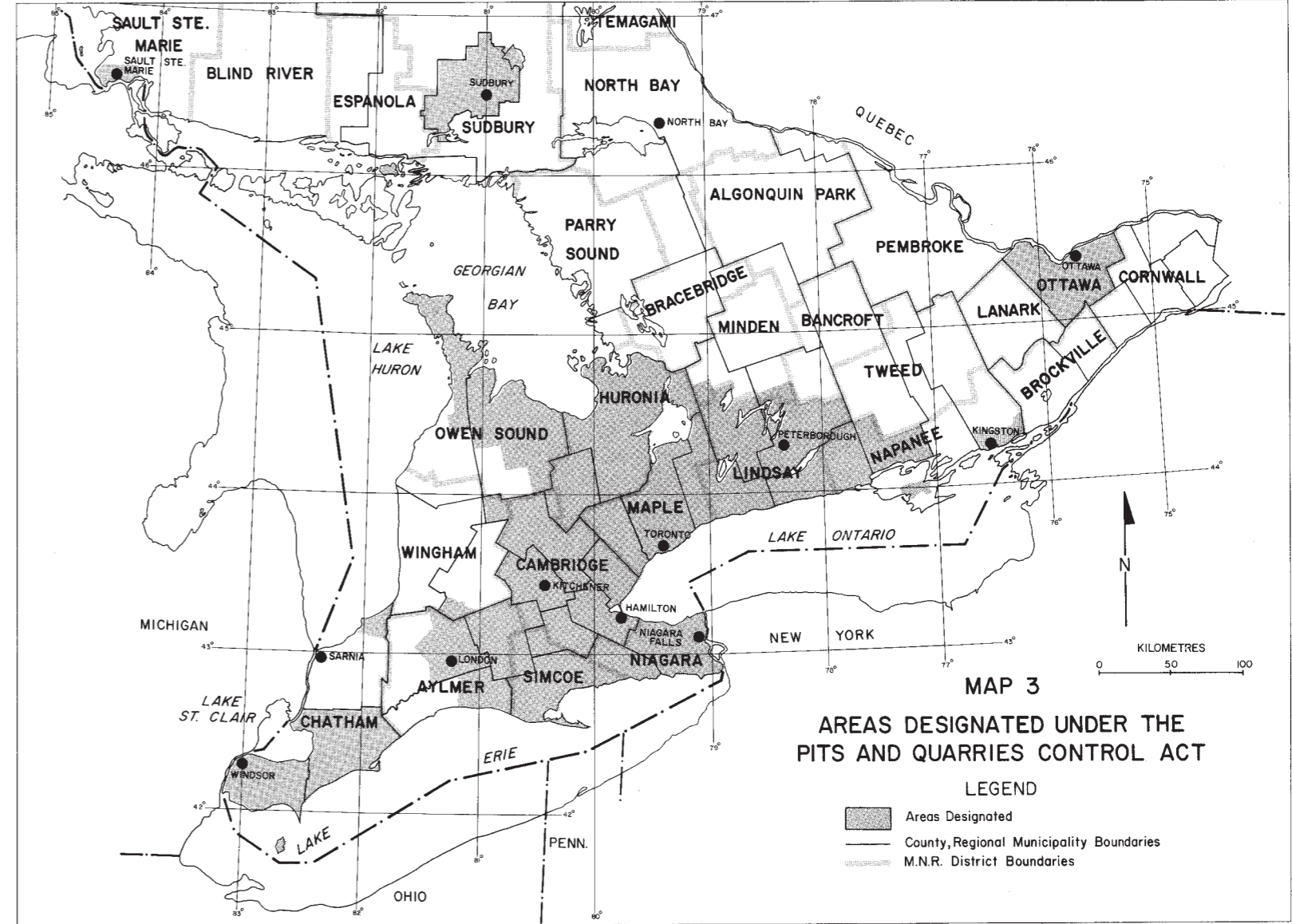
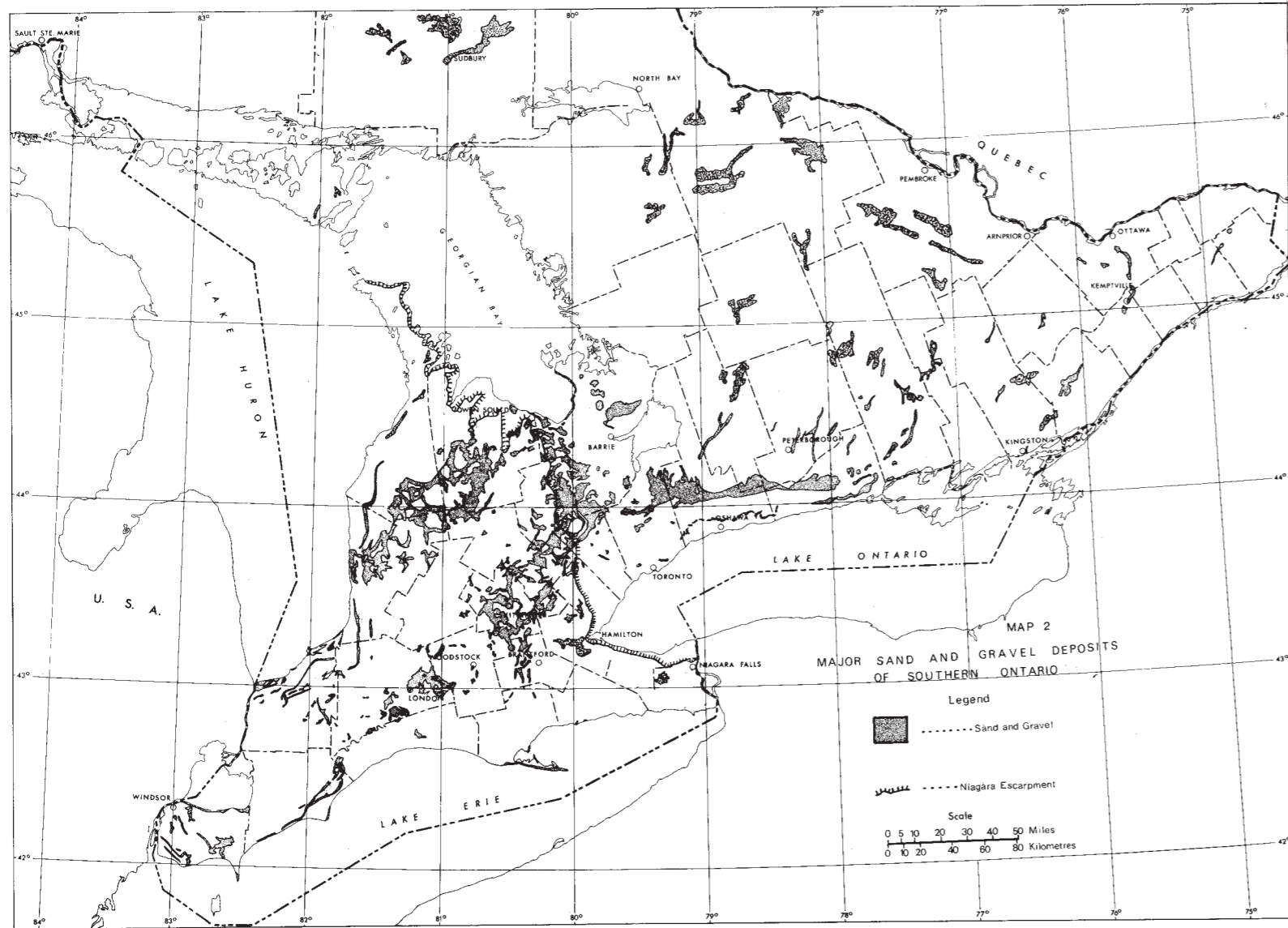
Since the rapid growth of the aggregate industry in the 1960's, many companies in Ontario have realized the need for improvement of their properties. Programs have been carried out to improve the appearance of active sites through landscaping and screening, and to rehabilitate extracted land by restoring it to an alternative after-use that is compatible with the surroundings.

The main incentives for screening and rehabilitation are legislation, profit and pressure from private citizens and local municipalities. The Pits and Quarries Control Act (1971)¹⁷ administered by the Ontario Ministry of Natural Resources, currently controls the licensing and operation of extraction sites in the main production areas of southern Ontario and the Sudbury and Sault Ste. Marie areas of northern Ontario (Map 3). Under the Act, licensed companies are required to carry out some form of screening and rehabilitation, and an annual payment at a prescribed rate is made as security for the rehabilitation of the site.

Many depleted sites across the province have been successfully restored to agriculture and natural areas, or developed into playgrounds, parks, golf courses, conservation areas, campgrounds, swimming pools, or industrial and residential sites. In many cases, significant profit has resulted from improved land values.

Some examples of rehabilitation in depleted and active sites are documented in recent papers and reports^{3, 4, 6, 7, 8, 10, 18, 19, 20}.





Vegetation of Ontario

The present vegetation varies greatly across the province, influenced by a combination of climate, soils and human activities. The most important climatic variable is temperature, which drops significantly from south to north, and is a major factor determining the distribution of plant species.

Natural forest regions

The natural vegetation in Ontario is mainly forest, described as three different regions: the Deciduous Forest Region, the Great Lakes-St. Lawrence Forest Region and the Boreal Forest Region (Map 4).

The Deciduous Forest Region occurs in the south, on land that is level or gently rolling, with mainly clayey and sandy soils, and some loam soils. Natural tree species in this region would be predominantly deciduous, with a scattered distribution of conifers, often restricted to the less fertile soils.

The Great Lakes-St. Lawrence Forest Region occurs in the central part of Ontario, and is quite varied. The land immediately south of the Shield is rolling or hilly with mainly loam soils, while east of the Shield includes clay plains. In both these areas the natural species are essentially deciduous, with some conifers. Further north, on the predominantly shallow soils of the Shield, conifers become increasingly dominant.

The Boreal Forest Region covers most of northern Ontario and consists mainly of conifers. It is the largest forested area, stretching northward from Lake Superior to Hudson Bay.

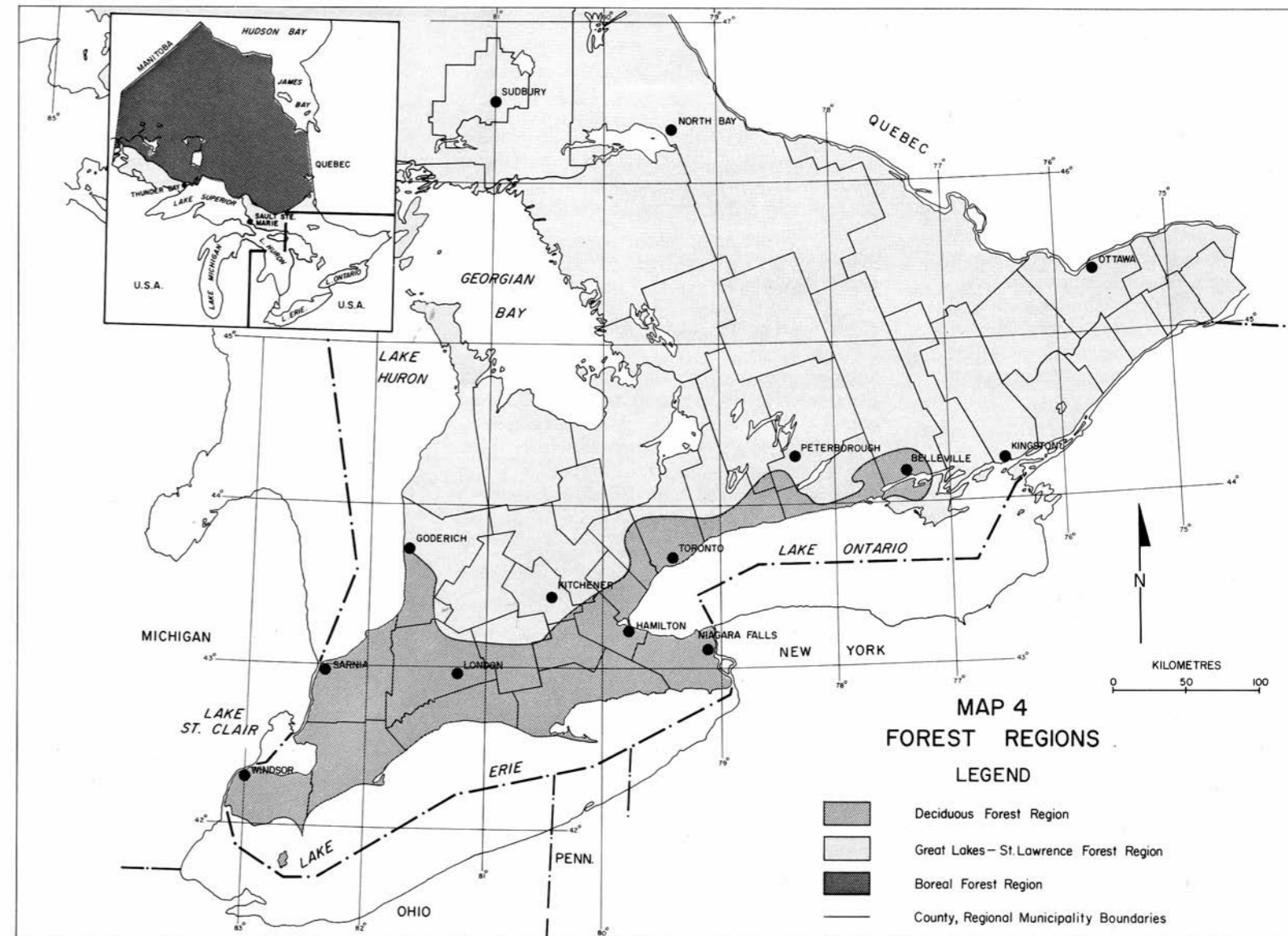
Current forests and woodlots

Approximately 80% of Ontario's land surface is currently forested. This varies from parts of the Canadian Shield, which are completely covered, and support a major forest industry, to the extreme south where land is now mainly agricultural, and forest is limited to remnants in farm woodlots, wetland areas, hedgerows and parks, on about 10% of the land area.

Forestry practice has altered the species composition of the forest, by extending the range of native trees, introducing new species from abroad, and encouraging more productive species that establish and grow readily. A major result is an increase in the predominance of conifers over deciduous species in woodlands south of the Shield, compared with the vegetation that would occur naturally.

Some reforestation occurs on private land in southern Ontario, on areas formerly cleared but now considered unsuitable for agriculture. Trees and shrubs are also planted for soil and water conservation, as windbreaks for field crops and farmsteads, and for wildlife management. In 1978 nearly 48 million trees were produced by the provincial government for reforestation purposes, of which 7 million were planted on private land, mainly in southern Ontario.

In addition to forests in rural areas, trees and shrubs have been planted in cities to establish an urban forest, consisting of many native and introduced species and cultivars (cultivated varieties), usually well suited for shade or ornamental purposes, and tolerant of a city environment. In 1978 the nursery industry in southern Ontario distributed over 6 million trees and shrubs, largely for landscaping purposes in southern Ontario's urban and suburban centres.



Ways of Using Trees and Shrubs

Introduction

Proper use of trees and shrubs in pits and quarries can improve the appearance of the active operation and help in rehabilitation following extraction. This section outlines recommended procedures for planning tree and shrub planting programs for various uses. Further advice and assistance is available from Ministry of Natural Resources District Offices (Appendix 1), various publications (see References) and Conservation Authorities, as well as landscape architects in the private sector¹.

Uses for trees and shrubs

Trees and shrubs can help reduce the impact of active operations on surrounding land users by improving appearance, acting as a visual screen, and reducing dust and noise. They also conserve soil moisture and reduce soil erosion. Furthermore, trees planted around the edge of a property will usually increase its value for most kinds of after-use.

Possible after-uses for pits and quarries depend on their location and characteristics, but trees may be an integral part of future development, and an early start on planting can often be made while the site is still active, under a program of progressive rehabilitation. After-uses that can involve trees and shrubs are:

- | | |
|----------------|----------------------|
| — Forestry | — Visual improvement |
| — Conservation | — Agriculture |
| — Recreation | — Residential sites |

Forestry. Although there are no proven examples in Ontario as yet, existing plantings suggest that production forestry should be possible in pits with adequate soils and gradients. This will be most appropriate in larger sites, where sufficient area is available for the establishment and maintenance of sizable stands of trees.

Conservation of soil, water and wildlife, can be achieved by the use of trees and shrubs as a vegetation cover, rather than a crop. This normally requires less intensive management than other uses of trees and is currently the most common type of tree planting in active extraction sites. It is particularly suited to pits or quarries near rivers and lakes, on marginal farmland in rural areas, and in areas having variation in grades and soils, or where steep grades require stabilization.

Recreation areas can benefit from the use of trees and shrubs for landscaping, shelter, shade and privacy purposes. There are many examples of attractive sites in Ontario that have been successfully rehabilitated as playgrounds, ball parks, golf courses, swimming pools, camping areas or multi-use recreation areas. The most suitable sites are those near urban areas where parks are needed, or those containing a lake for water sport activities. In many cases, it is preferable to grade and plant while parts of the site are still active, even though access by the public may not be feasible until extraction of the whole property is completed.

Trees planted for forestry or conservation purposes also bring about **visual improvement** of the site, and sometimes they can be planted specifically for this purpose. This is particularly desirable near sensitive scenic regions (such as the Niagara Escarpment) or on particularly unattractive landforms such as large piles of overburden or other mining wastes. Mixtures of trees and shrubs can sometimes be planted over the site to help it blend into the surrounding land more effectively.

Agriculture. Tree fruit crops may be established on better sites having good air drainage and fertile soils. Establishment of fruit trees is not dealt with in this report, but there are examples of apple and cherry orchards recently established in former gravel pits in southern Ontario. Trees planted as screens and windbreaks can also assist in the development of other agricultural uses.

Opportunities for attractive **residential** development occur on sites with existing trees or interesting natural features. As part of planned rehabilitation in sites on the urban fringes, early tree planting can sometimes increase land values.

Site Planning

The most efficient and effective rehabilitation occurs when the site is planned well in advance of extraction so that:

- advantage can be taken of natural features of the property, including existing vegetation
- planting necessary for landscaping and screening can be done ahead of time
- a good system of phased stripping, mineral extraction and rehabilitation can be planned so that major earth-moving operations are carried out efficiently.



Site design to take advantage of existing vegetation: haul routes through natural woodland are visible from the air only. (Dufferin Aggregates)

Existing vegetation

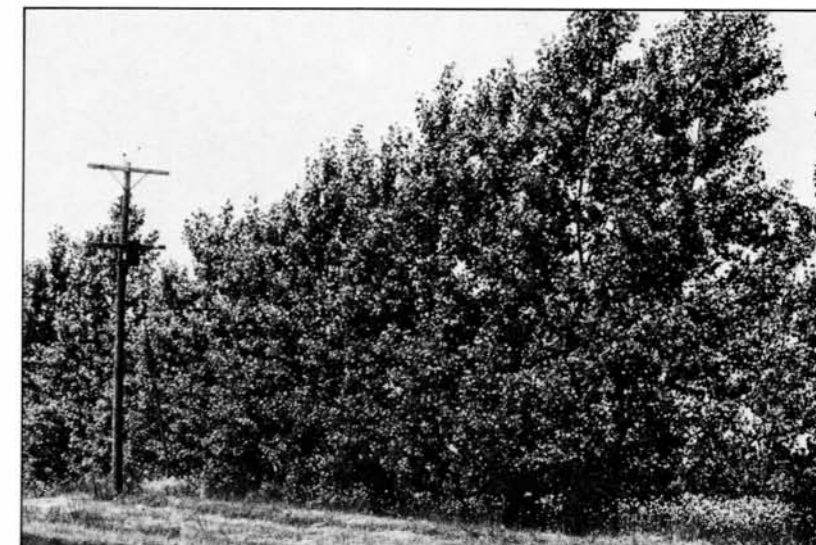
Hedgerows and wooded areas on the property should be protected wherever possible. In addition to improving soil and moisture conservation, existing vegetation is valuable for screening purposes, and is also a potential source of plants for other parts of the site.

Existing trees or shrubs growing along the hedge of the property should be left untouched to provide natural screening for the site. Care must be taken not to damage the trees or their roots by operating machinery or excavating too close. The extraction sequence, placement of haul routes, processing plants and stockpiles should also be designed to take advantage of larger wooded areas as natural screens.

The type and condition of the plants, soil conditions and available machinery will determine whether existing vegetation can be used as a source of plants for use on other parts of the property. If extraction operations are expected to damage the trees and shrubs (e.g., by changing the water table) they should be moved at an early stage of the extraction sequence.

Planting ahead of time

Natural landforms and existing vegetation do not usually provide an adequate screen on their own. One of the greatest advantages of planning ahead is the opportunity for planting trees in advance, so that the site becomes effectively screened and landscaped by the time extraction and processing are in progress. Five or ten years can



Planting ahead of time: screen planted 1972 is currently effective in preparation for extraction (1978). (Mersea Township)

¹Advice on agricultural crops including tree fruits may be obtained through local offices of the Ontario Ministry of Agriculture and Food.

make the difference between an insignificant group of plants and one that is vigorous, attractive and effective. Several companies are now planting trees well in advance on areas designated for extraction some time in the future.

