

Common Disorders of Broad-Leaved Trees

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Factsheet

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INTRODUCTION

Broad-leaved trees are an integral part of many landscapes. Trees function as windbreaks, boundaries for property lines, and also provide privacy, shade and aesthetic value to the home or cottage. Frequently, trees are planted in less than ideal sites or the conditions around established trees are modified in a detrimental way. If adverse conditions persist, the health of such trees may be at risk.

When trees are under stress they become more susceptible to invasion by insects and diseases. Pest problems are quite often symptoms of underlying health issues or stress factors. For example, root diseases are often a symptom of poor soil aeration, which may be caused by compaction. It is important to recognize and identify the cause of stress in trees in order to take appropriate remedial action.

This Factsheet is intended to be a technical resource for the landscape and nursery industry.

DIAGNOSING THE PROBLEM

The first task in identifying disorders of broad-leaved trees is to determine whether the stress is biotic (living) or abiotic (non-living) in nature. Biotic stresses are caused by insects, mites, disease (i.e. bacteria, fungi, and viruses), animals or other living organisms. Abiotic stresses are caused by non-living factors and often involve the excess or deficiency of water (flooding or drought), nutrients, chemicals (de-icing salts), heat or cold (freezing or low temperature injury) and wind.

Biotic Stresses

When looking for damage caused by insects, examine the affected tree carefully for signs and symptoms of infestation. Affected areas of the tree may contain insects or signs of their activity. For example, many wood-boring insects create holes in the bark and sawdust during their tunnelling activity. Some insects,

such as the Gypsy moth, leave empty cocoons behind after emerging as adults. Other indications of insects include egg cases, webbing, feces or honeydew. Honeydew is a sticky secretion produced by sucking insects such as aphids, leafhoppers and scales. Scale insects appear as fleshy bumps along the undersides of leaves or twigs and are often noticed because of the presence of a black mould called sooty mould, which grows on the surface of the honeydew.

Mites (arachnids) are tiny spider-like creatures that feed by sucking out plant sap through their tiny beaks. Look closely at the leaves for symptoms like bronzing, stippling and curling of tissue. Often mites leave tiny egg cases and webs around infested foliage. A 10x powered hand lens helps with insect detection and identification.

When checking for disease, examine twigs for sunken areas (cankers) or raised, blister-like structures (fungal fruiting bodies). Cut off affected twigs to examine the cambium (tissue just under the bark) and inner wood for brownish discoloration. Healthy cambium is usually green to greenish-white and inner wood colour ranges from greenish-white to creamy-yellow. Foliar disease symptoms often include tissue discoloration that ranges from yellow to red, brown or black. Discoloured spots and blotches, discoloured veins and pin-head size black or brown fruiting bodies along leaf and twig surfaces may be evident. (Note: some insects produce galls that resemble fungal structures.) Large fruiting bodies, either mushrooms or woody protruding shelf-like structures, can often be found at the base of large older trees. These structures indicate that the interior or the roots of the trees are rotting.

Animals can damage trees by feeding directly on the tree or by foraging for insects in the bark or wood. Squirrels can prune new growth from spruce in winter and elm, maple and oak during spring foraging.

A tell-tale sign of this activity is large bunches of healthy leaves littering the ground. Deer browsing and antler rubbing can also cause significant damage, resulting in torn plants and shredded bark. Many animals including mice, porcupines and some birds remove bark to feed on the tender underlying cambium layer (especially in winter). This damage is often noticed on thin-barked trees at ground level or on the main trunk. When a section of bark is removed in a ring around the tree this damage is referred to as “girdling” injury.

Animal girdling injury can be recognized by uneven tearing of the bark in the damaged area. Teeth marks and a general sparseness or dieback of the crown above the injured area are often a sign of girdling. Girdling is also the term used when a vine, root, rope, tree guard or cable encircles another root, stem or trunk and slowly constricts it over time leading to tree mortality. Failure to remove stakes and guy wires around trees within one to two years of planting often results in girdling injury.

