# Oregon Tilth Organic Land Care Field Guide

## Created by the Oregon Tilth and Clackamas Community College

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## Acknowledgements

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# Part 1: Organic Land Care—Background

## History of Organic Land Care (OLC)

As long as people have been growing plants, organic growing has been common practice. There was no special name for these practices until the 1940s. It was only after dramatic governmental and societal support for more mechanized and industrialized agricultural practices, which included increasing use of synthetic pesticides and synthetic fertilizers, that concerned individuals like Rudolph Steiner, Sir Albert Howard, Lady Eve Balfour, Lord Northbound (Walter Ernest Christopher James), Lawrence D. Hills and J.I. Rodale brought attention to the importance of biological systems in agriculture.

In the 1940s, the Soil Association was formed in England through the advocacy of Lady Eve Balfour and Lawrence D. Hills, along with many others. This organization brought together those concerned that soil health was being jeopardized by overuse of synthetic chemicals. Lawrence D. Hills helped form the Henry Doubleday Research Foundation as an organization for organic gardeners in England. In 1942, J.I. Rodale began publishing *Organic Farming and Gardening* magazine in the United States to spread information about how and why to grow organically.

In the 1980's, various groups in the United States began certifying food crops as being grown "organically," yet no programs existed for landscape settings. The first organic land care program designed specifically for managing ornamental landscapes was developed by the Northeast Organic Farming Association (NOFA). In 2000-2001, a group of practicing land care professionals, scientists, concerned citizens and technical advisors created the NOFA Standards document. NOFA has accredited about 700 landscape professionals since its inception.

In England, the Henry Doubleday Research Association has published the *HDRA Organic Guidelines* that serve as voluntary guidelines for those wishing to use organic practices in their landscapes. Yet, this does not involve any accreditation program.

## Organic Land Care Program Purpose

The Oregon Tilth Accredited Organic Land Care Program was developed in recognition of a general increase in awareness regarding the detrimental effects of conventional landscape practices in the Northwest and to enable a general shift to sustainable landscaping practices. The program includes instruction and accredits OLC Practitioners. The objectives of the program are to:

- Publish and evolve standards of practice for OLC Practitioners.
- Administer a training program to further the knowledge of and build community among organic land care professionals.
- Promote organic land care practices by offering professional accreditation widely recognized throughout the region.
- Contribute to regional sustainable development by reducing the use of environmentally degrading substances and fossil fuels while raising public awareness of the program.

# Why the OLC Field Guide?

The Oregon Tilth Organic Land Care Field Guide is intended to serve as an aid for Tilth-Accredited OLC Practitioners striving to offer quality organic landscape management services. This guide and Oregon Tilth's annual multi-day Landscape Professional Organic Land Care training session work to inform and clarify preferred, required and prohibited practices for use in the Organic Land Care Program. The information within the guide is intended as a starting point that can assist landscapers in their work with property owners. This field guide will likely undergo revisions as the program, and the knowledge base of organic practices for ornamental landscapes, grows.

This field guide is based on the *Oregon Tilth Organic Land Care Policies and Standards* which was developed by a broad base of interested individuals working with Oregon Tilth.

# Getting Started

A fundamental tenet of Organic Land Care is sustainability. This program seeks to provide practical instruction to help landscape professionals and their clients create sustainable landscapes that maintain the quality of natural resources while also sustaining quality of life for clients, workers and surrounding communities. In order to be successful, the OLC Practitioner must:

- Commit to ongoing education of organic practices
- Recognize the need to translate recent crop science research into landscape applications
- Educate clients about the specifics of the OLC approach and help them learn to tolerate any less-than-optimal landscape conditions that may occur during the process of adapting to a new management system
- Understand the variations of conditions from site to site and work to convert poorly managed land into a more healthy system

The OLC Practitioner works to make projects sustainable by implementing OLC practices, which are loosely based on the International Federation of Organic Agriculture Movement's (IFOAM) "Principles of Organic Agriculture:"

## Health

Organic Land Care should support and improve the health of all interrelated components of the landscape, including plants, animals, people, soils and the environment.

## Ecology

Organic Land Care should work with nature – not try to dominate it – and encourage biological cycles that involve plants, animals and microorganisms (including the soil food web) to create functional closed-system landscapes.

## Equity

Organic Land Care should promote the fair distribution of resources – biological, financial and social – and the development of business models that respect the needs of the environment, family, personal beliefs and aspirations, and sustainability.

## Care

Organic Land Care encourages responsibility for the daily care of people, plants, animals and landscapes in our immediate experience. We should be considerate of the greater social and environmental impacts of our actions on the job – including the selection of projects, materials and plants.

# Ecological Complexity

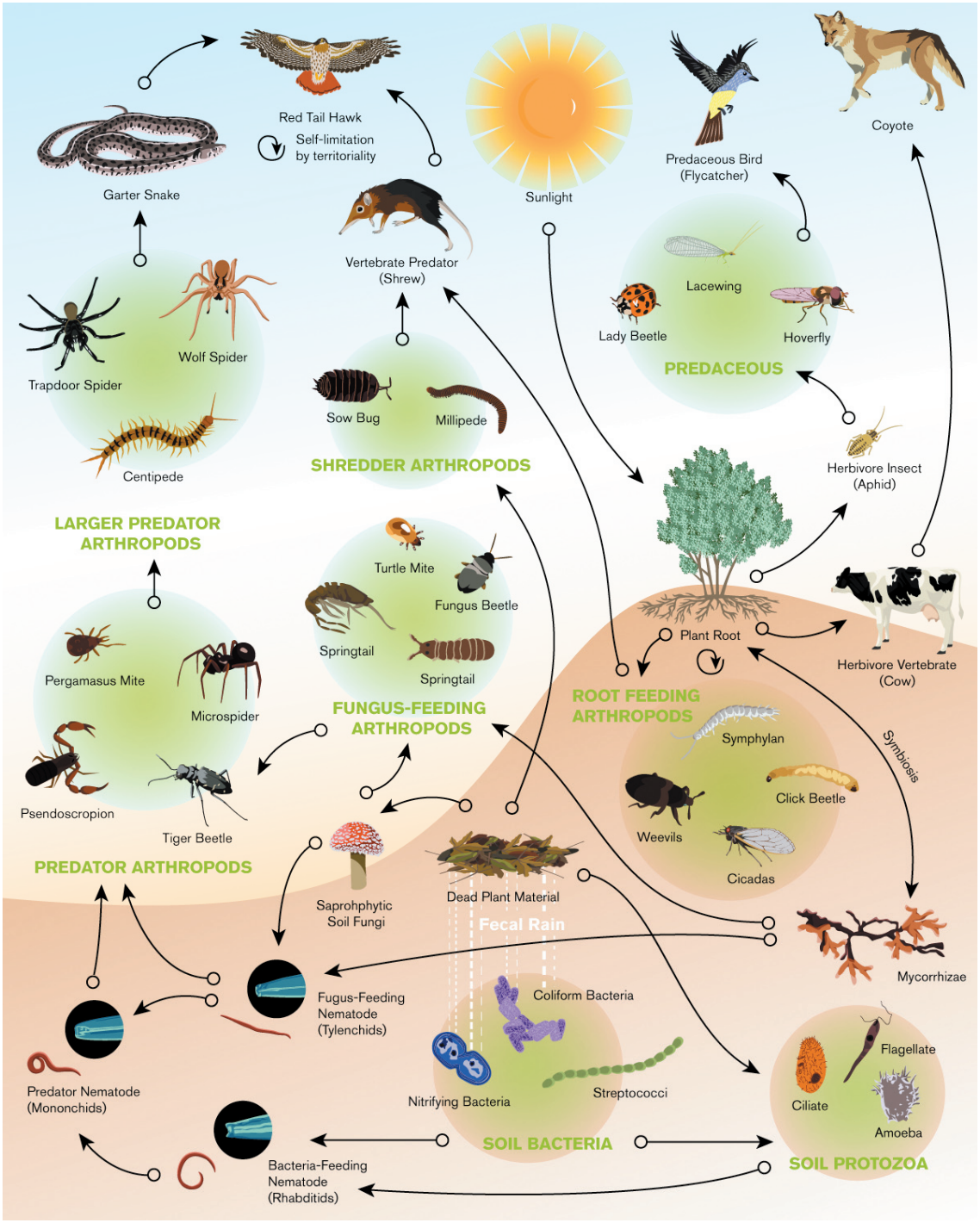



**Figure 1.** Reestablishing healthy soil, improving the rooting zone for plants, and creating an environment for beneficial arthropods to thrive are key components of an organically managed landscape.

*Graphic courtesy of Teaching Ecosystem Complexity Project (ecoplexity.org), Portland State University.*

Changing land management methods from conventional to organic can be difficult. The three most common challenges that the OLC Practitioner faces in converting a landscape to OLC practices are:

1. The condition of the soil
2. Inadequate rooting of plants due to poor soil conditions
3. Paucity of beneficial organisms due to past pest management practices detrimental to their survival.

Many soils that have been neglected or treated with conventional fertilizers and pesticides will have poorly structured soil that is unbalanced chemically and biologically. Soil compacted 4" will commonly result in shallow plant rooting. Correcting the soil will require tillage, changes in soil nutrients based on soil chemistry tests or the addition of organic soil matter.

Inadequate rooting of shrubs and trees in mulched beds is often caused by either over-enrichment of the planting hole with nutrient-rich materials or inadequate use of site soil in the planting hole. Both of these practices may restrict root growth. Appropriate root injections, vertical mulching or radial trenching may help remedy this challenge.

The scarcity of beneficial arthropods within the landscape may be the result of prolonged use of some pesticides in a landscape. Once pesticides are no longer used, it may some time before sufficient beneficial arthropods return and provide adequate control of spider mites, aphids or caterpillars. The OLC Practitioner can best address this short term challenge by identifying approved pest control materials and having them on hand, encouraging the use of insectary (habitat) plantings on site and targeting only life threatening plant pests while conveying this information to the owner.

Finally, it is required that OLC Practitioners understand and follow any appropriate land-use ordinances and license requirements for design, construction and installation. Check with local municipal and state land-use and planning agencies for current requirements. Often, certain requirements are set forth in regards to environmental zoning laws, tree removal, building requirements, plumingcodes and storm water management.

## RESOURCES

Northeast Organic Farming Association Organic Landcare Program *http://www.organiclandcare.net*

Henry Doubleday Research Institute, Organic Gardening Guidelines
*http://www.gardenorganic.org/uk/contents.php*

International Federation of Organic Agriculture Movement *www.ifoam.org/about_ifoam/principles*

# Part 2: Foundations of Organic Land Care

## Soil Management

### The Foundation Of Plant Health

*"Feed the soil, not the plants" – Organic Farming Adage*

### Overview

Managing soil resources on a site challenges the organic landscape professional, but also offers an enormous opportunity for enhancing plant health. Under optimum conditions for most plants, soil will consist of about 45% mineral components by volume and 5% organic matter. The remaining soil volume – the pore space – is evenly comprised of air (25%) and water (25%). Although organic matter accounts for a small proportion of soil volume, it exerts a disproportionate influence on soil properties. The OLC Practitioner strives to either maintain or achieve this soil volume composition through ongoing organic soil improvement practices.

Many landscape settings reflect the history of human disturbance at the site. Soil has likely been changed through human activities, including exporting or importing soil, compacting soil, changing local topography and water flow patterns, and blocking sun exposure due to building and other human activities. A fundamental principle of organic land care is the maintenance and improvement of soil quality through practices that enhance soil biological, chemical and physical properties. Soil quality describes the ability of a soil to "function within its ecosystem boundaries to sustain biological productivity and diversity, maintain environmental quality, and promote plant and animal health" (Brady and Weil, 2002). With careful attention to creating healthy soil, the plants grown within that soil also thrive.

To ensure the health of plants in a landscape setting, quality soil must be maintained and built. The most basic way to do this requires the addition and incorporation of organic matter. Such amendments help to stimulate the growth of the soil's biological community, which in turn positively affects the soil's chemical and physical properties.

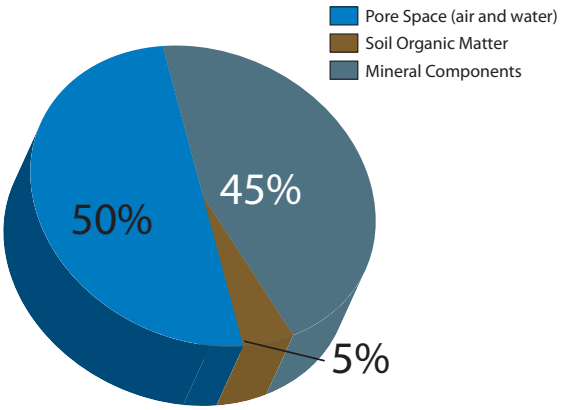



**Figure 2.** Ideal soil is comprised of 45% minerals, 5% soil organic matter, and 50% evenly distributed air and water pore space.
*Graphic courtesy of Creative Resource Strategies, LLC.*

# Soil Biology

An essential landscape management goal is to build the soil to feed the plant. To build soil, the OLC Practitioner needs to conserve existing soil organic matter and enhance it further by amending it with organic materials. A soil rich in organic matter (4-6%, by volume) provides the essential building blocks for a large and diverse microbial community to break down. This organic matter is critical food for the important decomposers of the soil microbial community.

It has been estimated that one teaspoon of quality soil contains millions of microorganisms. The organisms present in healthy soil include fungi, bacteria, actinomycetes, protozoa, nematodes, earthworms and many arthropods. Together they comprise the soil food web, responsible for the decomposition of soil organic matter and cycling of nutrients back into a form usable by other living organisms like plants. The OLC Practitioner must work to establish and conserve this important soil biological community. This requires regular addition of organic matter while eliminating activities that cause harm to the soil food web.

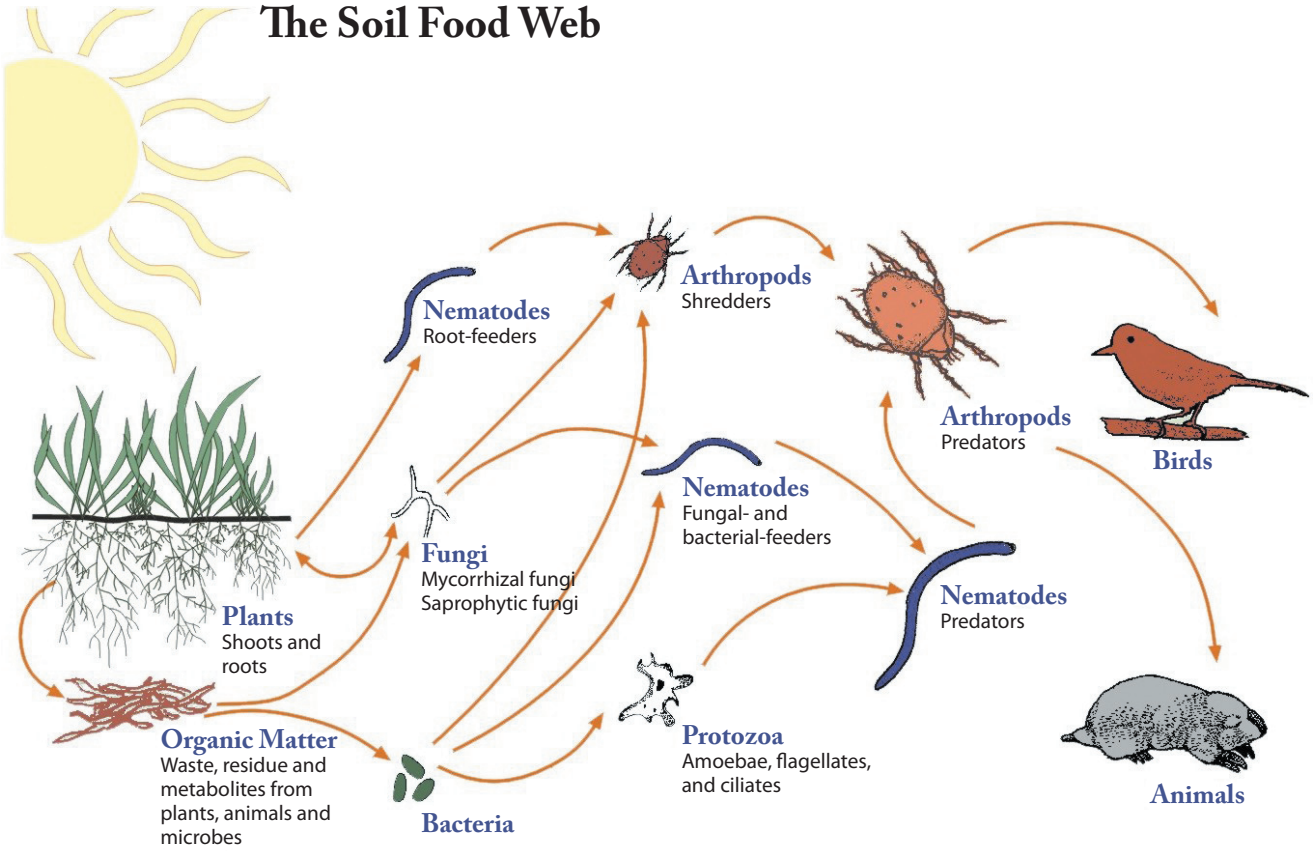



**Figure 3.** A healthy soil rhizosphere is rich with microorganisms.
*Graphic courtesy of USDA-NRCS.*

An active soil food web also enhances the soil's physical properties that in turn sustain healthy plants. Some soil microbes, especially bacteria and fungi, exude sticky organic glues that improve soil's physical structure by binding small soil particles together into larger aggregates. The strand-like threads of fungal hyphae also serve to bind soil particles into aggregates, increasing the pore space of soil and its capacity to hold water and transmit air. This aggregation gives healthy soil its fluffy, crumbly structure. The physical properties of soil and their relation to air and water movement through the soil are discussed in more depth in the Foundations of Water Management section.

In the short term, some microorganisms compete with plants for water and nutrients. However, as these microorganisms die they release nutrients for the plant. For example, a microorganism that may incorporate nitrogen into its body during growth will release that nitrogen upon death, making it available in the soil for plant growth.

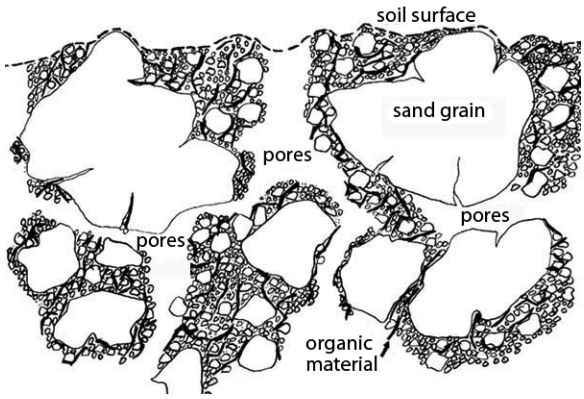



**Figure 4.** Healthy soil consists of sand, organic matter, and minerals mixed with air and water.

*This diagram is © State of Victoria Department of Primary Industries 2001. Reproduced with permission.*

One means of evaluating soil health is to compare the amount of soil microbes in the plant root zone (rhizosphere) to the amount of soil microbes in the soil away from plant roots. Microorganisms are more concentrated the closer they are to plant roots. A soil food web analysis, or soil bio-assay, will indicate both quantity and type of soil microorganism present and can be useful for devising soil management plans, as well as for selecting appropriate plants for a given site. This soil test provides recommendations for adding certain types of organic matter or compost teas to the soil as a means to develop a better balance in the soil microbial community. At this time these soil bio-assay tests are much more expensive than soil analyses for physical and chemical properties.

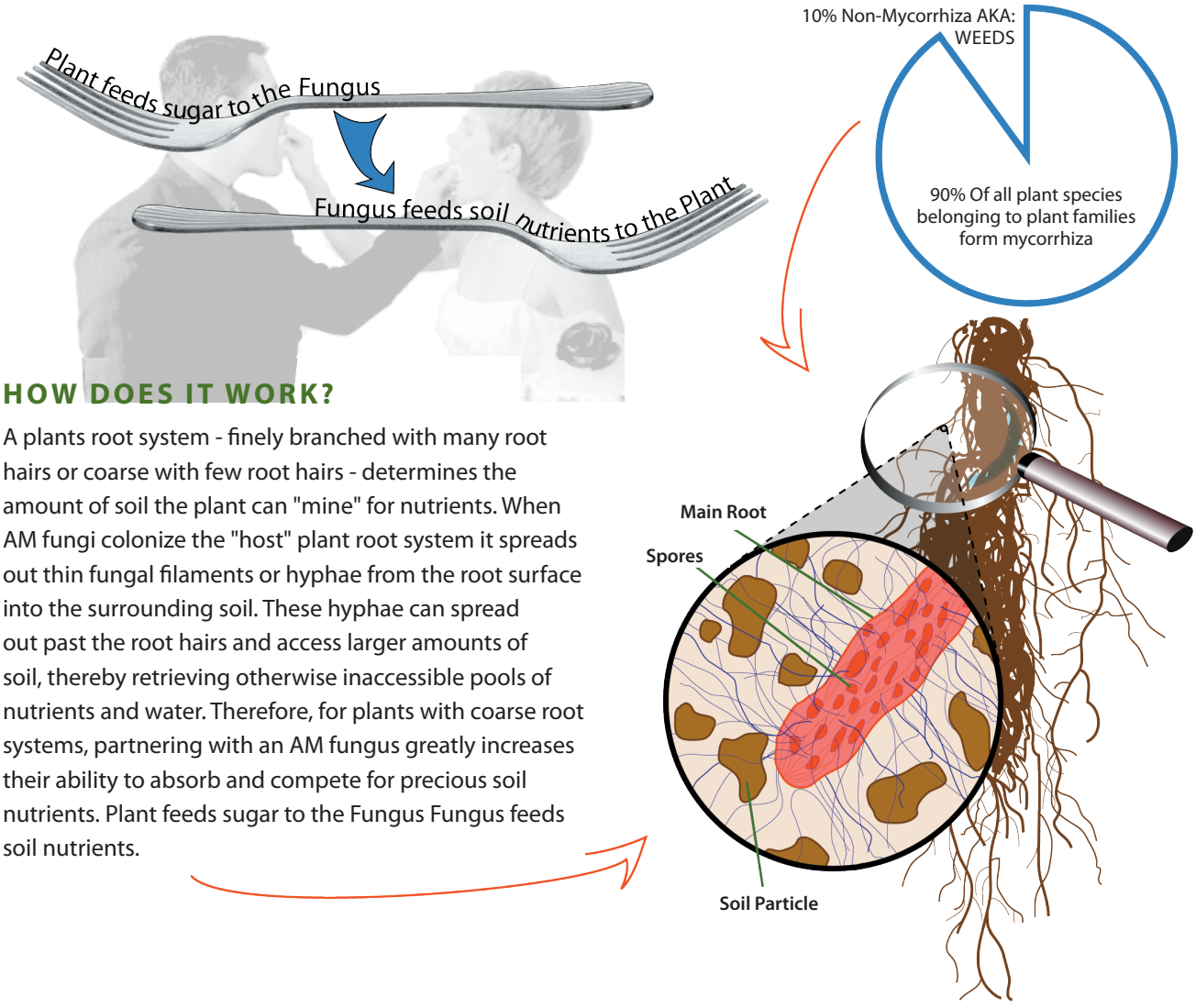
One area of increasing interest for OLC Practitioners is mycorrhizae, the group of beneficial fungi that inhabit many plant roots. As indicated from fossil records, mycorrhizae or fungus roots have been around over 370 million years and have been found on almost all terrestrial plants. A symbiotic relationship between plant and fungi helps improve overall plant growth by improving phosphorus and zinc nutrition, stimulating nitrogen fixation in nodulated plants, increasing disease tolerance and colonizing plant root space to prevent colonization by pathogenic microorganisms. Mycorrhizae also improve water use and drought tolerance of host plants, while immobilizing some heavy metals (zinc, cadmium, manganese) and improving soil structure by helping soil aggregates bind together.