Progressive rehabilitation

With good planning, extraction proceeds in a logical sequence so that depleted areas are rehabilitated while extraction continues in other areas. Planned stripping and replacement of topsoil, subsoil and overburden materials allows the establishment of vegetation over the maximum area possible, and a start can be made towards developing the site for a particular after-use. Progressive rehabilitation occurs in many sites in Ontario and includes several using trees.



Extraction proceeding in a logical sequence so that depleted parts of the quarry are rehabilitated while extraction continues in other areas. (Nelson Crushed Stone)

Site Preparation

Planting trees on undisturbed parts of the property usually requires little in the way of land preparation. However, plowing or spraying with herbicide the previous summer or fall is often necessary for controlling existing vegetation, and is especially important when planting deciduous species.

Excavated land, on the other hand, requires careful management to ensure that the final land area not only has stable grades, but can also support healthy vegetation. The most important considerations are (1) to establish suitable gradients and (2) to replace overburden, subsoil and topsoil separately, with as little handling as possible.

Grading

Since mineral extraction usually creates a depression in the ground ranging from a few metres deep in small borrow pits to 20-30 m in the larger quarries, considerable backfilling and grading is often needed to produce a landform suitable for most after-use activities. This process requires the use of heavy machinery and is usually the most costly part of rehabilitation programs.

Under The Pits and Quarries Control Act (1971) the maximum gradient allowed is 1:1 unless a water body is involved, in which a slope of 1.5:1 is required. However, slopes as steep as this are often not stable, and gentler gradients are preferable. A gradient of 3:1 is necessary for access by light machinery, while most recreation and forestry uses require slopes ranging from 3:1 to 10:1, or less.



Site preparation normally involves heavy machinery for earth moving and grading. (Guelph Dolime)

Overburden and topsoil

Materials available for filling and grading include topsoil, subsoil, overburden and mining or processing wastes. Topsoil, subsoil and overburden should be stripped separately, before extraction of the underlying mineral, and should be used in rehabilitation directly, rather than stockpiled for later use. This saves the cost of handling a second time, and ensures the topsoil is in good condition.

Overburden and mining or processing wastes are moved and compacted with graders or bulldozers during rough grading to establish a stable base. Subsoil is then applied carefully, avoiding compaction by machinery in the upper one metre of soil, which is critical for plant growth. If compacted, it should be loosened by ripping with a subsoiler to allow for drainage and aeration. Subsoil may consist of sand, till or clay and usually contains some nutrients, but is never as fertile as topsoil and is often very alkaline in southern Ontario. Fine grading is completed by applying a layer of topsoil.

The quality and placement of topsoil and subsoil will determine the plant species that can grow, and in many sites limit the success of rehabilitation. Older sites no longer having topsoil or subsoil available will have to obtain it elsewhere, at considerable expense. Current legislation requires a layer of topsoil over the entire surface of rehabilitated areas, usually necessary for establishing a good cover of grasses and legumes on slopes where surface erosion is likely to be a problem. For trees and shrubs, topsoil may be better used on individual plants, either in trenches or in separate planting holes. Nevertheless, the roots of trees and shrubs will normally grow into the subsoil layers after a few years.

Soil amendments

In many sites soil conditions¹ resulting from filling and grading are inadequate for healthy plant growth, and should be improved through the use of fertilizers or green manure crops. When using granular fertilizers, heavy applications are necessary, and although effects are usually short-lived, they may be long enough to help plants become established. Synthetic slow-release fertilizers, and organic fertilizers such as manure, compost or sewage have longer lasting effects on soil fertility. Organic fertilizers also improve the physical structure of the soil, and although they are more difficult to use than granular fertilizers, are recommended for extremely poor sites.

For green manure crops, a cover of legumes or grasses should be established for several years using fertilizer, and is then plowed under, leaving soil conditions improved both in soil structure and long-term fertility.

¹Soil samples may be sent to the Soil Testing Laboratory, Department of Land Resource Science at the University of Guelph, requesting a free analysis and fertilizer recommendation.

Planting Design

Landscaping

Use of plants to landscape the entrance and inside the property can make a great improvement to its general appearance. The public relations value of such plantings is considerable, and in addition to improving the site appearance, trees and shrubs planted in these areas also help to control dust. Effective plantings can be made using relatively few trees and shrubs in various locations:

- groups of trees or shrubs on either side of the entrance
- rows of trees or shrubs along the driveway to the office



Attractive groups of trees and shrubs at the entrance to the site improves its appearance considerably (taken early spring). (Arbro Materials & Construction Ltd.)

- groups of trees or shrubs around the office, car park, scale house, yard area, stockpiles and haul routes.

Landscape plantings offer a range of options in planting design, from informal groupings in rural areas to more formal arrangements around offices or at site entrances in urban areas, and effective use is sometimes made of the company sign, or the stone or gravel product, in entrance planting designs. The more elaborate landscape plantings often have higher maintenance requirements and should only be used where adequate maintenance is assured.

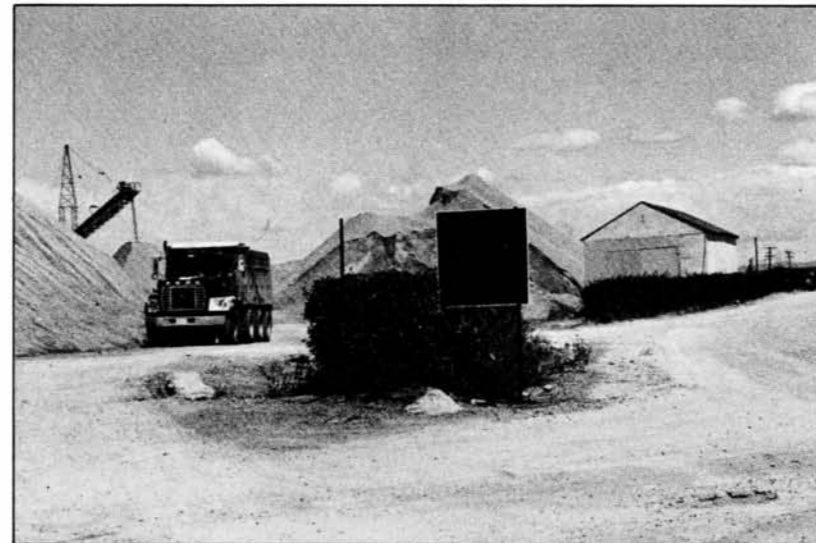
Screening

The main purpose of screening is to obstruct the view of a site, either through use of a complete screen that blocks the view entirely, or a partial

screen that allows parts of the site to be visible. Choice of planting arrangements depends on the following considerations:

- the part of the site to be screened
- type of screen needed—complete or partial
- location and size of screen in relation to the site and viewer
- the time and duration that the screen is to be effective.

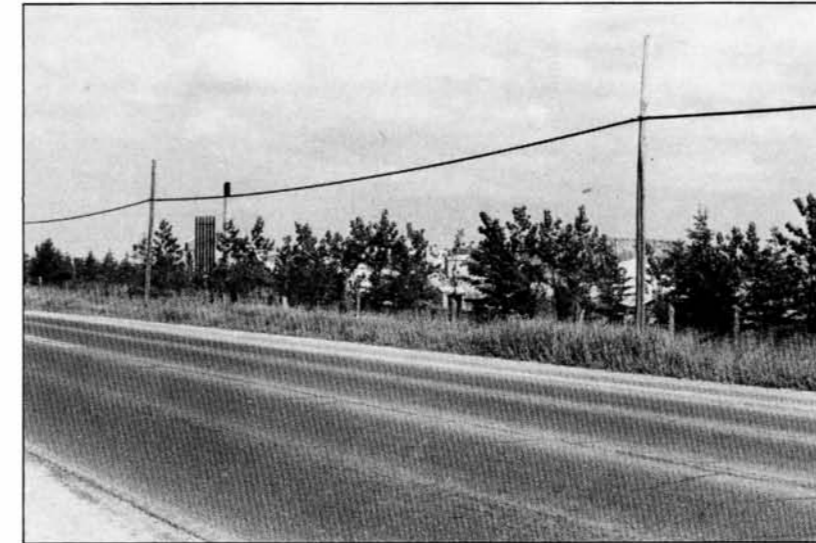
Most screens should be at the edge of the property, where a road or housing brings the extraction operation, stockpiles, or processing plants into view of the public. The most effective position for a complete screen is as close to the viewer as possible. When planted immediately beside the road allowance, a low screen 3-4 m high can often be effective, while taller screens are



Hedge established beside haul routes and stockpiles improves appearance and helps control dust. (Nelson Crushed Stone)

needed further away from the viewer (Figure 1). Some of the most difficult sites to screen are those separated from the public road by open fields not owned by the company. In these cases very tall screens are needed before they affect the view significantly.

In addition to being the necessary height, a complete screen also needs to be sufficiently dense for the view through it to be completely blocked. Several rows of trees or shrubs are usually necessary to provide sufficient density; they are also essential if death of plants is not to create gaps. An alternative to using trees, or trees and shrubs, as a screen on their own is to combine them with an earth berm. The 30 m (100 ft) setback now required to be left unextracted at the edge of licensed properties beside a public road allows ample space



An effective partial screen of deciduous and coniferous trees established in groups: summer. (Canada Crushed Stone)

for several rows and an earth berm (Figure 2). The common practice of planting trees along the crest of a berm is not recommended, for it looks extremely unnatural, and the trees usually grow very poorly under the droughty, exposed conditions.

A suitable distance between plants and rows for complete screening is 2.0-2.5 m (6-8 ft) with regular spacing and a staggered arrangement of plants from one row to the next. Closer spacings of 1 to 1.5 m (3-5 ft) are useful for quick screening results, especially where poor survival or slow growth of plants is expected, and for screens designed to act as windbreaks for blowing soil. Spacings wider than 2.0-2.5 m can be useful when plants are combined with a berm, in which case dense plantings are not so essential, and for partial

screens where variable distances between plants can be used to provide a more natural appearance (Figure 3).

In many situations partial screens allowing occasional views between the plants or over them are more effective than complete screens. For partial screening, trees and shrubs may be variable in height and spacing but are usually most effective when used in groups several plants deep, as with complete screening. The common practice of using a single row of trees for screening is rarely effective, even as a partial screen, unless trees are very densely planted, using a mixture of species. Single row screens are sometimes necessary on older sites where land has been excavated close to the property line leaving little space for either planting or earth moving.



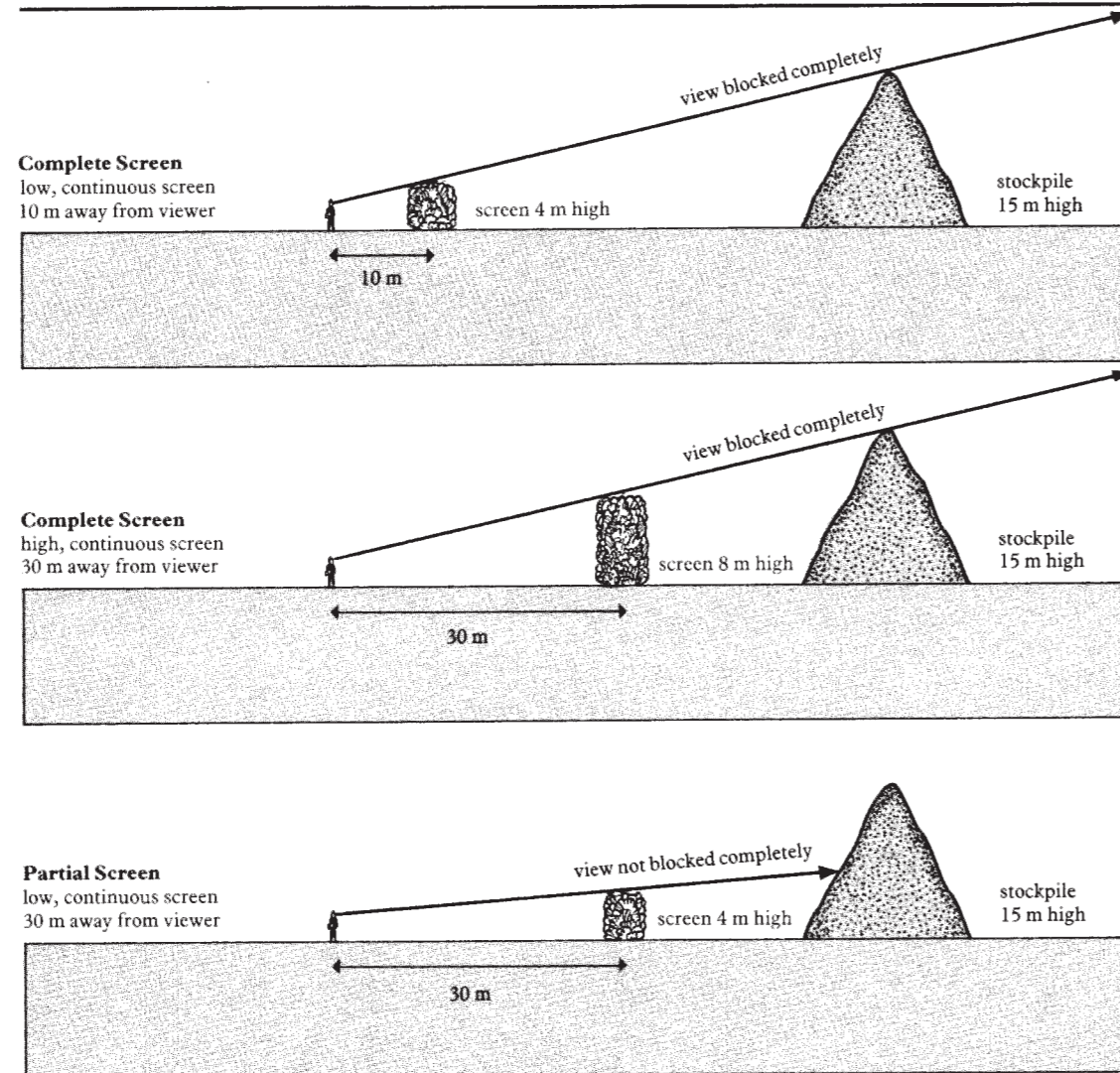
The same screen in winter: widely spaced conifers still providing partial screen, but less effective. (Canada Crushed Stone)

Rehabilitation

Planting trees and shrubs for rehabilitation of extracted land for **visual improvement, recreation** or **residential** after-uses allows a wide scope in planting arrangements. **Visual improvement** of some properties is achieved by dense tree planting to blend in the site with surrounding woodland, while in others it may be more appropriate to have a combination of dense and spaced plantings to soften the outline of a conspicuous landform. Planting for **recreation** purposes usually involves a combination of open space and grouped plantings, or specimen trees, depending on the kind of park or recreation activities.

For **forestry** or **conservation** purposes, higher density planting is required. For forestry, trees need to be in rows with regular spacings of 2 m (6 ft) between plants and rows, to give the maximum production of timber per unit area. Similar spacings are normal for conservation purposes, unless specific erosion problems require a high planting density. Where attraction of wildlife is part of a conservation plan however, groups of trees and shrubs should be alternated with open areas. This provides a range of habitats including important edges between planted and open areas. Planting in straight lines and regular blocks is not recommended in these multiple use areas.

Figure 1 — The most effective position for a complete screen is close to the viewer



Various plant spacings and numbers per hectare are given below:

Average distance between plants (metres)	Number of plants per hectare
1.0	10,000
1.5	4,444
2.0	2,500
2.5	1,600
3.0	1,111
4.0	625
5.0	400
6.0	278
8.0	156
10.0	100

Figure 2 — Combinations of trees and shrubs, alone or with an earth berm

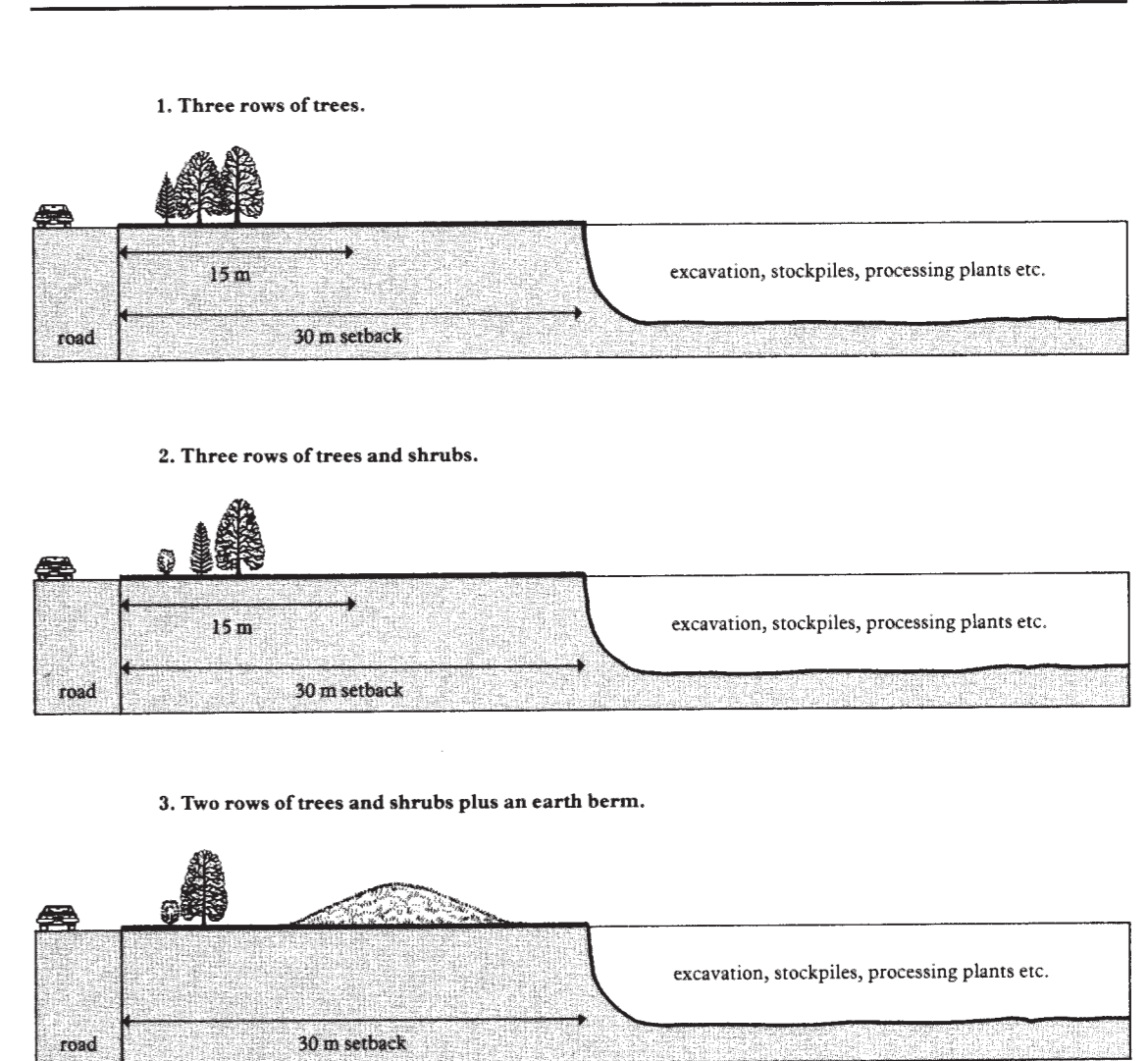
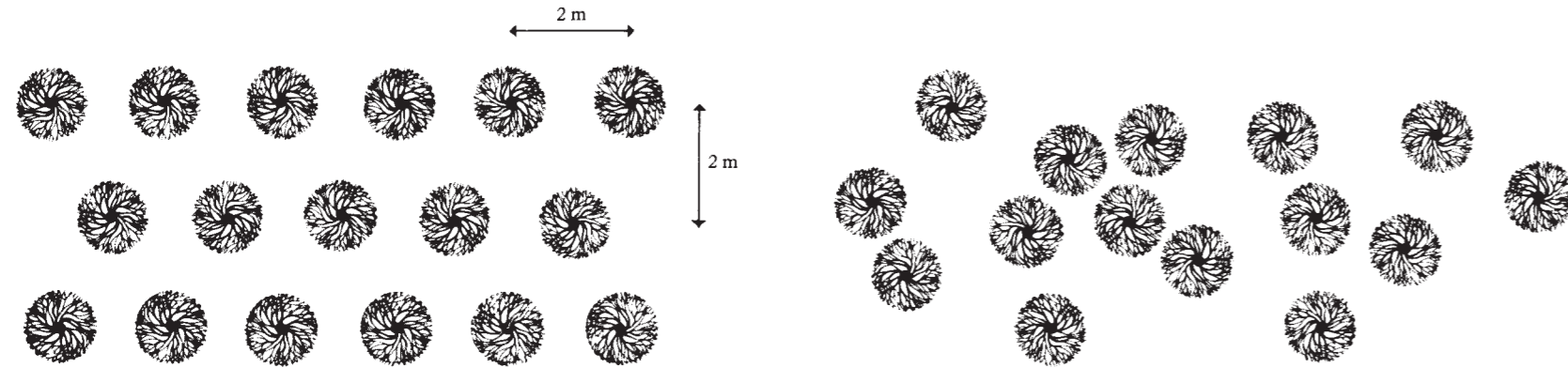


Figure 3 — Several rows of plants are more effective than single rows, and close spacing more effective than wide spacing



Effective Complete Screen

3 rows of plants closely spaced in a staggered arrangement provide an effective complete screen, but may look unnatural

Effective Partial Screen

groups of plants irregularly spaced provide an effective partial screen, and look more natural



Ineffective Screen

1 row of plants widely spaced is ineffective

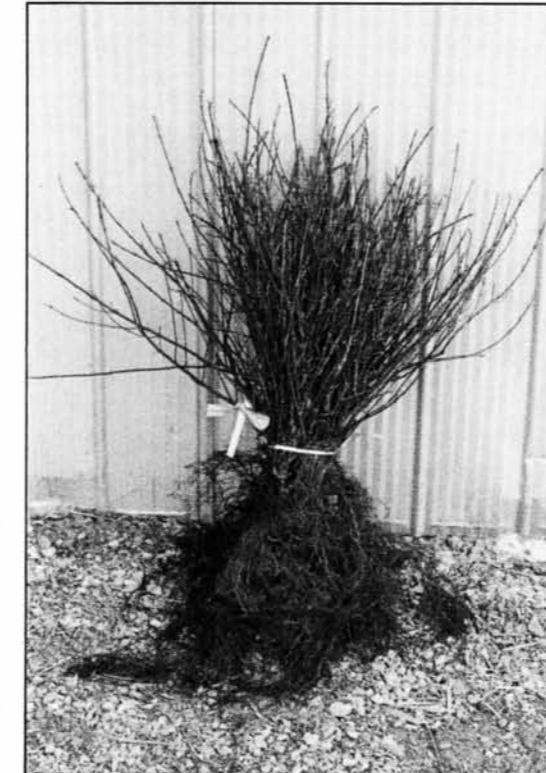
Sources and Types of Nursery Stock

Types of nursery stock

When planting on extracted land it is usually best to use young plants that have only been grown in a nursery for a few years, rather than the more mature trees commonly used in the landscap-

ing industry. Young plants include rooted cuttings, seedlings (plants grown for 1 to 3 years from seed), transplants (seedlings that have been transplanted once) or small trees and shrubs 1-2 m tall. In addition to being cheaper than larger stock, young

trees and shrubs usually transplant more readily and need less maintenance to become established. For landscaping purposes it is sometimes necessary to use larger trees, but these should only be planted if they can be well cared for during the first few years.