Abiotic Stresses

These types of stresses are usually more difficult to recognize and correct than biotic stresses. When assessing what is affecting the growth of a tree, examine not only the damaged portion of the tree, but the rest of the tree as well. Check the surrounding vicinity and examine other plant species to see if they are showing similar symptoms. Try to establish if the stress affecting the tree has been occurring for some time or if it appeared suddenly. Be sure to assess the soil, local weather conditions and any recent activities that have occurred around the tree (e.g., construction, grading, gardening, chemical application) or proximity to streets or sidewalks. Remember, tree roots extend far beyond the drip line of the canopy.

Soil disturbance can have a negative impact on tree roots, especially shallow-rooted trees such as beech, birch and sugar maple. Dig a small hole around the root system of smaller trees and shrubs and check for adequate/excessive moisture and good soil structure (i.e. is it difficult to break apart?).

There are four general factors to consider when assessing potential impacts on tree growth: soil, hardness, environmental stresses and human activities.

SOILS

The quality of soil in which a tree grows is one of the most important factors affecting tree health. Soil conditions, including the amount of organic matter, depth of topsoil, soil structure and type, pH (acidity/alkalinity), nutritional status, aeration and drainage all have a direct affect on tree health.

Drainage

The survival and growth of tree roots depends on soil drainage. Soil drainage and aeration affects the amount of oxygen available to the roots and is necessary for normal root growth and nutrient uptake. Soil drainage can be affected by many factors including texture (clay soils drain much more slowly), mineral composition, amount of organic matter and compaction (e.g. foot traffic, machinery) and contour (low areas where excess water pools).

Roots growing in poorly drained soil are deficient in oxygen and have limited nutrient uptake. If soil saturation with water is continuous, root hairs die and the tree becomes an easy target for root-rot organisms. The leaves of the tree begin to wilt because of the reduced number of water-conducting roots. Leaves will turn yellow and drop prematurely.

Trees growing in gravel or sandy soils that do not retain adequate soil moisture may show symptoms of stress during hot, dry periods. Lack of moisture is also a problem where soils are severely compacted or have a high clay content, as the water tends to run off the surface horizontally instead of percolating down through the soil, into the root zone.

pH (Reaction)

Soil pH is a measure of acidity or alkalinity of a soil. A soil pH reading above 7.0 is alkaline or basic, at 7.0 is neutral and below 7.0 is acid. Most plants grow well in soils with pH values of 6.0–7.5. Most of soils in southern Ontario are neutral to alkaline (7.0 and above). If the soil is too alkaline, it may reduce the plant’s ability to take up some nutrients resulting in the yellowing of foliage (chlorosis). Apply sulphur to the soil to help lower alkalinity. Acidic soil amendments, such as acidic leaf litter and bark composts, may also help. To increase the alkalinity of a soil, apply dolomitic limestone. The simplest approach is to test the soil and grow plants that can tolerate the soil pH.

Iron (Fe) and Manganese (Mn) Deficiencies

Deficiencies of iron and manganese may occur in trees growing on alkaline soils. Trees that commonly exhibit these deficiencies include red maples, red and pin oaks and tulip trees. Rhododendrons, azaleas and other ericaceous (acid-loving) plants usually fail on alkaline soils. Symptomatic leaves are chlorotic (yellow) with contrasting green veins and usually drop prematurely. For southern Ontario soils, manganese deficiency is usually more common than iron deficiency.

HARDINESS

The ability of a tree to withstand winter conditions is called hardiness. Hardiness varies with tree species, each species is assigned a numerical hardiness rating.

In Ontario there are seven hardiness zones. Each zone is divided into two subcategories (a and b). See Figure 1 for an illustration of the plant hardiness zones of Ontario. These zones are based on a number of factors including minimum temperature during the winter, the number of frost-free days, summer rainfall and wind conditions. Areas in the north are given a lower hardiness rating or number. This rating generally increases as one continues south.

When planting new trees it is important to know the hardiness zone of the area to be planted, as well as the hardiness rating of the trees being considered. A tree with a higher hardiness rating than the area it is planted in may not survive. If it does survive, it is more likely to be affected by environmental stresses. It may sustain injury in the form of branch dieback, severe trunk freeze-thaw cracks or desiccation of foliage (as seen in broad-leaved evergreens such as holly and Oregon grape). Such stresses leave a tree more susceptible to attack by insects and diseases.