# Mycorrhiza 101

## AM SYMBIOSIS

Arbuscular mycorrhiza is a mutually beneficial symbiosis or partnership between beneficial soil fungi and plants. The symbiosis works much like the cartoon - the plant gets something it needs from the fungus (mostly soil nutrients) and in exchange the fungus gets sugar or carbon. This symbiosis is ancient. It has been found in plant fossils dating back to 400 million years ago, which is approximately when plants first colonized the land. Scientists believe that this partnership with soil fungi was essential to the plants ability to establish on land. This simple but important relationship has changed little over the past 400 million years and remains a significant part of plant ecology.

*-Mycorrhiza is the natural state of most plants with an estimated 90% of all plant species belonging to plant families that form mycorrhiza. There are four major plant families that characteristically do not form mycorrhiza: Amaranthaceae or Pigweed family, Brassicaceae or Mustard family, Chenopodiaceae or Goosefoot family, and the Zygophyllaceae or Caltrop family. These plant families are well known as weeds.*




## HOW DOES IT WORK?

A plants root system - finely branched with many root hairs or coarse with few root hairs - determines the amount of soil the plant can "mine" for nutrients. When AM fungi colonize the "host" plant root system it spreads out thin fungal filaments or hyphae from the root surface into the surrounding soil. These hyphae can spread out past the root hairs and access larger amounts of soil, thereby retrieving otherwise inaccessible pools of nutrients and water. Therefore, for plants with coarse root systems, partnering with an AM fungus greatly increases their ability to absorb and compete for precious soil nutrients. Plant feeds sugar to the Fungus Fungus feeds soil nutrients.

**Figure 5**. A plants root system - finely branched with many root hairs or coarse with few root hairs - determines the amount of soil the plant can "mine" for nutrients.

*Graphic courtesy of Reforestation Technologies International.*

Another area that may bring useful tools to OLC Practitioners is research and development of products that use plant growth promoting rhizobacteria. Within this new field of soil science, bacteria are being discovered that can colonize plant roots or seeds and provide a variety of benefits to the host plant.

Due to the importance of the soil biological community, care must be taken to avoid practices that harm soil organisms. Burning of stubble can generate temperatures lethal to mycorrhizae. Soil tillage breaks up mycorrhizal hyphae strands, harms mycorrhizal spores, and contributes to more rapid breakdown of soil organic matter as well as more rapid drying of the soil environment — all detrimental to the long-term health of the soil food web. Soil compaction reduces soil porosity, affecting water and oxygen availability in the soil, both of critical importance to soil microorganisms.

Soil bio-assay tests for landscape sites may assist the landscaper in determining the status of the existing fungal and bacterial community. Most highly worked soil environments will show a bacterial-dominated community. Most common landscape plants originate from a native habitat containing a fungal-dominated soil. The bio-assay may assist the organic practitioner in determining the relative bacteria-fungi. A basic test with total bacteria count, active bacterial count, total fungi count and active fungi count is satisfactory. Results from this bio-assay test may assist the OLC Practitioner in determining further prescriptive actions (i.e., compost tea applications as soil inoculations, levels and types of organic matter for top dressing).

# Soil Chemistry

Much research exists on the nutritional needs of plants used for large-scale agricultural operations. Less work has been done for ornamental landscape plants. Essential plant nutrients needed in relatively large amounts include: carbon, hydrogen, oxygen, nitrogen, phosphorous, potassium, calcium, magnesium and sulfur. Iron, manganese, molybdenum, boron, copper, zinc and chlorine are other essential plant nutrients needed in much smaller amounts. A plant's health is partly dependent upon accessing appropriate amounts of these nutrients in a form available to plant roots. Large amounts of plant nutrients are commonly stored in soil organic matter. Through the actions of soil micro-organisms these nutrients are digested, mineralized and later become available to the plant roots.

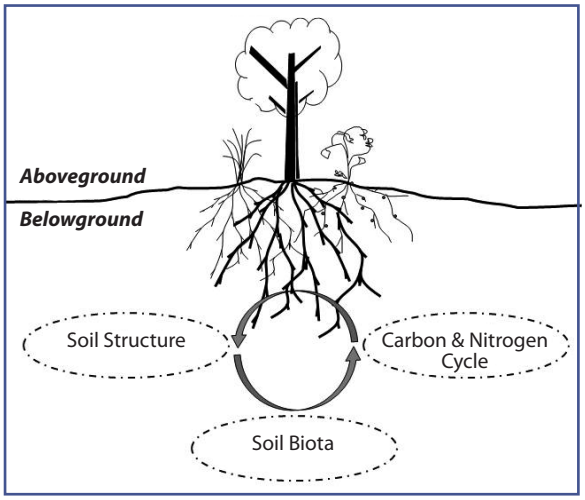



**Figure 6.** Nutrient cycling in the soil is influenced by the structure of the soil, soil microbes, and carbon and nitrogen cycles.
*Illustration courtesy of Johan Six, UC Davis.*

Soil pH can greatly affect nutrient availability in a soil. Generally a pH within a 6.0 – 7.0 range is desired for optimal plant growth. As the pH moves out of this range, soils lose their ability to hold certain nutrients, which makes it difficult for plants to obtain these nutrients. Soil pH, as well as soil nutrient levels, can be determined through appropriate soil chemistry tests.

## Soil Chemistry Testing

Soil chemistry testing provides descriptive baseline information regarding a site's soil environment. The Organic Land Care Program requires this test before adding processed fertilizers. This analysis is conducted by a professional soils lab based on soil samples gathered by the landscaper. Information typically requested in this test includes soil pH, cation exchange capacity (CEC), base saturation percentages, soil organic matter content, and available levels of macronutrients including nitrogen, phosphorus, potassium, sulfur, magnesium and calcium. Most soil labs can run this set and many will include the five important trace minerals of iron, manganese, copper, zinc and boron. Some labs call this the S3C test and offer recommendations for supplementing elements where they are low.

Desired end points are a pH of 6-7; a CEC of 15-20; base saturation levels of K=6%, Mg=12%, Ca=68%, Na=2%, and a soil organic matter content of 4-6%.

There are an increasing number of labs that will make recommendations for CEC adjustment – known as the Albrecht Method of soil balancing. When the OLC Practitioner does not know how to calculate the correct amounts of amendments from a conventional lab, it may be preferable to use a lab that employs the Albrecht Method. Most commercial labs will not offer recommendations for adjustment of cation exchange capacity, soil organic matter or base saturation. These three factors are measurements of the ability of the soil to perform in a natural system, so getting them to optimal levels is especially important for the organic practitioner.

### Testing Your Soil

Plant health depends on soil health. It is important to test for soil pH, Cation Exchange Capacity (CEC), base saturation percentages, soil organic matter content, and soil macronutrients to understand the overall health of your soil.

**Soil pH** is a measure of the acidity or alkalinity of the soil and affects the availability of nutrients. Soils with low or high pH makes it difficult for plants to absorb micronutrients and grow properly. Lime reduces soil acidity and provides calcium and magnesium for plants. Lime also raises the pH to the desired range of 6.0 to 6.5, the range in which nutrients are more readily available to plants, and microbial populations in the soil increase. Microbes convert nitrogen and sulfur to forms that plants can use. Lime also enhances the physical properties of the soil that promote water and air movement.

**CEC** is a good indicator of soil quality and productivity. A soil testing laboratories often estimates the CEC based on the quantities of calcium, magnesium, and potassium ions in a soil solution.

**Base saturation percentages** refer to the proportion of the cation exchange sites in the soil that are occupied by hydrogen, calcium, magnesium, and potassium cations. The surfaces of soil minerals and organic matter have negative charges that attract and hold the positively charged cations. Cations with one positive charge (hydrogen, potassium, sodium) will occupy one negatively charged site. Cations with two positive charges (calcium, magnesium) will occupy two sites. To determine the base saturation, you must first know the cation exchange capacity (CEC), which is a measure of the amount of negative charge in the soil. Fertilizer recommendations using base saturation are aimed at "balancing" the cations in the soil to meet a particular range of base saturation percentages for each cation.

**Soil organic matter** improves soil structure, nutrient holding capacity, water holding capacity, and infiltration. Frequent tillage and removal of crop material lowers soil organic matter levels. Fertility amendments such as animal manure, compost, and green manure cover crops increase the organic matter level.

#### Important Soil Macronutrients

**nitrogen** - a part of all living cells. Nitrogen is a part of chlorophyll, the green pigment of the plant that is responsible for photosynthesis. Helps plants with rapid growth, increasing seed and fruit production, and improving the quality of leaf and forage crops. Nitrogen often comes from fertilizer application.

**phosphorus** - an essential part of the process of photosynthesis. Helps transform solar energy into chemical energy, produce proper plant growth (including blooming and root growth), and help plants withstand stress. Phosphorus often comes from fertilizer, and bone meal.

**potassium** - absorbed by plants in larger amounts than any other mineral element except nitrogen and, in some cases, calcium. Helps to build protein, stimulate photosynthesis, and reduce diseases. Supplied to plants by soil minerals, organic materials, and fertilizer.

**sulfur** - essential for the production of protein, enzymes, and vitamins; improves root growth and seed production. Sulfur may be supplied to the soil from rainwater. Gypsum also increases soil sulfur levels.

**magnesium** - part of the chlorophyll in all green plants and essential for photosynthesis. Helps activate many plant enzymes needed for growth. Soil minerals, organic material, fertilizers, and dolomitic limestone are sources of magnesium.

**calcium** - an essential part of plant cell wall structure, helps to move and retain important elements as well as strengthen the plant. Sources of calcium are dolomitic lime and gypsum.

**Table 1.**

## Other Descriptive Techniques for Soil Evaluation at the Landscape Site

A number of hands-on approaches can be used by the OLC practitioner to get a better feel for the soil conditions at a site. These do not require sending samples to soil labs or contracting with outside consultants for services. They do require practice on the part of the organic landscape practitioner before using them in soil evaluations. Specific soil study approaches that may be helpful include:

1. Identify from a United States Department of Agriculture Soil Survey map the soil type for each landscape site. This information should include slope classes, drainage classes and native fertility. Note that quite commonly landscaping site soil has been so modified by past human activity that it may not reflect the properties of the soil native to that site.
2. Note existing vegetation and its state of health. This information can be helpful in developing a more complete understanding of the soil environment. For example, identification of common weeds can reveal information regarding pH, nutrient levels, soil compaction and water availability.
3. Examine different locations at the site to determine soil color. Color can indicate soil properties like organic matter and mineral content that can be instructive. Note that the soil chemistry test will give you some of this same information.
4. Determine the soil texture. This can be done relatively easily. First, scrape off the organic debris on the soil surface and take soil samples to a depth of 6-8" at multiple landscape locations. Mix the samples together in a container. Fill a glass quart jar with the integrated sample and add water to 2" from the top of the jar. Place lid on jar and shake vigorously to mix. Place on stationary surface. Mark the sand level in one hour, mark the silt level in one day and mark the final clay level in three days. Then use the relative volume of each textural class to get an approximate percentage of sand, silt and clay in the soil.

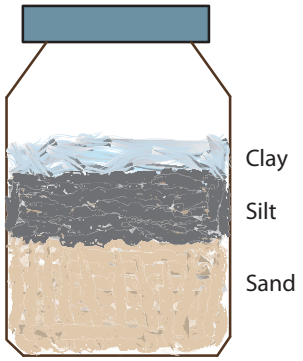



**Figure 7.**
*Illustration courtesy of Creative Resource Strategies, LLC.*

5. Examine plant roots (location, quantity and quality of roots) and record your observations.
6. Perform an earthworm count and record your results. Dig a 1' x 1' x 1' hole at several locations. Count the total number of earthworms in the sample. A count of 10 earthworms per cubic foot indicates a healthy soil food web.
7. Examine and record the soil layers by digging a hole 2-3' deep and smoothing the edges of the hole. Identify the different soil layers present, thickness and depth of each. Use of a soil probe in several locations may also provide the same information.
8. Perform a soil percolation test by digging several test holes, 1-2' deep. Next, fill the holes with water and allow them to drain. After draining, fill again and record the time it takes to drain completely this second time.

9. Determine soil bulk density. Several times during the growing season, use a penetrometer at various locations within the landscape site. A reading of less than 300 psi is considered appropriate for growing healthy plants. If a penetrometer is not available, then several test holes should be dug. Place soil from each hole into a container and dry the soil in the oven to remove moisture. Place a plastic bag in the hole and fill it with water. Using the metric system, record the volume of the hole (amount of water that filled the plastic bag put in the hole in milliliters) while recording the weight (in grams) of the oven-dried soil removed from the hole. The goal is to calculate a reading expressed as grams per milliliter. A reading greater than 1.7 indicates compacted soil.

### Soil Test Requirement

When soil chemistry tests are conducted the results must be recorded in the Site Record. Commonly this will be done annually. If soil chemistry test interpretation indicates a nutrient deficiency, then a United States Department of Agriculture National Organic Program (NOP) approved fertilizer may be applied. No other types of soil tests are required, recommended or prohibited currently. However, any soil observations or tests conducted that better describe the site conditions may be added to the Site Record. These written stored records provide the OLC Practitioner and their client with invaluable information for a site.

## Building Productive Soil

Through soil chemistry tests and other site observations, the OLC Practitioner develops essential information regarding the soil at the site. In many instances, there will be a need to make changes in the soil environment in order to grow healthy plants.

To remedy various soil problems, an array of options are available. These include:

- Ongoing additions of organic matter, at least equal to the organic matter harvested or otherwise removed from the site
- Development of an on-site composting facility and system as a mean to generate usable compost from vegetative debris
- Inoculate applications of selected microbial organisms via compost tea
- Selected additions of specific nutrients in appropriate amounts
- Installation of drainage or rain gardens in areas subject to poor drainage or especially susceptible to accumulation of water from rain events

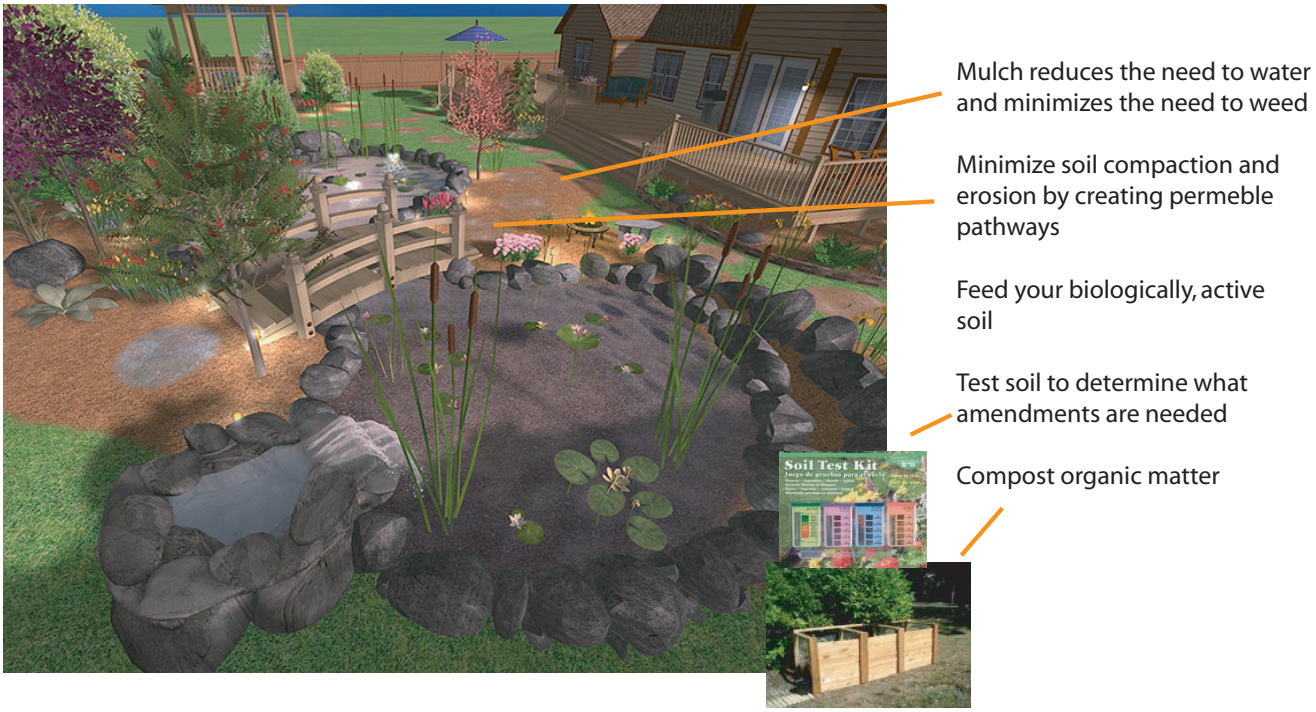



**Figure 8.** An organically managed landscape is biologically active, has organic matter additions in the form of mulch and compost, has regular soil tests to manage nutrient needs, and includes practices that minimize soil compaction and soil erosion.

*Backyard landscape image courtesy of IdeaSpectrum.com.*

# Compost

The OLC Practitioner can produce a great deal of compost by recycling organic debris generated on site. Consideration of the quantity of material to be processed, where this processing will occur and what specific composting method to use are best addressed at any early stage. It is preferred that OLC Practitioners develop a composting plan for each landscape site.

On-site composting works to break down manures, plant debris and food scraps into a stable and safe organic material. Hot bed or worm bin composting frequently eliminates many harmful pathogens and can reduce weed seed viability. Additionally, on-site composting reduces exportation of organic materials from a site, allowing the landscaper to reduce site exports and imports. Once the site composting facility is operational, finished compost can be applied as top dressing or mixed in with the soil as needed by the OLC Practitioner. Adding compost to the soil enriches the soil food web by providing organic matter which the microbes will feed on, and by making modest fertilizer value available to plants.

Even if site-produced compost is unavailable or insufficient, the Organic Land Care Program still strongly encourages the use of compost as a soil amendment. When qualified organic compost is available, it is preferred that it be used in place of other imported compost. Compost standards established by the U.S. Composting Council's Seal of Testing Assurance (STA) Program provide quality parameters for desirable compost. Compost meeting STA standards will be referred to as "qualified compost" throughout this text

The application rate for compost in a landscape is not precise. The starting condition of the soil, compost quality and the type of plants growing or to be grown all play a role in how much soil organic matter and nutrients are present in the soil environment and the rate at which they are used. Over-amending can be unnecessary, time consuming and expensive.

## The Benefits of Composting

- Improves soil structure and porosity – creating a better plant root environment
- Increases moisture infiltration and permeability, and reduces bulk density of heavy soils – improving moisture infiltration rates and reducing erosion and runoff
- Improves the moisture holding capacity of light soils – reducing water loss and nutrient leaching, and improving moisture retention
- Improves the cation exchange capacity (CEC) of soils
- Supplies organic matter
- Aids the proliferation of soil microbes
- Supplies beneficial microorganisms to soils and growing media
- Encourages vigorous root growth
- Allows plants to more effectively utilize nutrients, while reducing nutrient loss by leaching
- Enables soils to retain nutrients longer
- Contains humus – assisting in soil aggregation and making nutrients more available for plant uptake
- Buffers soil pH

**Table 2.** The benefits of composting *(U.S. Composting Council 2005)*.

# Soil Productivity

In a landscape setting, the value of the landscape is best determined by its contribution and effect on environmental and owner health. Concepts like yield per acre are not applicable for the organic landscaper. Successful landscapes offer a combination of aesthetic value and food production for the owners, ecological functions for the area and provision of wildlife. To grow healthy plants, it is crucial for organic landscapers to look at soil productivity.

In landscape settings the soil productivity factor most easily manipulated by the OLC Practitioner is soil fertility. Soil building via additions of either well digested organic material or decomposing organic material defines the essence of organic land care. Adding organic matter to the soil is an essential proactive step that positively affects cation and anion exchange capacity, releases mineralized nitrogen, phosphorus, and sulfur during decomposition, provides a storehouse of major plant nutrients and contributes to soil tilth. Only through ongoing addition of organic matter will these processes occur and continue.

One advantage that landscape settings have over agricultural crop settings is a potential for greater plant diversity within the landscape. This diversity within a small area helps reduce pest problems while leading to a more stable ecosystem within the landscape. The vast range of plant choices for varying soil conditions allows for excellent pairing of appropriate plants.

General guidelines are available for desired amounts of specific nutrients needed by ornamental plants. However, these guidelines generally do not refer to specific ornamental plants, but rather to "ornamental plants" as a group. The key here is to identify and build a soil with sufficient nutrient availability for plants, year in and year out. OLC Practitioners will observe that different plant species, and varieties of species, may show different nutrient needs. One example of this is *Euonymus alatus* 'Compactus' which readily shows nitrogen deficiency symptoms in cool spring temperatures when grown in well-drained sandy soil. Other species of plants in the same location may not exhibit these symptoms at all. Consequently, the landscaper may routinely develop soil management practices for

*E. alatus* 'Compactus' that are different from those for other portions of the landscape. Development of this kind of knowledge base is most likely to come from observant landscape practitioners with support from academic and industry research. Keen observation, personal experience, analysis, intuition and record keeping on the part of the OLC Practitioner will greatly assist in the development of best management practices for developing and maintaining productive soils.

An important objective of organic land care is to build and maintain soil that supports a healthy soil food web and, in turn, grows healthy plants resulting in a productive landscape. Ongoing additions of organic matter such as compost and mulch are most important to building soil. With plant growth and harvesting (including plant removal) organic matter is removed (oxidized or transported) from the soil environment. Sound horticultural practices that improve the landscape soil strive, at the very least, to balance the addition of organic matter with the loss of organic matter. Using local resources as organic soil amendments often mimics nature.

| ORGANIC AMENDMENTS | CHARACTERISTICS |
|---|---|
| Compost | • Moderate rate of decomposition (6 months)<br>• Adds nutrients to the soil<br>• Loosens the dirt<br>• Helps to make the soil absorb water better<br>• Increases desirable microorganisms |
| Manure | • Decomposes rapidly<br>• Adds nitrogen to the soil<br>• Age manure for at least 6 months before using because fresh manure is high in ammonia and will burn plants |
| Leaves | • Decompose rapidly<br>• Certain types of leaves, such as black walnut or pine, should not be used to amend soils because of the tannins in walnut and the fact that pine needles decompose slowly and thus will not alter the pH of the soil readily |
| Grass clippings | • Decompose rapidly |
| Wheat straw | • Decomposes rapidly<br>• Add nitrogen (animal manure, legumes) with wheat straw |
| Wood chips | • Decompose slowly (4 or more years)<br>• Add nitrogen (animal manure, legumes) with wood chips to help decompose the wood chips without depleting the available nitrogen in the soil<br>• Wood chips will lower soil pH, making it more acid |
| Sawdust | • Add nitrogen with sawdust to help decompose the sawdust without depleting the available nitrogen in the soil<br>• Sawdust is usually used only with acid-loving plants, such as blueberries |

**Table 3.** Common organic matter soil amendments and their characteristics. The type of soil amendment you choose depends on your goals. Fibrous amendments, such as wood chips or straw, are most effective if your goal is to improve soil porosity and permeability and improve aeration and drainage in clay soils.

# The Do's and Don'ts of OLC Soil Management

✓ Select and implement cultural practices that maintain or improve the physical, chemical and biological condition of soil and minimize soil erosion.