Bare-root nursery stock.
(John Connon Nurseries Ltd.)



Balled and burlapped nursery stock.
(John Connon Nurseries Ltd.)



Containerized nursery stock.
(John Connon Nurseries Ltd.)

Young deciduous trees and shrubs are normally purchased bare-root (where soil is not kept around the roots), and the plant must be moved while the buds are completely inactive. Coniferous seedlings and transplants are also moved bare-root, but small trees should be purchased with soil kept around the roots in a root ball, usually tied around with burlap (as balled and burlapped stock) or in a fibre or plastic pot (as containerized stock). This gives plant roots more protection, which is necessary with evergreens and larger deciduous trees.

Nurseries

Nursery stock may be bought from commercial and government nurseries, and some Conservation Authorities. Government nurseries supply bare-root seedlings, rooted cuttings and transplants of about

20 forestry species in the early spring at nominal charge. Trees should be ordered in the previous fall through the Ministry of Natural Resources District Offices (listed in Appendix 1). A wider range of native and ornamental trees and shrubs for northern and southern parts of the province can be purchased in various sizes from numerous commercial nurseries in southern Ontario (listed in Appendix 2). Availability of different types of stock should be confirmed before placing an order. In the case of coniferous species from government nurseries it may be possible to choose transplants rather than seedlings, while in commercial nurseries smaller sizes of trees and shrubs than are listed may be available on request.

An additional source of plants is sometimes found on the property itself, in existing hedgerows

and wooded areas on unextracted land and in areas regenerating trees and shrubs naturally on excavated land. Young, vigorous plants may be dug carefully and replanted successfully elsewhere. Large trees may sometimes be moved successfully, but are more risky.

Nurseries established on the property have proved to be extremely useful for growing young trees from purchased seedlings provided they are well managed, with suitable soil conditions, weed control and plant spacing. A nursery also allows propagation of new plants from seeds, cuttings and plant suckers collected from suitable species growing on the property. For larger companies, establishment of a nursery is therefore highly recommended for the supply of a range of planting stock with significant financial saving.



Seedlings and transplants of forest species are available from government nurseries. (Ministry of Natural Resources)



Production of young trees in a nursery established on the quarry property. (Nelson Crushed Stone)

Planting and Maintenance Techniques

Time to plant

The best time to plant is in early spring from the time the frost leaves the ground until mid-May. This is critical for bare-root stock, and gives the plants a chance to establish themselves during the growing season, before winter sets in. Planting in the fall is more risky, since plants have little time to establish roots before winter, and are often heaved by frost. Planting through the summer is not recommended at all for even with balled or containerized stock, plants are under considerable moisture stress and are likely to die under most site conditions found in pits and quarries.

Care of trees before planting

It is important that plants are kept in a healthy condition before planting. If they cannot be planted immediately on arrival from the nursery, they should be stored carefully, placed side by side in a trench in a sheltered area with the roots or root ball covered with moist soil. Plants "heeled in" in this manner may be stored in a healthy condition for a week if necessary provided they are kept moist. Placing plants in the edge of a pond with the bare roots in water can also keep them fresh for a day, especially if they are in shade.

Careful handling at planting is also critical, especially with bareroot stock on warmer days. Allowing roots to dry out in the air for 5 to 10 minutes can be fatal. Seedlings and transplants can be carried in buckets with water or moist moss in the bottom to keep the roots wet. In container-grown and balled-and-burlapped stock, roots are protected by soil, but plants need careful handling

so that the branches and trunk are not damaged. Wrapping cloth around the trunk prevents grazing the bark with chains or mechanical equipment.

Planting seedlings and transplants

Seedlings and young transplants are usually planted by hand on sites with steep slopes and stony soils, or on areas needing fewer than 4,000 trees, and by machine when larger numbers of trees are needed on gentle gradients accessible by machinery.

Hand planting involves making a hole with a hand shovel, placing the tree in the hole so that the roots are well extended below ground level with the stem upright above ground level, and packing the soil back firmly around the roots with the heel. Two methods of hand planting are as follows:

- the wedge method—in which a wedge of soil is removed by vertical and sloping cuts, suitable when planting on heavy soils, or in turf, as in many screen plantings
- the slit method—in which a hole is simply made by moving the shovel around in the soil, suitable when planting into looser soil with no turf, as on many rehabilitated areas (Figure 4).

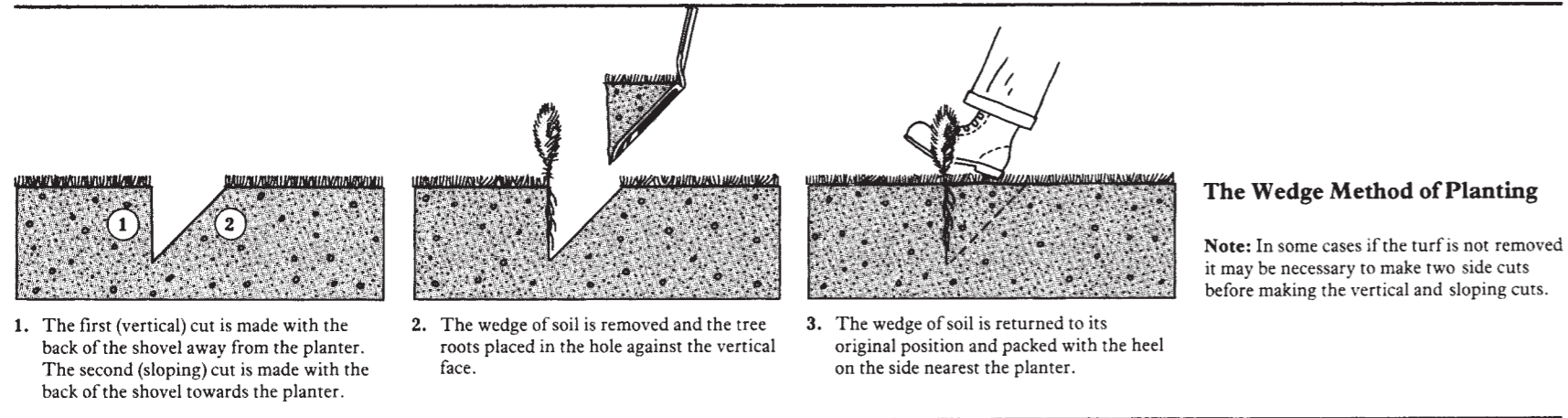
Machine planting involves a two or three man crew with a tractor-drawn planting machine. The machine cuts a trench or plows a furrow for the tree, and firms the soil back around it with packing wheels. Planting machines are available from the Ministry of Natural Resources and some Conservation Authorities. Machine planting is faster than hand planting, but care still needs to be taken to ensure that trees are inserted upright at the correct level, with roots well spread out.

As an alternative to a tree planting machine, a furrow may be plowed with standard agricultural equipment. Trees are then planted and soil packed back around the roots manually. One advantage of a plow is that it turns back the surface layer of sod

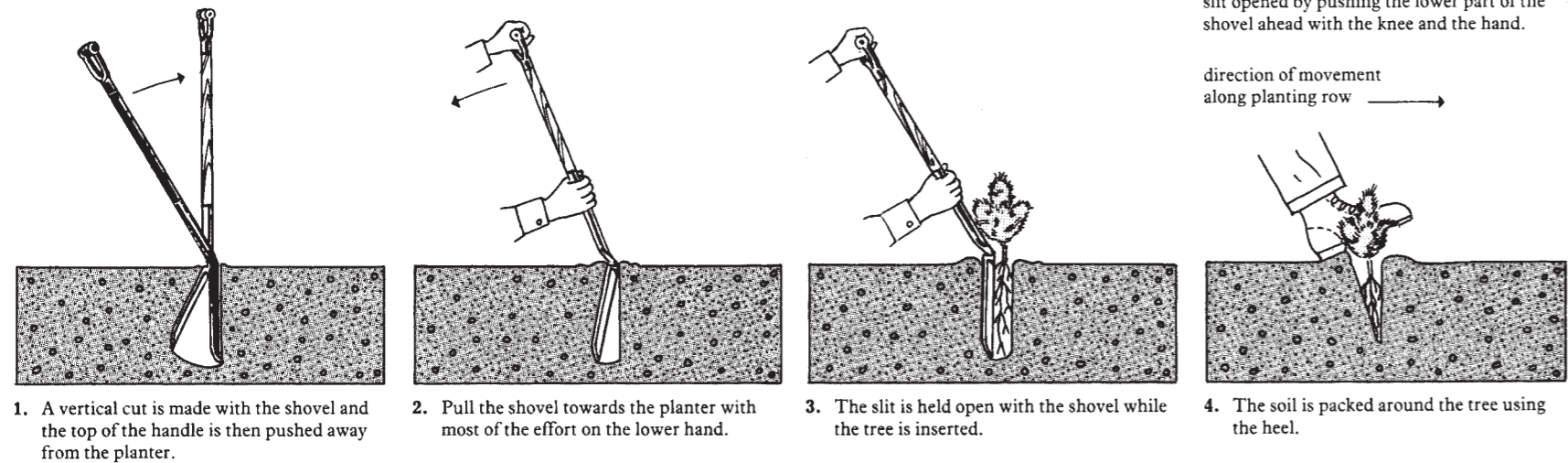


Planting bare-root seedlings of forest species by hand. (Cox Construction Ltd.)

Figure 4 — The wedge and slit methods of hand planting seedlings and transplants From Forest Tree Planting, Ministry of Natural Resources 1975 pp. 32 and 33.



Slit Method of Planting



or weeds, keeping them away from the young tree. However it may also remove a valuable layer of topsoil from the rooting area. If possible this should be replaced at planting.

Undisturbed areas at the edge of the property or rehabilitated land that has been seeded will commonly have a vigorous cover of grass which provides a serious problem for newly planted trees, competing with them for light and water, and encouraging mice. Grass should be controlled by mechanical or chemical treatment, or hand scalping. Chemical herbicides may be used safely when planting coniferous trees but many deciduous species are easily damaged, and scalping or cultivation are better methods of weed control.

Mice are a major problem for seedlings of deciduous species and can be controlled by the use of

poisoned bait, preferably inside pieces of rubber hose, or commercially available mouse-baiting stations. Conifers are usually damaged less, and should only need protection for production forestry purposes.

Planting young trees

Young trees 1 to 2 m tall are usually planted by hand when bare-root. However, digging holes that are wide and deep enough for trees to be planted at the right depth, with the roots well spread out, may take considerable hand digging. A post-hole digger can be used if the site is accessible to machinery and the soil not too stony, while a backhoe is helpful for digging larger holes or trenches.

Trees are placed in the hole by hand and the roots spread out carefully. The tree is then kept upright while soil is filled back into the hole and packed around the roots to prevent air pockets. Wherever possible, topsoil mixed with better quality subsoil should be used in the planting hole. If only a little topsoil is available, it should be mixed in with the subsoil in the bottom half of the planting hole, rather than being left at the surface, where it will be of little use to the roots. A handful of fertilizer may also be mixed in if the soil is very infertile. For balled-and-burlapped stock any rope around the trunk is cut and removed after the tree has been placed in the hole and the hole is partly filled. The exposed burlap wrapping is then loosened and cut off, leaving the remainder at the bottom of the hole, which is then completely filled



Planting bare-root seedlings of forest species with a tree-planting machine. (Port Colbourne Quarries Ltd.)



Grass controlled by application of herbicide at planting has helped establishment of young forest transplant. (Queenston Quarries)

in with soil. In the case of containerized stock, containers must be removed completely before planting.

After planting, young trees should be pruned back, staked, watered, mulched, and protected against mice. The soil surface should be left in a condition that will encourage the collection of moisture for the roots by building a small ridge or "dish" around the plant to reduce surface run-off. A layer of woodchips, bark or peat moss may be added to the soil surface as a mulch. In addition to conserving moisture, mulches reduce weed growth and modify extremes of soil temperature.

Pruning back about one-third of the plant helps in the establishment of most deciduous trees and shrubs, for it compensates for roots lost in digging and moving. Pruning shears are used to remove or shorten some of the side branches while the main branch or "leader" on trees is left untouched. Not only does it help them survive the first growing season, but increased vigour the following year more than compensates for the growth removed by pruning.

Staking on the northwest side of the plant is necessary for trees over 1 m tall to prevent the prevailing winter winds from rocking the plant

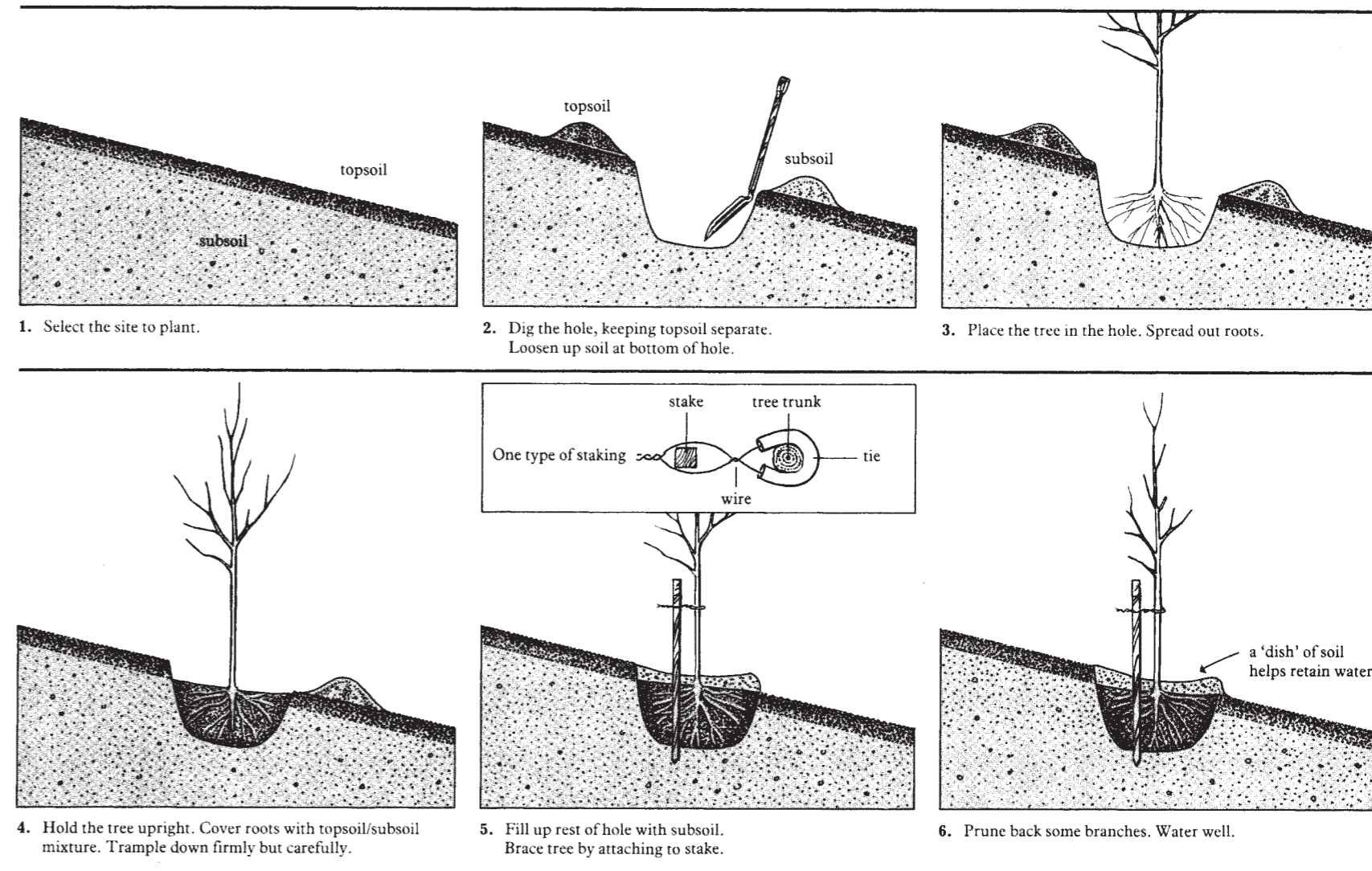
and damaging the roots. A wooden or metal stake is driven firmly into the ground close to the tree and attached to the trunk by a commercial tie or a length of heavy wire passed through a piece of rubber hose. The tie is looped around the tree, the ends crossed over, and the wire twisted securely around the stake. Trees larger than 2 m tall may need 2 or 3 stakes or guy wires attached to pegs in the ground. In all cases, it is essential to position the loops correctly around the trunk so that they do not slip down, but they should be loose enough not to restrict the growth. Ties and stakes must be removed the second season after planting, or serious damage can occur to the trunk.

In areas covered with long grass, mice often damage trees by chewing the bark in winter and early spring. While most shrubs are able to recover from mouse damage, a badly girdled tree will often die. Deciduous trees are most susceptible and should be protected by wrapping the trunk with a commercially available tree guard from ground level up to a height of 50 cm. Planting procedures for young bare-root deciduous trees are summarized in (Figure 5).



Planting bare-root young trees in early spring, while the buds are still dormant. (Standard Aggregates)

Figure 5 — Planting bare-root trees



Transplanting from the property

Trees and shrubs being transplanted from natural areas or a nursery on the property, should always be replanted as soon as possible after digging, so that they are out of the ground for the shortest period of time. Small deciduous plants can be dug by hand with a shovel, starting below the outer edge of the branches, and working toward the trunk until the main roots are found. The roots are then severed and the plant lifted with as much soil kept in place as possible. Several trees can be loaded into a truck or trailer, with additional soil thrown over the roots for protection during transportation to their new location.

Larger deciduous trees and all conifers should be dug with loaders or commercial tree spades so that soil is kept in place around the roots, and they should be dug, transported and planted one by

one. Tree bucket attachments for front end loaders are available for digging in heavy soils, but in lighter soils trees can be dug by lowering the normal bucket as far as possible into the ground under the tree in order to collect sufficient roots and soil. Wrapping the trunk with burlap protects it from being damaged by the bucket. The tree is then transported to its new location, and with guidance from one or two men on the ground, is lowered gently into a hole dug previously.

When transplanting trees from natural areas the most suitable plants are young, vigorous stock growing in a situation with similar exposure and soil conditions to the new location. However, if trees have to be moved directly from a wood into an exposed situation, wrapping the trunk around with burlap will give it some protection in its new site.

Trees and shrubs growing naturally also transplant more successfully if their extensive root systems are first pruned to encourage growth of new young roots that can be dug with the rest of the plant. Roots are cut by digging a trench or slit around the tree in the spring or fall, and the tree is left in place until the next spring, when a mass of fibrous roots will have formed and the tree may be dug and moved to its new location (Figure 6).