Hardiness ratings are intended as guidelines only. Many plants can be grown in an area beyond their hardiness rating in areas where a warmer microclimate exists. An example would be a south facing area that has protection from north winds, such as a patio.

The hardiness of a particular tree also varies with the season and with cultural practices (such as burlap wind barriers). Cold hardiness increases as the autumn progresses and decreases over the winter to a very low level in the summer. Many plants can be severely damaged by extreme temperature fluctuations (e.g. early fall and late spring frosts, late winter low temperature events).

Many nursery and garden centre catalogues list a hardiness rating along with a description of the tree.

Hardiness zones of many popular trees can be found in reputable gardening references.

ENVIRONMENTAL STRESSES

Environmental stresses refer to stresses caused by weather conditions or other natural factors.

Winter Injury

Winter injury is perhaps one of the most difficult disorders to diagnose due to the different forms of injury that can occur (listed below). Repeated freezing and thawing causes damage to plant tissues. The recurring formation of ice crystals within the cells of buds, sapwood and cambium causes cells to rupture. Tissues will turn watery, mushy and eventually dry up and turn brown or black. It is easy to confuse freezing or low temperature injury with other disorders, like disease. Broadleaf evergreens such as boxwood and euonymus are especially sensitive to low temperature injury. Their newly emerged leaves can be damaged, even at temperatures just above freezing.

Winter injury may be caused by the following factors:

- extreme temperature fluctuations or extreme low temperatures (not necessarily freezing)
- excessive soil moisture in fall and winter
- winter burn or desiccation of foliage

Symptoms of winter injury include:

- buds failing to open in the spring
- buds opening but the leaves are smaller than normal and wilt and turn brown by early summer, resulting in twig dieback
- sunscald — splitting of bark revealing inner wood
- browning of evergreen foliage (winter burn)

Sunscald appears on the south and south western exposure and is caused by the rapid freezing and thawing of the underlying tissue (cambium) on mild winter days/cold nights. Young, thin-barked trees (e.g. fruit trees, Norway and sugar maple) commonly exhibit this injury.

Foliar browning or winter burn occurs on evergreens when the roots in frozen soil are unable to replenish the moisture that has been lost from the foliage. Mainly due to desiccating winds, this water loss occurs in late winter and early spring when daytime temperatures begin to warm up, signalling transpiration (opening of leaf pores). Winter burn is a common sight on broad-leaved and narrow-leaved evergreens in spring but is soon masked by the first flush of leaf growth.