✓ Manage inputs to maintain or improve soil organic matter content in a manner that does not contribute to contamination of crops, soil or water by plant nutrients, pathogenic organisms, heavy metals or residues of prohibited substances. Materials include:

- Manures
- Compost
- Uncomposted plant materials as mulch
- NOP approved processed mulch

✓ Obtain soil or leaf tissue chemical assays before application of processed fertilizers. All soil test results and written recommendations must be kept and available for review.

✓ Prevent soil compaction in planted areas.

✓ When it is necessary to source compost off-site, it is preferred that the OLC practitioner use qualified compost where it is available.

✗ Use genetically modified organisms.

✗ Burning as a method of disposal of plant residues, except as a method of disease management (always observe state and local restrictions).

✗ Use PVC-based plastic mulches except for solarization (which must be removed by the end of the growing season).

✗ Use raw manure or non-qualified compost on plants intended for human consumption, except if applied at least 120 days prior to harvest.

✗ Use substances listed as prohibited in this standard.

✗ Contaminate the soil through the application any non-allowable material that damages the soil ecology or unbalances the soil chemistry.

## RESOURCES:


Ingham, Elaine. 2000. *The Soil Food Web. Soil and Water Conservation Society.* Ankeny, Iowa. 48 pp.

National Sustainable Agriculture Information Center Portland Area Metro *http://www.attra.org/soils.htm*

Guide to Effective Composting *http://www.oregonmetro/gov/index.cfm/go/by.web/id+553*

US Composting Council *http://www.compostingcouncil.org*

How to Compost.org *http://www.howtocompost.org*

Burket, J.; Dick, R.; Seiter, S.; Tugel, A.; McGrath, D.; and C. Seybold. 1999. *Willamette Valley Soil Quality Card Guide.* Oregon State University Extension Publication EM 8710. 25 pp.

# Water Management

## Overview

Water is a critical component of our environment, providing many essential ecological functions and services. Water is a limited resource that moves between gardens and lawns, waterways and bodies of water and the atmosphere via the water cycle. Just like productive soil and fresh air, clean water is vital to the establishment and healthy function of a living landscape. Poorly managed landscapes commonly lead to reduced water quality due to the over-application of chemical inputs and soil erosion caused by excessive site preparation and clearing of vegetation. In addition, managed landscapes often under-utilize the potential for recycling and capturing water, as well as increasing water infiltration.

Limited access to fresh water has become a paramount and defining issue for communities around the world. When a landscape's surface is altered through paving, construction, compaction or removal of vegetation, the ability of water to infiltrate into the soil decreases significantly. Paving, and the construction of impervious surfaces, increases the volume of storm water runoff. As a result, the natural flow of rainwater is disrupted and cannot seep into the landscape, be taken up by plants or flow into deeper groundwater. This disruption contributes to a host of environmental problems, including flooding and non-point pollution.

Water quality can be compromised by excessive input applications. As mentioned earlier, the Oregon Tilth Organic Land Care Program requires that prior to the application of any processed fertilizers, a soil test must be conducted and the results must indicate a deficiency of the nutrient to be added. This provision helps to reduce excessive input applications and protect water quality.

Organic land care prioritizes water conservation and the protection of existing natural water features such as wetlands, ponds, marshes, and streams through an applied awareness of water use, supply and demand. Water conservation measures are essential and can be incorporated into a landscape project at many phases – including design, installation and maintenance. As clean freshwater becomes increasingly scarce, the importance of designing drought-tolerant, irrigation-free landscapes grows. Many municipalities across the country have imposed mandates which reduce or prohibit the use of water for landscape plantings. These mandates have greatly limited the landscape industry's ability to continue using conventional planting strategies. In some cases, landscape professionals are forced to abandon projects entirely or develop alternative designs that maximize water conservation and reduce or eliminate the need for irrigation.

The efficient and innovative use of existing water resources brings a managed landscape closer to sustainability. Beyond water efficiency, it is preferred that projects be designed and engineered to cycle, filter and purify water across the landscape. This can be achieved through a combination of earthwork, water features and selection of appropriate plants. Design and installation of rain gardens has become increasingly popular for storm-water mitigation and drainage, as have cisterns, ponds and rain barrels for water collection and storage.

Such alternative designs require a holistic approach to landscaping that links multiple landscape factors — soil, plants, built structures and hardscapes — to create multi-functional solutions to common challenges. Problems with excess water or drought in the landscape can often be resolved through a variety of simple techniques promoting infiltration — including rain gardens, rainwater harvesting, improvement of soil quality and appropriate selection and siting of plants based on soil texture and depth to groundwater.

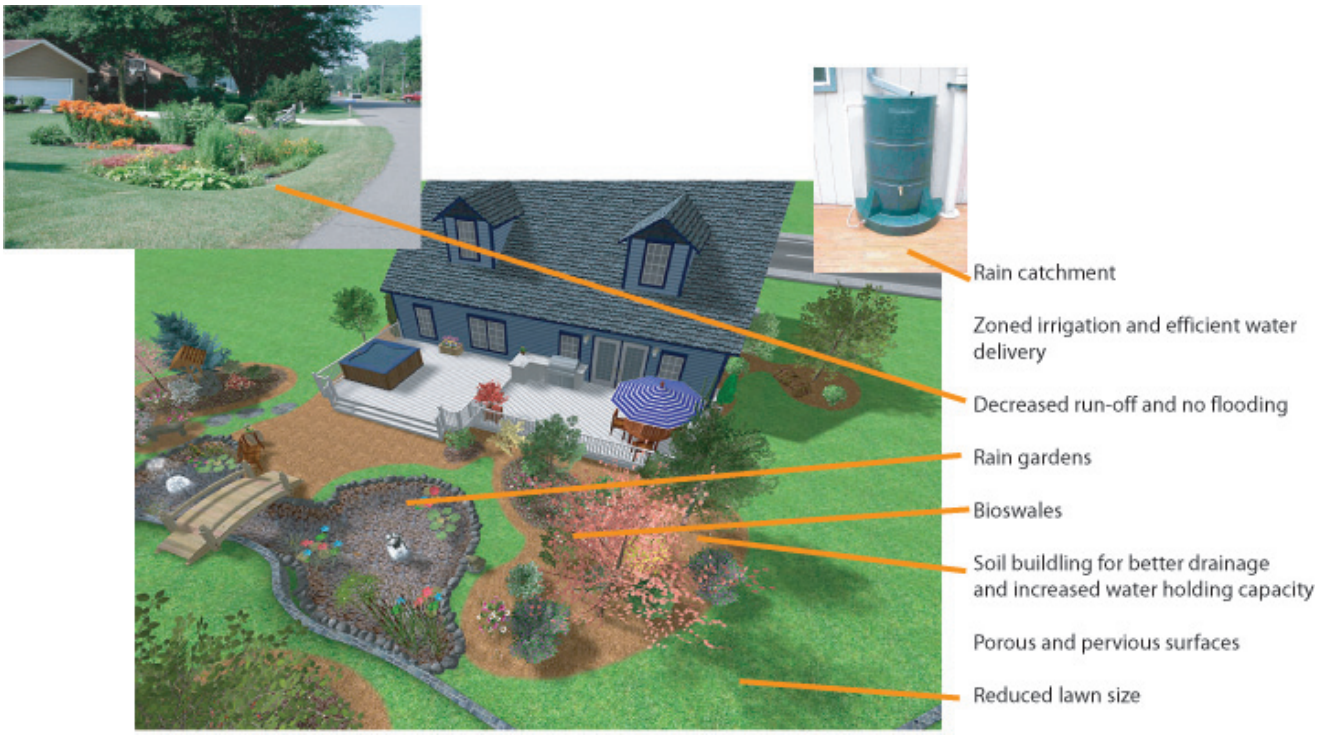



**Figure 9.** An organically managed landscape has rain catchments, a rain garden, zoned irrigation, bioswales, pervious and porous surfaces, and a reduced lawn size.

*Backyard landscape image courtesy of IdeaSpectrum.com.*

# Design

Organic landscape design employs an ecological approach through techniques derived from the observation of natural systems. This approach is applied responsibly and in concert with new products and innovative technologies. Design must be informed and inspired by many factors and details that are personally, socially, economically, ecologically and culturally appropriate to the site, microclimate, client and community. Meeting these standards often involves great ecological merit while encouraging simple and practical solutions to many landscape challenges.

Strategies for water conservation must be included in all landscape designs. Without conservation recommendations at the design phase a project will have difficulty maximizing the potential for smart water use, flow and drainage. Generally, in a cooperative project environment where multiple contractors are at work, the landscape designer informs (and often dictates) the techniques and materials used in landscape installation and maintenance. Thus, understanding and addressing the importance of conservation measures, organic techniques and materials at the design phase is critical to creating a successful organic landscape. It is this multi-tiered cooperative approach that is inherent to the organic method and philosophy.

Sustainable landscape design operates on multiple scales seeking to simultaneously integrate landscape-scale factors such as site topography and hardscapes with finer details such as proper plant selection and soil quality. The goal is to create multi-functional, low-impact landscapes that fit well with their surrounding environments. In general, it is this intention to maximize ecological function while minimizing negative environmental impact that distinguishes the organic landscape approach.

While the field of sustainable and organic landscape design is broad, there are core practices used by OLC Practitioners for creating water efficient landscapes. These core practices include:

- Conservation in earthwork and construction
- Water collection
- Cultural practices for turf and soil management
- Improving site drainage
- Proper use of irrigation systems

## Earthwork and Construction

Earthwork refers to any initial site preparations that involve major movement of soil, rock or other landscape features. From a hydrological standpoint, it is important to respect and maintain natural water sources and flow whenever possible. Organic land care generally seeks to create the most desired effects using the least effort, naturally. This means working with native site conditions in a practical and environmentally sensitive manner, while meeting client desires and the requirements of the *Oregon Tilth Organic Land Care Policies and Standards*.

In addition to earthwork, sometimes a site will need to be graded, shaped or constructed to further improve soil quality, water infiltration and drainage. In this case, it is important to balance the need for new construction with its ecological impact while protecting existing soil, plant and water resources to the greatest extent possible. This balance point may differ between sites, depending on various factors: type of construction, soil type, site gradient, water supply, surface material and microclimate. It is important to observe and consider the greater ecological impact (immediate and long-term) of site construction and earthwork. This can ultimately be determined by asking questions such as:

1. Does the construction require use of heavy machinery (and fossil fuels)?
2. Does it require the importation of scarce resources?
3. Will it cause significant soil compaction or erosion?
4. Will it significantly alter the existing natural features, vegetation and water infiltration?

## Site Contouring and Flow

A contour is a surface depiction of the general topography of land. Contour lines can be found on USGS or soil survey maps and indicate the gradient, or rise and fall, of the land. Historically, contour farming, or the cultivation of crops along contour lines, has been a popular technique for minimizing erosion and improving water infiltration. These conservation techniques — either contour planting or shaping soil along contours —are useful for organic landscaping as well.

Simply put, the idea of contouring is to slow the flow of on-site water and improve water infiltration while preventing soil erosion. When contouring and the manipulation of surface conditions is necessary, the use of simple, effective and low-impact techniques can both improve water flow and infiltration while conserving vital soil resources.

**SWALES** are elongated no-flow trenches dug on the contour or slope of a landscape. The primary function of a swale is to capture and hold water so that it can slowly seep into the soil and recharge groundwater rather than becoming runoff. Swales can vary greatly in width and materials, ranging from 2' to more than 10' wide and constructed of soil, mulch, rock or woodchips. While materials may vary, swales share the primary function of water retention. Swales in the Pacific Northwest are commonly 2-4' deep, due to the high amount of water runoff combined with the slow infiltration rate of clay soil. In sandy soil, shallower swales can be constructed because sandy soil drains water more rapidly.

While swales primarily catch and hold water, they also help prevent soil loss from erosion by slowing water and capturing sediment. This soil capture is of great value when we again consider issues of topsoil loss and degradation of soil quality.

**Figure 10.** Bioswales play an important role in urban areas, filtering groundwater runoff.

*Photo courtesy of Jennifer Goodridge.*

Swale construction is simple and straightforward. Swales are built on level survey or contour lines, designed to hold water and prevent water flow. Swales — unlike ponds or dams — are not compacted at their base or banks. Instead, swales are intentionally porous and constructed to encourage seepage and drainage of water.

The number of swales in a landscape will vary depending on factors such as: the size of the landscape, desired functions and flow of the site, quantity of storm water runoff, client preference and the appropriateness of swale construction (a steep slope may be impractical for swale construction).

Landscapes may also feature multiple swales connected to a larger diversion drainage system that includes ponds, basins or rain gardens. Swales are simple, cost-effective earthworks that offer many benefits for Pacific Northwest landscapes.

**HARDSCAPES** are built components of the landscape, generally consisting of rock, brick or concrete that covers the upper soil profile and provides structural support for patios, retaining walls, paths, sidewalks, roads and parking lots. Hardscapes also include larger paved projects such as large business complexes, apartment buildings and highways. These landscapes present many challenges for managing water runoff, as they generally are impervious and prevent rain from infiltrating into the soil. This leads to increased storm water runoff and causes a host of internal and external landscape problems, from erosion and non-point pollution to water waste and flooding. As an OLC Practitioner, it is important to minimize impermeable areas when designing a landscape.

Hardscapes are an important and functional part of the landscape and generally integral to a holistic landscape design. For the Accredited OLC Practitioner, it is essential to consider two issues when constructing hardscapes. First, assess the total impact hardscapes will have on water infiltration within the landscape. Generally, hardscape projects create impermeable surfaces that *prevent* water infiltration. Likewise, hardscapes in the form of large business complexes, roads, parking lots and other industrial developments are a primary cause of excessive storm water runoff.

Second, it is important to evaluate how hardscapes change – or will change – the existing course of water from source (inflow) to sink (outflow). The Oregon Tilth Organic Land Care Program prohibits activities causing surface runoff that negatively affect neighboring properties or environmentally sensitive areas. The program by its nature lessens the possibility of flooding, erosion or leaching of nutrients and soil amendments from surface runoff. Designers and installers should consider creating permeable areas within and around hardscapes to maximize potential infiltration. Unrelated to water conservation, but equally important, hardscape materials should be purchased or gathered (when possible) from socially and environmentally responsible sources.

| HARDSCAPE MATERIAL | PROS | CONS |
|---|---|---|
| Permeable concrete pavers | • Permeable concrete pavers installed in sand allow for permeability between and within pavers<br>• Excellent longevity | • A great deal of energy is used to produce concrete materials, however, the final product has excellent longevity |
| Wood | • Free of chemical treatments<br>• Is aesthetically pleasing<br>• Can often be sourced locally<br>• Is durable<br>• Is recyclable | • Wood treated with any synthetic chemicals is not allowed |
| Gravel | • Easy to install<br>• Inexpensive<br>• Allows for good drainage | • These materials can be difficult to walk on and uncomfortable in bare feet<br>• Unless used with landscaping material, does not provide a good barrier against weeds<br>• Can scatter and get thrown up by the lawn mower |
| Mulch | • Organic, readily available and environmentally friendly<br>• Provides a natural look and drain well<br>• Easy to apply and generally inexpensive | • Scatter easily and because they decompose quickly, they need to be replaced every couple of years<br>• Color choices are limited |
| Crushed hazelnut shells | • Often available locally<br>• Do not compose readily<br>• Can deter slugs and snails<br>• Because of their density, they serve as a weed barrier | • Can be expensive initially, but their durability makes them less expensive when compared to fine-bark mulch long-term |

*Note that hardscape material made from PVC is not allowed.*

**Table 4.** Permeable hardscape materials and their pros and cons.

Designing and installing permeable hardscapes has become popular (and more common) as environmental health and resource conservation gains priority across many professions. As discussed earlier, permeable surfaces allow water to pass through and percolate into the soil. This is vital for groundwater recharge and storm water management, in addition to improving plant health and water conservation (by decreasing water demand). Permeable surfaces vary widely in form and materials though are often constructed from common landscape materials — gravel, stone, woodchips, pavers and recycled plastic products. For driveways, semi-permeable concrete is an option to be considered.

Also, permeable areas can be created within existing non-permeable surfaces through the construction of swales, paths, planters, drains, etc. Bioswales have become a popular and effective means of mitigating storm water runoff while creating multi-functional (beauty, shade, cooling) habitat gardens in otherwise urban environments.

**Figure 10.** Porous aggregate allows water to flow through concrete structure.
*Photo courtesy of UNI-GROUP U.S.A.*

## Plant Selection and Placement

While modifications to the physical features of a site can improve water and soil conservation, appropriate plant selection is a critical component of a water-conserving landscape. "Right plant, right place" is the Organic Land Care motto for choosing plants well suited to site conditions. The importance of this cannot be overstated.

The cultural conditions of a site, compared with the cultural requirements of a plant will guide the selection of appropriate plants for a given site. Conditions of the site to consider include light availability, moisture level, soil type, texture, condition and fertility. Other factors may include available space, microclimates (temperature, moisture, soil quality) and client preferences. Cultural requirements for specific plants can be referenced through a variety of widely available plant indexes. See the Resources at the end of this chapter for recommended plant reference books.

### The Key Points to Consider When Selecting Plants

**Select plants that:**

- have normal pollen loads
- offer multiple positive characteristics, such as hosts for beneficial insects
- are drought-tolerant
- produce abundant leaves or woody material that can later be used for mulching and compost
- contribute to a well-functioning carbon cycle
- ensure long-term sustainability of your landscape
- require low maintenance

**Table 5.**

The careful selection of plants that fit the conditions of the landscape helps to conserve resources including time, money, water, amendments, fuel and the plants themselves. When an appropriate plant is placed properly in the landscape it generally experiences less stress. Maintaining this plant requires fewer inputs such as water, fertilizer and pest control products. Appropriate selection also results in a higher success rate for the plant. When a plant is well-adapted to a landscape it will generally not need to be replaced. This saves time and money for when plant recovery and replacement is necessary.

# Water Collection

Water collection refers to the harvesting and storage of water within the landscape. Designing and installing features for water collection is another way to conserve water resources. Water collection systems effectively reduce storm water runoff and store water for future use. This is particularly helpful for regions of seasonal drought and rainfall, such as the Pacific Northwest. In fact, many companies and municipalities in the Pacific Northwest have encouraged homeowners to disconnect residential downspouts in order to increase infiltration of water throughout the landscape. This helps reduce the burden of storm water runoff on local waterways.

## Water Catchments and Storage Systems

Landscape-scale water catchments and storage systems come in many types and sizes, ranging from low-tech recycled plastic barrels to higher-tech underground cisterns and engineered ponds. A common and affordable type of water catchment for smaller-scale residential use is the rain barrel. Generally, a rain barrel is a 50 gallon barrel connected to the gutter of a building that captures water runoff from the roof. Barrels provide a simple and cost-effective means of collecting and reserving relatively small quantities of water.

Rain barrels can be linked together for greater collection capacity and relative location in the landscape, providing more convenient access for irrigating gardens. For larger sites with a higher volume of runoff and greater irrigation demands, cisterns – ranging from 300 gallons and up – provide excellent storage capacity though are more expensive.

## Ponds and Water Features

The design and construction of ponds, flow forms, bioswales and water catchment systems – appropriate to a site and client – are recommended mechanisms for increased water conservation, filtration and cycling. Creating small ponds, basins, birdbaths and other water features enhances the ecology within a landscape. Water features perform important functions of harvesting and storing water while also providing habitat for beneficial plants, animals and insects. Low Impact Development (LID) principles, techniques and technologies are preferred when planning and installing larger water features. LID involves land planning and engineering design that maintains and enhances the pre-development hydrologic regime of urban and developing watersheds. Inclusion of LID ensures that native watershed ecology is considered in the total design and impact of landscape construction.

# Rain Gardens

An excellent and increasingly popular water-efficient feature for residential landscapes is the rain garden. Rain gardens — landscape areas planted with native or well-adapted vegetation and designed, like swales, to capture and filter runoff — offer numerous local and regional environmental benefits.

Rain gardens perform multiple functions:

- Protect communities from flooding and drainage problems
- Protect local waterways from pollutants carried by urban storm water, including chemical fertilizers and pesticides, automobile fluids (including oil) and toxic substances from roofs and roadways
- Enhance natural beauty for yards and neighborhoods
- Provide valuable urban and suburban habitat for beneficial wildlife, including birds, butterflies and beneficial insects

Rain gardens have become increasingly popular as a low-cost way to support watershed health. They are located no less than 10' from the foundation of a building (with a basement) and designed to capture water exiting the downspout. A shallow swale is dug from the base of the downspout, enabling water to flow directly into the rain garden. Rain gardens are planted with native and well adapted plants, favoring flowering herbs, shrubs and grasses for habitat. The center of a rain garden can hold water during heavy rain, allowing water to soak gradually into the soil. A rain garden is not a water garden and installing a rain garden in poorly drained soils may lead to slow infiltration and unwanted ponding.

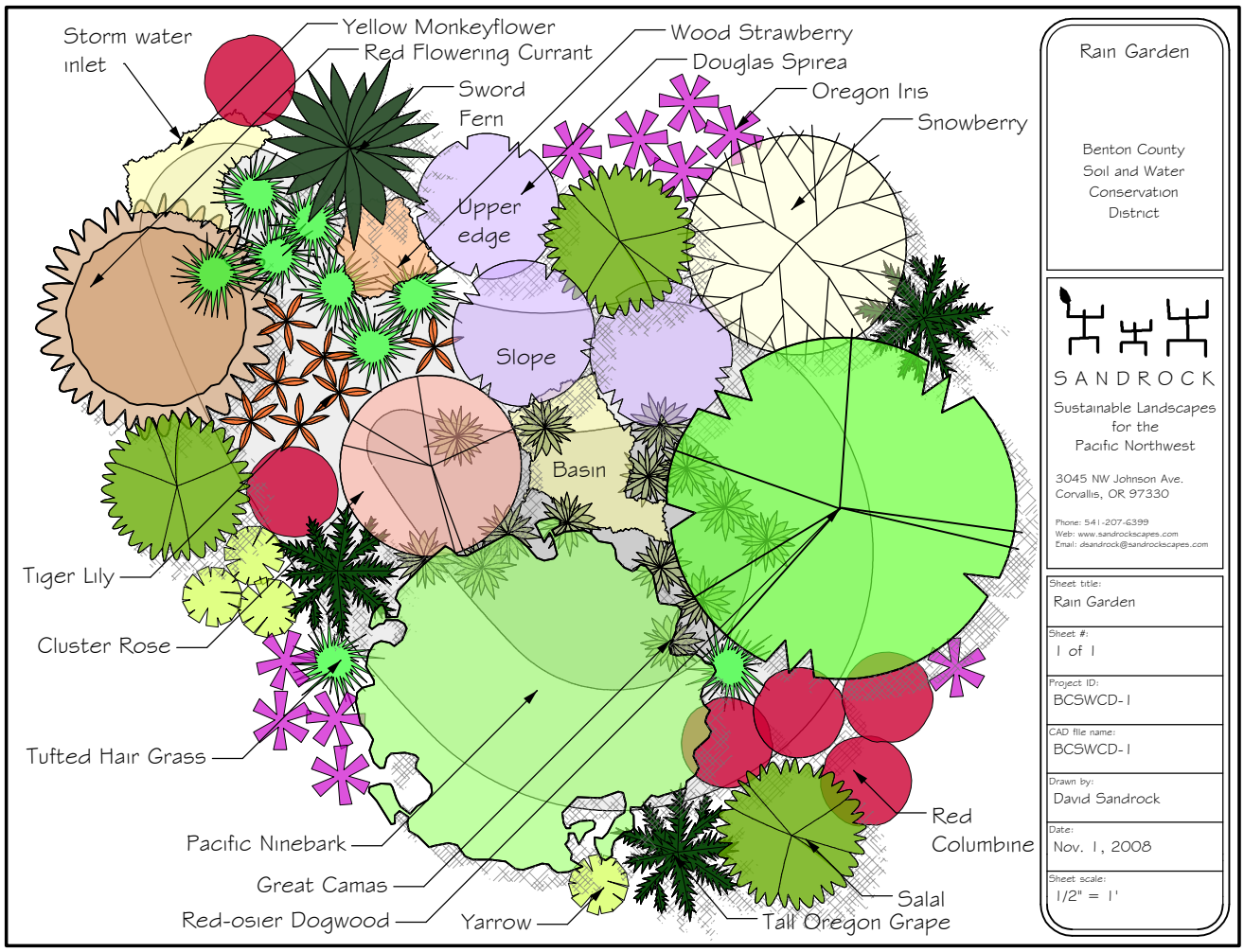



**Figure 11.** A typical rain garden in the Pacific Northwest.
*Illustration courtesy of Dave Sandrock*

# Cultural Practices

For the OLC Practitioner, water conservation also involves applying wise cultural practices such as a tolerance for seasonal turf senescence (seasonal die-back) and soil management that improves soil quality over time. Minimizing lawn (to reduce maintenance, irrigation and runoff) is a preferred landscape design and installation practice reiterated in the Landscape Design and Maintenance sections of this guide.