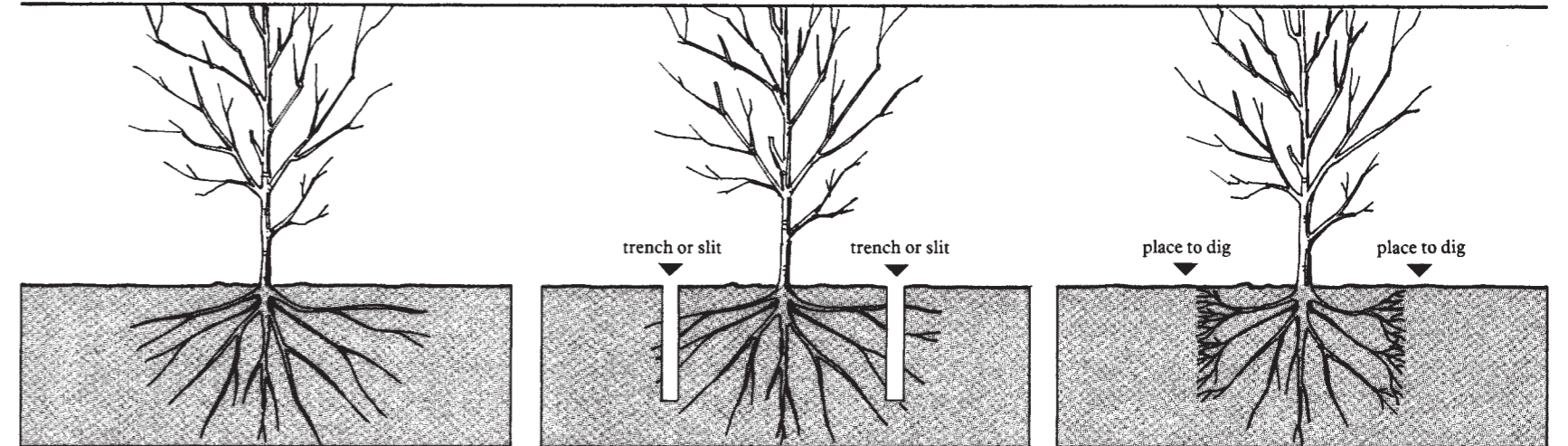


Transplanting from the property: use of loader to dig the tree from a natural woodland . . .

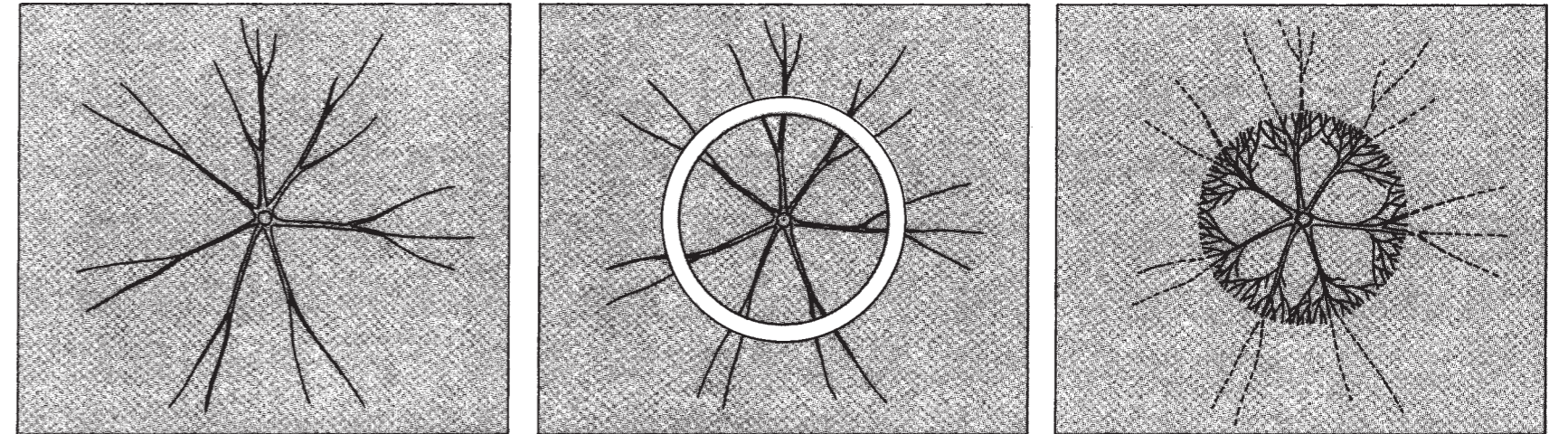


. . . and replant it in a new location (Note: greater success is likely with smaller trees and spring planting).
(Custom Aggregates)

Figure 6 — Root pruning one or two years before digging helps in transplanting trees from the wild



1. A tree or shrub growing in the wild has an extensive root system.
2. Roots are cut by making a trench around the tree (a slit is adequate for small trees.) The trench is filled back with soil.
3. By the following spring new roots have grown. Tree may be dug and moved.



Maintenance

Trees and shrubs take 1 or 2 years after planting to get established, and some maintenance during this time is essential for their survival. The most important maintenance procedures are:

- watering
- mowing or spraying grass
- checking stakes and tree guards
- replacing dead plants.

Watering recently planted trees and shrubs in dry periods throughout the first summer is essential for larger stock and should also be carried out on seedlings wherever possible. Plants near a road are easily watered from a company water truck using a hose, or an irrigation line can be set up for the season. Adequate water during this period can often mean the difference between success and failure of plantings.

Staked trees should be checked before winter for 2 years to make sure the ties and wire are still secure, and should be retied if necessary. After two or three years ties and stakes should be removed. It

is *essential* that ties are not left around the trunk, for this will girdle the tree and eventually kill it. Tree guards should also be checked in the fall to make sure they remain in place without damaging the trunk.

Keeping down grass and weeds around trees by mowing two or three times a year or by spraying with herbicide is particularly important for small stock which otherwise becomes smothered. Care needs to be taken not to damage trees or run over them, especially when they are planted close to-



Watering through the first growing is good for small stock and *essential* for larger trees, carried out here with the company water truck. (Capital Paving Ltd.)



Ties used to attach trees to a stake *must* be loosened and removed before they girdle the trunk, as occurred here. (Dufferin Aggregates)

gether. More frequent mowing produces the formal setting required for some landscape plantings but is not necessary for healthy growth of trees. Unless required for appearance or accessibility, mowing should usually be stopped after two or three years when trees become established, allowing natural regeneration of additional species of trees and shrubs.



Care must be taken when mowing grass not to damage the tree as occurred here with trees planted close together. (Standard Aggregates)

All types of plantings should be checked the first fall or following spring to see if plants are alive and healthy, and to take corrective action. In the difficult site conditions found in most pits and quarries, a low survival rate is common, and dead plants will have to be replaced by replanting in subsequent years. This is especially critical for screen plantings and for production forestry.



A plastic tree guard around the trunk will protect the tree against mice during winter. (TCG Materials Ltd.)

Criteria for Choosing Species

A much wider range of trees and shrubs can be grown successfully in pit and quarry sites than are commonly being used. While cost and availability are important, plantings are most successful when the choice of species is based on a range of criteria including winter hardiness, tolerance of soil and air conditions, and suitability for the purpose of planting.

Winter hardiness

Based mainly on minimum winter temperature, Ontario is divided into 7 regions called plant hardiness zones, ranging from Zone 1 in the north to Zone 7 in the south (Map 5). The zones are used to describe the furthest north that a species may be safely planted under normal conditions. In exposed and difficult sites often found in pits and quarries, it is sometimes safer to restrict the species to one hardiness zone further south than its normal limit.

It is essential that a plant is very hardy in the local area. Species differ in their ability to survive cold winters, and while some are hardy enough to grow throughout the province (e.g., white spruce and choke cherry) many trees and shrubs that are hardy in southern Ontario will not survive in northern Ontario (e.g. Norway maple and multi-flora rose).

Tolerance of soil conditions

Plant species have to be able to withstand soil conditions that are often very difficult for plant growth, especially in excavated areas, where soil structure, fertility and moisture depend largely on the type of overburden and subsoil used for back-

filling and grading. Planting sites are often very infertile and may be extremely dry; in southern Ontario soil conditions are also commonly alkaline.

Trees that survive dry, infertile planting sites, such as occur on coarse-textured and shallow soils, or on steep slopes, include jack pine, Scots pine, trembling aspen, black locust and Siberian elm; suitable shrub species include staghorn sumac, Siberian peashrub and shrubby cinquefoil.



Plant species often have to withstand poor soil conditions when planted for rehabilitation of excavated areas. (Premier Concrete Products Ltd.)

Trees that tolerate infertile soils if they are moist or wet, as on clay soils and the pit floor areas, include silver maple, white spruce and weeping willow; suitable shrub species include red osier dogwood and Tatarian honeysuckle.

A characteristic that helps some species to survive low soil fertility is an ability to fix nitrogen from the soil air. Examples of such species are black locust, Siberian peashrub, autumn olive and European alder. By using these species, it is possible to build up the amount of nitrogen in the soil.

Tolerance of air conditions

Most planting areas have little shelter, exposing plants to wind and sun on large, open sites and

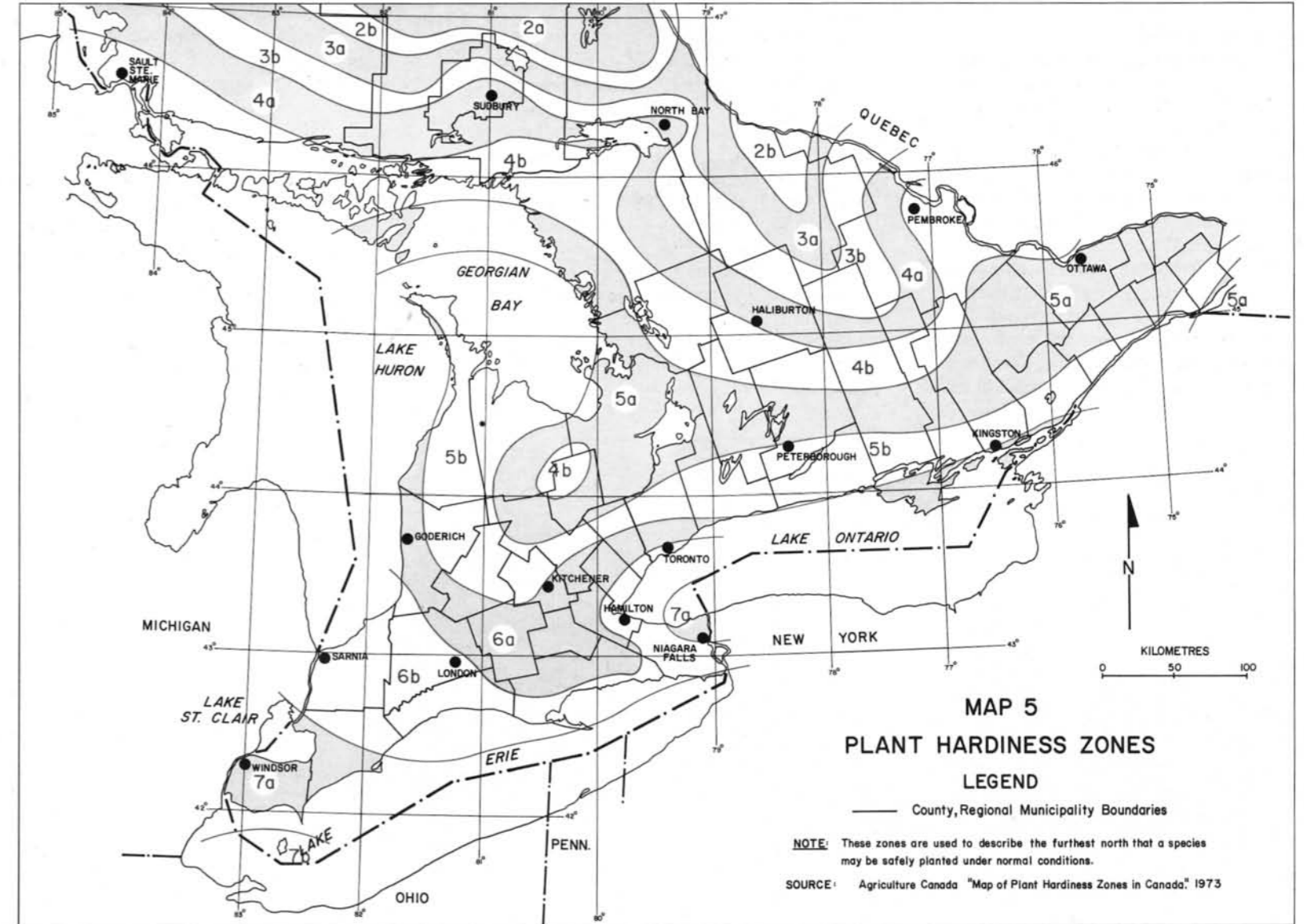


Plants may be exposed to blowing dust, which becomes deposited on the foliage. (Standard Aggregates)

west facing slopes, or to dust and salt along haul routes and adjacent public roads.

Species that are tolerant of extreme exposure include conifers like pines and spruces, and some deciduous species like trembling aspen and Carolina poplar, as well as many shrubs. Many deciduous species should benefit from being planted in mixtures with conifers on extreme sites.

Trees that appear to be tolerant of drifting dust and salt include Austrian pine, Scots pine, Russian olive, Siberian elm and weeping willow. These are particularly valuable in exposed landscape and roadside plantings, as well as several shrub species.



Purpose of planting

For **landscaping** purposes a wide range of species may be used, and the most attractive plantings often include a combination of deciduous and coniferous trees and shrubs. Weeping willow, thornless honey locust and Austrian pine are among the more ornamental trees for landscape purposes, and suitable shrubs include Siberian peashrub, autumn olive, shrubby cinquefoil and various junipers. Where a more natural appearance is needed, trees and shrubs that are native or naturalized in Ontario are better than the more ornamental introduced species and cultivars.

For **screening** purposes and windbreaks, fast-growing deciduous species such as Carolina poplar are valuable for the quick effect needed in many

sites, but should be combined with slower growing coniferous species like white spruce or eastern white cedar. Since conifers grow slowly, they are likely to take 10-15 years before becoming effective but they eventually provide a screen all year, while deciduous species are effective in the summer only. Additional species rarely planted in screens at present but worth considering for quick effect are black locust, Siberian elm and Russian olive. Shrub species with dense foliage such as Tatarian honeysuckle have shown promise in low screens and deserve to be planted more often. They are also effective for filling in the base of trees in taller screens, and provide an attractive contrast to trees in groupings for partial screens or for massing along the side of berms.

For **production forestry**, coniferous species are more suitable than the more demanding hardwoods, and it may be possible to grow commercial stands of red pine or white spruce in southern Ontario, and jack pine and white spruce in northern Ontario.

For **conservation** of soil, water and wildlife, a range of coniferous and deciduous forest tree species is suitable in addition to timber species. A good tree cover can be established using Scots pine, European larch, black locust, trembling aspen, and balsam poplar on dry sites, or silver maple, eastern white cedar and Norway spruce on moist sites. These species may also be planted as a "nurse" crop providing shelter for more valuable timber species such as white pine or white ash,

which may be planted at the same time, or some years later. Many sites with woodland or hedgerows nearby will eventually regenerate a mixture of trees and shrubs naturally, and this should be encouraged.

For attracting a range of wildlife, mixtures of coniferous and deciduous trees combine shelter and food, but additional food for birds is provided by planting shrubs with edible fruits. Examples are red osier dogwood, highbush cranberry, choke cherry and autumn olive.

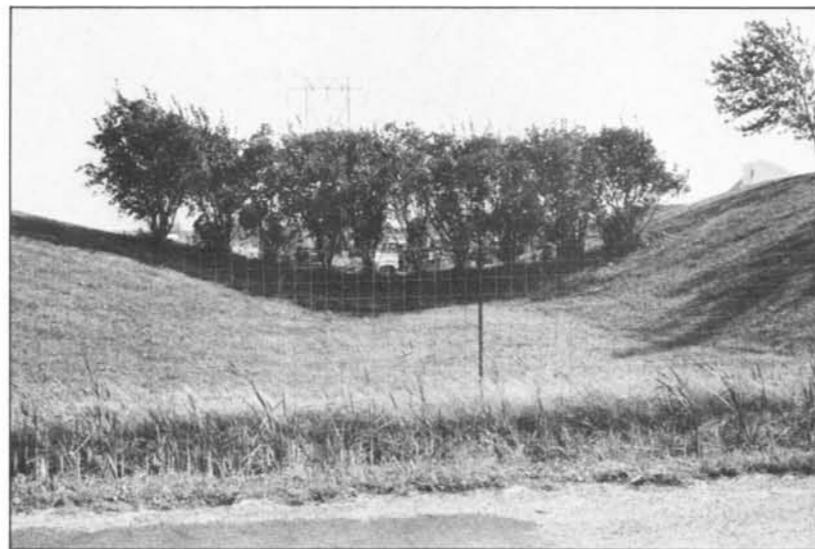
For erosion control purposes, trees and shrubs that spread into clumps or masses by suckering from underground stems or roots can be used, such as pin cherry, staghorn sumac, silverberry and common lilac. Other useful species have a vigorous

fibrous root system, or a fast growth rate to provide a windbreak. Forest tree species used in erosion control include Scots pine, jack pine, black locust and Carolina poplar.

For the purposes of **visual improvement and recreation**, various kinds of trees and shrubs may be planted. When the main purpose of planting is to blend the site in with its surroundings, native or naturalized species are normally more appropriate than introduced ornamentals. A similar choice may be made for campgrounds and other rural recreation areas. For recreation areas with more formal settings such as parks and golf courses, a wider range of introduced and ornamental trees and shrubs is suitable.



A range of ornamental trees and shrubs may be planted for more formal landscaping around office and plant areas, with high levels of maintenance. (Nelson Crushed Stone)



A planting of shrubs provides an effective low screen for yard area. (Port Colbourne Quarries Ltd.)



A mixture of forest species being used effectively in rehabilitation of extracted land for forestry or conservation purposes. (Standard Aggregates)



Various ornamental and forest species are being used in rehabilitation of extracted pit areas for a golf course (Note: damage to original trees from excavation activities). (Steed and Evans Ltd.)

Fifty Recommended Trees and Shrubs

Fifty tree and shrub species recommended for use in landscaping, screening and rehabilitation of pits and quarries are described here, listed in alphabetical order according to botanical names. The performance of most of the species has been observed by the author in licensed sites in southern Ontario, or in a demonstration collection of plants in a former pit at the University of Guelph Arboretum. Additional information is also available in earlier publications^{3, 5, 14}.

Notes on description of species are as follows:

Range is based on the hardiness of plants under normal horticultural conditions (see p. 27). While this is suitable for some landscaping situations, it is usually safer to restrict species to one or two hardiness zones further south when planting in exposed and difficult sites.

Description outlines the normal characteristics and use of the species, and its availability where appropriate.

Uses in pits and quarries indicates the specific uses and attributes of the species for landscaping, screening and rehabilitation, and makes reference to its occurrence in existing plantings in southern Ontario. pH values are an index of soil acidity or alkalinity: tolerance of high pH means tolerance of alkaline, lime-rich soils. Growth rates, where cited, have been derived from trees planted in at least 20 sites in southern Ontario.

Establishment suggests recommended planting stock, emphasizing the use of young plants: larger trees should only be used in special landscaping situations. Reference to the use of seeds or unrooted cuttings for some species is based on trials conducted by the author at the University of Guelph Arboretum.