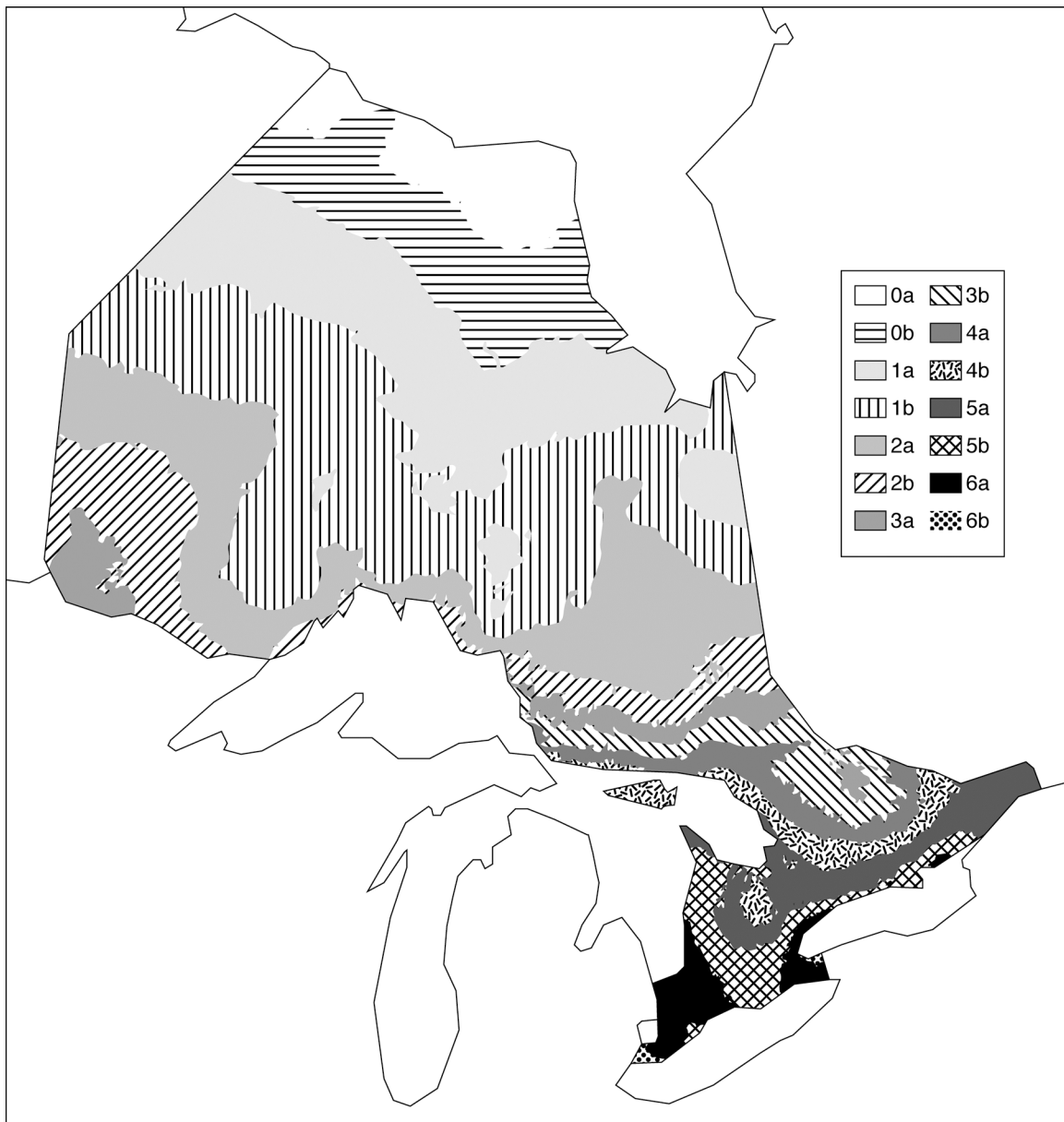


Figure 1. Plant Hardiness Zones of Ontario, 2002

Lightning Injury

Lightning has an enormous amount of electrical energy, which can be grounded through the tree into the soil. Tall trees growing in exposed locations such as open fields, hill tops and along fencerows are more likely to be struck by lightning than those trees growing in groups or low-lying areas. However, all trees are susceptible to lightning damage. The severity of lightning damage varies depending on the directness of the strike and the strength of the charge. Typical symptoms of lightning damage include large strips of bark and inner wood being blown out, or large portions of a tree suddenly turning black after a recent electrical storm. Occasionally a large clump of

soil and roots are disturbed where the electrical energy left the tree.

To minimize stress caused by lightning strikes, remedial measures are recommended. Remove long strips of burnt bark with a clean sharp knife so that callus tissue can form and repair the damage. If conditions are hot and dry, give the soil a long, slow irrigation about every 10 days.

Wind Damage

The damage usually associated with strong winds is broken and torn branches, although similar damage can also be caused by lightning. Shallow-rooted trees

are especially susceptible to strong winds and complete uprooting of these trees can occur. Weak-wooded, fast growing trees such as willows and poplars are especially vulnerable to high winds, since they have large crowns with dense foliage that can easily “catch” the wind. Branch and trunk breakage is more likely to occur on trees with wood decay. High winds can also desiccate, damage or tear off leaves. Affected leaves appear tattered with large missing portions, and occasionally the margins are scorched. These symptoms are more severe in drought stressed trees.

Hail

Hail can cause serious injury to a tree especially to the young succulent tissues. Hail damage is characterized by severely shredded leaves and a large number of “pock” marks on twigs and branches that later heal, leaving many small callused scars. Severe callusing can result in a branch becoming partially girdled and eventually dieback occurs. These wounds may in turn provide entrances for insects and disease causing organisms, such as crown gall on stems.