The improvement of soil condition and quality (as outlined thoroughly in the soil management section) is another important cultural practice for the total health of an organic landscape. Soil that has a well-balanced composition (5% organic matter – 25% air – 25% water – 45% mineral content, by volume) will absorb and retain water better than soils with poor structure.

## Turf Senescence

During seasonal droughts, such as the dry summers of the Pacific Northwest, turf will naturally senesce, drying and becoming dormant. This seasonal browning is a mechanism by which perennial plants self-prune during stress, redirecting energy below ground to maintain health. In the absence of heavy water and fertilizer applications, due to its shallow growth habits, turf naturally goes through a period of senescence every summer when days are hot and dry. This surface dieback is an essential mechanism that allows turf to maintain root health while replenishing plant energy for new fall growth.

It is preferred that the OLC Practitioner develops and encourages tolerance among clients for seasonal turf senescence. This tolerance encourages water conservation by reducing lawn irrigation during peak dry seasons. It also helps clients and other landscape professionals develop an appreciation and tolerance for natural growth cycles.

**Figure 12.** Turf senescence: photo of summer-dry grass

If a landowner does not tolerate seasonal turf senescence, other water-conserving practices including early morning watering, timed irrigation and foliar feeding, can maintain turf appearance while reducing water use. See the Water Delivery section for more detailed conservation practices.

## Soil Building and Improvement

As described in the Soil Management section of this guide, a well-balanced soil is comprised of 50% pore space (evenly shared by air and water), 45% mineral content and 5% organic matter, by volume. The OLC Practitioner works toward this ideal composition through soil improvement practices that include mulching, additions of compost, the use of ground covers and proper soil cultivation and preparation. When a soil is in good condition, often referred to as "in good tilth," its capacity to retain moisture and supply nutrients to plants improves significantly.

Improving soil quality increases the pore space of soil, where water and air are held. Healthy, well-conditioned soil acts as a "living sponge" holding and releasing water slowly for plant roots and beneficial soil-borne organisms. A well-conditioned soil also provides a better medium for healthy and uninhibited plant root growth. When plant roots grow freely and penetrate deeply they can more readily access moisture from underground water reserves. Water infiltrates better through well-conditioned soil, again encouraging deeper root growth and better plant establishment. For these reasons, *Oregon Tilth Organic Land Care Policies and Standards* require landscape practices that encourage deep rooting of plants through both improving soil tilth and appropriate watering of plants.

Often, especially in urban areas, soil is neglected, compacted and abused. Soil conditions and the potential for soil improvement will vary across sites. Sometimes it may require great measures to significantly improve soil conditions. As an OLC Practitioner, remember that any attention to improving soil conditions, as slight as they may seem, are important contributions to improving overall landscape health. It is important to maintain and improve soil quality and structure whenever possible.

# Drainage

Adequate drainage is essential for a healthy and productive landscape. Normally in the Pacific Northwest, inadequate drainage due to compacted or heavy clay soil presents challenges for landscapers and landscape plants. For soil types with high sand content, drainage often happens too quickly resulting in difficulty retaining moisture and nutrients. Interestingly, regular additions of organic matter such as compost or mulch will improve soil conditions in both of these situations.

Good surface and sub-surface drainage is important for both plant and landscape health. Most landscape plants require alternating periods of moisture and drainage for long-term success. In poorly drained and waterlogged soils plant roots suffer from lack of oxygen. This leads to stunted growth, increased disease and possibly death. It is preferred that the OLC Practitioner design and construct landscapes that prevent pooling of water, except where desired, such as in ponds, rain gardens or recharge areas.

By focusing on soil improvement and appropriate site design and renovation, land care professionals can often improve the drainage of a site through fairly simple measures.

## Surface Drainage

Surface drainage involves all above ground landscape features including swales, hardscapes, drains, water catchments and rain gardens. It is preferred that OLC Practitioners design and construct landscape surfaces that provide maximum water collection, infiltration and drainage. Preferred practices such as site grading, soil and turf aeration, construction of permeable hardscapes and soil improvement can contribute to improved surface drainage.

Directing drainage toward environmentally sensitive areas or neighboring properties is prohibited in the OLC Program.

### Subsurface Drainage

Subsurface or below-ground drainage is also critical for sustaining overall landscape health, including the effective infiltration and flow of water through the landscape. This is particularly important for the Pacific Northwest where water-logged soils can inhibit plant success and overall landscape health. It is preferred that efforts to improve subsurface drainage, such as swale construction, sub-soil cultivation and aeration, attempt to minimize flooding, erosion, nutrient leaching and pollution in order to reduce the environmental impacts of these efforts. As with any landscape construction, subsurface drainage projects should also work to protect any existing natural features.

## Water Delivery

Water delivery is essential for establishing healthy plants. However, in an ideal landscape environment, irrigation is only a means to an end. An ultimate goal in designing and installing sustainable landscapes is self-regulation, or providing nutrient and water needs through natural cycles and processes.

While it may take years of supplemental amendments, fertility and irrigation to establish an autonomous landscape, it is important (and potentially necessary) to design and install systems that generate and conserve as much of their own nutrient and water needs as possible. Integrating intelligent and functional systems to create landscapes that can evolve on their own and that not only conserve resources but provide a variety of important eco-system functions, such as habitat, food, beauty, storm-water mitigation and soil stabilization is fundamental to organic, ecological and permaculture schools of design.

Conscious attention to building soil, selecting appropriate plants, constructing permeable surfaces and installing water collection features (i.e. catchments, rain gardens, swales, drains, etc.) will significantly reduce — if not eliminate — the need for irrigation over time. However, in less mature landscapes, it is important to provide irrigation to ensure plant health and survival.

The OLC Program requires water delivery in sufficient quantity as to prevent any damage to plants. Thus it is important to be sure, at any stage of a landscape's evolution, that plants receive sufficient, but not excessive water to sustain plant and landscape function. If sufficient water needs are not achievable through fundamental landscape practices such as soil conditioning, water collection and appropriate plant installation, then irrigation becomes necessary.

The delivery of water via irrigation is another important opportunity for conserving water. In general, most landscape plants prefer balanced and consistent periods of moisture combined with equal and alternating periods of dryness. Ideally, landscape soils will drain thoroughly before receiving water again. This drainage allows for sufficient air exchange to support the health of plant roots and soil microorganisms. Waterlogged soils do not contain enough air space or exchange and can also lead to nutrient pollution. Thus, it is important to create irrigation systems that provide focused and appropriate delivery of water.

### Technique and Timing

Because improper watering is often a cause of poor plant performance, it is important to briefly address a few important techniques for proper watering. As mentioned, most landscape plants prefer consistent periods of adequate moisture followed by short periods of dryness. A majority of landscape plants also benefit from deep and less frequent watering rather than shallow and more frequent watering. This strategy encourages deeper plant rooting that can access available subsurface water, resulting in more self-reliant plants.

Particularly among urban and suburban gardeners, it is common to water quickly and erratically, at different times of the day and for different durations. Most often, this style of watering does not allow sufficient soil drying between watering, nor does it provide the subsurface water necessary to encourage deeper root establishment. Additionally, excessive surface moisture can encourage the development of disease.

In general, early morning watering is advised. Morning watering allows unused water to evaporate from soil and plant surfaces over the course of the day, thus reducing leaf and soil-surface wetness. Watering at night may reduce evaporative water loss but leads to a longer period of surface wetness. Timed, consistent, early morning watering can improve plant health while allowing excess moisture to evaporate naturally.

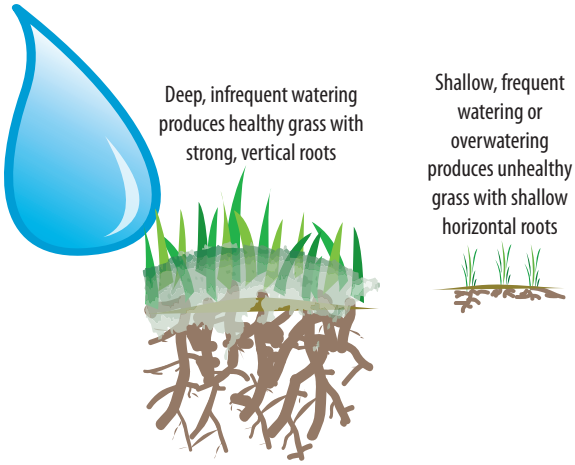



**Figure 13.** The difference between deep, infrequent watering and shallow, infrequent watering or overwatering creates a difference in the health of your lawn.

*Illustration courtesy of Creative Resource Strategies, LLC.*

## Over-watering

Over-watering is prohibited in the OLC Program. Over-watering is both a hindrance and a waste. It contributes to the over-consumption of a precious resource while often causing adverse landscape conditions. Over-watering often occurs when irrigation systems are improperly installed and maintained, or when land managers are inexperienced.

Signs of over-watering can include soil surface remaining constantly wet, excessive runoff, surface pooling of water and plants with leaf curl, stunted growth or disease.

To avoid over-watering:

- Perform a simple soil moisture test: dig 6" deep and if soil is dry, water. If soil is moist, don't water.
- Deactivate irrigation systems during times of significant precipitation.
- Install timed irrigation systems and customize watering schedule by zone, plant need and seasonal variations in precipitation.

## Zoned Irrigation Planning

Zoned irrigation systems conserve water by grouping landscape plants based on water requirements and water availability. Plants that are water loving are arranged together in one zone, while more drought-tolerant plants may be arranged in a separate zone. Each planting zone gets an appropriate irrigation set-up, based on the required quantity of water and delivery type preferred by plants. By controlling water volume and delivery type in this way, improved water conservation and plant performance is possible. Irrigation zones allow the client or landscape manager to distribute only enough water necessary to support healthy plant growth, rather than applying the same water volume to an entire landscape. Efficiency and ecological considerations in a managed landscape are at the heart of sustainable landscape design.

## Delivery Systems

Many different types of irrigation systems exist for the landscape professional. This section explores only the more popular systems and provides important considerations for selecting the type of delivery system best suited for a given project. When considering irrigation for a given site, it is essential to evaluate plant water requirements and soil conditions, specifically water drainage and retention. A project's budget will also guide the type of system selected. The most common types of landscape water delivery systems are: hand watering (with a hose or can); broadcast sprinklers; micro-sprinklers; and drip irrigation (including soaker hoses).

As the budget for a project permits, it is recommended that water delivery systems be constructed with materials of least embodied energy and purchased from local manufacturers or distributors. Installing irrigation timers, particularly digital multi-cycle types, is helpful in providing consistent water with little effort required by the property owner. Timed irrigation systems save allow clients or land managers to focus on other aspects of the landscape, such as soil building, plant health and personal enjoyment, while water is delivered deeply and consistently.

**HAND WATERING** provides low-tech and low-cost irrigation but is mainly reserved for small landscapes. However, if a property owner's time and dedication to watering are limited, this method will not provide the consistent deep watering necessary for optimal plant performance. While hand-watering is an age-old method and can inspire a closer relationship with the land, it is impractical for larger landscapes.

**BROADCAST SPRINKLERS** or overhead sprinklers are easy to install and maintain, provide broad coverage and are fairly inexpensive. However, they have the potential to waste water through evaporation and poor placement if not used properly. Overhead sprinkling wets plant foliage and can increase the potential for foliar diseases in susceptible plants. In landscapes with plants 3-4 feet or taller, overhead watering may not evenly deliver water to the soil and root zone because of the "irrigation shadow" caused by taller plants. For this reason, broadcast sprinklers are most commonly used for turf or large open areas planted with low-growing plants such as groundcovers, vegetables or small perennials and annuals. Because open areas with good air flow tend to dry more quickly, overhead sprinkling contributes to disease less in these applications.

**MICRO-SPRINKLERS** are a functional medium between broadcast delivery and drip irrigation. There are many types and brands of micro-sprinkler, but the basic design involves a small sprinkler head supported by a 6-24 inch riser of pipe, stake or tubing, connected to the main irrigation line. Micro-sprinklers deliver water in a horizontal, umbrella-like stream that can generally be custom fit for different delivery spectrums (i.e. 45 degrees, 90 degrees, 180 degrees, full circle, etc.) to best suit an area approximately 3-5 feet in circumference.

Micro-sprinklers provide better coverage for groundcovers, small lawns, shrubs, herbs, flowers and other bedding plants because they sit close to the ground and aren't blocked as easily as broadcast sprinklers. They also generally deliver higher volumes of water and are excellent for keeping soil evenly moist when germinating new seeds. Micro-sprinklers are also easy and inexpensive to install and maintain. Like any other overhead delivery system, micro-sprinklers can waste water when improperly designed and installed. When designed and placed well, micro-sprinkler systems provide efficient water delivery for irrigating new or established landscapes.

**DRIP IRRIGATION** can be one of the most efficient ways to irrigate a landscape. Drip irrigation systems typically include water emitters and low-volume sprayers, drip tape, soaker lines and other porous pipe systems. They can deliver consistent and precise amounts of water to specific areas at a low flow rate. The slow application rate prevents excess surface water build-up and reduces evaporation. The water application rate can be tailored to fit each individual plant. This is accomplished by the use of different quantities of emitters, and emitters with different discharge rates.

These systems are useful because they can place water where it is needed and in the correct amount that is necessary for optimum plant growth. The slow application rate means smaller quantities of water are used with the greatest efficiency. Drip irrigation can maintain near perfect moisture levels in the root zone of the plants, avoiding the too wet/too dry swings typical of overhead watering.

Drip irrigation is often easier to install in difficult locations (i.e. slopes), requiring less trenching than other systems. Another advantage to drip irrigation is that weed growth is reduced because areas between plants are not irrigated. Drip irrigation systems can be controlled manually or by the use of an automatic timer.

## The Do's and Don'ts of OLC Water Management and Conservation

- ✓ Conserve water through application of measures to increase natural deep rooting in landscape plants.
- ✓ Supply water in sufficient quantity to prevent damage to plants.
- ✓ Design landscapes for minimal irrigation requirements.
- ✗ Surface drainage into sensitive sites or onto neighboring property without permission.
- ✗ Over-water.
- ✗ Drain or fill wetland habitat without jurisdictional consent.

### RESOURCES:


East Multnomah County Soil and Water Conservation District *www.emswcd.org*

Lancaster, Brad. 2006. *Rainwater Harvesting for Dry Lands*, Chelsea Green Publishing *www.harvestingrainwater.com*

Malison, Bill. 1988. *PERMACULTURE: A Designers' Manual*, Tamari Press.

Drip works – Irrigation Consult and Supply *www.dripworksusa.com*

U.S. Environmental Protection Agency: Green Landscaping *http://www.epa.gov/greenacres*

The Irrigation Association *www.irrigation.org*

Portland Regional Water Consortium *www.waterweb.org*

Low Impact Development Center, Inc. *www.lowimpactdevelopment.org*

Sandrock Sustainable Landscapes for the Pacific Northwest *www.sandrockscapes.com*

# Air Quality Management

## Overview

Clean air, well circulated in the landscape, is essential to plant and ecosystem health. However, human activities can negatively impact the air quality around us. From local issues of particulate pollution caused by dust, pollen and field burning, to global issues of climate change and greenhouse gas emissions, air quality affects everyone.

It is widely accepted that the primary cause of air pollution is human activity. The actions of landscape professionals have potential to significantly impact local air quality. Air quality in managed landscapes is primarily an issue of design and maintenance; however it is also affected by the selection and placement of plants and hardscapes.

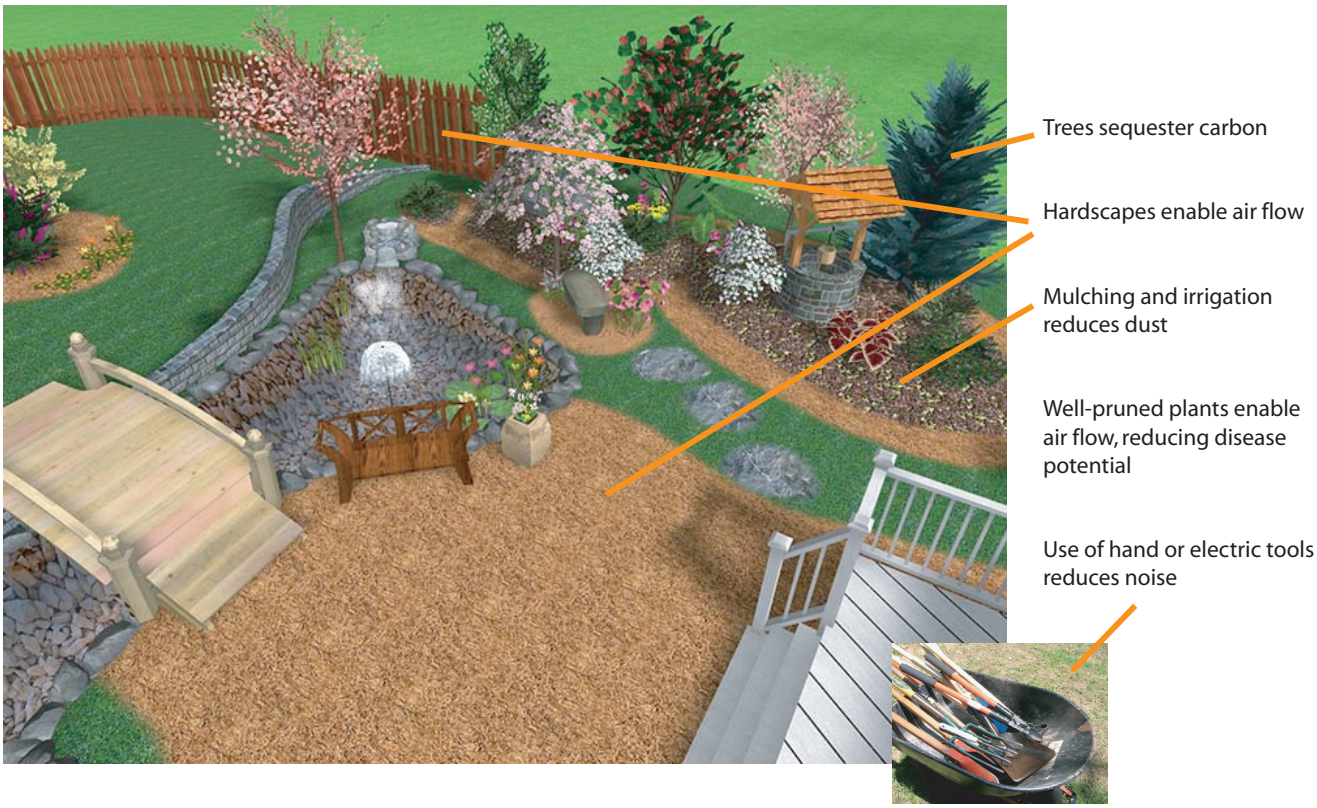



**Figure 14.** An organically managed landscape has trees that capture carbon, hardscapes that enable airflow, pervious surfaces, and well-pruned plants, and is maintained using hand or electric tools to minimize noise.

*Backyard landscape image courtesy of IdeaSpectrum.com.*

## Air Quality

For the OLC Practitioner, air quality management mainly consists of reducing airborne particulates (dust, dirt, smoke) that are released through landscaping practices, selecting appropriate plants, planting and carbon sequestration. Improving and maintaining good air quality is critical to sustaining landscape health and the health of landscape occupants, both human and non-human. Good air quality, in this context, means an environment which supports minimal-to-no airborne pollution and allows air to circulate freely.

# Pollution

## Noise

Noise pollution does not directly contribute to air quality, but is often a by-product of practices that contribute to poor air quality. In addition, noise pollution is a cause of stress and tension on a job site, not just for workers but for residents and neighbors as well. Blowers, mowers, chippers, chainsaws and tillers cause high-decibel noise. This noise, especially when frequent and persistent, easily becomes a disturbance to humans and wildlife, possibly to the point of displacement.

Oregon Tilth's Organic Land Care Program favors landscape practices that minimize noise pollution, using non-motorized tools whenever practical. It is important to design and construct landscapes whose maintenance requires little to no use of high-volume power equipment. The use of hand tools and labor can often replace power tools for small to medium-scale jobs. It may be necessary to educate the property owner about the social and environmental advantages of choosing people power over gas power, especially if costs are higher for manual labor. Electric tools can replace gas-powered tools to reduce noise pollution.

## Air

Air pollution is another problem often resulting from conventional landscape practices. Most commonly caused by excessive dust, smoke (from burning and power equipment) and pollen, air pollution can be detrimental to the health of people, particularly those suffering from asthma, allergies and other respiratory-related ailments. Burning as a means of disposing of waste material is prohibited in the Oregon Tilth Organic Land Care Program, except as a method of disease control.

**DUST** is primarily caused by activities that occur in landscape maintenance and installation.

These activities include:

- Cultivating soil when it is too dry
- Blowing and sweeping debris
- Cutting hardscape materials

Installing plants and constructing swales, ponds or hardscapes will significantly minimize dust. Alternatively, such activities can be scheduled for a time when the soil is moist (but not saturated). During particularly dry and dusty times of the year, it can also be helpful to apply a light layer of water to leaves, mulch, stone or graded slopes when raking or sweeping.

Landscapes should be designed to minimize exposed soil by increasing the total vegetation cover which reduces the need for cultivating and minimizes dust. This vegetation cover becomes "living mulch," offering many landscape benefits including weed suppression, moisture retention, soil-stabilization, habitat and dust reduction.

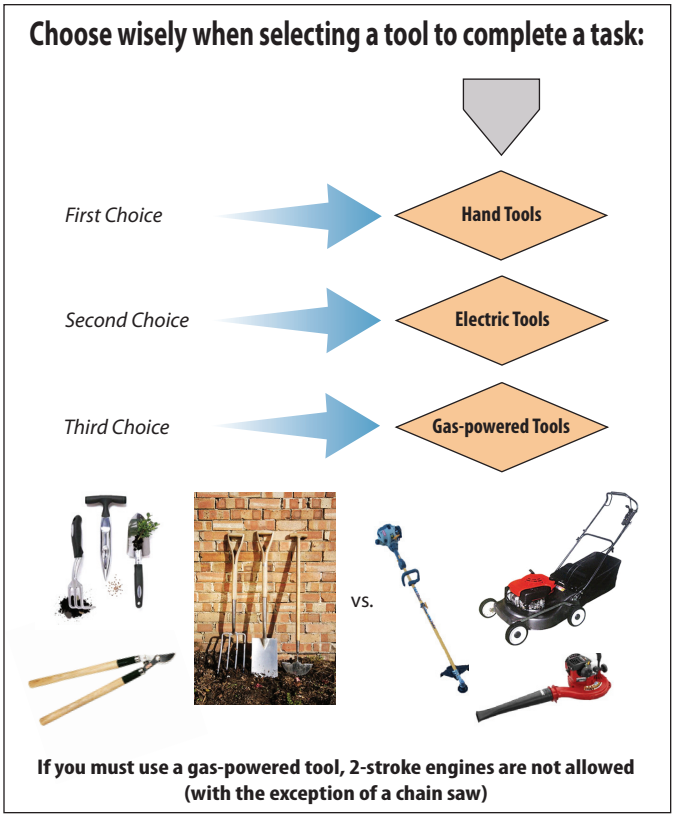



**Figure 15.** Flowchart depicting preferences for tools used in organic land care. *Illustration by Creative Resource Strategies, LLC.*

As previously mentioned, the design and construction of ecological low-maintenance landscapes will significantly reduce the need for power tools and equipment, and in turn reduce air pollution (smoke and emissions) and the consumption of non-renewable resources (fossil fuels). To this end, 2-cycle engine powered equipment is prohibited in Oregon Tilth's Organic Land Care Program (with exception to chainsaws).