Trees

Botanical name	Common name	Soil fertility			Soil moisture		
		Low	Medium	High	Dry	Moist	Wet
<i>Acer negundo</i> L.	Manitoba maple	▲	▲		▲	▲	▲
<i>Acer platanoides</i> L.	Norway maple		▲		▲	▲	
<i>Acer rubrum</i> L.	red maple		▲	▲	▲	▲	
<i>Acer saccharinum</i> L.	silver maple	▲	▲		▲	▲	
<i>Alnus glutinosa</i> (L.) Gaertn.	European alder	▲	▲		▲	▲	
<i>Elaeagnus angustifolia</i> L.	Russian olive	▲	▲		▲	▲	
<i>Fraxinus americana</i> L.	white ash		▲	▲		▲	▲
<i>Fraxinus pennsylvanica</i> var. <i>subintegerrima</i> (Vahl) Fern.	green ash	▲	▲		▲	▲	
<i>Gleditsia triacanthos</i> var. <i>inermis</i> L.	thornless honey locust		▲	▲	▲	▲	
<i>Juniperus virginiana</i> L.	eastern red cedar	▲	▲		▲	▲	
<i>Larix decidua</i> Mill.	European larch	▲	▲		▲	▲	
<i>Larix laricina</i> (Du Roi) K. Koch	tamarack		▲		▲	▲	
<i>Picea abies</i> (L.) Karst.	Norway spruce	▲	▲		▲	▲	
<i>Picea glauca</i> (Moench) Voss	white spruce	▲	▲		▲	▲	
<i>Pinus banksiana</i> Lamb.	jack pine	▲	▲		▲	▲	
<i>Pinus nigra</i> Arnold	Austrian pine	▲	▲		▲	▲	
<i>Pinus resinosa</i> Ait.	red pine	▲	▲		▲	▲	

Selection guide based on soil fertility and moisture

Botanical name	Common name	Soil fertility			Soil moisture		
		Low	Medium	High	Dry	Moist	Wet
<i>Pinus strobus</i> L.	white pine		▲	▲		▲	
<i>Pinus sylvestris</i> L.	Scots pine	▲	▲		▲	▲	
<i>Populus alba</i> L.	white poplar	▲	▲		▲	▲	
<i>Populus balsamifera</i> L.	balsam poplar	▲	▲		▲	▲	▲
<i>Populus X canadensis</i> 'Eugenei'	Carolina poplar	▲	▲		▲	▲	▲
<i>Populus deltoides</i> Barr.	cottonwood		▲	▲		▲	▲
<i>Populus tremuloides</i> Michx.	trembling aspen	▲	▲		▲	▲	
<i>Prunus pensylvanica</i> L.	pin cherry	▲	▲		▲	▲	
<i>Robinia pseudoacacia</i> L.	black locust	▲	▲		▲	▲	
<i>Salix alba</i> var. <i>tristis</i> (Ser.) Gaudin	weeping willow	▲	▲			▲	▲
<i>Thuja occidentalis</i> L.	eastern white cedar	▲	▲		▲	▲	▲
<i>Ulmus pumila</i> L.	Siberian elm	▲	▲		▲	▲	

Shrubs

<i>Acer ginnala</i> Maxim.	amur maple		●	●		●
<i>Caragana arborescens</i> Lam.	Siberian peashrub	●	●		●	●
<i>Cornus racemosa</i> Lam.	grey dogwood		●		●	●

Shrubs

Selection guide based on soil fertility and moisture (cont'd)

Botanical name	Common name	Soil fertility			Soil moisture		
		Low	Medium	High	Dry	Moist	Wet
<i>Cornus sericea</i> L.	red osier dogwood	●	●			●	●
<i>Elaeagnus commutata</i> Bernh.	silverberry	●	●		●	●	
<i>Elaeagnus umbellata</i> Thunb.	autumn olive	●	●		●	●	
<i>Juniperus communis</i> var. <i>depressa</i> Pursh	common juniper	●	●		●	●	
<i>Lonicera tatarica</i> L.	Tatarian honeysuckle		●	●		●	●
<i>Pinus mugo</i> var. <i>mugo</i> Turra	mugo pine	●	●		●	●	
<i>Potentilla fruticosa</i> L.	shrubby cinquefoil	●	●		●	●	
<i>Prunus virginiana</i> L.	choke cherry		●	●		●	
<i>Rhus typhina</i> L.	staghorn sumac	●	●		●	●	
<i>Rosa multiflora</i> Thunb.	multiflora rose	●	●		●	●	
<i>Rosa rugosa</i> L.	rugosa rose	●	●		●	●	
<i>Salix caprea</i> L.	goat willow	●	●			●	●
<i>Salix purpurea</i> L.	purple osier	●	●			●	●
<i>Symphoricarpos albus</i> (L.) S. F. Blake	snowberry	●	●		●	●	
<i>Syringa vulgaris</i> L.	common lilac		●	●		●	
<i>Viburnum lantana</i> L.	wayfaring tree		●		●	●	
<i>Viburnum lentago</i> L.	nannyberry		●			●	●
<i>Viburnum trilobum</i> Marsh	highbush cranberry		●	●		●	●

Trees

Description of species

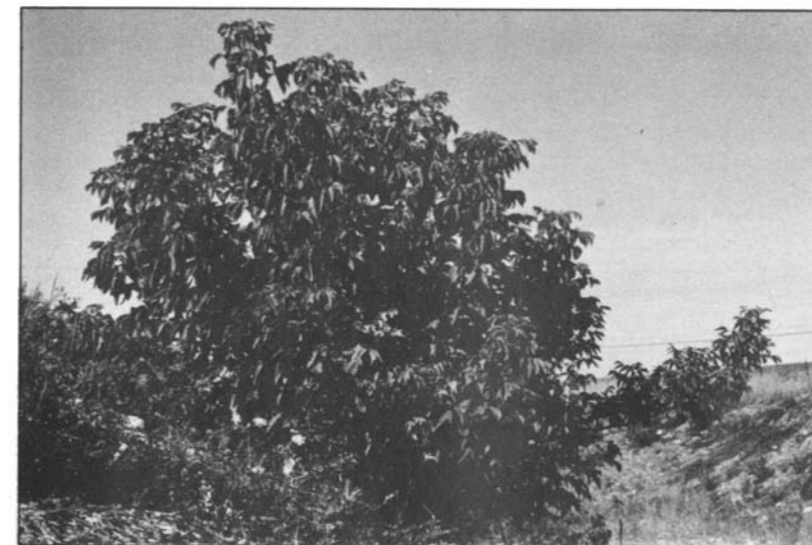
Acer negundo/Manitoba Maple

Range: Zone 2 southward

Description: Native deciduous tree growing to 8-15 m (26-50 ft); rapid grower often branching close to the ground forming a bushy, irregular shape; spreads readily by heavy production of seed; available in a few nurseries but planted rarely; commonly found growing naturally in pits and quarries.

Uses: Screening and rehabilitation; will grow almost anywhere, in infertile, wet to dry soils, and a range of pH; has been planted in occasional sites, and deserves to be used much more, especially in difficult areas.

Establishment: Seedlings or small plants up to 1 m (3 ft) bare-root; plants from own property up to 2 m (7 ft) with soil around roots.



Manitoba Maple—this plant occurring naturally survived being run over by bulldozer during grading in 1977 (taken 1979). (University of Guelph, Arboretum)

Acer platanoides/Norway Maple

Range: Zone 5 southward

Description: Introduced deciduous tree growing to 15-18 m (50-60 ft); medium growth rate, with a symmetrically round crown; common shade tree in urban plantings in southern Ontario, with several ornamental cultivars.

Uses: Landscaping; adaptable to a range of conditions including dry, alkaline soils and dust or other air pollutants; has been planted in several sites in southern Ontario.

Establishment: Small trees up to 1.5 m (5 ft) bare-root or balled and burlapped.

Acer rubrum/Red Maple

Range: Zone 3 southward

Description: Native deciduous tree growing to 18 m (60 ft); medium growth rate, with a roughly oval shape; forestry species of medium value, also planted as a shade tree, with excellent fall colour.

Uses: Landscaping, screening and rehabilitation; prefers moist sites with medium to high fertility; not recommended for alkaline soils; has been planted in occasional sites in southern Ontario.

Establishment: Seedlings or small trees up to 1.5 m (5 ft) bare-root or balled and burlapped.

Acer saccharinum/Silver Maple*

Range: Zone 2b southward

Description: Native deciduous tree growing to 15-25 m (50-80 ft); medium to fast growth rate with a spreading crown and root system; forestry species of medium value, also planted as a shade tree.

Uses: Landscaping, screening and rehabilitation; prefers moist conditions with low to medium fertility, but widely adaptable; has been commonly planted in sites in southern Ontario and is highly recommended.

Establishment: Seedlings or small trees up to 1.5 m (5 ft) bare-root; plants from own property up to 2.0 m (7 ft) with soil around roots.

*available from government nurseries

Alnus glutinosa/European Alder

Range: Zone 4 southward

Description: Introduced deciduous tree growing to 10-14 m (30-40 ft); medium growth rate, with a roughly oval to pyramidal shape; is a nitrogen fixer and therefore builds the soil; not readily available in Ontario, and rarely planted.

Uses: Rehabilitation; prefers moister areas but is adaptable to a range of moisture, fertility and pH; used in Europe and U.S.A. and could be tried in Ontario for cover on difficult sites.

Establishment: Seedlings or small trees up to 1.5 m (5 ft) bare-root.

Elaeagnus angustifolia/Russian Olive

Range: Zone 2b southward

Description: Introduced, small deciduous tree or large shrub growing to 4-8 m (15-25 ft); medium to fast growth rate with a rounded crown and silvery foliage held on into late fall; fixes nitrogen from the soil; planted as an ornamental and for wildlife.

Uses: Landscaping, screening and rehabilitation; widely adapted to a range of conditions including very poor, alkaline, droughty soils, dust and salt; good as an accent plant in a landscape planting, as a dense screen and for wildlife; has been planted successfully in several sites in southern Ontario and deserves to be used much more.

Establishment: Seedlings or small plants up to 1.0 m (3 ft) bare-root.

Fraxinus americana/White Ash*

Range: Zone 4b southward, best restricted to southern Ontario

Description: Native deciduous tree growing to 15-20 m (50-65 ft); slow to medium growth rate, with a roughly oval crown; valuable timber species in southern Ontario, also planted as a shade tree.

Uses: Landscaping, screening and rehabilitation; prefers moist sites and medium fertility, but is adaptable; has been planted successfully on better sites in southern Ontario and is recommended in mixtures with other species.

Establishment: Seedlings or small trees up to 1.5 m (5 ft) bare-root.

*available from government nurseries

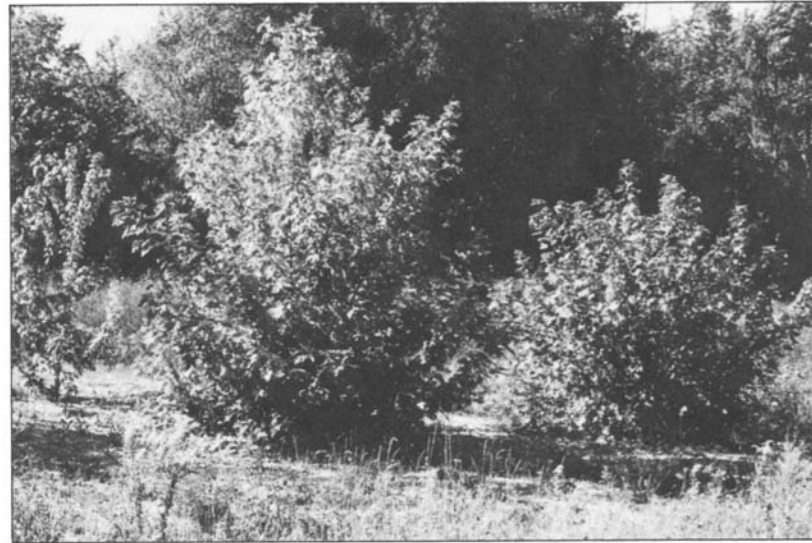
Fraxinus pennsylvanica var. *subintegerrima*/Green Ash

Range: Zone 2b southward

Description: Native deciduous tree growing to 12 m (40 ft), medium growth rate, with a pyramidal to oval form; planted as a shade tree.

Uses: Landscaping, screening and rehabilitation; tolerates dry to moist soils, low fertility and high pH; has been planted rarely but deserves more use.

Establishment: Seedlings or small trees up to 1.5 m (5 ft) bare-root.



Silver Maple—trees successfully planted with a bulldozer several years previously, for rehabilitation. (Milton Limestone Aggregates)



Russian Olive—planted in a group on side of berm for screening. (Canada Crushed Stone).

Gleditsia triacanthos var. *inermis*/Thornless Honey Locust

Range: Zone 4b southward; best restricted to southern Ontario.

Description: Native deciduous tree growing to 18 m (60 ft); medium growth rate with a very open, broad crown; fixes nitrogen from soil; commonly planted as a shade tree in southern Ontario.

Uses: Landscaping and rehabilitation; tolerant of drought, high pH, salt and dust; has been planted occasionally in southern Ontario and should do well.

Establishment: Small trees up to 1.5 m (5 ft) bare-root, larger stock balled and burlapped.

Juniperus virginiana/Eastern Red Cedar

Range: Zone 3 southward, best restricted to shoreline of southern Ontario.

Description: Native evergreen tree growing to 6-8 m (20-28 ft); medium growth rate, with a dense pyramidal form; various selections planted as ornamentals.

Uses: Landscaping, screening and rehabilitation; will tolerate shallow alkaline soils and droughty conditions; has been planted rarely but deserves to be used more often.

Establishment: Small trees up to 60 cm (2 ft), container-grown or balled and burlapped.

Larix decidua/European Larch*

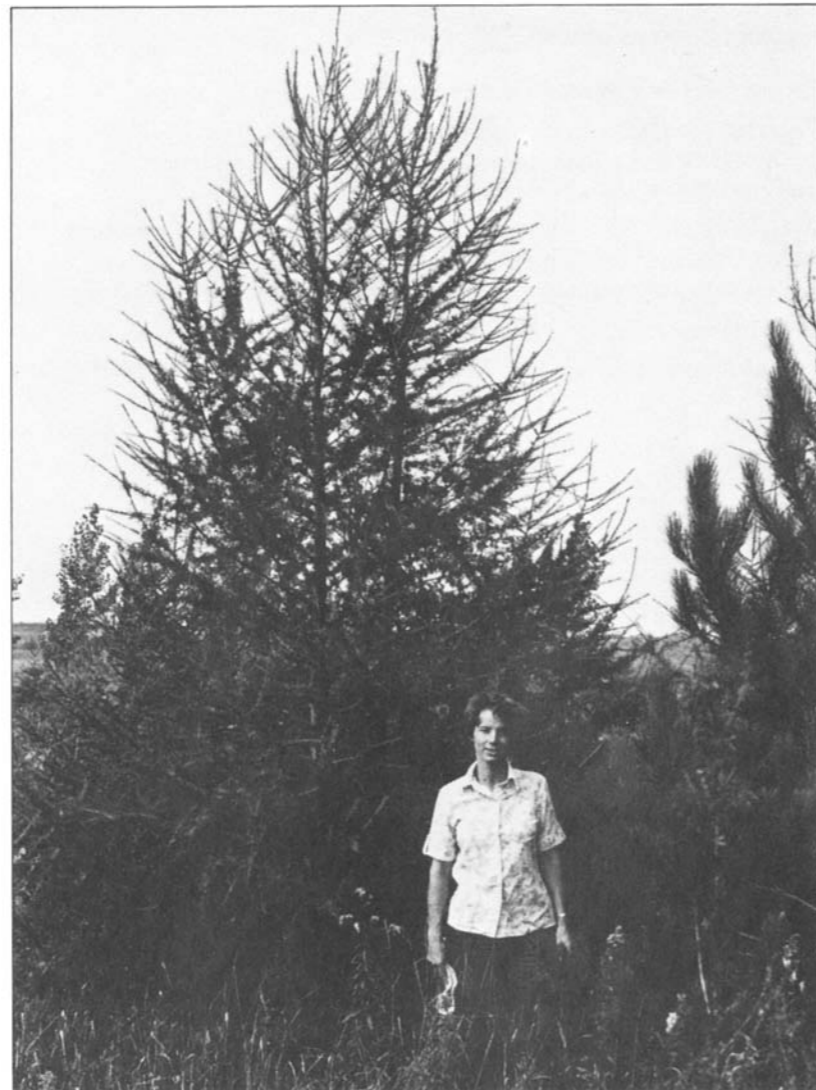
Range: Zone 3b southward

Description: Introduced coniferous tree (but drops its needles in winter), growing to 15-20 m (50-65 ft); medium to fast growth rate with pyramidal form and soft foliage; forestry species in southern Ontario.

Uses: Rehabilitation; better than most forestry species on poor soils; tolerates dry to moist sites; has proved fast growing on several sites, and is highly recommended.

Establishment: Seedlings or small trees up to 60 cm (2 ft); small trees container-grown or balled and burlapped.

* available from government nurseries



European Larch—showing excellent growth in 10 years since planting for rehabilitation of former gravel pit. (Standard Aggregates)

Larix laricina/Tamarack*

Range: Zone 1 southward

Description: Native coniferous tree (but drops its needles in winter), growing to 15-22 m (40-70 ft); slow to medium growth rate, with pyramidal form; forestry species of medium value in northern and central Ontario.

Uses: Rehabilitation; prefers moist to wet sites and medium fertility; has been planted occasionally in southern Ontario.

Establishment: Seedlings or small trees up to 60 cm (2 ft); small trees container-grown or balled and burlapped.

Picea abies/Norway Spruce*

Range: Zone 2b southward

Description: Introduced coniferous tree growing to 15-25 m (50-80 ft); medium to fast growth rate when young; broadly pyramidal in form; forestry species used for windbreaks in southern Ontario.

Uses: Screening and rehabilitation; adaptable to a range of soils and moisture, often faster growing than white spruce when young; has been planted occasionally in southern Ontario and deserves more use.

Establishment: Transplants or small trees up to 60 cm (2 ft); small trees container-grown or balled and burlapped.

Picea glauca/White Spruce*

Range: Zone 1 southward

Description: Native coniferous tree growing to 15-25 m (50-80 ft); slow to medium growing with a pyramidal form; valuable timber species especially in northern Ontario.

Uses: Screening and rehabilitation; fairly adaptable to a range of soil conditions, including clays if well drained; very commonly planted in southern Ontario with annual growth rate of 13 cm (5 ins).

Establishment: Transplants or small trees up to 60 cm (2 ft); small trees container-grown or balled and burlapped.



White Spruce—commonly used for screening and rehabilitation but slow growing, as illustrated here, 10 years after planting. (Standard Aggregates)

Pinus banksiana*/Jack Pine

Range: Zone 1 southward, best in northern Ontario

Description: Native coniferous tree growing to 8-20 m (25-65 ft); medium growth rate with a conical, open crown, somewhat scraggly on poor sites; valuable timber species in northern Ontario, planted for erosion control of sandy areas in southern Ontario.

Uses: Screening and rehabilitation; adaptable to poor, dry soils, preferably not alkaline; suitable for timber in northern Ontario; has been planted occasionally in southern Ontario and could be used more often in the poorest soils in preference to red pine.

Establishment: Bare-root seedlings.

** available from government nurseries*

***Pinus nigra*/Austrian Pine**

Range: Zone 4 southward, best restricted to southern Ontario

Description: Introduced, coniferous tree growing to 12-20 m (40-65 ft); medium growth rate with a dense pyramidal shape; used as an ornamental in urban plantings.

Uses: Landscaping, screening and rehabilitation; tolerant of a wide range of conditions including poor, droughty and alkaline soils; withstands considerable dust and salt, so excellent for roadside screens and entrance landscaping; has been planted occasionally in southern Ontario and should be used much more.

Establishment: Seedlings, transplants or small trees up to 60 cm (2 ft); small trees container-grown or balled and burlapped.



Austrian Pine—planted earlier the same year as large stock for screening purposes. (Ministry of Natural Resources)

Pinus resinosa*/Red Pine

Range: Zone 2b southward

Description: Native coniferous tree growing to 12-25 m (40-80 ft); medium growth rate with a symmetrical, oval crown; valuable timber species, mainly in southern Ontario; readily available as seedlings only.

Uses: Screening and rehabilitation; prefers light, well-drained soils; tolerates low fertility but grows poorly in alkaline soils, where other pines are preferable; very commonly planted in southern Ontario, with average annual growth rate of 18 cm (7 ins); recommended for forestry on suitable sites.

Establishment: Bare-root seedlings.

Pinus strobus*/Eastern White Pine

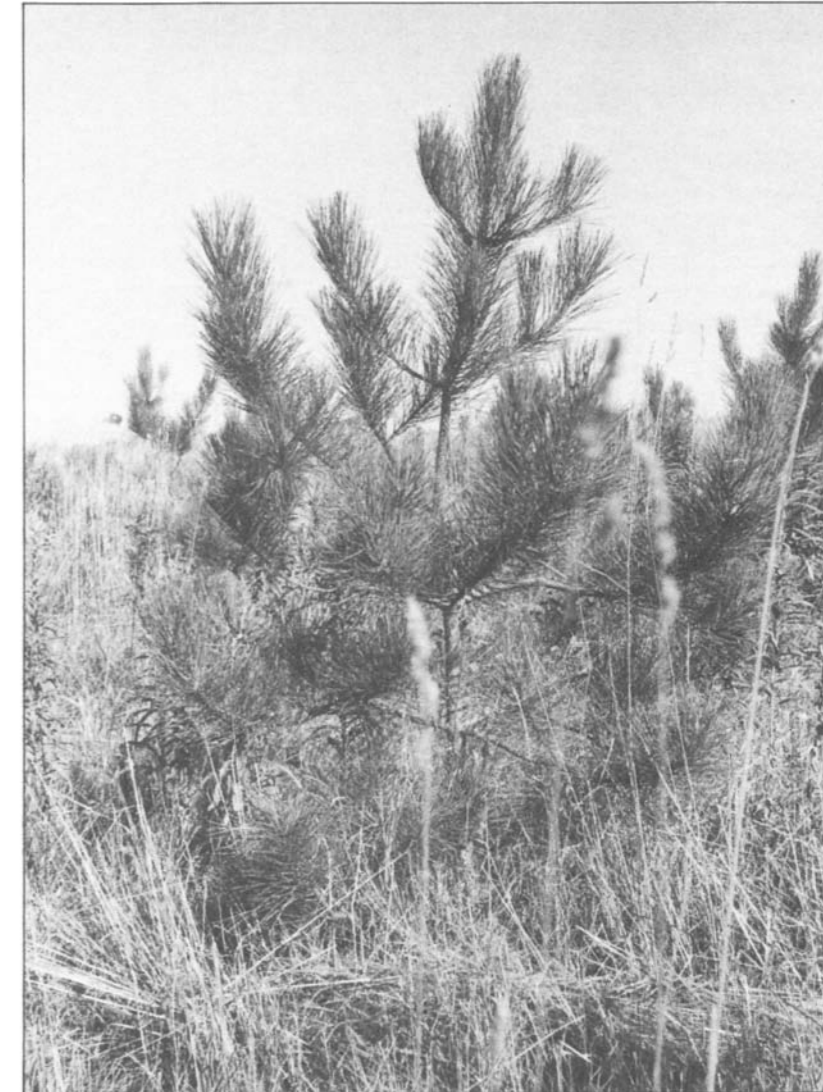
Range: Zone 2b southward

Description: Native coniferous tree growing to 15-25 m (50-80 ft); normally one of the fastest growing pines; pyramidal in youth, producing wide-spreading crown at maturity; valuable timber species, also planted as an ornamental.