Freezing Rain, Ice and Wet Snow

The large amounts of ice and wet snow that can accumulate after a winter storm may be heavy enough to cause branches to snap, especially on evergreens. Small trees that still have a few leaves attached can easily be broken from the weight of snow and ice. This injury can be prevented by properly staking small trees, and gently removing snow and ice from larger specimen trees (within reason) with a broom.

Competition from Other Plant Species

The fine root hairs, which absorb water and nutrients, are found in the upper 30 cm of soil and extend well beyond the spread of the crown. It is in this zone that the roots of turf and other plant species are also competing for space, nutrients and water. If a tree does not get enough nutrients, it begins to show deficiency symptoms in the leaves. Affected leaves may appear pale green in the case of nitrogen deficiency or purple-red in the case of phosphorous or potassium deficiency. A soil test is often the most effective method of testing for soil nutrient deficiencies. A foliar nutrient analysis is a more precise means of identifying a specific nutrient deficiency. A sample from a neighbouring healthy specimen is required for comparison. When nutrient and pH levels are appropriate, soil drainage, compaction and other stresses may be causing root problems.

Drought

Trees may suffer from both short-term and long-term drought stress. The leaves of trees experiencing short-term drought stress tend to wilt during the hottest part of the day, and later the leaf margins turn brown and become brittle. This damage is more severe if the site is windy and exposed. Extended dry periods may also result in some defoliation in midsummer and the development of premature fall colour. Because trees are perennial plants, they can exhibit symptoms of drought stress beyond the year in which it was experienced.

Trees growing in clay soil may suffer longer periods of drought because sun-baked clay soil particles tend to swell-up when wetted, blocking moisture from reaching the roots. Aeration or loosening of the soil well beyond the trunk may help reduce this problem.

Trees may be subject to winter drought as well. It is important to keep soils watered for newly planted trees during extended periods of dry weather in autumn. Soil moisture in the autumn will help facilitate uptake and storage of nutrients and, in turn, will help with winter hardiness.

HUMAN ACTIVITIES

Every year many trees are killed or damaged indirectly by human activities. In this section stresses are listed along with common activities that contribute to them.

Transplanting Stress

There are a number of stresses that affect trees before, during and after transplanting. Some of these include:

- exposure of bare roots to high temperatures, direct sunlight or drying winds between harvest and planting
- failure to spread roots out during transplanting, which can cause a condition known as “girdling roots”
- planting the root collar too deep or piling too much landscape mulch around the lower trunk (burying the lower trunk causes it to rot)
- using unsuitable soil (too light, too heavy) for backfill or failing to firm down the soil after transplanting, resulting in inadequate contact between roots and soil
- failure to remove ropes and ties that surround the lower trunk and hold the soil ball together, which may result in girdling that could kill the tree in later years

- insufficient supplemental watering after transplanting

Improper Watering

Most landscape plants require supplemental watering in the year following transplanting. Root systems from containers or balled and burlapped material are quite small and therefore very limited in their ability to take up water, until they become established. Overzealous watering actually saturates the root zone, reducing the amount of oxygen available for root growth and causing root rot. In new housing developments, the likelihood of overwatering is even greater since the soils are often heavily compacted and are of poor quality below the topsoil.

Water woody plants every seven to 10 days after transplanting. A trickle from the hose, a sprinkler or a slow release irrigation bag will help improve water infiltration and reduce horizontal runoff. Water long enough to moisten the upper few inches of the soil. A long, gentle watering cycle encourages the development of healthy roots at a reasonable depth. Short, frequent irrigation cycles cause roots to form near the soil surface, making them more susceptible to drought stress in summer. Run irrigation systems either at night or preferably in the early morning to limit the amount of loss by evaporation. Avoid wetting the foliage. Leaf wetness promotes disease, creating more problems for a plant that is already under stress. When it's sunny, water droplets act as a lens on the foliage and can cause foliar burn through the action of the sun's rays. Direct the water to the soil surface.