## Carbon Cycle

The carbon cycle is a commonly neglected (and unseen) component of our biosphere. Plants of all kinds sequester carbon from the atmosphere and store it in their vascular tissues. In combination with the soil food web and the cycling of organic matter, our landscapes act as carbon banks for the local and global atmosphere. The amount of carbon stored depends on the plant variety, growth rate and age (maturity) of the ecosystem. The ancient forests of the world, for example, make up our greatest carbon banks and climate regulators.

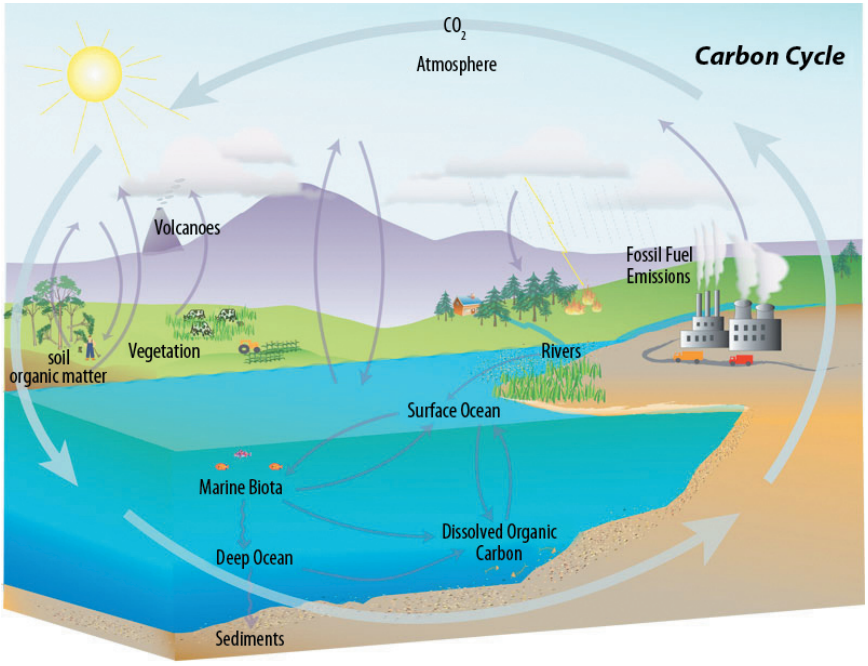



**Figure 16.** Designing and installing sustainable landscapes will help ensure the Earth's carbon cycle continues to function.

*Illustration courtesy of NASA.*

The carbon cycle is important to the OLC Practitioner for a few reasons. First, climate change is an issue that affects all life on earth, including our landscapes and environmental resources. If actions are not taken to reduce greenhouse gas emissions, deforestation, habitat (land) conversion and other human activities causing climate change, our plants, landscapes, air and water will be at further risk of decline and potential collapse.

Second, carbon plays an important role in the structure and function of soil organic matter. The organic matter in soil stores carbon, starches and sugars that become food for the soil food web. In this way, organic landscapes become carbon banks themselves, cycling and storing carbon in organic matter and soil microorganisms.

Making compost is another important human role in the carbon cycle. By recycling plant debris and turning it into usable soil organic matter, landscapers can create a valuable soil amendment while reducing greenhouse gas emissions associated with the manufacturing and transportation of off-site inputs. In addition, a significant amount of greenhouse gases are created in the manufacturing process of synthetic nitrogen fertilizer — contributing significantly to climate change.

"Closing the loop" (i.e. creating landscapes that generate and recycle natural materials on-site) saves time and money by minimizing costs associated with waste disposal and manufacturing, transportation and purchasing of soil amendments. Ultimately, designing and working toward closed-loop systems is essential for creating sustainable organic landscapes.

# Design

Designing landscapes for improved air quality and circulation, while reducing air borne pollutants (and environmental impacts) may significantly enhance the quality of life within a landscape for residents and wildlife. In many cases, air temperature can also be altered by the presence or absence of vegetation in the landscape. Designing for improved air quality involves the appropriate selection and placement of plants, hardscapes and buffers (i.e. fences or plant "screens"). Good air circulation is especially important for landscapes of the Pacific Northwest as high moisture levels and dense foliage favor plant diseases. Air quality can be improved through a combination of simple efforts involving thoughtful design, proper installation and spacing of landscape features and environmentally sound maintenance.

## Plant Selection and Placement

Proper plant spacing is a critical part of successful landscaping as it dictates many factors from canopy coverage, soil exposure, airflow and nutrient demand, to other important aspects such as access, view, cost and more.

Some plants are known to have bioremedient properties and can actually purify air on a very local scale. Some are known as preferred plants for coppicing and for building soil. These plant characteristics contribute to a well-functioning carbon cycle and long-term sustainability of a landscape, by generating valuable organic matter (for mulching and compost) and even purifying local air.

## Hardscape Construction and Placement

Hardscapes should be placed and installed in a way that minimizes negative impacts on soil condition and the soil food web. See the Landscape Installation – Hardscapes section for more details on proper installation of hardscapes. When installing hardscapes, it is important to take precautionary measures for minimizing dust. Lightly irrigating hardscape areas before and after work can help reduce air borne dust from becoming a problem. It is generally a good idea to water hardscapes at the end of the workday to encourage settling of soil and gravel. This action also helps reduce dust.

Hardscapes should be constructed to complement (rather than impede) natural air movement within the landscape. Walls, patios and stairs should be carefully placed as to not block or trap airflow. In particularly windy sites walls can block wind sectors or create "heat traps" or pockets of modified microclimate.

## Structures and Barriers

It is important to consider the impacts of existing and proposed structures on air quality and flow, working to improve circulation wherever possible. It can be beneficial to add a physical buffer (fence, hedge or trellis structure) for protecting a landscape from spray drift, dust, fumes and other airborne pollutants originating from neighboring properties, highways and streets. Beneficial hedgerows provide a host of benefits, offering valuable habitat, food, privacy and beauty, while increasing the ecological function of a landscape.

# Cultural Practices

Cultural practices in organic land care seek to mimic and support nature whenever possible. In the case of air management, cultural practices give preference to hand-labor (and hand-tools) while creating landscapes that regenerate and recycle organic matter and reduce maintenance needs, inputs and pollutants caused by unnecessary landscape practices.

## Pruning

Annual pruning and thinning of woody perennials is another cultural practice for improving airflow and circulation in the landscape. Pruning is a highly functional art and should be prioritized, particularly in smaller urban and suburban landscape areas. Proper seasonal pruning can improve airflow, sun exposure, flowering, fruiting, growth of groundcovers and herbaceous understory and aesthetics of a landscape. See Landscape Maintenance – Pruning Section for more detailed recommendations for proper pruning.

# The Do's and Don'ts of OLC Air Quality Management

✓ Allow for good air circulation.

✗ Burning as a method of disposal of materials except for disease control (always observe state and local restrictions).

✗ Use of two-cycle gasoline powered equipment, except for chainsaws.

## RESOURCES

Architecture 2030 – Architects + Designers taking a lead against global warming *www.architecture2030.org*

US Environmental Protection Agency Green Landscaping *http://epa.gov/greenacres*

# Part 3: Applications of Organic Land Care

# LANDSCAPE DESIGN

Organic land care design is the creative application of these principles to the landscape: employing ecological and sustainable methods to create landscapes that can be managed organically. This approach often results in low maintenance, naturally resilient landscapes that provide food, habitat and sanctuary for people and wildlife, and include locally grown native species and well-adapted plants when available. Attention to topography, water supply and demand, drainage and soil conditions, as well as appropriate plant selection, is essential for a successful organic land care design. When possible and appropriate, organic land care design requires the protection of biodiversity and natural ecosystems and encourages the creation and restoration of wildlife habitat.

## Introduction

A fundamental tenet of organic land care is designing for sustainability. An important initial step in designing for sustainability is performing a site analysis. Site analysis is the observation and examination of key site elements (soil, vegetation, water, structures, animals and people). How these elements interact and affect the relationship between living organisms is at the heart of organic landscape design.

By better understanding key site elements and the relationships within a landscape, OLC Practitioners can determine appropriate uses for the land including plant selection and placement, hardscape construction and placement and potential for site modifications to enhance or establish new landscape relationships.

The OLC Practitioner should always seek to balance the client's desires with a design that incorporates principles of sustainability. It is useful to keep in mind IFOAM's "Principles of Organic Agriculture" supporting the health, ecology, equity and care of people, plants, animals and the land. The underlying goal is to apply these principles in an effort to meet or exceed the standards set forth by the OLC Program.

# Requirements and Recordkeeping

It is required that OLC Practitioners understand and follow any appropriate land-use ordinances and license requirements for design, construction and installation. Check with local municipal land-use and planning agencies for current requirements.

Organic seed and organic planting stock must be specified in all organic land care designs. If organic planting stock or seeds are not available, installers may use conventional products not treated with prohibited materials. Strong plant genetics, like good soil, are a fundamental piece of a healthy sustainable ecosystem. Organic seed and organic planting stock generally respond more favorably to landscapes under organic management because they have been bred and grown using organic methods. Often, conventionally grown seeds and planting stock develop dependencies on synthetic chemical fertilizers and pesticides for survival. When these seeds and plants are transplanted to organic landscapes, they sometimes experience symptoms of shock or "withdrawal" from such chemical inputs. Such shock can lead to plant weakness or loss. The Organic Land Care Program requires the use of organic seed and organic planting stock. This requirement also serves to encourage seed producers and nursery managers to use organic and ecological methods.

### Graphic Site Plan

The graphic site plan will include a detailed description of site elements (structures, vegetation, soil types, hardscapes, pathways, buildings, roads, design features, etc.) as well as provide a clear and practical format for keeping landscape records.

### Recycling

Recycling is another element of sustainability in organic land care. The green maxim "Reduce, Reuse, Recycle" is an appropriate aspiration for the OLC Practitioner.

Efficient water use and reduction of processed fertilizer inputs are important aspects of organic land care. Recycling of waste materials such as wood, trimmings, soil, plastics, fabric, etc. is encouraged for organically managed sites. In recent years, municipalities and private waste disposal companies across the Pacific Northwest have significantly improved their recycling efforts and generally offer recycling services for a large variety of materials. Consider which materials at the site might be useful and incorporate them into the design. Biodegradable waste can be "recycled" through on-site composting or mulching. This is an important way of transforming a "waste product" into food for the organic landscape.

## Site Analysis

Understanding the details and activities at a site is important in determining the most appropriate landscape practices for a site. Site analysis is the observation and examination of key site elements: soil, vegetation, water, structures, animals and people. Site analysis is a critical process for better understanding the ecology, health and needs of a landscape. Through observation and documentation of key factors such as microclimates, sunlight availability, shade, soil, wind and air circulation, temperature, vegetation, moisture, client involvement and desires, budget, access and wildlife/natural areas, landscapes can be designed and constructed with uniqueness and sustainability in mind.

### Soil

Because soil is the foundation of healthy and productive landscapes, it is important to be very familiar with the condition of a site's soil, including the texture, nutrient availability, pH, soil organic matter content, and drainage class. This can be done through a variety of simple, low-tech and inexpensive quantitative and qualitative tests.

See the Soil Management section at the beginning of this guide for more detailed information regarding soil management and types of testing.

An understanding of the site's soil conditions is essential when selecting appropriate plant species, determining irrigation needs and assessing suitability for rain gardens or hardscapes. If food crops are grown it is essential to identify areas of adequate drainage, maximum sun exposure and available soil nutrients.

### Vegetation

Existing vegetation can provide additional information about the soil environment, moisture, shading and other environmental conditions of a site. Many plants will grow only where certain soil nutrients and moisture levels are present. These plants can provide initial indication of nutrient presence and whether a soil is dry or wet.

It is also important to get a sense of the overall maturity of the landscape vegetation, and whether plants have reached their maximum size or need additional room to grow. This is critical to determining the total number of plants a landscape can sustainably support.

### Topography

Observing, identifying and basic mapping of the topography of a landscape including areas already under construction is important for determining a course of action for any required earthwork or site modifications for improved drainage, irrigation, bioswales, hardscapes or rain gardens. Topographical maps can be obtained through your local U.S. Geological Survey office and can help in finding the contours of a site. Regrading can often have negative consequences and should be considered carefully in the design phase.

### Natural Areas

A priority of organic land care is the preservation of existing and sensitive ecosystems. It is preferred that native ecosystems are left intact, protected, restored or created to enhance the ecological function of a site. "Design by exclusion" is a method often employed in sustainable landscape design where natural areas are "excluded" or left untouched, allowing natural ecosystems to restore and evolve.

## Designing for Sustainability

### Soil

Organic land care prefers that soil tests be specified at the design phase for any new plantings. This informs the plant selection process so the most appropriate plant species can be matched with the soil conditions of a specific area to be planted. It is important to follow the instructions outlined in previous sections of this guide for improving and building soil quality, condition and drainage.

### Plantings

Natural ecosystems generally contain a diverse mix of perennial and annual plants. More mature landscapes tend to have a higher percentage of perennial plants. Perennials require less maintenance and, due to larger and more established root systems, can more easily acquire their own moisture and nutrients. Thus, to develop a low-maintenance managed landscaped, the designer may wish to specify perennial plantings whenever possible. While annual plants provide many important functions in the organic landscape, they generally require more maintenance while their cultivation more frequently disturbs the soil. The OLC Practitioner strives to conserve natural resources and foster the ecological functions of a site.

| LOW MAINTENANCE PLANTS | HIGH MAINTENANCE PLANTS |
|---|---|
| **Groundcovers** | **Groundcovers** |
| Wood strawberry (Fragaria vesca) | Bluegrass (Poa pratensis) |
| Sword fern (Polystichum munitum) | Buffalograss (Bouteloua) |
| Prostrate ceanothus (Ceanothus prostratus) | Carpetgrass (Axonopus) |
| Creeping juniper (Juniperus horizontalis) | Elk clover (Aralia) |
| Kinnikinnick (Arctostaphylos uva-ursi) | Goat's beard (Tragopogon) |
| **Perennials** | **Perennials** |
| Yarrow (Achillea) | Hybrid tea roses (Rosa) |
| Black-eyed Susan (Rudbeckia hirta) | Hydrangea (Hydrangea) |
| Douglas aster (Symphyotrichum subspicatum var. subspicatum) | Sedges (Carex) |
| Bishop's hat (Epimedium x rubrum) | Rushes (Cyperus) |
| Canada goldenrod (Solidago canadensis) | Camas (Camassia) |
| **Shrubs** | **Shrubs** |
| Tall Oregon grape (Mahonia aquifolium) | Salal (Gaultheria) |
| Red elderberry (Sambucus racemosa) | Salal (Gaultheria) |
| Mountain mahogany (Cercocarpus) | Winterberry (Euonymous) |
| Red-flowering currant (Ribes sanguineum) | Creek dogwood (Cornus sericia) |
| **Trees** | **Trees** |
| Giant sequoia (Sequoiadendron giganteum) | Fruit trees (Pyrus, Prunus) |
| Oregon white oak (Quercus garryana) | Oregon ash (Fraxinus) |

**Table 6.** Low maintenance plants require less water, pruning, fertilization, and other practices than high maintenance plants.

It is required that landscape designs specify organically-grown planting stock. Plants grown using organic methods are more acclimated to organic conditions and will perform better under organic management. Locally grown plants may be more acclimated to local environmental conditions such as precipitation, soil type and quality and climate, requiring less input and maintenance to flourish. Local plants also require less embodied energy due to reduced shipping impact.

The selection of pest-resistant and site appropriate plants is preferred in organic land care. Often new varieties are available in disease resistant form. Selecting such varieties can reduce the need for pest management inputs and improve the overall performance of the landscape.

Choosing well-bred varieties, combined with soil quality improvement and functional designs, allows the landscape professional to create landscapes that support sustainability and resilience. Self-reliant landscapes not only conserve resources but significantly reduce maintenance requirements.

## Hardscapes

When designing hardscapes for organic land care, it is important to site them in a way that least interferes with natural habitat, water flow and infiltration.

Well-placed hardscapes can enhance the ecological function of a landscape. The thermal mass of a hardscape constructed in full to partial sun creates a heat pocket, or a microclimate of warmer air that can help non-hardy and tender plants survive. Hardscapes can also be designed to collect and carry water to planted areas for irrigation. It is best to site hardscapes where minimal grading is required and where greatest environmental benefits, both aesthetic and functional, can be achieved. Less grading means reduced soil disturbance and erosion, and requires less imported soil or amendments for leveling.

When possible, hardscapes should be constructed with a certain degree of permeability and designed to allow sufficient drainage and maximum water infiltration. Selecting alternatives to pavement such as wood chips, gravel, or crushed hazelnut shells improves the hardscape's environmental impact. Bricks and pavers can also allow sufficient drainage when installed with drainage in mind. When specifying any impervious surfaces, be sure to check with local ordinances regarding storm-water mitigation rules and recommendations.

A contributing factor to the sustainability of a landscape is the total environmental cost and ecological impact of materials required for the project. Organic land care prefers specifying materials for hardscape construction that are locally manufactured, salvaged or derived from recycled or natural materials. As recycling has become more commonplace, it is easier to source recycled materials for landscape projects.

Any opportunity to incorporate on-site materials (branches for fencing, existing stones for walls and paths, trimmings for mulch and path chips, etc.) into the landscape project can reduce financial and environmental costs.

For the sake of forest conservation and restoration, it is preferred to reuse wood products whenever possible. When purchasing, ask retailers if wood products are made with recycled materials, salvaged or Forest Stewardship Council (FSC) certified. Some clients may be interested in supporting the use of recycled materials and be willing to pay the extra cost to locate and purchase them. More and more, with the spread of sustainable forestry and forest products, inspired greatly by the FSC "Smart Wood" program and other conservation forestry groups, it is possible to find sustainably produced wood products.

**Figures 17.** Woven fences are structurally sound and use natural materials, reducing our footprint.

*Photo courtesy of Ecoferme.*

## Irrigation

Any person designing irrigation systems for hire should either have a Certificate of Irrigation Design, a degree in Landscape Architecture, should be working with contractors or staff with such credentials, or have suitable certification from the Professional Landcare Network.

Back flow devices are required on exterior plumbing in many areas to prevent contamination of potable water supplies. Be sure to check with state and local regulatory agencies when specifying exterior water features/plumbing. Any fixtures to reduce pressure should be installed downstream of the backflow, while emergency water shut off valves should be installed above the backflow. All valves should be approved by the American Society of Safety Engineers (ASSE) or the International Association of Plumbing and Mechanical Officials (IAPMO).

Thoughtful irrigation design is a cornerstone of the sustainable organic landscape. Designing and installing irrigation systems that conserve and deliver water most efficiently improve the health and performance of a landscape while minimizing its environmental footprint. Programmable (timed) systems are recommended to save time and water.

The water needs of a landscape are dynamic and cannot be satisfied by a constant "one-volume-fits-all" delivery approach. Programmable systems allow managers and clients to adjust irrigation accordingly, depending on a host of factors including: rain, wind, heat, and soil moisture levels. Seasonal adjustments to the timer should be made regularly. It is preferred that systems with built-in environmental sensors be used to allow automatic shut-off during periods of rain.

Irrigation designs should specify locally manufactured and distributed materials when available and work with existing site conditions to deliver water appropriately and efficiently. Appropriate watering means delivering sufficient volume when natural precipitation and soil moisture are insufficient to support plant health. Irrigation systems should always be designed in concert with the natural precipitation, drainage and flow of a site while also taking into account slope, soil quality, vegetation type and percent cover.

Systems should be designed to deliver water only as fast and in such a quantity as can be absorbed by plants and the soil. Watering beyond the point of absorption leads to water waste, pooling and runoff. Runoff carries a host of environmental ramifications including erosion, local flooding and the transport of pollutants.

As fresh water resources become increasingly scarce worldwide, it is important to practice designing and installing landscapes that require little or no irrigation. Using drought tolerant, low-maintenance and native plant species while working to improve soil conditions and minimize impermeable surfaces for increased infiltration, can significantly reduce the irrigation requirements of a landscape. Combining practices such as xeriscaping, earthwork and mulching with appropriate plant selection and placement will improve water conservation.

Once appropriate plants are selected, it is important to arrange them in the landscape according to water need. This placement allows for improved management, diversion and conservation of irrigation water. Zoned systems can better maintain desired soil moisture levels in each zone by customizing water volume for specific plant groups. This subtle design specification contributes significantly to the health and performance of a landscape by giving plants the frequency and quantity of irrigation they need for best growth. In the process, water is conserved throughout zones where less irrigation is needed. As a landscape matures, water needs should lessen and the irrigation system adjusted accordingly. Considering these changes over time is often referred to as "designing for growth."

## Low Maintenance

Designing landscapes that are low-maintenance is fundamental to the OLC Program. Low maintenance landscapes consume fewer resources — time, fossil fuel, inputs and money — than conventional landscapes. As a result, designing and installing low-maintenance landscapes contributes significantly to resource conservation and sustainability, both locally and globally.

Designing a low-maintenance landscape involves the selection of plants best suited for a site. Consider appropriate plant size, maintenance needs (pruning, fertility, pest control and irrigation) and other conditions such as sun exposure and soil type. The low maintenance design must specify the best soil amendments for each particular site. Improving soil quality reduces plant maintenance as healthy, well-structured soil requires less frequent irrigation, fertilizing and amendment.

Often, landscape clients will need to be reminded that a "low" maintenance landscape is not a "no" maintenance landscape. With time, low maintenance landscapes will evolve toward self-regulation ecological, beautiful, functional and productive.

## The components of a low-maintenance landscape:

- Select plants suitable for your soil type
- Reduce the amount of turf and replace with locally adapted trees, shrubs, rock gardens and drought-tolerant plants
- In areas where you have lawns, use appropriate irrigation techniques that save water and create a healthy lawn
- Use local sources for biological pest controls, plants, and hardscape materials
- Plant perennials instead of annuals
- Use zoned irrigation and collect rainwater in barrels and cisterns
- Build and maintain a healthy soil
- Compost and recycle
- Mulch with organic materials, such as tree bark and hazelnut shells
- Prune trees and shrubs
- Be aggressive about watching for and removing invasive plants
- Use environmentally-friendly methods of controlling weeds such as hand pulling, mulching, and preventing seed heads from developing
- Design your landscape intelligently and creatively to use least-impact practices

**Table 7.**

## Bugscaping

Organic land care encourages the preservation and conservation of native habitat whenever possible. In addition, landscapes can be designed and modified to improve or increase habitat on a site. Conservation-based "naturescaping" of this kind has become more common as landscape professionals combine principles of ecological restoration, permaculture, organic gardening and wildlife conservation to design and create landscapes that support human *and* non-human needs.