Uses: Rehabilitation; prefers moist sites with medium fertility; sensitive to salt and air pollution, limiting its value in roadside screen plantings; very commonly planted in southern Ontario, with average annual growth rate of 13 cm (5 ins).

Establishment: Seedlings or small plants up to 60 cm (2 ft); small plants container-grown or balled and burlapped.

** available from government nurseries*



Red Pine—planted as seedlings 7 years previously for screening purposes. (Franceschini Brothers Construction Ltd.)

Pinus sylvestris/Scots Pine*

Range: Zone 2 southward

Description: Introduced coniferous tree growing to 10-25 m (30-80 ft); medium to fast growth rate with an irregular shape, often becoming picturesque with age; commonly planted in southern Ontario for Christmas trees.

Uses: Screening and rehabilitation; tolerates dry, infertile soils with high lime content; has been planted occasionally in southern Ontario and is recommended for greater use on very poor sites in mixtures with other species.

Establishment: Bare-root seedlings.

*available from government nurseries



Scots Pine—planted as seedlings 8-10 years previously for rehabilitation. (J. N. Corbett)

Populus alba/White Poplar

Range: Zone 2 southward

Description: Introduced deciduous tree growing to 12-25 m (50-80 ft); very rapid growth rate with a loose, wide crown; spreads readily by suckers; occasionally planted as an ornamental but upright cultivars are more common; only cultivars are readily available.

Uses: Screening and rehabilitation; tolerant of a wide range of soil conditions including drought and high lime soils; deserves to be planted in many sites, upright cultivar 'Pyramidalis' (Bolleana poplar) also useful for landscaping.

Establishment: Suckers or small plants up to 1 m (3 ft) bare-root.

Populus balsamifera/Balsam Poplar

Range: Zone 1 southward

Description: Native deciduous tree growing to 12-15 m (40-50 ft); rapid growing with a fairly narrow open crown; commonly found growing naturally in pits and quarries, otherwise not readily available.

Uses: Screening and rehabilitation; adaptable to a range of conditions from dry to wet and low to medium fertility; natural regeneration should be encouraged on some sites.

Establishment: Seedlings or small trees up to 1.5 m (5 ft) bare-root; can be transplanted from own property up to 2 m (7 ft), with soil around roots.

Populus X canadensis 'Eugenei'/Carolina Poplar*

Range: Zone 2 southward

Description: Introduced, deciduous tree, growing to 15-25 m (50-80 ft); very rapid growing with a pyramidal shape; commonly planted for windbreaks in southern Ontario; readily available as rooted cuttings only.

Uses: Screening and rehabilitation; longer lived and better shape than Lombardy poplar; tolerates a range of soil conditions; very commonly planted in southern Ontario with average annual growth rate of 47 cm (19 ins); this and other hybrid poplars highly recommended for rapid screening.

Establishment: Rooted cuttings or young trees up to 1.5 m (5 ft) bare-root; unrooted cuttings have shown great promise.

*available from government nurseries



Balsam Poplar—regenerating naturally in gravel pit. (Carmen E. Hopkin)



Carolina Poplar—planted 6-8 years previously, beginning to thin out at base. (Standard Aggregates)

Populus deltoides/Cottonwood*

Range: Zone 4b southward, best restricted to southern Ontario

Description: Native deciduous tree growing to 15-20 m (50-65 ft); fast growth rate, with a pyramidal shape; occasionally planted for timber in southern Ontario; readily available as seedlings only; often found growing naturally in pits and quarries.

Uses: Screening and rehabilitation; prefers moist but well-drained soils; less adaptable or hardy than Carolina poplar; natural plants worth encouraging in some sites.

Establishment: Seedlings up to 1.0 m (3 ft) bare-root; can be moved from own property up to 1.5 m (5 ft) with soil around the roots.

**available from government nurseries*

Populus tremuloides/Trembling Aspen

Range: Zone 1 southward

Description: Widely distributed native deciduous tree growing to 12-15 m (40-50 ft); medium growth rate, with an oval crown; forestry species of medium value; not readily available; commonly found growing naturally in pits and quarries.

Uses: Landscaping and rehabilitation; tolerates a range of growing conditions including poor, dry sites; natural regeneration should be encouraged on many sites.

Establishment: Seedlings or small trees up to 1.5 m (5 ft) bare-root; may be moved from own property with soil around roots.

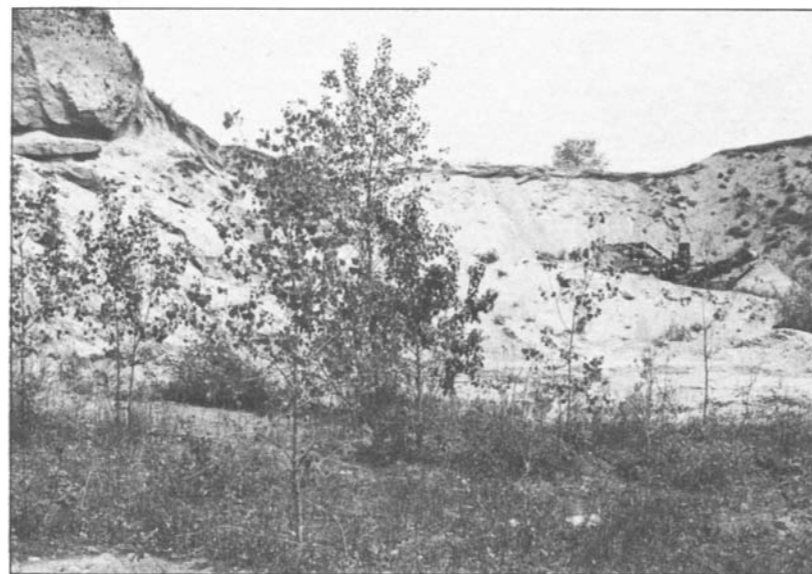
Prunus pensylvanica/Pin Cherry

Range: Zone 1 southward

Description: Small native deciduous tree growing to 4-7 m (14-24 ft); medium growth rate when young, with an oval crown; spreads to form clumps; planted for wildlife but not readily available; sometimes found growing naturally in pits and quarries.

Uses: Screening and rehabilitation; tolerates dry, infertile sites; and excellent source of wildlife food; should be well worth trying.

Establishment: Seedlings or small plants up to 1.5 m (5 ft) bare-root; can be moved from own property with soil around the roots.



Trembling Aspen—regenerating naturally in gravel pit. (Carmen E. Hopkin)

Robinia pseudoacacia/Black Locust*

Range: Zone 4 southward, best restricted to southern Ontario

Description: Introduced deciduous tree growing to 8-12 m (25-40 ft); very fast growing with loose, horizontal branching and rounded shape; forestry species planted for erosion control in southern Ontario.

Uses: Screening and rehabilitation; adaptable to a range of conditions including infertile, dry sites; fixes nitrogen; very good for fast screen or erosion control; has been planted in several sites in southern Ontario and is highly recommended.

Establishment: Seedlings or small trees up to 1.0 m (3 ft) bare-root.

**available from government nurseries*



Black Locust—excellent growth in 7-8 years since planting as seedlings for rehabilitation of extracted area of pit. (Standard Aggregates)

Salix alba var. tristis/Weeping Willow

Range: Zone 4 southward, best restricted to southern Ontario

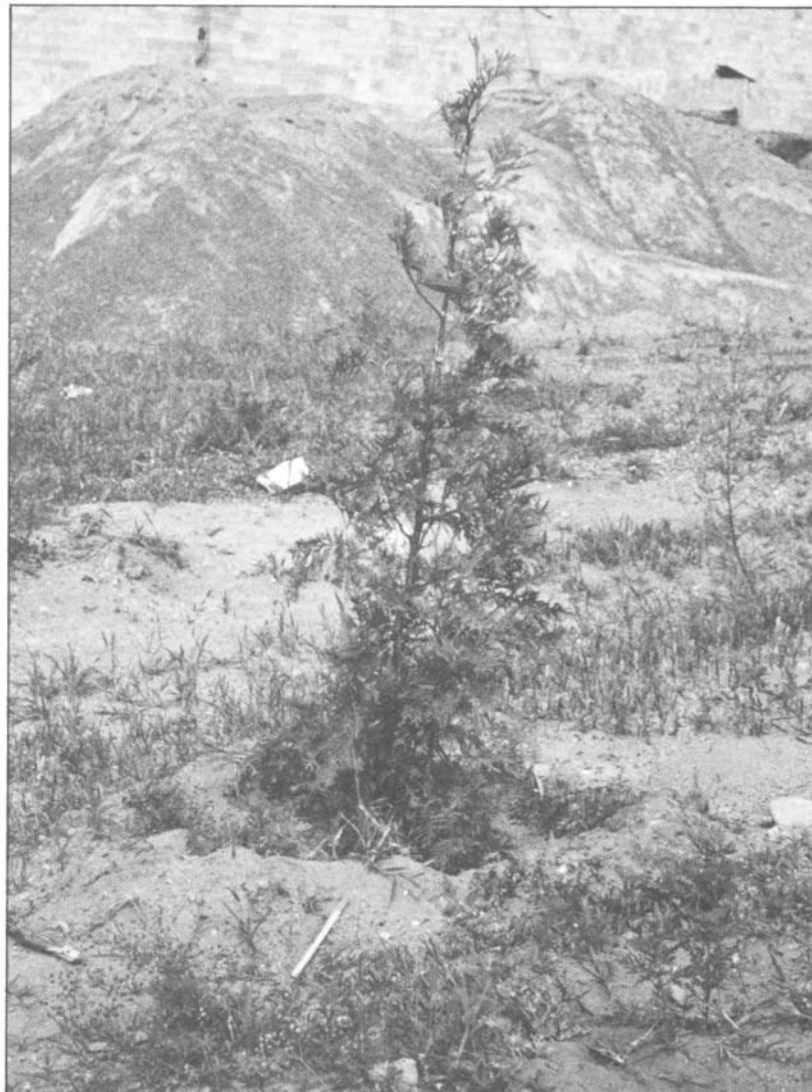
Description: Introduced deciduous tree growing to 12-15 m (40-50 ft); very rapid growth rate with drooping branches; commonly planted as an ornamental.

Uses: Landscaping, screening and rehabilitation; prefers moist soils but is adaptable, tolerating infertile soils, dust and salt; has been planted in several sites in southern Ontario and is highly recommended.

Establishment: Rooted cuttings or small trees up to 1.0 m (3 ft) bare-root.



Weeping Willow—excellent growth in 8-10 years since planting for landscaping pumping station area on quarry floor. (Nelson Crushed Stone)



Eastern White Cedar—young trees planted earlier the same year for screening, and ‘dished’ for water retention. (Spratt Sand and Gravel Ltd.)

Thuja occidentalis/Eastern White Cedar*

Range: Zone 3 southwards

Description: Native coniferous tree growing to 12 m (40 ft); slow to medium growth rate, with a dense pyramidal form; forestry species of medium value, planted in windbreaks, as an ornamental and for wildlife.

Uses: Landscaping, screening and rehabilitation; tolerant of high lime soils; adaptable to wet, dry and infertile soils; has been commonly planted in southern Ontario and is recommended for many sites, especially if combined with faster growing species.

Establishment: Transplants or young trees up to 60 cm (2 ft); can be moved from own property up to 1.5 m (5 ft), with soil around roots.

* available from government nurseries

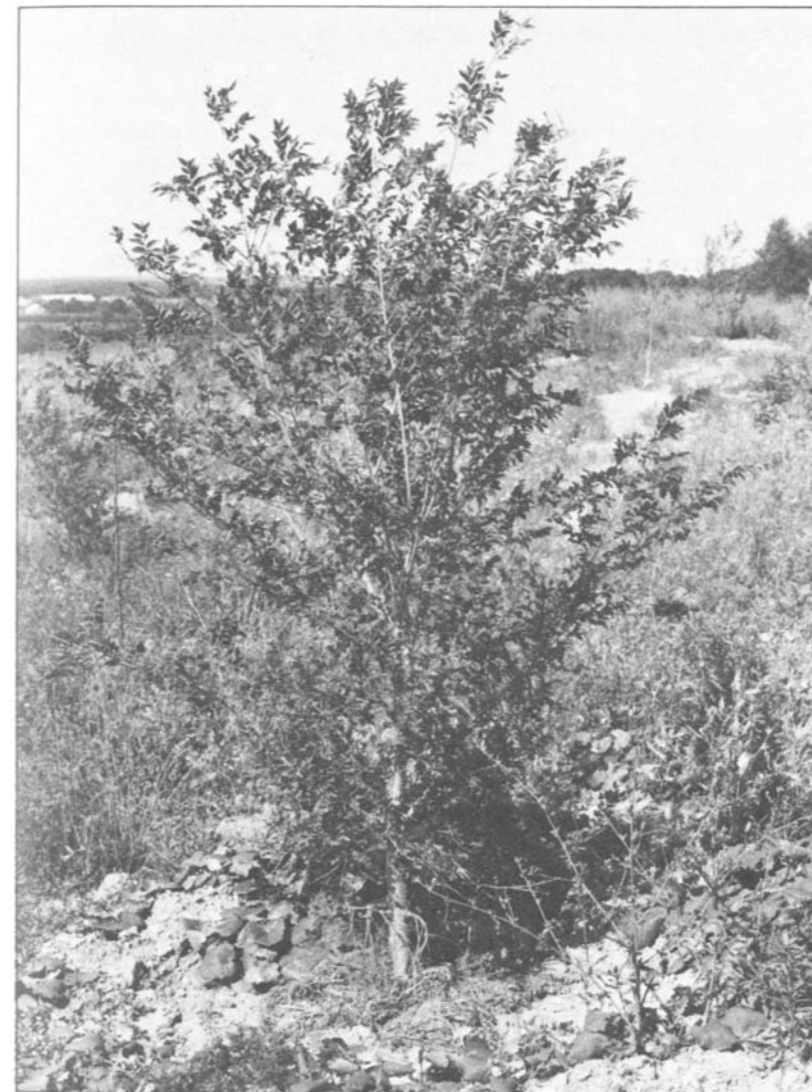
Ulmus pumila/Siberian Elm

Range: Zone 3b southward

Description: Introduced, deciduous tree growing to 15 m (50 ft); very fast growth rate especially when young, with ascending branches and loosely oval shape; may become unkempt with age; commonly planted for hedging.

Uses: Landscaping, screening and rehabilitation; tolerates infertile, dry, alkaline sites, dust and salt; has been planted in several sites in southern Ontario and is highly recommended for difficult conditions.

Establishment: Seedlings or young plants up to 1.0 m (3 ft) bare-root.



Siberian Elm—planted earlier the same year for rehabilitation of overburden piles. (Walker Brothers Quarries Ltd.)

Shrubs

Description of species

Acer ginnala/Amur Maple

Range: Zone 2b southward

Description: Introduced deciduous shrub or small tree growing to 4-6 m (15-20 ft); medium growth rate with a trunk usually divided into many stems close to the ground; planted as an ornamental for fall foliage.

Uses: Landscaping, screening and rehabilitation; prefers moist, well-drained soils of medium fertility but is adaptable to a range of conditions.

Establishment: Small plants up to 1.0 m (3 ft) bare-root; balled and burlapped or container-grown stock up to 1.5 m (5 ft).

Caragana arborescens/Siberian Peashrub

Range: Zone 2 southward

Description: Introduced deciduous shrub growing to 3 m (10 ft); medium growth rate with a generally round form and yellow flowers; fixes nitrogen from the soil; planted mainly for wildlife.

Uses: Landscaping, screening and rehabilitation; well adapted to dry, infertile, exposed sites; good for mass planting of low screens; has been planted in occasional sites in southern Ontario and deserves more use.

Establishment: Small plants to 60 cm (2 ft) bare-root.



Siberian Peashrub—in flower, planted on side of berm for screening quarry, 4 years previously. (Canada Crushed Stone)

Cornus racemosa/Grey Dogwood

Range: Zone 2b southward

Description: Native deciduous shrub growing to 2-3 m (7-10 ft); medium growth rate, spreads slowly by suckering to form large, dense clumps; planted for screening and for wildlife; has attractive fruiting colour in fall.

Uses: Rehabilitation; prefers moist soils but tolerates a wide range of soil conditions, including low fertility and high pH; should be worth trying on many sites.

Establishment: Small plants up to 60 cm (2 ft) bare-root.

Cornus sericea/Red Osier Dogwood

Range: Zone 1b southward

Description: A native deciduous shrub growing to 2 m (7 ft); medium growing, attractive shrub with red twigs and open form; spreads by suckering to form clumps; planted as an ornamental and for wildlife.

Uses: Landscaping and rehabilitation; tolerates a wide range of conditions including low fertility, but prefers moist soils; may suffer under high pH; has been planted on several sites in southern Ontario, and could be used much more often.

Establishment: Small plants up to 60 cm (2 ft) bare-root.

Elaeagnus commutata/Silverberry

Range: Zone 2 southward

Description: Native, deciduous shrub growing to 2 m (7 ft); medium growth rate with open form and silvery foliage; suckers profusely and fixes nitrogen from the soil; not readily available and rarely planted in Ontario.

Uses: Rehabilitation; very well adapted to poor, dry, alkaline soils; should be good for slope stabilization and wildlife.

Establishment: Seedlings, suckers or small plants to 0.5 m (18 ins) bare-root; has shown some success planted directly as seed.



Red Osier Dogwood—planted 3 years previously on side of berm for screening purposes. (Indusmin Ltd.)

Elaeagnus umbellata/Autumn Olive

Range: Zone 5 southward

Description: Introduced deciduous shrub growing to 2-3 m (7-10 ft); medium to fast growth rate with spreading stems; has silver-green leaves, inconspicuous but fragrant flowers and red berries; fixes nitrogen from the soil; planted as an ornamental, and for wildlife in southern Ontario.

Uses: Landscaping, screening and rehabilitation; tolerant of moist to dry, infertile soils and high pH; good for slope stabilization and wildlife; highly recommended for many sites.

Establishment: Seedlings or small plants up to 60 cm (2 ft) bare-root.



Autumn Olive—very vigorous growth over 3 years since planting in former gravel pit, as part of demonstration collection of trees and shrubs for poor sites and steep slopes. (University of Guelph, Arboretum)

Juniperus communis var. *depressa*/Common Juniper

Range: Zone 2b southward

Description: Native evergreen shrub growing to 1 m (3 ft) in height and 2-3 m (7-10 ft) spread; slow to medium growth rate; planted mainly as ornamental cultivars, otherwise not readily available.

Uses: Landscaping and rehabilitation; tolerates dry, infertile and shallow soils with high pH; should be good for slope cover and stabilization.

Establishment: Seedlings or small plants up to 30 cm (12 ins), balled and burlapped or container-grown.

Lonicera tatarica/Tatarian Honeysuckle

Range: Zone 2 southward

Description: Introduced but naturalized deciduous shrub growing to 3 m (10 ft); vigorous grower with a broadly rounded form; inconspicuous flowers and yellow or red fruit; the most commonly planted honeysuckle, as an ornamental and for wildlife.

Uses: Screening and rehabilitation; adaptable to poor alkaline soils but prefers moisture; good for mass planting on slopes, and for low screens; has been planted in several sites in southern Ontario and should be used more often.

Establishment: Small plants up to 60 cm (2 ft) bare-root.

Pinus mugo var. *mugo*/Mugo Pine

Range: Zone 1 southward

Description: Introduced coniferous shrub growing to 3 m (10 ft); medium growth rate with spreading branches; usually pruned into an ornamental dwarf shrub.

Uses: Landscaping, screening and rehabilitation; prefers moist soils but will tolerate a range of conditions including high pH and salt; when left unpruned should be good for many sites.

Establishment: Transplants up to 30 cm (12 ins) bare-root; container-grown stock up to 0.5 m (18 ins).

Potentilla fruticosa/Shrubby Cinquefoil

Range: Zone 1 southward

Description: A native deciduous dwarf shrub growing to 1 m (3 ft); medium growth rate with a mound-like appearance and attractive flowers throughout the summer; several cultivars commonly planted as ornamentals.

Uses: Landscape planting; attractive low bush, withstanding poor, dry, sandy soils and extremes of temperature; should be good for entrance and office plantings.

Establishment: Small plants up to 30 cm (12 ins) bare-root.

Prunus virginiana/Choke Cherry

Range: Zone 1 southward

Description: Native deciduous shrub or small tree growing to 4-5 m (14-17 ft); medium growth rate, with either a multistem or single stem form; planted for wildlife; commonly found growing naturally in pits, otherwise not readily available.

Uses: Landscaping, screening and rehabilitation; prefers moist, fertile soils but tolerates a range of conditions; good for wildlife; should be worth encouraging in some sites.

Establishment: Small plants up to 1.0 m (3 ft) bare-root; may be moved from own property with soil around the roots.

Rhus typhina/Staghorn Sumac

Range: Zone 3 southward

Description: Native deciduous shrub growing to 3-5 m (10-17 ft); medium growth rate with an open, flat crown; spreads readily by suckers; planted as an ornamental and for naturalizing; commonly found growing naturally in pits.