Improper Maintenance

Applying large amounts of fertilizer, especially nitrogen, at any time of the year, stimulates excessive, succulent vegetative growth. Excess nitrogen may inhibit flowering and reduce the plant's natural ability to resist stress. Applications of fast-release fertilizer late in the summer, especially if coupled with unusually-warm temperatures, may result in the failure of woody tissue to harden-off sufficiently before winter. Trees that have not had enough time to harden-off are generally more susceptible to winter injury. Fertilizing trees in the autumn, once leaves start to turn colour and drop, will not affect their winter hardiness.

Pruning in early autumn may stimulate lateral bud break and succulent, vegetative growth in the autumn months especially if fall temperatures are higher than

normal. These trees may not have enough time to harden off before winter. Improper pruning techniques that leave large stubs and torn bark leaves a wound vulnerable to pests and environmental stresses.

Girdling Stresses

Girdling or strangling of a tree trunk can be caused when wire fencing, nylon, tree guards or steel cables have been tied around the tree for anchorage or protection. If the device is left around the tree for a number of years, the bark slowly grows around it. The device gradually restricts the flow of water and nutrients in the cambium. Similar damage may also occur when guy-wires become too tight. Check them regularly. Remove the staking wires after one to two years. Flexible stakes are much better than rigid, allowing the tree trunk to strengthen.

Partial girdling of the trunk, especially in young or thin-barked trees, can result when weed-eaters and lawn-mowers are used in close proximity to a tree.

Site Alterations

Increasing the soil level by more than 8 cm around an established tree reduces the oxygen and moisture supply to the roots, resulting in tree decline. If soil must be added because of landscaping needs, the tree may be saved by placing a radiating grid of drainage tile and gravel around the tree. When the fill is less than 45 cm deep, drainage tile is adequate. However, when the fill is over 45 cm, add a layer of gravel 20–30 cm deep along with the drainage tile.

Construction Stress

Trenching and excavation activities within the root zone of trees damage roots, causing a reduction in the uptake of moisture and nutrients. This eventually causes defoliation and dieback in the crown. Trees with many roots damaged by excavation equipment may also set large amounts of seed. Although some trees naturally set heavy crops in alternate years, heavy seed set may also be a stress-related response to physical damage to the roots or trunk. This phenomenon is most frequently observed in maples, ash, birch and elm.

Using heavy machinery or installing driveways, sidewalks or patios in the root zone will cause soil compaction. Compaction of the upper few inches of soil, especially in a clay soil, results in the depletion oxygen and water in the root zone. Trees growing in these areas will start to show symptoms of decline,

including defoliation and dieback. The added stress causes them to be more vulnerable to attack by pests, which may result in premature death of the tree.

Salt Damage

Trees growing along a street or sidewalk may be stressed by de-icing salt spray and by de-icing salt build-up in the soil. Damage increases with proximity to the road and is more severe on the branches facing the road. The foliage of roadside evergreens may appear “burned” by early spring due to salt spray. The frequent use of de-icing salts causes the accumulation of salts in surrounding soils. The adjacent trees are subjected to a greater degree of moisture stress or physiological drought. In general, high salt levels can cause root burning and decreased root function, resulting in symptoms of drought and nutrient stress in the crown. Quite often, deciduous trees with salt damage will exhibit tufts of adventitious shoots since bud kill has led to the formation and breaking of several lateral buds over a number of years. If salt damage is suspected, take a soil sample and test for salt levels, E.C. or “electrical conductivity” at an accredited laboratory.

Fertilizers and rotting organic matter are other sources of soluble salts that can damage roots.

Other Stresses

Gas leaking from underground pipes can cause root damage. Natural gas does not usually cause direct injury to trees, but may cause damage by displacing soil oxygen needed for root growth.

GETTING PROFESSIONAL HELP FOR YOUR TREES

For further assistance in diagnosing tree problems, consult a professional arborist or speak with the staff at a local nursery or garden centre.

Samples can be submitted to the Pest Diagnostic Clinic in Guelph. There is a fee for this service.

The Pest Diagnostic Clinic
Laboratory Services Division
University of Guelph
95 Stone Rd. West
Guelph, Ontario. N1H 8J7
Phone: 519-767-6256
Fax: 519-767-6240
E-mail: pdc@lsd.uoguelph.ca
www.labservices.uoguelph.ca/units/pdc/

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