Bugscaping describes landscape practices that encourage and create habitat for beneficial insects. Bugscaping combines the conservation and creation of insect habitat to encourage predatory and parasitic beneficial insects that aid in pest control.

Common practices include forming appropriate-sized debris piles as habitat, leaving wild and uncultivated areas for ground nesters, and hosting or installing a selection of plants known to attract beneficial insects.

| BEE-FRIENDLY PLANTS | |
|---|---|
| Choosing the right flowers that attract bees and pollinators includes providing a range of plants that offer pollen and nectar throughout the growing season. Some general guidelines include:<br>• Use local native plants<br>• Choose several colors of flowers and flowers with different shapes<br>• Plant flowers in clumps | |
| **NATIVE PLANTS** | |
| Aster (Aster) | Pacific waterleaf (Hydrophyllum) |
| California poppy (Eschscholzia) | Penstemon (Penstemon) |
| Currant (Ribes) | Rabbitbrush (Chrysothamnus) |
| Elder (Sambucus) | Rhododendron (Rhododendron) |
| Fireweed (Chamerion) | Saskatoon (Amalanchier) |
| Goldenrod (Solidago) | Scorpion-weed (Phacelia) |
| Huckleberry (Vaccinium) | Snowberry (Symphoricarpos) |
| Larkspur (Delphinium) | Stonecrop (Sedum) |
| Lupine (Lupinus) | Sunflower (Helianthus) |
| Madrone (Arbutus) | Wild buckwheat (Eriogonum) |
| Mint (Mentha) | Willow (Salix) |
| Oregon grape (Mahonia) | Yarrow (Achillea) |
| **GARDEN PLANTS** | |
| Basil (Ocimum) | Hyssop (Hyssopus) |
| Borage (Borago) | Marjoram (Origanum) |
| Cotoneaster (Cotoneaster) | Mexican sunflower (Tithonia) |
| English lavender (Lavandula) | Rosemary (Rosmarinus) |
| Globe thistle (Echinops) | Wallflower (Erysimum) |

**Table 8.** A list of plants that attract beneficial insects.

**Figure 18.** Perennial gardens require less maintenance than gardens comprised mostly of annual plants. Consider plants that attract beneficial insects to further reduce maintenance.

*Photo courtesy of Eugene PRWeb.*

Specifying "blooming plant" habitat areas in the total landscape design is critical for supporting many vital ecological functions, including plant pollination and pest regulation by beneficial insects. Bugscaping and enhancing site ecology is one of the OLC Practitioner's best natural defenses against pest damage. As it requires selecting plants for extended bloom over many months, bugscaping also involves a host of aesthetic benefits as well.

See Resources for more information on bugscaping.

## Buffers

Organic land care favors that landscape designs specify buffers to protect organic landscapes from adjacent potential sources of contamination such as from non-organically managed landscapes. These buffers may include shrubs, trees, hedgerows, fencing or hardscapes. Buffers not only provide protection from contamination, but also can provide privacy screening, shade, soil building and wildlife habitat.

## Rain Gardens

Rain gardens are an important part of sustainable landscape design because they provide for water conservation, storm water mitigation, wildlife habitat and food. Rain gardens provide a beautiful and functional complement to landscapes where significant rain events are possible.

When designing a rain garden, do not site over a septic system, water supply or well. Also, avoid placement in a low landscape area where the soil is always wet or pooling. Perform a simple percolation test by digging a hole 2' deep and filling it with water. If there is still water in the hole after 24 hours, the site is not suited for a rain garden. Rain gardens are easiest to construct and maintain in flat or slightly sloped areas.

To maximize roof water collection, calculate the appropriate rain garden size by measuring the footprint of the house, calculating how much of this area will flow through a downspout into the rain garden, then dividing this area by six. This will determine the total size for a rain garden that holds one inch of roof runoff in a garden 6 inches deep.

# The Do's and Don'ts of OLC Landscape Design Practices

- ✓ Follow all applicable ordinances with respect to environmental, including licensing requirements for design personnel.
- ✓ Specify organic seeds or planting stock.
- ✓ Create a graphic site plan for reference and record keeping.
- ✗ Specify invasive plants.
- ✗ Use non-organic seeds or plants where organic options are available.

## RESOURCES

Assoc. of Professional Landscape Designers *www.apld.com*

American Society of Landscape Architects *www.asla.org*

Site Analysis - Questions You Should Ask. Landscape & Garden Design Tips - Design Basics *www.landscapeusa.com/tips/design8.htm*

Oregon Landscape Contractor's Association *www.oregonlandscape.org*

Oregon DEQ, Northwest Region *www.deq.state.or.us*

National Wildlife Federation Habitat Landscaping *www.nwf.org/backyardwildlifehabitat*

Audubon Society *www.paws.org/work/wildlife/naturescaping.html*

Oregon Native Plant Society *www.npsoregon.org*

Professional Landcare Network *www.landcarenetwork.org*

The Irrigation Association *www.irrigation.org*

International Federation of Organic Agriculture Movement *www.ifoam.org/about_ifoam/principles*

# LANDSCAPE INSTALLATION

## Introduction

Employing low-impact installation practices is important for ensuring healthy plant growth while minimizing environmental impacts in landscape construction. Organic land care encourages an environmentally sensitive approach to installing new landscapes. It is required that OLC Practitioners understand and follow any appropriate land-use ordinances and license requirements for design, construction and installation. Check with local municipal land-use and planning agencies for current requirements.

Be sure to protect and store input materials (amendments, plants, fertilizers, hardscape, etc.) and protect existing soils so that erosion and pollution from runoff is avoided. Use planting practices that involve mulching and encourage fast plant establishment in order to minimize exposed soil and thereby prevent soil compaction and erosion. Cover and protect soil or input materials from the elements by using tarps and ground cloth. Always minimize grading and, when necessary, protect graded areas with fabric, tarps or other functional coverage to avoid erosion and runoff.

When working to landscape design specifications, installers shall ensure that all Organic Land Care Program policies and standards are met. It is also incumbent on the installer to communicate with the designer when site conditions make design specifications impossible or impractical.

# Preparation and Planting

## Graphic Site Plan

Oregon Tilth's Organic Land Care Program requires that all landscape practitioners develop a Graphic Site Plan for reference and record keeping. This plan is particularly important for tracking input applications across different landscape areas over time. A Graphic Site Plan can also be very helpful for comparing plant health and landscape performance over time in relation to applied practices, treatments and input application rates.

The contents of the Graphic Site Plan include:

- Soil types, texture and condition
- Existing vegetation
- Design specified vegetation (to be planted)
- Grade
- Irrigation
- Drainage
- Existing buildings, hardscapes and other structures
- Buffers

## Soil

"An ounce of prevention is worth a pound of cure." – Ben Franklin

During all phases of landscape installation and construction, it is important to follow the recommended practices outlined in the Soil Management section. Proper attention to soil quality, amendments and conditioning at the planting phase will have many plant performance rewards and cost savings benefits down the road.

It is more ecologically sound, economically viable and preferred in organic land care to improve existing site soil rather than import top soil.

It is very important to construct and install landscapes when the soil is neither too wet nor too dry. When conditions are too dry, soil is vulnerable to erosion from cultivation, wind and flash flooding. During summer months, superficial dryness can be relieved with light irrigation but soils that are too wet are best left to dry before any serious landscape construction or planting occurs. Thus, in the Pacific Northwest, fall is the preferred time to perform most landscape installations. When timing is right (i.e. after a 2-3 day window of warm sun), spring can also be a good time for planting, enabling plants to get good root establishment before the dry heat of summer.

On the other hand, when soil is too wet, it is prone to compaction and soil aggregates are more easily damaged. Organic land care requires that practitioners minimize soil compaction, or at least confine activities that may compact soils to areas where plants will not be harmed. Compacted soils are of significant concern because they do not provide adequate air space for healthy root growth or soil microorganisms. Soil compaction is caused mainly by the use of heavy machinery and vehicles, storage of landscape materials (rock, gravel, soil, lumber, etc.) and improper mechanical tillage, particularly when soils are wet.

Winter rainfall on heavy clay soils of the Pacific Northwest contributes significantly to compaction of the soil surface. Protecting (covering) soils through cover crops, row covers, mulch and plastic becomes equally important to preventing compaction as a result of installation activities.

## Integrating Nursery Soil with Landscape Soil

The success of new plantings often depends upon how quickly and easily plants become established. Nursery plants are grown primarily in potting mixes with little to no native soil content. Landscape soils can have complex layers that may vary significantly in structure and quality. Organic land care requires that, when planting, soil be integrated to encourage rapid plant establishment. This integration helps nursery stock more readily acclimate to native soil conditions.

## Soil Improvement

The landscape installation phase is an excellent time for improving and amending soil. Because a perennial is planted once, unlike annuals, the initial installation provides an essential opportunity for preparing soil well through fertilizing and amending in accordance with soil test results. Such proactive soil building will greatly enhance the long-term health and success of landscape plantings.

# Planting

## Plant Stock

Equally important to building soil quality, selecting quality, pest-free plant stock is critical to the success and sustainability of the organic landscape. Indicators of stock quality and suitability include (but are not limited to):

- **Organic** – organically grown plants adapt better to sites already using organic methods and are required by the Organic Land Care Program when commercially available.
- **Local** – generally, plants grown locally are better adapted to local climatic conditions.
- **Site Appropriate** – plants should have cultural requirements that match the conditions of the site. For example, select drought tolerant plants for dry sites, and shade-loving plants for shady sites.
- **Disease Resistant** – for improved natural pest resistance and lower maintenance requirements.
- **Overall Health** – be sure to assess stock for signs of decay, disease or pest infestation. Note signs of past pest damage, as pests may still be present, but hidden (i.e. eggs inserted into stem or leaf tissue). Also, plants should not show evidence of nutritional or environmental stress.
- **Root Health** – check root ball for tangled, dead, disfigured, bound or other root abnormalities.

## Good Planting Technique

Recommended planting practices include removing any highly invasive weeds or plants competing for moisture and nutrients, digging deep and wide enough to provide ample rooting space for new plants, incorporating soil amendments and fertilizers, and mulching for weed suppression and moisture retention.

When preparing a site for planting, it is preferred that unwanted vegetation be removed by mechanical means, or solarized using clear plastic mulch, instead of with organic herbicides. NOP approved herbicides, while appropriate for use when necessary, can still have undesired effects on surrounding plant and soil communities when used excessively.

When preparing the soil for planting, dig a hole approximately twice the width of the root ball or plant container. The depth of the hole should be slightly shallower than the root ball, so the plant sits about 2-4" above the soil surface. This prevents water from pooling around the plant's trunk (which often encourages disease) and instead helps water infiltrate toward the root zone. Once the plant is in place, it can be topdressed with a 2-4" layer of mulch.

Generally, it is recommended that planting holes be backfilled with the same native soil removed from the hole mixed with a soil amendment, except for trees which do best in native soil conditions with little to no amending. However, if a soil is compacted, it can be beneficial to condition the soil with finished compost. For bedding annuals, herbs and vegetables it is best to amend the planting soil with compost and a NOP approved fertilizer (based on soil test results). For all other perennials, topdress with approximately 1-2" of compost and an appropriate application of fertilizer based on soil test results.

Once planting is complete, create a small soil dam around the plant root zone to encourage water infiltration, and soak the root area until pooling begins. When pooled water has completely soaked in, topdress with a final layer of mulch.

## Good Planting Techniques

- Remove invasive weeds or plants that may compete for moisture and nutrients using mechanical methods or clear non-PVC plastic mulch instead of herbicides
- Dig deep enough and wide enough to provide ample rooting space
  - Width should be 2x the width of the root ball or plant container; if soil is compacted, dig a hole 3-5x wider for adequate rooting space
  - Depth should be slightly shallower than the root ball so that the plant sits about 2-4 inches above soil surface
- Add soil amendments and fertilizers. Note: It is not recommended to add amendments for trees that need to survive and thrive in existing soil, however amendments and fertilizers are suitable for perennials/annuals with limited root zones
- Create a small soil dam around the plant root zone to encourage water infiltration
- Soak the root area until pooling of water appears
- Add 2-3 inches of mulch for weed suppression and moisture retention

**Table 9.** Good planting techniques include removing competing plants, proper digging, appropriate soil amendments and fertilizers, ample watering, and mulching.

# Rain Gardens

When installing a rain garden, choose a level or slightly sloped area. Dig out a bowl 6" deep to fit the appropriate size and location. If the yard is sloped, a small berm may need to be constructed on the downslope side to prevent erosion. Be sure the bottom of the garden is level for maximum water storage. Create gradual slopes on the edges of the rain garden — not too steep as they can more easily erode.

Use native and well adapted species that can tolerate both wet and dry conditions. The high areas dry out more quickly than the low areas. After planting, install a vegetative groundcover or use hardwood mulch to reduce weeds and conserve moisture.

# Hardscapes

The installation of hardscapes can be very taxing on the environmental conditions of a site, the landscape practitioner and the greater environment. When constructing hardscapes, the OLC Practitioner needs to consider a few important questions:

**Are the building materials considered environmentally appropriate and of lowest embodied energy?**

Embodied energy refers to the total energy used in the manufacturing, distribution, transportation and disposal of any material. To support and promote materials that are most environmentally benign, it is preferred that OLC Practitioners choose materials according to least embodied energy. Environmentally appropriate indicators include materials that are free of chemical treatments, locally manufactured, made with recycled materials, long-lasting, reusable and recyclable.

**Are waste products being disposed of properly?**

The Organic Land Care Program strictly prohibits any pouring of concrete wastes or washout into undeveloped property, waterways or drains. If using concrete, it is necessary to dispose of excess concrete or concrete wash properly, either by spreading on surfaces or containing where they can dry and be dug up to be reused as backfill rubble or recycled at a local construction waste recycling center.

**Are there any hardscape materials that are prohibited in the Organic Land Care Program?**
Yes. PVC-based weed barriers are prohibited, as well as wood products treated with any synthetic chemicals prohibited for use in organic agriculture. In recent times, many manufacturers are researching and developing products with lower toxicity.

# The Do's and Don'ts of OLC Landscape Installation

✓ Use organically grown seeds, seedlings and planting stock, with the following exceptions:

- Non-organically produced, untreated seeds and planting stock may be used when an equivalent organically produced variety is not commercially available – the practitioner must document three attempts to locate organic seeds or planting stock before using non-organic materials.
- Seeds, annual seedlings and planting stock treated with prohibited substances may be used in an organic application when required by Federal or State phytosanitary regulations.

✓ Integrate soil levels to avoid layering when preparing soils for planting.

✓ Perform a soil chemistry test with recommendations before application of processed fertilizer.

✓ When it is necessary to source compost off-site, it is preferred that the OLC practitioner use qualified compost when it is available.

✓ Create a Graphic Site Plan as a reference and basis for record keeping.

✓ Create adequate rooting space for trees and other perennial landscape plants.

✓ Limit activities leading to soil compaction or confining the activities to areas that will not injure plants.

✓ Recycle waste materials.

✗ Use of polyvinyl chloride (PVC) based weed barriers.

✗ Use of treated wood.

✗ Pour concrete wastes or washout onto undeveloped property or into waterways or grates in the street.

✗ Installation of plants considered to be invasive by the local soil and water conservation district.

## RESOURCES

Utility Notification Center (Portland Area) 503-246-6699

SoilTrader *www.cleanrivers-pdx.org/soiltrader*

City of Portland Office of Planning and Development Review 503-823-7300

International Erosion Control Association (IECA) *www.ieca.org*

Soil and Water Conservation Districts (Soils) *http://usda.gov/soil_survey/pub_sur/or.htm*

Oregon Department of Agriculture: 1-866-INVADER
*http://oda.state.or.us/plant/weed_control/index.html*

Pacific Northwest Exotic Pest Plant Council *www.wnps.org/eppclist.html*

The Nature Conservancy *http://tncweeds.ucdavis.edu/esadocs.html*

METRO Natural Gardening Program 503-234-3000

City of Portland Naturescaping for Clean Rivers
*www.cleanrivers-pdx.org/get_involved/naturescaping.htm*

Oregon State University Cooperative Extension Agency *http://eesc.orst.edu.htm*

Hardy Plant Society of Oregon *www.hardyplant.com*

# LANDSCAPE MAINTENANCE

## Introduction

Organic land care maintenance requires the OLC Practitioner to employ environmentally sound practices while attaining the client's landscaping goals. The challenge of improving the environment through the contributions of the individual landscape while satisfying individual client desires on specific properties can be daunting.


**Figure 19.** Maintaining your landscape includes a variety of activities, from identifying the sources of your seed and plants to controlling pests and invasive plants.

The OLC Practitioner needs to exercise creative problem-solving while carefully sensing the landscape environment potential for sites. The *Oregon Tilth Organic Land Care Policies and Standards* provide guidance, within the framework of organic farming and gardening principles. Within this document are sections that seek to encourage and enhance natural biological controls for likely landscape pest problems. Use of locally derived, renewable resources is encouraged. When local products and site-generated compost are significant landscape inputs, the landscape practitioner clearly demonstrates progress toward creating a closed loop ecosystem within a landscape site. Is the landscape constantly requiring external inputs? Are plants suited to the site? Is soil quality improving over time? Is water quality enhanced by the landscape management practice? Is the landscape a safe and healthy place for living organisms?

The OLC Practitioner oversees the landscape's maintenance with a primary focus on the health of the plants and the satisfaction of the landscape users. Attention to pests and how to best deal with them encompasses an Integrated Pest Management (IPM) program, a required record keeping component of Oregon Tilth's Organic Land Care Program. Ongoing maintenance practices for the OLC Practitioner need to address 1) soil building, 2) sources for seeds, transplants, and other plant material, 3) watering practices and sources, 4) mulching practices and materials, 5) pruning, 6) plant replacement and garden redesign, 7) strategies for removal of invasive plants, 8) recycling organic debris, 9) lawn care tactics, 10) weed management, and 11) other pest control considerations. In material selection alone, considerations about what materials to use, where they come from, and at what environmental costs need to be addressed by the OLC Practitioner. Many of these same areas are addressed in the Landscape Design sections earlier in this document and should be reviewed.

All accredited OLC Practitioners are responsible for site log entries of external inputs and Graphic Site Plan updates. Through accurate record keeping, practitioners document for the Oregon Tilth Organic Land Care accreditation Program observance of required land care practices as well as successes and challenges encountered in the maintained landscape. This written record facilitates the future successful implementation of Organic Land Care Programs at different sites and introduces the possibility of sharing successes and challenges with others, and moving toward wide spread implementation of organic practices.

# Soil Building: Including Fertilizing and Soil Amendments

For established landscapes under organic land care, it is essential to develop an accurate description of the existing soil, following the procedures previously described in the Soil Management section. Once this description is completed, appropriate soil maintenance and improvement activities can be planned and executed. It is essential that no processed fertilizers be added unless a soil chemistry test indicates the need. Compost may be added on a regular basis, without the need for a soil test although a soil test showing a high level of soil organic matter may indicate that a woody mulch would be better than compost. Soil compacting activities as well as soil grade changes made in proximity to established trees or adversely affecting the soil water movement should be avoided. Long term soil building practices should nurture a diverse soil microbial community. These may include ongoing mulching, compost additions to soil, and on-site composting.

# Sources for Seeds, Transplants, and Other Plant Material

It is required that certified organic seeds and plants be used in organic land care when commercially available. However, it may be challenging for the OLC Practitioner to find certified organic seeds and plants grown following the procedures allowed under the NOP and certified by an appropriate certifying entity. If no organic source is available then the OLC Practitioner may use conventionally grown shrubs, trees, seedlings, plugs, rootstocks and other propagated forms of plants. However, the practitioner should document three efforts, with due diligence, to locate organic seeds or plants before using non-organic materials. If no organic source is available, conventionally produced, untreated seeds and pelletized seeds may be used as long as they do not contain prohibited materials. Using fungicide-treated seeds and genetically-modified (GMO) seeds or plants is prohibited.

# Water Practices and Sources

Irrigation water, an increasingly scarce resource, should be judiciously used to maintain healthy plants. Irrigation practices should prevent irrigation run-off from leaving the property, as this can lead to erosion, waste and pollution of waterways. The OLC Practitioner should strive to group plants with similar water needs, to create a water-efficient zoned irrigation system. Encouraging a tolerance of seasonal senescence of turf may greatly reduce water use. Knowing the site's soil and plant water needs will guide the frequency and length of irrigation applications. When irrigation systems are upgraded, installation of more efficient irrigation systems should be encouraged. This may include linking irrigation systems to weather stations or envirotranspiration controllers, using drip irrigation, installing zoned irrigation systems and using improved sprinkler heads.

The OLC Practitioner should work to provide surface and subsurface drainage adequate to prevent water pooling that leads to anaerobic soil conditions except in wetlands or recharge areas.

In some settings, installation of storm-water catchment systems should be encouraged. Utilization of this water for irrigation should be encouraged, as permitted by local, state and federal regulation. Harvesting, storage and use of roof top rain water may be realistic. Additionally, as building codes change, household gray water may become acceptable for use as irrigation on non-food plants. The use of landscape rain gardens may help divert rain water from storm drains. This can help cleanse surface water and slow its entry into large waterways.

# Mulching Practices and Materials

Mulching of open soil areas is an important cultural practice of organic land care. Appropriately applied mulch protects both soil and plants. Plant roots and soil microorganisms are insulated from temperature extremes by a protective mulch layer. Additionally, mulch protects the surface layer from compaction by rain and irrigation. Mulch also reduces moisture loss and improves water filtration. Especially for annual weeds, mulch can be an effective suppression measure. The regular addition of organic mulches supplies soil microorganisms with a steady stream of food, critical for their growth and the subsequent development of healthy plants. Plant-available nutrients derived from microbial activity and microbial death usually assist in the growth of plants in close proximity to this microbial activity.

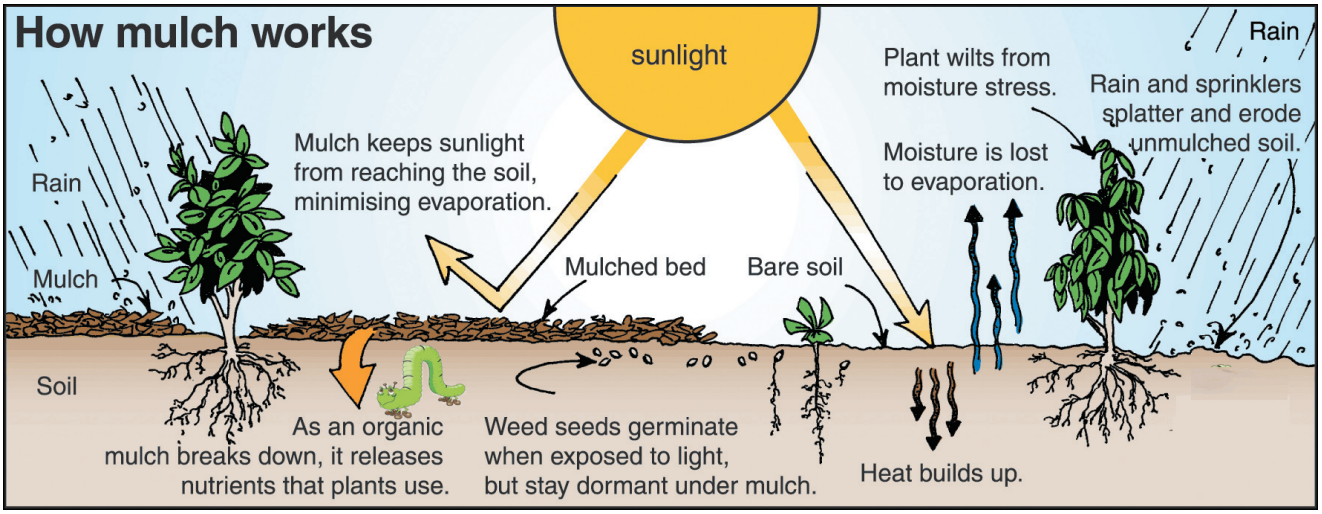



**Figure 20.** Mulch is an important component on your landscape because it reduces evaporation, releases nutrients, and minimizes weeds. *Graphic courtesy of Centenary Landscaping Supplies, www.CentenaryLandscaping.com.au.*

Despite all these critically important benefits, there are situations when the use of mulch can create problems. Mulch layers that are too thick prevent adequate gas exchange in the root zone which can lead to root death or secondary plant root development which would be insufficient in supporting the plant's water and nutrient needs. Mulch that is piled thickly around the base of a plant encourages decay organisms at the base of the plant. To prevent the spread of unwanted weeds, mulch materials should be free of pest plant seeds or other propagative plant parts. Organic mulches that are very high in carbon, such as sawdust, can tie up soil nitrogen for periods of time or affect the soil pH. These materials should be used carefully to avoid creating fertility deficiencies in nearby plants.