Uses: Landscaping, screening and rehabilitation; withstands the driest, most infertile soils; good for slope stabilization and wildlife attraction; has been planted occasionally in southern Ontario and should be used more often.

Establishment: Suckers or small plants up to 1.0 m (3 ft) bare-root; may be moved from stands on the property; use of root cuttings has shown potential.



Common Juniper—planted 3 years previously in former gravel pit, as demonstration collection of plants for poor sites and steep slopes. (University of Guelph, Arboretum)



Staghorn Sumac—plants have grown from root pieces, planted 2 years previously in former gravel pit. (University of Guelph, Arboretum)

Rosa multiflora/Multiflora Rose

Range: Zone 5b southward

Description: Introduced deciduous spreading shrub growing to 1-2 m (3-7 ft) with a spread of 2-3 m (7-13 ft); fast growing with trailing branches; planted as a coarse hedge and for wildlife.

Uses: Landscaping and rehabilitation; will tolerate a wide range of conditions including drought and salt; good for erosion control and wildlife attraction, could also be massed on side of berms.

Establishment: Rooted cuttings or small plants up to 60 cm (2 ft) bare-root.

Rosa rugosa/Rugosa Rose

Range: Zone 3 southward

Description: Introduced deciduous shrub growing to 1-2 m (3-7 ft); medium growth rate with attractive foliage, flowers and fruit; spreads by suckering; planted as an ornamental.

Uses: Landscaping and rehabilitation; tolerates drought, dust and salt; good for slope stabilization and wildlife; is very attractive and should be worth planting on many sites.

Establishment: Rooted cuttings, suckers or small plants up to 60 cm (2 ft) bare-root.



Rugosa Rose—attractive flowers on plants established 2 years previously in former gravel pit. (University of Guelph, Arboretum)

Salix caprea/Goat Willow

Range: Zone 5 southward

Description: Introduced deciduous shrub growing to 4 m (14 ft); fast growing with upright branching; planted as an ornamental for its “pussy willow” catkins in southern Ontario.

Uses: Screening and rehabilitation; prefers moist soils but tolerates a range of conditions; should be worth planting in many sites.

Establishment: Rooted cuttings or small plants up to 60 cm (2 ft) bare-root; use of unrooted cuttings has shown potential.



Goat Willow—planted as unrooted stem cuttings 3 years previously in former gravel pit. (University of Guelph, Arboretum)

Salix purpurea/Purple Osier

Range: Zone 2b southward

Description: Introduced deciduous shrub growing to 2 m (7 ft); fast growth rate with slender ascending branches; dense, elegant foliage; planted as hedges.

Uses: Landscaping and rehabilitation; prefers moist soils but survives low fertility; good for slope stabilization.

Establishment: Rooted cuttings or small plants up to 60 cm (2 ft) bare-root; can be planted as unrooted cuttings.

Symphoricarpos albus/Snowberry

Range: Zone 2 southward

Description: Native, deciduous shrub reaching 1-2 m (3-7 ft); fairly rapid grower with open rounded form and conspicuous white fruit; suckers profusely; planted as informal ornamental.

Uses: Landscaping and rehabilitation; tolerant of most conditions including lime rich soils; good for slope stabilization.

Establishment: Small plants up to 60 cm (2 ft) bare-root.

Syringa vulgaris/Common Lilac

Range: Zone 2b southward

Description: Introduced deciduous shrub growing to 3-5 m (10-18 ft); slow to establish, then medium growth rate with a loosely oval shape; spreads by suckering; planted as informal hedge and has become naturalized in southern Ontario.

Uses: Landscaping, screening and rehabilitation; adaptable, but prefers moist soils with medium fertility; good for slope stabilization; should be good for many sites, once established.

Establishment: Small plants up to 1.0 m (3 ft) bare-root.



Common Lilac—spreading naturally from neighbouring clump into a planted screen area. (Franceschini Brothers Construction Ltd.)

Viburnum lantana/Wayfaring Tree

Range: Zone 2b southward

Description: Introduced deciduous shrub or small tree growing to 4 m (14 ft); medium growth rate with a rounded form and white flowers; planted as an ornamental.

Uses: Landscaping and rehabilitation; tolerates dry to moist soils with high pH; good for wildlife attraction; has been planted on occasional sites in southern Ontario and should do well.

Establishment: Small plants up to 1.0 m (3 ft) bare-root.



Wayfaring Tree—planted on side of berm for screening purposes. (Canada Crushed Stone)

Viburnum lentago/Nannyberry

Range: Zone 2 southward

Description: Native deciduous shrub or small tree reaching 3-6 m (10-20 ft); medium growth rate and loosely oval shape; spreads by suckering; planted mainly for wildlife.

Uses: Screening and rehabilitation; prefers moist or wet soils of medium fertility; good for slope stabilization and wildlife; should be worth trying in many sites.

Establishment: Small plants to 1.0 m (3 ft), bare-root.

Viburnum trilobum/Highbush Cranberry

Range: Zone 2 southward

Description: Native deciduous shrub reaching 3 m (10 ft); vigorous growth with a rounded crown, attractive flowers and edible berries; planted as informal ornamental and for wildlife.

Uses: Screening and rehabilitation; prefers good moist soils but fairly adaptable; good for wildlife; has been planted on occasional sites in southern Ontario and should be used more often.

Establishment: Small plants to 1.0 m (3 ft) bare-root.

Description and Evaluation of Existing Plantings

Study Objectives

In 1978 a study was carried out to describe and evaluate existing plantings in pit and quarry sites, for although trees and shrubs have been planted over a number of years and for a variety of purposes, there is currently little evaluation of these or other kinds of rehabilitation activities. The principal objectives were:

- to identify properties with trees or shrubs planted for screening or rehabilitation purposes
- to describe procedures used in planting programs
- to evaluate the effectiveness of plantings
- to indicate how improvements in procedures or information could be made.

The study was reported in full, and provided a basis for the recommended procedures for using trees and shrubs, described in the previous sections of this publication. A summary is given below.

Study Methods

The study was carried out in an area of southern Ontario that included 11 districts of the Ministry of Natural Resources, ranging from Chatham in the west to Ottawa in the east. A sample of 85 licensed sites, consisting of 61 pits and 24 quarries, was selected from a total of 168 sites that had plantings for screening and/or rehabilitation purposes (Map 6). Following site visits and interviews with company personnel during summer 1978, procedures used for site preparation, planting and maintenance were described for each property, and each rehabilitation area or screen was described and evaluated.

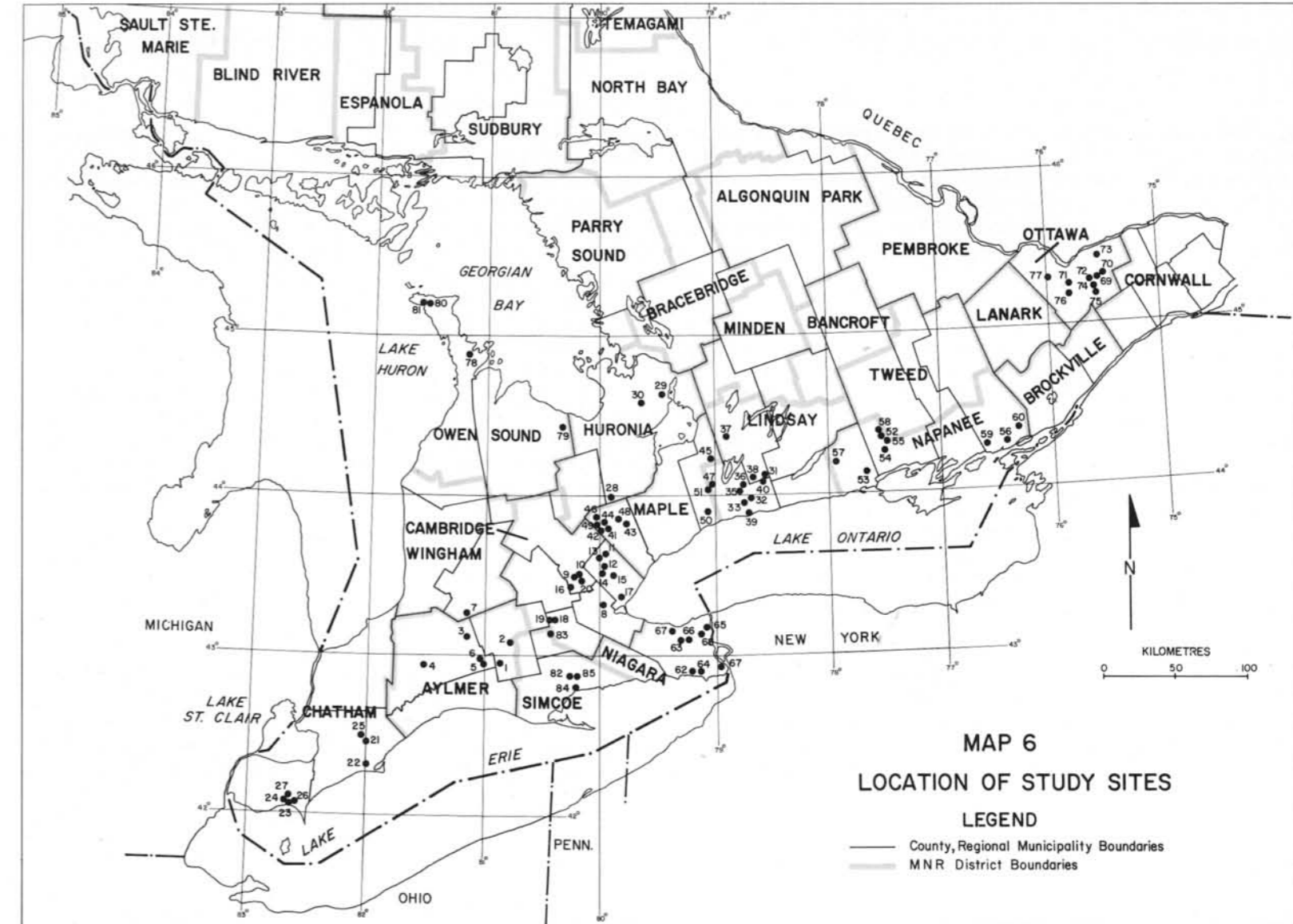
The following definitions were used in the course of the study:

Trees were defined as woody plants that would grow to a height of at least 6 m (20 ft) with a single trunk, while **shrubs** are smaller, and have several woody stems.

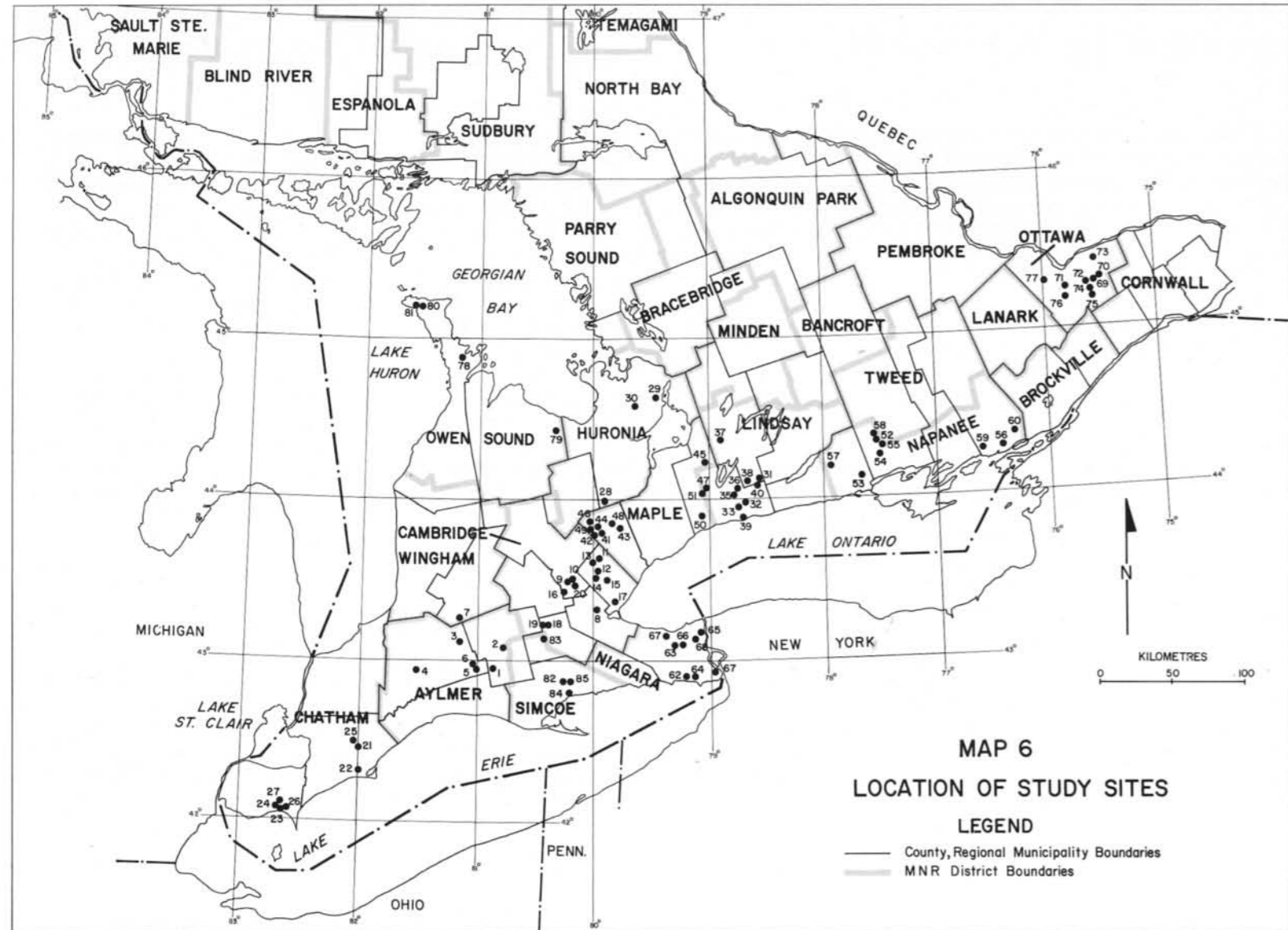
Screens were defined as plantings designed primarily to screen all or part of the extraction operation from view.

Rehabilitation Plantings were defined as plantings on areas that had been extracted or otherwise disturbed and were being restored to a semi-permanent or permanent after-use. Four different kinds of rehabilitation plantings were recognized as follows:

- **Forestry and Conservation**, involving the use of forestry species planted closely together as seedlings or transplants with or without a seeded groundcover and usually with little maintenance after planting.
- **Recreation**, involving the use of forestry or ornamental species usually planted as young trees at wider spacings, with a maintained groundcover.
- **Visual Improvement**, involving either of the above planting materials and methods, but planted specifically for improving the appearance of part of the site.
- **Orchard**, involving the use of fruit trees planted for production purposes.



MAP 6
LOCATION OF STUDY SITES
LEGEND
County, Regional Municipality Boundaries
MNR District Boundaries



MAP 6
LOCATION OF STUDY SITES
LEGEND
 — County, Regional Municipality Boundaries
 - - - MNR District Boundaries

Occurrence of Tree and Shrub Plantings

Trees and shrubs have been planted for screening or rehabilitation purposes in at least 168 licensed pits and quarries in southern Ontario, representing about 10% of the total number of licensed properties in the area. They occur most commonly as screens, but in over 25% of sites have been planted for rehabilitation of areas disturbed by extraction activities.

In most of the properties evaluated, planting had occurred in the last 6 years, and planting sites were usually in open, exposed areas, having soils that were often low in nutrients (about 70% sites) in addition to being alkaline, with pH values exceeding 7.5 (52% sites).

Screens occurred most frequently beside public roads at the edge of properties, and had an average length of 450 m (1500 ft), ranging from 30 m to over 1500 m. Although usually planted to screen stockpiles, processing plants and areas already under extraction, several were planted on undisturbed parts of the site, well in advance of extraction activities.

Rehabilitation plantings were usually less than 4 ha (10 acres) in size, but ranged up to 40 ha (100 acres). They were mainly on backfilled and graded slopes or pit floor areas, with some on former silting

ponds and overburden stockpiles. Although often established without a definite after-use in mind, the principal kinds of plantings were described as forestry and conservation (50% sites) or recreation (28%), while the remainder had been planted for visual improvement (16%) or as an orchard (6%).

In addition to planted areas, many properties with hedgerows or wooded areas nearby had some natural regeneration of trees, shrubs and vines on disturbed areas. These usually occurred as scattered individuals or sparse populations, but eventually produced a significant cover in the better sites.

Operating companies varied greatly in size, and about 50% were members of the Aggregate Producers' Association of Ontario. Some developed a planting program on their own initiative; many received assistance from government publications and personnel, conservation authorities, nurseries, and professional landscape architects. Others planted trees with minimal input, merely to fulfil legislation requirements.

Planting and Maintenance Techniques

Planting materials

Companies more commonly used forestry stock from government nurseries (64% sites) than plants from commercial nurseries or from natural areas on the property, but several used planting stock from more than one source, and some had established their own nursery on the property. The large majority of stock was planted bare-root, with only 20% sites using balled and burlapped or containerized plants.

Although nearly 60 different species of trees and shrubs were planted in total, only 19 were found in more than 5 sites, including two species of shrubs (Appendix 4). The most common by far were four forestry species: red pine, white spruce, Carolina poplar and white pine, followed by white cedar, silver maple and white ash. Other species occurred in less than 10% of the sites and included ornamental trees, shrubs and vines as well as additional forest species.

The main factor influencing the choice of planting stock appeared to be cost and availability, with forestry seedlings and transplants readily available from government nurseries at a minimal price of \$10.00 per 1000, compared with commercial prices of \$0.25-\$0.50 each for seedlings and \$3.00-\$5.00 for young deciduous trees. Young trees and larger stock were usually chosen in preference to seedlings when quick results were needed, or when trees were being transplanted within the property.

The suitability of different species for particular purposes was considered to some extent in screen plantings but was less common in rehabilitation plantings, where timber species were often used regardless of the site's suitability for production forestry. The erosion-control or soil-improving properties of plants, or their value in attracting wildlife were apparently considered rarely, for species that fixed nitrogen or bore edible fruit were uncommon. There was also little use of many species that regenerate naturally on disturbed sites (Appendix 5).

Planting and maintenance procedures

Although planting was mainly in the spring and fall, stock from commercial nurseries was also planted in the summer. Hand planting was most common (64% sites) but many companies used a mechanical tree planting machine for seedlings, and several used mechanical equipment for digging holes, or for transplanting trees on the property. Most companies planted with their own personnel, while others had assistance from government or conservation authority staff, the private sector, or boy scouts.

The majority of stock was planted without treatments; some companies watered at planting (25% sites), and some applied fertilizer, but only a few pruned, staked and mulched plants or protected them against mice.

Maintenance of plantings, which occurred in about 50% of sites, consisted largely of mowing

grass. Some sites continued to apply water through the first growing season; other forms of maintenance and replacement of dead plants occurred rarely.

Cost of plantings

Actual planting costs (plants plus labour) obtained from a few companies for recent plantings, ranged from \$25.00 per ha (\$10.00 per acre) to \$3,150.00 per ha (\$1,300.00 per acre). Low costs resulted from the use of government seedlings, common in screens and forestry or conservation plantings, rather than larger stock from commercial nurseries, found in some screens and in recreation and visual amenity plantings.

Two estimates of backfilling, grading (and in one case hydroseeding) of extracted areas before planting were \$8,406.00 per ha (\$3,360.00 per acre) and \$6,655.00 per ha (\$2,660.00 per acre), both substantially greater than planting costs.

Evaluation of Plantings

Plant survival and growth

In better sites, with careful planting and maintenance procedures, plants established well and grew vigorously. However, many sites had poor survival and slow growth, limiting the success of both screen and rehabilitation plantings.

The high mortality rate (40% plants) occurred largely in the first year or two of planting, and probably resulted from two main factors: drought stress (observed in 70% sites) and girdling by mice (observed in 40% sites). Drought stress and low fertility will also have contributed to the slow growth of plants in many sites; additional damage occurred from wind, dust, pests and maintenance practices. Average annual growth rate of the four commonly planted forestry species ranged from 50 cm (20 ins) in Carolina poplar to 8-15 cm (3-6 ins) in conifers, and was sometimes surpassed by other species planted less often. Several plantings could have been improved by the use of plant species better adapted to the site conditions.

While good species selection, planting and maintenance procedures to minimize the effects of drought, low fertility and mice, could produce satisfactory results on many sites, some conditions were poor enough to need additional site preparation or soil improvement before they would be adequate for healthy plant growth.

Screens

About 50% of the screen plantings had adequate planting arrangements and survival to be successful, although they were usually too recent to be effective at the present time. Plantings that included an earth berm, or consisted of at least two rows of closely spaced trees, established 5 to 10 years previously, produced the screens that were currently effective (14% sites). Most sites used good spacing between plants, and many combined a deciduous species with an evergreen (50% sites).

Insufficient numbers of rows or groups of plants and high mortality were the principal reasons limiting success in the other 50% sites, with some use of inappropriate species and planting arrangements. The fairly common practice of planting in single rows (20% sites) was usually unsuccessful; and even with close spacing of plants in several rows the gaps left by dead plants often resulted in poor screening. In many cases restocking one or two years after initial planting would have helped considerably.