It is preferred that the OLC Practitioner implement an aggressive mulching program of all bare soil as soon as possible. Additionally, mulching of recently seeded areas is important to minimize erosion. As a guideline, mulch should be no more than 3-4" deep around woody plants but no closer than 4" from the trunk. A mulch layer of no more than 2-3" deep is appropriate for herbaceous plants, with mulch kept away from plant crowns. As this mulch layer breaks down, regular additions of mulch can be made, ensuring that the mulch depth does not exceed the recommendations. In selected settings, prior to landscape planting, layers of mulch up to 6" thick may be used to smother undesirable weeds that can be effectively eliminated or greatly reduced through this mulching practice.

The *Oregon Tilth Organic Land Care Policies and Standards* document encourages use of recycled materials and use of materials in a manner that will allow future re-use or recycling. Mulching practices that use organic materials generated on site (i.e. leaves, grass clippings, wood chips) or off site (i.e., wood chips from a tree company) can provide a local source of invaluable and often inexpensive mulch. Another form of mulch that can be useful is finished compost, generated on-site or from a qualified composting facility (if available). In limited situations, the use of cover crops as a living mulch may be feasible. Multiple layers of newsprint that is then covered by wood chips, compost or some other plant based material can be effective mulch. Colored or glossy newsprint may not be used.

The key considerations remain: use of appropriate depth of mulch, appropriate placement of mulch, and use of mulch that is free of contamination from known hazards (i.e. herbicides, PVC, human pathogens). Other mulch materials may be possible but safety should be considered first.

# *Pruning*

Appropriate pruning techniques used on landscape plants serve many important purposes in the landscape. For both ornamental and edible plants, various pruning techniques are possible. A general recommendation is to follow the standards set by the International Society of Arboriculture, as spelled out in pruning brochures available at *www.treesaregood.org*. For woody trees and shrubs, pruning to attain a specific form (also called training) is best started when plants are established and young so that smaller cuts can be made. No material is needed to cover pruning cuts.

Pruning practices for an organic land care landscape are no different than for any well-maintained site, with the goal being the long term health and safety of the plant. Additionally, pruning practices should strive to create and maintain a sound structure and aesthetically desirable look.

As a disease prevention strategy, use pruning to encourage good air movement within the canopy which will help reduce foliar diseases in susceptible woody trees and shrubs. Pruning can reduce disease incidence in two ways: 1) by removing diseased tissue in order to reduce pathogen load in close proximity to the plant and 2) by thinning the canopy which increases air circulation, shortens the drying time of plant tissue after wetting by rain or irrigation, and therefore decreases survival of many different plant pathogens.

Good pruning practices include removal of dead and diseased wood in a timely manner. Pruning of living tissue should occur when energy reserves are high (winter) or when the plant is in a healthy state. On fruit trees, summer pruning is appropriate to minimize vegetative sucker growth.

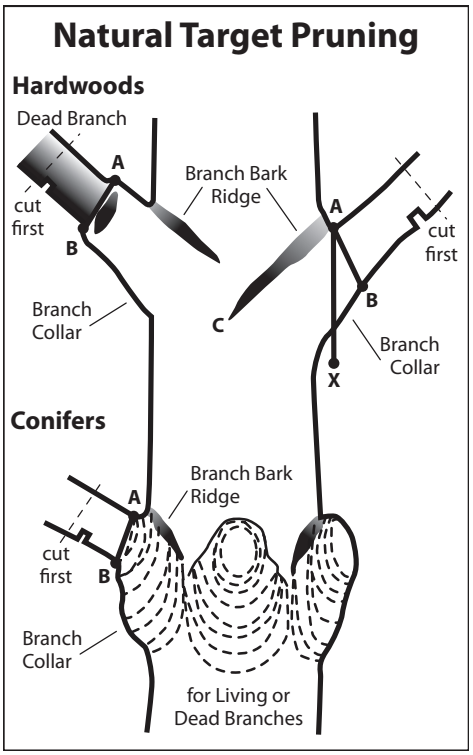



**Figure 21.** Natural target pruning is an effective method to prune trees. It is important to understand the proper location to cut a branch, and the three-cut process used to properly prune. Here are the guidelines:

**Natural Target Pruning**

1. Locate the branch bark ridge (BBR)
2. Find target A - outside BBR
3. Find target B - where branch meets collar
4. If B cannot be found, drop an imaginary line at AX. Angle XAC equals XAB.
5. Stub cut the branch.
6. Make final cut at line AB .

*Permission to use graphic granted by Shigo and Trees, Associates.*

For woody trees and shrubs, removal of deadwood, diseased tissue and crossing branches is appropriate as soon as possible. One notable exception is in plants susceptible to Dutch elm disease where pruning is restricted to times when adult beetle vectors are not present. Other exceptions may exist locally so check local tree ordinances.

Two practices that can cause long term damage to trees and are discouraged by the pruning standards of the International Society of Arboriculture are: 1) the use of tree grafts or spurs when working in trees unless required for the safety of the climber or unless the tree is being removed and 2) topping of trees.

# Plant Replacement and Garden Redesign

Over time many landscape revisions will occur as client needs and environmental conditions change. These opportunities allow the OLC Practitioner to redesign a landscape to better reflect Organic Land Care practices. (See the Landscape Design.)

It is preferred that plants raised locally by certified organic growers be used, when available. Additionally, the use of site-appropriate plants is encouraged to reduce the need for fertilizer inputs, heavy irrigation and repetitive pest control measures. "Site-appropriate" most commonly refers to plants native to the bio-region that can thrive in the environmental conditions found at the site. "Site appropriate" may also include exotic plants that are well-suited to the landscape setting and yet do not pose the threat of being invasive. Plants that can serve a variety of functions within the landscape help to develop a richer habitat. These functions include shade or sun tolerance, wildlife habitat, wildlife food, attractive flowers or fruit, human food or fiber source, nitrogen fixing, winter interest, unusual form and color contrast.

OLC Practitioners are encouraged to remove and replace plants that demonstrate a poor adaptability to the site. It may be appropriate to transplant some of these plants to a more suitable site. Careful consideration of the site's growing environment, soil type, drainage, and amount of sun, shade and wind are essential.

Hardscape features are often added to a landscape as part of modifications. Consideration should be given to the environmental impact of materials used, including the mining, assembling and ultimate disposal of these materials. This concept is often referred to as "cradle to grave" considerations. Using building materials of lowest embodied energy sufficient to the site is desirable as is the use of local rock and wood. Hand tools or electric powered tools in hardscape installations are preferred over the use of fossil fuel burning equipment. Two-cycle gasoline powered equipment is prohibited under the program except for chainsaws.

It is prohibited to install plants that are recognized as being "invasive" for the specific area. Consult lists from local government agencies. Removal, seed collection or destruction of native plants from the wild, the roadside, public or private land, particularly removal of threatened or endangered species, is not allowed unless prior approval of a plant rescue has been granted.

# Strategies for Removing Invasive Plants

As OLC Practitioners carry out environmentally sensitive maintenance practices, there will be situations where invasive plant species must be appropriately removed. In some cases ornamental plants intentionally planted on a property in the past may now be recognized as "invasive." As part of this process, lists of alternative plant suggestions should be available. In many cases these have been developed by local government agencies, local non-profit organizations or the local extension office.

Through contact with the appropriate state entity, the OLC Practitioner will stay informed about invasive plant species that are of concern and exclude them from any future plantings. It is incumbent upon the OLC Practitioner to remain up-to-date about invasive plant species in the various areas where she/he works and to be able to identify plants on the local "Invasive Plant" list.

Upon locating invasive plants on an organically maintained site, the OLC Practitioner will have to research the available control measures and begin utilizing those allowable under the *Oregon Tilth Organic Land Care Policies and Standards*. If invasive plant presence is extreme, it may be necessary to use control measures not allowed under the Organic Land Care Program. In such a case, a Non-Organic Treatment Agreement and plan would be developed.

| INVASIVE PLANTS | ALTERNATIVE NATIVE PLANTS | ALTERNATIVE ORNAMENTAL PLANTS |
|---|---|---|
| **Invasive Trees and Shrubs** | | |
| Butterfly bush (*Buddleja davidii, B. variabilis*) | Blue blossom (*Ceanothus thyrsiflorus*)<br>Mountain mahogany (*Cercocarpus ledifolius*)<br>Mock orange (*Philadelphus lewisii*)<br>Red-flowering currant (*Ribes sanguineum*) | Meyer lilac (*Syringa meyeri*)<br>Eastern ninebark (*Physocarpus opulifolius*)<br>Koreanspice viburnum (*Viburnum carlesii*)<br>Weigela varieties (*Weigela florida*) |
| English holly (*Ilex aquifolium*) | Pacific waxmyrtle (*Myrica californica*)<br>Tall Oregon grape (*Mahonia aquiflolium*)<br>Red elderberry (*Sambucus racemosa*)<br>Hairy manzanita (*Arctostaphylos columbiana*) | Meserve hybrid blue (*Ilex x meserveae cvs.*)<br>Strawberry tree (*Arbutus unedo*)<br>Chinese holly (*Ilex cornuta*)<br>Holly oak (*Quercus ilex*) |
| Russian olive (*Elaeagnus angustifolia*) | Quaking aspen (*Populus tremuloides*)<br>Blue elderberry (*Sambucus cerulean*)<br>Scouler's willow (*Scoulter's willow*)<br>Silver buffaloberry (*Shepherdia argentia*) | Variegated boxelder (*Acer negundo 'Variegatum'*)<br>Common hackberry (*Celtis occidentalis*)<br>Silverberry (*Elaeagnus commutata*) |
| Saltcedar, Tamarisk (*Tamarix ramosissima*) | Blue elderberry (*Sambucus cerulea*)<br>Native roses(*Rosa nutkana*, *R. woodsii*)<br>Birchleaf spirea (*Spiraea betulifolia*)<br>Ponderosa pine (*Pinus ponderosa*)<br>Narrowleaf willow (*Salix exigua*) | Black elderberry (*Sambucus nigra cvs*)<br>Escallonia (*Escallonia 'Apple Blossom'*)<br>Chinese fringetree, White fringetree (*Chionanthus retusus, C. virginicus*) |
| Spurge laurel (*Daphne laureola*) | Evergreen huckleberry (*Vaccinium ovatum*)<br>Tall Oregon grape (*Mahonia aquifolium*)<br>Salal (*Gaultheria shallon*)<br>Western rhododendron (*R. macrophyllum*)<br>Sword fern (*Polystichum munitum*) | Winter daphne (*Daphne odora*)<br>Rhododendron (*Rhododendron spp. and cvs*)<br>Fragrant sweet box (*Sarcocca ruscifolia*)<br>Delavay osmanthus (*Osmanthus delavayi*) |
| Tree of heaven (*Ailanthus altissima*) | Sitka or Pacific mountain ash (*Sorbus sitchensis*)<br>Bigleaf maple (*Acer macrophyllum*)<br>Ponderosa pine (*Pinus ponderosa*)<br>Greene's mountain ash (*Sorbus scopulina*) | Autumn purple ash (*Fraxinus americana*)<br>Japanese tree lilac (*Syringa reticulata*)<br>Kentucky coffeetree (*Gymnocladus dioicus*)<br>Japanese zelkova (*Zelkova serrata*)<br>Ginkgo (sterile male) (*Ginkgo biloba*) |

*Table 10 continued on next page.*

| INVASIVE PLANTS | ALTERNATIVE NATIVE PLANTS | ALTERNATIVE ORNAMENTAL PLANTS |
|---|---|---|
| **Invasive Herbaceous Plants** | | |
| Fennel (*Foeniculum vulgare*) | Yarrow (*Achilea millefolium*)<br>Wild white aster (*Aster divaricatus*)<br>Goat's beard (*Aruncus dioicus*)<br>Canada goldenrod (*Ligustichum apiifolium*) | Cosmos (*Cosmos bipinnatus*)<br>Annual sunflowers (*Helianthus annuus*)<br>Golden Alexander (*Zizia aurea*)<br>Anise (*Pimpinella anisum*) |
| Hawkweeds (*Hieracium* spp.) | Oregon sunshine (*Eriophyllum lanatum*)<br>Douglas aster (*Aster subspicatus*)<br>Orange sneezeweed (*Helenium hoopesii*)<br>California poppy ( *Eschscholzia californica*) | Tickseed (*Coreopsis verticillata*)<br>Black-eyed Susan (*Rudbeckia hirta*)<br>Mt. Atlas daisy (*Anacyclus depressus*)<br>Common sneezeweed (*Helenium autumnale*) |
| Herb Robert and Shiningstar geranium (*Geranium* spp.) | Stream violet (*Viola glabella*)<br>Beach strawberry (*Fragaria chiloense*)<br>Wood strawberry (*Fragaria vesca*)<br>Wild bleeding heart (*Dicentra formosa*)<br>Sea pink (*Armeria maritime*) | Cranesbill geranium (*Geranium sanguineum cvs*)<br>Bishop's hat (*Epimedium pinnatum*)<br>Japanese painted fern (*Athyrium nipponicum*)<br>Chinese false spirea (*Astilbe chinensis*) |
| Jubata grass (*Cortaderia jubata*) | Idaho fescue (*Festuca idahoensis*)<br>Giant chain fern (*Woodwardia fimbriata*)<br>Tufted hairgrass (*Deschampsia caepitosa*)<br>Roemer's fescue (*Festuca roemeri*)<br>California fescue (*Festuca californica*) | Deergrass (*Muhlenbergia rigens*)<br>Big bluestem (*Andropogon gerardii*)<br>Little bluestem (*Schizachyrium scoparium*)<br>New Zealand flax (*Phormium tenax*)<br>Giant ryegrass (*Leymus condensatus*) |
| Policeman's helmet, Jewelweed (*Impatiens glandulifera*) | Red columbine (*Aquilegia formosa*)<br>Western maidenhair fern (*Adiantum aleuticum*)<br>Alum root (*Heuchera micrantha*)<br>Wild bleeding heart (*Dicentra formosa*)<br>Western meadowrue (*Thalictrum occidentale*) | Cardinal flower (*Lobelia cardinalis*)<br>New England aster (*Aster novae-angliae*)<br>Spider flower (*Cleome hassleriana*)<br>Meadowrue (*Thalictrum aquilegifolium*)<br>Toad lily (*Tricyrtis hirta*) |
| Toadflaxes (*Linaria dalmatica* and *L. vulgaris*) | Blue flax (*Linum lewisii*)<br>Blue-eyed grass (*Sisyrinchium bellum*)<br>Yellow-eyed grass (*Sisyrinchium californicum*)<br>Oregon sunshine (*Eriophyllum lanatum*)<br>Oregon iris (*Iris tenax*) | Snapdragons (*Antirrhinum majus*)<br>Torch lily (*Kniphofia 'Little maid'*)<br>Penstemon (*P. barbatus 'Schooley's yellow'*)<br>Daylillies (*Hemerocallis 'Stella de oro', 'Hyperion'*) |

*Table 10 continued on next page.*

| INVASIVE PLANTS | ALTERNATIVE NATIVE PLANTS | ALTERNATIVE ORNAMENTAL PLANTS |
|---|---|---|
| **Invasive Groundcover and Vine Plants** | | |
| English and Irish ivy (*Hedera helix, H. hibernica*) | Beach strawberry (*Fragaria chiloense*)<br>Wood strawberry (*Fragaria vesca*)<br>Sword fern (*Polystichum munitum*)<br>Prostrate ceanothus (*Ceanothus prostratus*)<br>Kinnikinnick (*Arctostaphylos uva-ursi*) | Allegheny spurge (*Pachysandra procumbens*)<br>Creeping juniper (*Juniperus horizontalis cvs*)<br>Star jasmine (*Trachelospermum asiaticum*)<br>Barren strawberry (*Waldsteinia fragarioides*)<br>Creeping raspberry (*Rubus calycinoides*) |
| Old man's beard (*Clematis vitalba*) | Orange honeysuckle (Western trumpet) (*Lonicera ciliosa*)<br>Rock clematis (*Clematis columbiana*)<br>Hairy honeysuckle (*Lonicera hispidula*) | Anemone clematis (*Clematis montana*)<br>Purpleleaf grape (*Vitis vinifera 'Purpurea'*)<br>Ornamental kiwi vine (*Actinidia kolomikta*)<br>Silvervein creeper (*Parthenocissus henryana*)<br>Clematis cultivars (*Clematis 'Jackmanii'*) |

**Table 10.** List of trees, shrubs, herbaceous plants, groundcover, and vine plants that should not be planted because they are invasive. Recommended alternative native plants and ornamental plants with similar plant features (color, shape, etc.) are listed. Excerpted from *GardenSmart Oregon—A Guide to Non-Invasive Plants* (http://www.nature.org/wherewework/northamerica/states/oregon/files/gardensmart_oregon_reduced.pdf).

| Invasive | Non-invasive |
|---|---|
|  <br>**Dalmation Toadflax**<br>Utah State University Archives,<br>Utah State University, Bugwood.org© |  <br>**Blue Flax**<br>Joy Viola, Northeastern University, Bugwwod.org© |
|  <br>**Butterfly Bush**<br>Tom Forney, Oregon Department of Agriculture© |  <br>**Blue Elderberry**<br>Matt Below© |

**Table 11.**

Practices used to eliminate invasive plant species or to control their spread should work to limit undesirable environmental damage. Control tactics that may be helpful, include:

- Hand pulling prior to seed set
- Hand-powered mechanical means
- Repeated cutting of invasive woody plant as a means to wear down stored energy reserves
- Digging up with hand tools
- Pouring of boiling water directly over roots
- Mowing with a push mower
- Smothering with a thick (more than 4") weed free mulch layer
- Trunk girdling
- Appropriate animal grazing

**Figure 22**. Goats are an excellent tool to clear land heavily infested with invasive species, such as Himalayan blackberry (Rubus armeniacus).

*Photo courtesy of Healing Hooves, LLC, healinghooves.com.*

Other control practices worth considering, depending on the site and the invasive species, include:

- Using motorized equipment
- Pruning to remove flowers or seeds to prevent spreading
- Using solarization, which is the use of clean plastic to raise the soil temperature and kill plants through extreme heat (this may also kill the beneficial soil microorganisms)
- Post solarization application of compost or compost tea
- Flame weeding
- Application of NOP approved herbicides

# Recycling of Organic Debris and Compost Use

During landscape maintenance, the OLC Practitioner will handle a great deal of organic "debris" generated at the site from weeding, pruning, plant removal, and seasonal clean-up activities. This waste material is a valuable resource in the landscape, with some exceptions.

Organic debris generated at a given landscape site can be composted on-site and then later returned to the landscape as a mulch or as a soil amendment incorporated into the soil, if adequate space is available and appropriate composting methods are utilized. This may also include grinding/chipping of stumps and woody debris for later re-use in the landscape. It is very helpful if a specific site at a landscape is established for the composting and other processing of these organic waste materials. An important consideration is the disposal of plant debris from invasive plant material. For some invasive plants this will require removing them from the premises to an off-site composting or disposal area.

If it is not possible to compost materials on-site due to space limitations or customer request, OLC Practitioners may carry organic materials to an off-site location for appropriate composting.

Basic enclosed bin composter. Low maintenance, plus the lid deters animals. Failure to physically aerate the compost can delay decomposition.

Rolling composters can be rolled to your yard waste, loaded up and then rolled away. A quick tumble every day or two mixes and aerates the pile, eliminating the need to aerate with a pitchfork or compost aerator. Low maintenance, plus they make aerating the pile easy. Lid keeps rain off compost and helps deter animals. Downsides: Fully loaded bins can become heavy and difficult to roll.

Compost tumblers are designed so that they turn their contents easily. More expensive than basic and rolling composters, and because they're easy to aerate by turning, they quickly compost. Available in various sizes. Lid keeps rain off compost and helps deter animals. Once these units are full and the composting process begins, you have to wait before adding additional materials. Tip: Store kitchen wastes in plastic buckets with tight fitting lids during this time, using sawdust or similarly absorbent materials to minimize odors.

Using redworms to compost (vermicomposting) is a convenient way to dispose of kitchen scraps and turns them into rich, organic soil conditioner known as worm castings. Worm bins can be located anywhere from under the kitchen sink to outdoors or in your garage. Once up and running they require very little maintenance. A worm bin can be used year-round. Ideally a worm bin should be located in an area where the temperatures are between 40-80 degrees F in cold climates, bring your bin inside during the winter to avoid freezing. In hot climates, keep it wet and cool.

**Figure 23.** Diagram of home compost systems.

*Source: www.composting 101.co*

## Compost Use

The OLC Practitioner will apply a compost top dressing or compost incorporated into the soil at specific planting locations as deemed necessary. Good quality compost from a reliable source is essential. Well-managed, on-site composting may provide the needed compost. However, if compost generated off-site is used, the OLC Practitioner should use qualified compost when available. The most recent copy of the Seal of Testing Assurance (STA) report from the commercial composting facility should be obtained and reviewed. Special attention should be paid to information regarding herbicide contamination, weed seed contamination, moisture content (desire 30-45%) and uniformity in appearance and size.

A layer ⅛ to ¼" is good for maintenance topdressing of turf while less than ½" is appropriate for topdressing for flower and shrub beds. A layer ¾ – 1 ½" is fine for mulch for tree areas while greater than 1 ½" is not desirable.

# Lawn Care Tactics

An important component of many ornamental landscapes is the turf area. The OLC Practitioner works with clients to have healthy, attractive and functional turf areas that are safe for families, pets and the environment while striving to reduce the use of fossil fuels, water and fertilizer.

It is important for the client and the OLC Practitioner to clearly identify how the turf area will be used and what the client expects for the area. How the client anticipates to use the area greatly affects the maintenance practices used on the turf area, including watering and mowing practices, pest control approaches and fertilization regimes.

Soil health will greatly affect the health of the turf. Soil building for deficient soils and care to preserve soil quality are critical components of an organic land care lawn maintenance program. A turf program begins with appropriate soil sampling for baseline information on nutrient levels and physio-chemical parameters like CEC and Base Saturation percentages. Most nutrient amendment activities must be based on the soil sample results and recommendations. For best soil test results, test soil in mid to late spring or early fall, taking samples from the root zone of turf (3 ½" deep). The application of any processed fertilizers must be based on the soil chemistry results that show a deficiency. All of this baseline information must be kept in a written form by the OLC Practitioner. The OLC Practitioner is striving for a 6" deep layer of topsoil for the turf area. For areas where the topsoil is much shallower, an ongoing program of compost addition (up to a ½"annually) is appropriate.