Rehabilitation plantings

Satisfactory rehabilitation occurred among plantings for the purpose of conservation, recreation, visual amenity and orchard production (66% sites), but the remaining sites needed additional planting or improved maintenance before they could be considered effective. While survival rate is not always as critical for rehabilitation as for screening, many sites would have benefited from better plant survival as well as improved vigour, and from a better choice of species and planting arrangements.

In many cases better site preparation and soil conditions would lead to much improved rehabilitation. Some examples suggest that production forestry could be feasible on the better sites, provided adequate stocking rates are maintained.

Conclusions

It is encouraging that trees, and to some extent shrubs, are being used for screening and progressive rehabilitation of pits and quarries in southern Ontario. Successful examples of effective screening and rehabilitation for a variety of after-uses provide an excellent demonstration of what can be achieved with good planning and careful practices. There are many more sites, both licensed and abandoned, that could benefit from a planting program.

Despite many successful plantings, resulting from good site preparation, planting and maintenance procedures, poor survival and growth of plants in many sites suggests a need for improved practices. Better site preparation could often improve the growing conditions. The selection of adapted species, with more careful planting and maintenance procedures to alleviate the major hazards of drought and mice, should lead to better survival and growth. However, it is often realistic to expect a need for replacements one or two years after initial planting.

Adequate planning and design of plantings has occurred in several sites, with examples of planting ahead of extraction, establishment of nurseries, organization of labour, good selection of planting materials and suitable arrangement of plants. However, plantings could be much more effective if better planned at all stages, with a clearer approach to the purpose of planting and the use of relevant procedures.

An improvement in the amount and quality of information available to extracting companies is considered necessary, to clarify the various options available for screening and rehabilitation, and provide more technical guidance for their implementation. This can be achieved through published information outlining recommended procedures, as well as increased consultations between companies and professionals in the public and private sectors. The earlier sections of this publication are intended to supply some of this necessary information, by clarifying the techniques available to pit and quarry operators for using trees and shrubs for both screening and rehabilitation purposes.

Acknowledgements

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Most of the photographs were taken by members of the study team but some were taken by Don Hamilton, Glenn McArthur & Herb Rauscher.

Appendix I

Ministry of Natural Resources District Offices¹

(Up-to-date addresses and phone numbers)

Aylmer District

Box 340
353 Talbot Street West
Aylmer, Ontario
N5H 3R2
(519) 773-9241

Cambridge District

Beaverdale Road
Cambridge, Ontario
N3C 2V3
(519) 658-9356

Chatham District

Box 1168
435 Grand Ave. West
Chatham, Ontario
N7M 5L8
(519) 354-7340

Huronia District

Midhurst, Ontario
L0L 1X0
(705) 728-2900

Lindsay District

322 Kent St. West
Lindsay, Ontario
K9V 2Z9
(705) 324-6121

Maple District

Maple, Ontario
L0J 1E0
(416) 832-2761

Napanee District

Postal Bag 3040
Napanee, Ontario
K7R 3M8
(613) 354-2173

Niagara District

Box 1070
Highway No. 20
Fonthill, Ontario
L0S 1E0
(416) 892-2656

Ottawa District

Ramsayville, Ontario
K0A 2Y0
(613) 822-2525

Owen Sound District

611 Ninth Ave. East
Owen Sound, Ontario
N4K 3E4
(519) 376-3860

Sault Ste. Marie District

Box 130, 69 Church St.
Sault Ste. Marie, Ontario
P6A 5L5
(705) 949-1231

Simcoe District

645 Norfolk Street North
Simcoe, Ontario
N3Y 3R2
(519) 426-7650

Sudbury District

Box 3500, Stn. A
Sudbury, Ontario
P3A 4S2
(705) 522-7823

Appendix 2

Commercial Suppliers of Nursery Stock¹

Aylmer District

Blondeel Nursery Inc., Straffordville.
Canadale Nurseries, St. Thomas.
H. C. Downham Nursery Co. Ltd., Strathroy.
Ebert's Tree Service, Thamesford.
Little Tree Farm, London.
McConnell Nursery Co. Ltd., Port Burwell.
Spruce Acres Nursery Ltd., Ailsa Craig.
Strathroy Nursery Ltd., Strathroy.
Thames Nursery Distributing Co., Mitchell.
Tulip Gardens, Ingersoll.
Van Beek's Nursery, Ingersoll.

Cambridge District

R. H. Barnsley Nursery Ltd., Guelph.
Braun's Nursery, Mount Hope.
John Connon Nurseries Ltd., Waterdown.
Dutch Landscape & Nursery, Norval.
Dutch-Mill Nursery, Guelph.
Flamborough Nurseries and Landscaping Ltd.,
Millgrove.
Groens Nursery, Dundas.
Hortico Inc., Waterdown.
Kraus Nurseries Ltd., Carlisle.
McLean & Peister Ltd., Kitchener.
R. Nielsen and Son Nurseries, Oakville.
Oriental Nurseries, Mount Hope.
Redleaf Nurseries Ltd., Hornby.

¹ Based on List of Growers from Landscape Ontario, Woody Plant Source List 1977 (Agriculture Canada), and nurseries known to have supplied plant material to pits and quarries.

¹ Application for trees from government nurseries should be made through the district offices.

Appendix 2

Commercial Suppliers of Nursery Stock¹ (cont'd)

Royal City Nursery, Guelph.
Tillich's Nursery, Breslau.
Tree-Man Ltd., Rockwood.

Chatham District

Allied Nurseries, Windsor.
Colonial Nurseries & Garden Centre, Chatham.
De Groot's Nurseries Ltd., Sarnia.
Malden Tree Farms Ltd., River Canard.
Scott Whaley Nurseries, Ruthven.

Huronia District

Huronia Nurseries, Wyevale.

Lindsay District

Brookdale-Kingsway Ltd., Bowmanville
Brooklin Nurseries, Brooklin.
Dynarose Ltd., Brooklin.
Henk Kobes Nursery, Bowmanville.
Meyers Garden Centre Ltd., Peterborough.
W. Richardson Ltd., Pontypool.

Maple District

Associated Landscaping Ltd., Mississauga.
Bisgaard's Nurseries, Thornhill.
Blithe Hill Nurseries, Toronto.
Creemore Holdings Ltd., Alliston.
C. A. Cruickshank Ltd., Toronto.
Jerry Hasek Nursery, Pickering.
Humber Nurseries Ltd., Woodbridge.

Lakeshore Landscape Association Ltd.,
Mississauga.
Litz Landscaping & Enterprises Ltd., Brampton.
Mississauga Tree Farms, Mississauga.
Oakland Nursery, Scarborough.
Pinehaven Nurseries Ltd., Mississauga.
Sheridan Nurseries Ltd., Etobicoke.
Solt Garden Centre, Scarborough.
Springdale Nurseries, Bradford.
Carl Stewart Nursery, Mississauga.
Treeland Wholesale Nursery Inc., Mississauga.
Van Dongen's Nurseries Ltd., Mississauga.
Vaughn Nurseries Ltd., Agincourt.
Weal & Cullen Nurseries Ltd., Willowdale.
White Rose Nurseries, Unionville.
Willow Farm Nursery, Don Mills.
Woodland Nurseries, Mississauga.

Napanee District

Walter J. Holsgrove & Sons Ltd., Westbrook.

Niagara District

J. C. Bakker & Sons Ltd., St. Catharines.
Barrons Flowers, Fonthill.
Campberry Farms, Niagara-on-the-Lake.
Gauld Nurseries Ltd., Niagara Falls.
Hasselman Nurseries Ltd., Sherkston.
Hollandia Nurseries, Port Robinson.
Holloway Bay Nurseries, Holloway Bay.
Maple Leaf Nurseries, St. Catharines.
Mori Nurseries Ltd., Niagara-on-the-Lake.

Niagara Holland Nurseries, Niagara-on-the-Lake.
Niagara Nurseries, St. Catharines.
Carl Pallek & Sons Nurseries, Virgil.
J. M. Peeters Nurseries, Beamsville.
Reimer's Nursery, Virgil.
Jim Vlaar's Nurseries, St. Catharines.
Ziraldo Farms & Nurseries Ltd.,
Niagara-on-the-Lake.

Ottawa District

Artistic Landscape Designs Ltd., Ottawa.
Fines Flowers Ltd., Ottawa.
Golden Triangle Nursery Inc., Spencerville.
Roger Laport Flowers & Nursery, Cumberland.
A. D. Maginnes & Sons, Ramsayville.
Vlamings Tree Nursery, Ottawa.

Owen Sound District

Haavaniit's Springmount Nurseries, Owen Sound.

Simcoe District

Keith Somers Trees, Tillsonburg.
Waterford Nurseries, Waterford.

Note: There are no major suppliers of nursery stock in Sudbury and Sault Ste. Marie Districts. Stock is shipped to these districts from nurseries in southern Ontario.

Appendix 3

Description and evaluation of existing plantings—List of operators (Map 6).

1. J. N. Corbett	29. King Paving & Materials (Div. of Flintkote Co. of Canada)	56. McGinnis & O'Connor
2. Domtar Chemicals Ltd.	30. Ken Traux Const.	57. Corp. of the County of Northumberland
3. Matthews Group Ltd.	31. Larry Bradley	58. James O. Stapley
4. Alex Newbigging Ltd.	32. John L. Coombes	59. Wood's Sand & Gravel
5. Stebbin Paving & Const. Ltd.	33. Harnden & King Const. Ltd.	60. Wood's Sand & Gravel
6. Stebbin Paving & Const. Ltd.	34. W. G. Jackett & Sons Const. Ltd.	61. Campbell Quarries & Const. Ltd.
7. St. Marys Cement Co.	35. G. Kovacs	62. R. E. Law Crushed Stone Ltd.
8. Canada Crushed Stone	36. G. Kovacs	63. Port Colborne Quarries Ltd.
9. Capital Paving Ltd.	37. Dean McKague	64. Queenston Quarries (Div. Steetley Ind. Ltd.)
10. Custom Aggregates	38. William E. Reid	65. Steed and Evans Ltd.
11. J. C. Duff Ltd.	39. St. Marys Cement Co.	66. T C G Materials Ltd.
12. Dufferin Aggregates	40. Standard Aggregates	67. Vineland Quarries & Crushed Stone Ltd.
13. Indusmin Ltd.	41. Armbro Materials & Const. Ltd.	68. Walker Bros. Quarries Ltd.
14. Indusmin Ltd.	42. Town of Caledon	69. Armbro Aggregates
15. Milton Limestone Aggregates	43. T & K DeBoer Const. & Exc. Ltd.	70. 71. 72. Dibblee Const. Ltd.
16. MNR, Cambridge Office	44. Franceschini Bros. Const. Ltd.	73. Francon
17. Nelson Crushed Stone	45. Hancock Sand & Gravel	74. 75. 76. 77. Spratt Sand & Gravel Ltd.
18. Standard Aggregates	46. Basil Horan	78. Angelstone Ltd.
19. Standard Aggregates	47. MNR, Maple Office	79. Gordon Conn
20. T C G Materials Ltd.	48. John McCormick	80. Mike Robins
21. Adams Sand & Gravel	49. Premier Concrete Products Ltd., (Div. of Lake Ontario Cement Ltd.)	81. Douglas F. Watson
22. Doey Gravel & Const.	50. Standard Aggregates	82. Donald Walker
23. Essex County	51. Standard Aggregates	83. Township of Burford
24. Essex County	52. Canada Cement Lafarge Ltd.	84. W. D. Cookson Ltd.
25. Huron Gravel Ltd.	53. James Finlan	85. City of Nanticoke
26. Kennette Contracting	54. Carmen E. Hopkin	
27. Mersea Township	55. Andy Kooistra	
28. Town of Caledon		

Appendix 4

Description and evaluation of existing plantings—List of planted trees, shrubs and vines

Botanical name	Common name	Botanical name	Common name
Trees			
<i>Acer ginnala</i> Maxim.	amur maple	<i>Picea glauca</i> (Moench) Voss	* white spruce
<i>Acer platanoides</i> L.	* Norway maple (and cultivars)	<i>Picea pungens</i> 'Glauca'	Colorado blue spruce
<i>Acer rubrum</i> L.	* red maple	<i>Pinus banksiana</i> Lamb.	* jack pine
<i>Acer saccharinum</i> L.	* silver maple	<i>Pinus nigra</i> Arnold	Austrian pine
<i>Acer saccharum</i> Marsh.	sugar maple	<i>Pinus resinosa</i> Ait.	* red pine
<i>Betula papyrifera</i> Marsh.	white birch	<i>Pinus strobus</i> L.	* white pine
<i>Castanea</i> sp.	chestnut	<i>Pinus sylvestris</i> L.	* Scots pine
<i>Elaeagnus angustifolia</i> L.	Russian olive	<i>Platanus X acerifolia</i> (Ait.) Willd.	London plane tree
<i>Fraxinus americana</i> L.	* white ash	<i>Platanus occidentalis</i> L.	sycamore
<i>Fraxinus pennsylvanica</i> var. <i>subintegerrima</i> (Vahl) Fern.	green ash	<i>Populus X canadensis</i> 'Eugenei'	* Carolina poplar
<i>Gleditsia triacanthos</i> var. <i>inermis</i> Willd.	thornless honey locust	<i>Populus nigra</i> 'Italica'	* Lombardy poplar
<i>Juglans cinerea</i> L.	butternut	<i>Prunus cerasus</i> 'Montmorency'	Montmorency sour cherry
<i>Juglans nigra</i> L.	* black walnut	<i>Quercus alba</i> L.	white oak
<i>Juniperus virginiana</i> L.	red cedar	<i>Quercus rubra</i> L.	red oak
<i>Larix decidua</i> Mill.	* European larch	<i>Robinia pseudoacacia</i> L.	* black locust
<i>Larix laricina</i> (Du Roi) Koch	tamarack	<i>Salix alba</i> var. <i>tristis</i> (Ser.) Gaudin	* weeping willow
<i>Malus</i> cvs.	apple, fruit varieties	<i>Sorbus aucuparia</i> L.	European mountain-ash
<i>Malus</i> cvs.	crab apple cultivars	<i>Thuja occidentalis</i> L.	* eastern white cedar
<i>Picea abies</i> (L.) Karst.	Norway spruce	<i>Ulmus pumila</i> L.	* Siberian elm

*planted in at least 5 sites.

Botanical name	Common name
Shrubs	
<i>Amelanchier</i> sp.	serviceberry
<i>Caragana arborescens</i> Lam.	Siberian peashrub
<i>Cornus alba</i> ‘Spaethii’	yellow edged dogwood
<i>Cornus sericea</i> L.	*red-osier dogwood
<i>Corylus</i> sp.	hazel
<i>Forsythia X intermedia</i> ‘Lynnwood Gold’	Lynnwood Gold forsythia
<i>Lonicera korolkowii</i> var. <i>zabelii</i> (Rehd.)	Zabel’s honeysuckle
<i>Lonicera morrowii</i> Gray	Morrow honeysuckle
<i>Lonicera tatarica</i> L.	*Tatarian honeysuckle
<i>Rhus typhina</i> L.	staghorn sumac
<i>Ribes americana</i> L.	American currant
<i>Salix purpurea</i> L.	arctic willow
<i>Syringa X prestoniae</i> McKelv.	Preston lilac
<i>Syringa vulgaris</i> L.	common lilac
<i>Viburnum dentatum</i> L.	arrowwood viburnum
<i>Viburnum lantana</i> L.	wayfaring tree
<i>Viburnum trilobum</i> Marsh.	high-bush cranberry
Vines	
<i>Celastrus scandens</i> L.	American bittersweet
<i>Parthenocissus quinquefolia</i> (L.) Planch.	Virginia creeper

Appendix 5

Description and evaluation of existing plantings—List of trees, shrubs and vines found regenerating naturally

*found in at least 5 sites.

Botanical name	Common name	Botanical name	Common name
Trees		Shrubs	
<i>Acer saccharinum</i> L.	silver maple	<i>Alnus</i> sp.	alder
<i>Acer negundo</i> L.	*Manitoba maple	<i>Cornus sericea</i> L.	red osier dogwood
<i>Crataegus</i> sp.	hawthorn	<i>Juniperus communis</i> var. <i>depressa</i> Pursh.	common juniper
<i>Fraxinus americana</i> L.	white ash	<i>Lonicera tatarica</i> L.	Tatarian honeysuckle
<i>Pinus sylvestris</i> L.	Scots pine	<i>Prunus virginiana</i> L.	choke cherry
<i>Populus alba</i> L.	white poplar	<i>Rhus typhina</i> L.	*staghorn sumac
<i>Populus balsamifera</i> L.	*balsam poplar	<i>Rubus</i> sp.	wild raspberry
<i>Populus deltoides</i> Bartr.	*cottonwood	<i>Salix</i> sp.	*shrub willow
<i>Populus tremuloides</i> Michx.	*trembling aspen	<i>Sambucus pubens</i> Michx.	red-berried elder
<i>Prunus pensylvanica</i> L.	*pin cherry	Vines	
<i>Quercus rubra</i> L.	red oak	<i>Celastrus scandens</i> L.	American bittersweet
<i>Salix nigra</i> Marsh.	black willow	<i>Vitis</i> sp.	wild grape
<i>Thuja occidentalis</i> L.	eastern white cedar		
<i>Ulmus</i> sp.	elm		

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Index to Recommended Species

- Acer ginnala* 33,47
Acer negundo 32, 35
Acer platanoides 27, 32, 35
Acer rubrum 32, 35
Acer saccharinum 28, 30,32, 36
Alnus glutinosa 28, 32, 36
Amur maple 33, 47
Austrian pine 30, 32, 40
Autumn olive 28, 30, 31, 34, 49
Balsam poplar 30, 33, 42
Black locust 28, 30, 33, 45
Caragana arborescens 28, 30, 33, 47
Carolina poplar 30, 31, 33, 43
Choke cherry 27, 31, 34, 51
Common juniper 34, 50
Common lilac 31, 34, 54
Cornus racemosa 33, 48
Cornus sericea 28, 31, 34, 48
Cottonwood 33, 44
Eastern red cedar 32, 38
Eastern white cedar 30, 38, 46
Elaeagnus angustifolia 28, 30, 32, 36
Elaeagnus commutata 31, 34, 49
Elaeagnus umbellata 28, 30, 31, 34, 49
European alder 28, 32, 36
European larch 30, 32, 38
Fraxinus americana 30, 32, 37
Fraxinus pennsylvanica var. *subintegerrima* 32, 37
Gleditsia triacanthos var. *inermis* 30, 32, 37
Goat willow 34, 53
Green ash 32, 37
Grey dogwood 33, 48
Highbush cranberry 31, 34, 55
Jack pine 28, 30, 32, 40
Juniperus communis var. *depressa* 34, 50
Juniperus virginiana 32, 38
Larix decidua 30, 32, 38
Larix laricina 32, 39
Lonicera tatarica 28, 30, 34, 50
Manitoba maple 32, 35
Mugo pine 34, 50
Multiflora rose 27, 34, 52
Nannyberry 34, 55
Norway maple 27, 32, 35
Norway spruce 30, 32, 39
Picea abies 30, 32, 39
Picea glauca 27, 28, 30, 32, 39
Pin cherry 31, 33, 44
Pinus banksiana 28, 30, 32, 40
Pinus mugo var. *mugo* 34, 50
Pinus nigra 30, 32, 40
Pinus resinosa 30, 32, 41
Pinus strobus 30, 33, 41
Pinus sylvestris 28, 30, 33, 42
Populus alba 33, 42
Populus balsamifera 30, 33, 42
Populus X canadensis 'Eugenei' 30, 31, 33, 43
Populus deltoides 33, 44
Populus tremuloides 28, 30, 33, 44
Potentilla fruticosa 28, 30, 34, 51
Prunus pensylvanica 31, 34, 44
Prunus virginiana 27, 31, 34, 51
Purple osier 34, 53
Red osier dogwood 28, 31, 34, 48
Red maple 32, 35
Red pine 30, 32, 41
Rhus typhina 28, 31, 34, 51
Robinia pseudoacacia 28, 30, 33, 45
Rosa multiflora 27, 34, 52
Rosa rugosa 34, 52
Rugosa rose 34, 52
Russian olive 28, 30, 32, 36
Salix alba var. *tristis* 28, 33, 45
Salix caprea 34, 53
Salix purpurea 34, 53

Scots pine 28, 30, 33, 42
Shrubby cinquefoil 28, 30, 34, 51
Siberian elm 28, 30, 33, 47
Siberian peashrub 28, 30, 33, 47
Silverberry 31, 34, 49
Silver maple 28, 30, 32, 36
Snowberry 34, 53
Staghorn sumac 28, 31, 34, 51
Symphoricarpos albus 34, 53
Syringa vulgaris 31, 34, 54
Tamarack 32, 39
Tatarian honeysuckle 28, 30, 34, 50
Thornless honey locust 30, 32, 37
Thuja occidentalis 30, 38, 46
Trembling aspen 28, 30, 33, 44
Ulmus pumila 28, 30, 33, 46
Viburnum lantana 34, 54
Viburnum lentago 34, 55
Viburnum trilobum 31, 34, 55
Wayfaring tree 34, 54
Weeping willow 28, 33, 45
White ash 30, 32, 37
White pine 30, 33, 41
White poplar 33, 42
White spruce 27, 28, 30, 32, 39

Notes