Turf use and turf soil pH will influence the selection of grass seed mixes. Use of site appropriate, low maintenance mixes of grasses, broadleaf plants and legumes can be beneficial. An ideal mix may include varieties that are pest resistant or pest tolerant and appropriate for the planned turf use. In areas where livestock grazing may occur on grass, grass types containing endophytically-enhanced grasses should not be used. Low-mow lawns or native grasses or wildflower plantings may be appropriate. Mowing turf at a height of 3" or above is encouraged to allow for deeper rooting, to shade out weed species and to reduce irrigation during the dry months. Core aeration and over seeding with appropriate grass seed mixtures can be beneficial. Appropriate watering and fertilizing practices can reduce thatch build up. The OLC Practitioner may remove thatch mechanically as well as use thatch-reducing soil amendments. The use of mulching mowers is one means of regularly returning grass clippings and the nutrients contained within them to the turf area. To assist in the development and maintenance of a healthy soil microbial community, an annual top dressing of up to a ½" of compost and spraying with compost teas is also beneficial.

When use of a mulching mower is not practical, grass clippings and leaves can be picked up and removed from turf areas. As long as no persistent herbicides have been used in the past two years, these clippings should ideally be composted on-site.

# Weeds

Weed control can be one of the most challenging aspects as many commonly used herbicides are prohibited for use under the Organic Land Care Program. Knowledge, persistence and education form the backbone of the tools available for organic weed control.

The Integrated Pest Management (IPM) approach used in OLC emphasizes the identification of key weed species and understanding their life cycles as a critical starting point. Local weed guides with pictures can be very helpful in identification. With this base knowledge, the practitioner can then identify critical control times and effective practices.

To control weeds along fence lines, installation of durable concrete mow strips under fences greatly improves weed control efforts while reducing the need to use herbicides. Flaming is quite common along fence lines. Temporary weed control may be attained through mulching with layers of clean paper or phytotoxic leaves such as walnuts or eucalyptus. In some situations, planting of a low maintenance eco-lawn mix that will shade out weeds can be useful once it is established.

Near hardscape features, a range of weed control tactics can be considered. For crack and crevice control of weeds, options include regular flaming, sweeping or brushing cracks to remove soil making it inhospitable for weed seed germination and covering cracks with a pounded-in neoprene that is then smoothed out with mineral oil. For dirt and crushed rock paths, weeding with a hoop hoe is common. Commonly, gravel or dirt paths may be flamed for weed control. It is often effective to use compacted ¼" minus gravel to suppress weed growth. Larger gravel size will allow for too much soil to settle in the gaps, providing a suitable habitat for weed growth.

In shrub beds and landscaped areas, many of the weed control tactics discussed above are also applicable, depending on the weed and the situation. Careful redesign may remove an ongoing weed control issue. For example, an ornamental bed along a property border where large weed populations grow on the other side of the property line must be designed with the knowledge that the adjacent large weed population will be an ongoing problem. Careful attention to bringing in only weed-free soil and organic amendments is critical to reduce unwanted introduction of weeds in newly planted areas. Mulching is an especially important weed control strategy that reduces open space that would prove hospitable for unwanted weeds. Dense plantings and plants of various sizes can also serve to cover otherwise bare space. Valuable mulching materials include wood chips, commonly available from tree care companies, and leaf mulch, which is effective, but decomposes rapidly. Hand weeding, although commonly necessary, will often expose weed seeds because, as the soil is disturbed and turned over, the emergence of weed seedlings that otherwise would have remained dormant, will occur. Mulching beds that have recently been hand weeded can limit the emergence of new weed seedlings. Flame weeding commonly needs to be done repeatedly and may not be as effective against grass seedlings as it is against broadleaf weed seedlings. Too much flaming can be harmful to microorganisms in the soil. A hoop hoe can efficiently weed beds when weeds are small.

Corn gluten meal works by preventing sprouting seeds from developing roots. Uneven results are recorded in trials in the Pacific Northwest city parks districts when corn gluten meal products have been used for weed control. Effective use by many landscape professionals and gardening enthusiasts is most likely due to an appropriate application rate, a sufficient budget, appropriate timing of application and watering with a follow-up dry period.

Organic contact herbicides like vinegar (causes loss of cell membrane integrity resulting in leakage of cellular fluids) and clove oil (cell membrane disruptor) have shown challenges relating to public perception (smell from materials) and safety to application equipment (acetic acid concentrate corrodes metal). OLC Practitioners are encouraged to provide education to the public likely to encounter the smell of these materials as to what the material is and why it is being used. Additionally, OLC Practitioners must use at least the required personal protective equipment listed on the label. With the use of the acetic acid materials care must be taken if using spray equipment that contains metal parts. However, these NOP approved herbicides do provide a weed control option worthy of consideration.

# OLC Weed Control Tactics

### Weeds along fence lines

- Install durable concrete mow strips under fences
- Flame weeds
- Mulch with layers of clean paper or phytotoxic leaves such as walnut or eucalyptus
- Plant a low-maintenance eco-lawn mix to shade out weeds

### Near hardscape features

- Crack and crevice control
  - Regular flaming
  - Sweeping or brushing cracks to remove soil to make it unfriendly for weed germination
  - Pound neoprene into the cracks, then smooth out with mineral oil
- Dirt and crushed rock paths
  - Weed with a hoop hoe
  - Flame weeds
  - Use compacted ¼ inch gravel to suppress weed growth; larger size gravel will allow soil to fill the gaps and encourage weed growth

### Shrub beds and landscaped areas

- Regular flaming
- Mulch with wood chips and leaf mulch
- Weed with a hoe or by hand; mulch after handweeding to limit emergence of new seedlings
- Use weed-free soil and organic amendments to discourage establishment of weeds from neighboring areas
- Plant densely using plants of various sizes to cover bare space
- Use corn gluten meal to prevent sprouting seeds from developing roots
- Consider the use of vinegar and clove oil as organic herbicides, but recognize corrosion could occur with sprayers that have metal parts

### Turf

- Mow using a mower deck height of about 3 inches, and mow frequently to create healthy turf
- Aerate compacted turf areas
- Overseed bare turf spots
- Select more drought tolerant grass cultivars
- Ensure soil fertility encourages healthy turf growth
- Irrigate efficiently to develop hardy turf
- Use top dressing on high use sports-use areas

### Trees

- Apply wood chips at the base of trees to avoid damage with mowers and string trimmers
- Plant desirable ground cover plants to eliminate bare soil
- Consider flaming, however, restrict it to the wet season when you will be less likely to avoid damaging tree roots

**Table 12.** Organic weed control tactics.

Landscape turf health greatly influences the weed population. Factors that contribute to healthy organically managed turf include higher mowing heights and appropriate frequency, aeration of compacted areas, overseeding of bare spots, selection of more drought tolerant grass cultivars, appropriate soil fertility, turf irrigation and top dressing on high use sports-use areas. When irrigation systems are upgraded, site factors like soil and vegetation type and weather information may be measured and fed into the irrigation system to increase the efficiency of frequency and timing of irrigation.

An ongoing maintenance concern of OLC Practitioners includes weed control around the base of trees, where mowers and string trimmers can cause tree damage. Wood chips are one effective weed control tactic, being careful to keep them away from the base of the tree. Another approach to consider is planting of desirable ground cover plants around a tree to eliminate bare soil where weeds could grow. The Eugene Parks and Recreation Department in Oregon is trying a blue fine fescue as a ground cover for weed control. Different plants may be effective in different settings. Flaming can be used around trees but care must be used to avoid buttressing tree roots. It is safer to do flaming during the wet season.

Many different control options are available to the OLC Practitioner using IPM for weed control. Know the weed, know its biology, determine the life cycle stages that can be effectively disrupted with the tactics available, use an assortment of tactics rather than relying on just one, constantly evaluate the effectiveness of control tactics used, be persistent and constantly consider ways to design out a persistent weed problem.

# Other Pests and Plant Health Care

The *Oregon Tilth Organic Land Care Policies and Standards* require the elimination of the use of pesticides not acceptable under the NOP. This goal is more broadly aimed at growing healthy plants in an environment that is also healthy for a wide variety of organisms, including people. The OLC Practitioner does not merely substitute an organic pest control product for the prohibited synthetic materials. Good stewardship of the land requires an integrated approach that includes attentive observation of the site conditions and plant health. Appropriate watering, plant selection and soil conservation all positively influence the health of landscape plants. A preventative approach to pest management is emphasized over a reactionary approach to pests.

Within an agricultural setting, the principles of IPM are used on many crops. Since the 1970's there has been a slow transfer of IPM principles into the ornamental landscape setting. Within this setting, the appropriate focus has been on plant health rather than the economic return of the food crop grown. This has led to the use of the term Plant Health Care, when using IPM principles for ornamental plants in a landscape setting.

An IPM program needs to a) identify key pests and their natural enemies, b) utilize appropriate means of monitoring key pests in a timely fashion, c) understand basic biology of key pests, d) determine and use action thresholds for pests, e) research and use as needed appropriate pest control options (cultural, physical, biological, chemical) that are acceptable under NOP standards and may be considered least impact, and f) establish and use an evaluation procedure following any treatments. All of this information should be developed into a site specific, written document that changes over time as the OLC Practitioner gains familiarity with the special site conditions present.

The challenge to the OLC Practitioner mirrors some of the challenges faced by organic food growers at different times in the past. Research is scarce on action thresholds for pests in an ornamental landscape setting. Arbitrary levels, based on the concept of tolerance, will need to be set by OLC Practitioners, along with their clients, and revised based on experiences. Additional research may be conducted by governmental entities, academic institutions or non-profit agencies that could add to the knowledge base concerning organic pest management for landscape plants.

IPM plans will certainly evolve over time. Initially, the plan for a site may merely state that for one year, the site will be monitored regularly and common pests encountered will be recorded. After this period of observation, appropriate organically acceptable pest control tactics might be applied. Within the IPM plan, a follow-up evaluation of the effectiveness of any control measures used should be documented. Necessary changes in landscape management practices that influence plant health and plant pest status can then be implemented. The IPM plan is an important part of the Organic Land Care Program and an evolving written record working within the framework of stewardship of the landscape ecosystem.

The term "pests" is very broad term and includes many types of living organisms considered potentially problematic within the landscape setting. An important question, however, is whether this "pest" does in fact affect the health of the desirable landscape plants. This question becomes blurred in the ornamental landscape setting where human aesthetic tastes come to the forefront. As an example, "clover" in turf may not give the look that the owner is seeking and therefore be considered a pest. Educating the client about the benefits of clover may shift the owner's perception of this "pest."

Weeds, pathogens, insects, mites, rats, mice, birds and deer all may be viewed as pests in certain settings. For each of these pest groups, the OLC Practitioner should develop an assortment of appropriate monitoring procedures and pest control tactics, as deemed necessary.

Only pest control materials acceptable under the NOP may be used in organically maintained landscapes. For the OLC Program, like the NOP, natural products are allowed for use while synthetic products are not allowed. However, certain natural products (i.e. arsenic) which are known to be highly toxic or carcinogenic are prohibited by NOP. Certain synthetic products are allowed if they have a history of organic use, are low in toxicity and break down rapidly in natural environments.

In deciding among allowed materials, one tool that may be helpful to OLC Practitioners is the concept of Environmental Impact Quotient in which the higher the quotient the more adverse impact on the environment. This allows for a broad look at materials, considering a variety of environmentally sensitive issues. Specifically, a practitioner may choose one organically approved material over another, based on this broader type of evaluation. This is one means of evaluating materials to determine which has the least environmental impact on the landscape site environment and the larger environmental setting. See Cornell University's New York State IPM Program at *http://nysipm.cornell.edu/publications/eiq* for more information.

For many of the natural products, there may not be as extensive testing as there is for synthetic materials. Given this situation, the prudent approach for the OLC Practitioner is always to look first for cultural or mechanical or biological control practices. Only then should NOP approved chemical control measures be considered.

## Insects and Other Arthropods

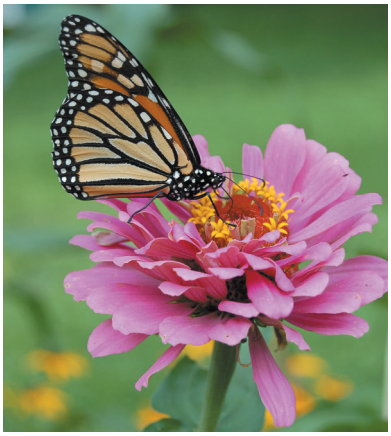


**Figure 24.** Butterflies and other beneficial insects feed in perennial beds that have a variety of flowers that produce pollen throughout the growing season.

*Photo courtesy of Barbara K. Folts.*

Many different species of insects have been identified as important biological control agents (beneficials) of plant-damaging insects and other arthropods. These beneficial insects include ground and rove beetles, parasitic wasps and flies, ladybugs, green lacewings, syrphid flies, soldier beetles, predaceous bugs, certain mite and thrips species, spiders and more. The beneficials population will likely vary tremendously from one site to the next. Over time, the OLC Practitioner hopes to establish a sufficient population of these beneficials that can keep many pest problems at a tolerable level, year in and year out, without heroic and costly human intervention.

The OLC Practitioner works with the client to develop or maintain a landscape with minimal pest insect explosions. Selection of a diversity of pest resistant and site-appropriate plants can assist in reducing selected insect pest populations. Designs that include a wide variety of plant species and varieties, with a long range of bloom times can provide habitat and food for beneficial insects. Purposeful insectary plantings carry this general practice to a more precise level where plant mixes of shallow flowers (often in the formerly called Umbelliferaceae family which now called Apiaceae) provide nectar and pollen as an energy source for a variety of small parasitic wasps and predatory insects that are critical in the biological control of many arthropods. Another aspect of this approach is of the use of beetle banks to increase ground beetles. These constructed habitats provide minimally disturbed habitat favorable for ground beetle populations that can successfully survive and thrive by feeding on soil dwelling arthropod pests.

The OLC Practitioner, like all quality land care technicians, needs to work toward minimizing unnecessary plant stress. Strong, healthy plants are best able to naturally resist and recover from pest damage. This concept is captured in the mantra of "Right Plant, Right Place, Right Care." Applying this to the landscape, the OLC Practitioner should strive for appropriate soil preparation, plant selection, watering practices, pruning and fertility management. All play an important role in the environmental stress faced by the landscape plants. Although some plant stress may be beneficial in plant development, high levels of plant stress adversely affect the plant's defenses against certain pest insects (i.e. bark beetles).

### Beneficial Arthrropods

Ladybird beetles (Coccinellidae)

Green lacewings (Chrysopidae)

Syrphid flies (Syrphidae)

Ground beetles (Carabadie)

Honey bee (Apis mellifera)

Parasitic wasps (Aphid parasites—Aphidius spp. and more; Insect egg parasites including Trichogramma spp.; whitefly parasite—Encarsia formosa)

Tachinid flies (Tachinidae)

Rove beetles (Staphylinidae)

Orchard mason bees (Osmia lignaria)

Wolf spiders (Lycosidae)

**Table 13.** List of common beneficial arthropods in the landscape.

Timely inspection of landscape plants to detect and remove any undesirable insect/arthropod infestation before purchasing and planting can help reduce their introduction. Despite all efforts, it is likely that insect problems will occur in a landscape. Often these problems can be detected at an early stage due to visible signs of the insect or visual symptoms of plant damage caused by the insect. Timely observations of landscape plants may allow the OLC Practitioner to remedy an insect pest problem before it explodes. This requires timely monitoring and knowledge of the most likely insect problems to be encountered on the plants present.

A wide array of insect control measures exist. Many types of insect traps are available for monitoring and sometimes controlling insects. As long as these traps do not contain materials prohibited by the NOP they are available for use by the OLC Practitioner. Additionally, more and more insecticides are available as well. These include certain soaps, oils, plant extracts, diatomaceous earth, *Bacillus*-derived materials and more products each year. All of these must be used in the manner specified on the label and are best considered as a part of an integrated pest management program, rather than the basis or entirety of the program.

A highly diversified, complex landscape that is able to ward off severe pest outbreaks remains an important objective for the OLC Practitioner. The use of least impact practices is key.

## Snails and Slugs

In areas of the Pacific Northwest, slugs can be particularly problematic in the spring time, due to the cooler, damp conditions. In high visibility areas, careful plant selection is important for the spring time interval. As an example, primroses planted out for early spring color in a highly visible area are a magnet for slug feeding. As important as these color spots are to landscape aesthetics, either close attention to plant protection from slugs or close attention to plant selection, are necessary.

An important window for slug reduction, often missed by the landscaper, is the fall when some species are breeding. Traps or hand picking or other control tactics at this time can be very important as a means to reduce the populations before egg laying occurs.

Preference is for modification of the environment to make the habitat drier and to eliminate protected hiding places for snails and slugs. OLC Practitioners should also encourage owners to use plant species and varieties less favored by slugs or snails. Attentive observation in the landscape over time will help determine these plants.

| Slugs | Snails |
|---|---|
| European red slug (Arion rufus) | Brown garden snail (Cornu [Cryptomphalus=Helix = Cantareus] asperses) |
| European black slug (Arion ater) | European apple snail (Helix pomatia) |
| Brown-banded Arion (Arion circumscriptus) | White garden snail (Theba pisana) |
| Darkface Arion (Arion distinctus) | Milk snail (Otala lacteal) |
| Dusky Arion (Arion subfuscus) | Grove snail or brown-lipped snail (Cepaea) |
| Spanish slug (Arion vulgaris [= A. lusitanicus]) | Vineyard snail (Cernuella virgata) |
| Milky slug (Deroceras reticulatum) | Wrinkled dune snail (Candidula intersecta) |
| Marsh slug (D. laevae) | Xerolenta conspurcata |
| Three-band garden slug (Lehmannia valentiana) | Oxyloma spp. |
| Great gray garden slug or tiger slug (Limax maximus) | Succinea spp. |
| Tawny garden slug (L. flavus) | Achatinid or giant African snails such as Achatina fulica, and A.achatina |
| Greenhouse slug (Milax gagetes) | Bradybaena similaris |
| Shelled slug (Testacella haliotidea) | Orchid snail (Zonitoides abroreus) |
| Brown slug (Vaginulus [Sarasinula]) | Cuban land snail (Zachrysia provisoria) |
| Sloan's slug (Veronicella sloanii) | |
| Two-striped slug (Veronicella cubensis) | |
| Semi-slug (Parmarion cf. martensi) | |

**Table 14.** List of common snails and slugs in the Pacific Northwest.

European Red Slug

Brown Garden Snail

Milky Slug

Grey Garden Snail

**Figure 25.**

*Photos courtesy of Robin Rosetts, Oregon State University*

Slug-attacking ground beetles, ducks (especially runner ducks, *Anas platyrhynchos*), chickens and slug-attacking nematodes (*Phasmarhabditis hermaphrodita*) are all biological control agents for slugs and snails, although availability and practically for use will vary.

Slug fences for high value crops offer another option. This method requires that an area is first free of slug eggs and slug individuals. Boards with zinc or copper strips are then placed around the area to be protected. The strips give off an electrical charge that mildly shocks slugs and snails when their slime interacts with the metal. Slug passage over the strips is thus deterred.

Additionally, certain formulations of iron phosphate are available for use by OLC Practitioners, for the control of slugs and snails.

## Disease Control

Plant pathologists have a long tradition of focusing on cultural control practices as a means to deal with plant diseases. For OLC Practitioners, this should also be the primary means of addressing plant disease issues. For diseases to become problematic, the three aspects of the disease triangle are important: susceptible host, pathogen presence and appropriate environmental conditions. Sometimes through appropriate plant species or cultivated variety selection, disease-susceptible plants can be eliminated from landscapes. As an example, many rose selections are available that are not affected by black spot, rust or mildew — the three common rose diseases in the Pacific Northwest. Additionally, landscape designs that contain large blocks of the same disease-prone plant are much more likely to experience severe disease outbreaks than designs that contain isolated smaller groups of a particularly disease-prone plant selection. Through sanitation practices (removal) of disease infested tissue, the amount of disease-causing pathogens in the landscape environment can be reduced significantly, which can also reduce the probability of disease occurring.

| DISEASE RESISTANT PLANTS | |
|---|---|
| **Crabapple cultivar** | |
| Adams | |
| **Dogwood cultivars** | |
| The white flowering Kousa Dogwood (Cornus kousa) | 'Stellar' Hybrid series, 'Aurora', 'Celestial', 'Constellation', Ruth Ellen', 'Stardust', and 'Stellar Pink' |
| **Roses** | |
| Hybrid tea rose cultivars<br>Electron, Keepsake, Las Vegas, Silver Jubilee, Voodoo | Floribunda rose cultivars<br>Europeana, Impatient, Liverpool Echo, Matangi, Play Girl, Play Boy, Regensberg, Sarabande, Sexy Rexy, Trumpeter, Viva |
| Grandiflora rose cultivars<br>Love, Tournament of Roses | Climbing rose cultivars<br>Dortmund, Dublin Bay, Royal Sunset |
| **Birch** | |
| River birch (Betula nigra), particularly the cultivar "Heritage" | Japanese white birch (Betula platyphylla japonica 'Whitespire') |
| **Other examples of trees and shrubs that are relatively disease-free to common diseases—Oregon grape, Douglas fir, shrubby cinquefoil, Rugosa rose, lace shrub, Carolina silverbell, Carolina allspice, mountain laurel, Serbian spruce, Japanese yew, downy serviceberry, glossy abelia, European hornbeam, summersweet, Hinoki false cypress, burning bush, Kousa dogwood, border forsythia, rose-of-Sharon, Japanese holly, Japanese snowbell.** | |

**Table 15.** Examples of disease-resistant plants in the landscape.

Environmental conditions that allow for pathogens to thrive and cause disease outbreak or shrink to insignificance can sometimes be managed by the OLC Practitioner. Irrigation methods that keep water off of foliage can reduce the incidence of many foliar fungal and bacterial diseases. Well drained soil conditions can also help reduce common soil borne diseases like Armillaria, Phytophthora and Verticillium. Pruning practices that thin out foliage to promote better air flow through a plant and more rapid drying of wet tissue help create a plant environment less favorable for diseases started by fungal pathogens requiring moisture on foliage for spore germination. Appropriate soil fertility can also assist plants in combating disease. Sufficient potassium availability and uptake assists in plant resistance to disease.

Timely observation of landscape plants to detect and identify diseases as early as possible can be helpful for future planning of disease control programs. The OLC Practitioner, through timely observations, can then develop a coordinated plant disease control program as part of the IPM program for the site.

A variety of materials are allowed for organic disease control including various copper and sulfur materials, oils, soaps and botanically-derived mixes. The OLC Practitioner should check with the current NOP National List for acceptable materials.

## Wildlife Management

**Figure 25**. Fencing is an excellent way to protect elements of your landscape from wildlife damage.

Depending on the site location, birds and deer may cause problems in organically managed landscapes. For deer, high deer proof fences are the best protection. Dogs and cats may also offer some deterrence. Sometimes, a water sprinkler with a motion sensor is sufficient. Lists of plants not eaten by deer have been developed for other parts of the United States and can be consulted. In limited situations fencing of individual plants may be helpful. Barrier plantings may also be useful as a means to deter deer.

For birds, depending on the species and the plants vulnerable, deterrence can be increased through the use of netting, placement of plants in close proximity to high levels of human activity or random sound production.

## In the Event of a Crisis

Oregon Tilth recognizes the necessity of non-organic treatments in cases where valuable plants may otherwise be lost. The non-organic plant rescue provision is designed to accommodate the client who has a landscape under organic management and has a plant of significant value at risk. A plant of significant value is any perennial plant or group of plants of historic merit, size, cost or aesthetic quality that cannot be replaced or for which replacement would cause a financial hardship ($500 or more).

The non-organic treatment provision requires a standard agreement between the practitioner and the landscape owner or owner's agent. A copy of the Non-Organic Treatment Agreement must be sent to the Oregon Tilth Program Manager. When the non-organic plant rescue provision is utilized, a site enters transitional status and all signage or other means promoting the site as organically managed must be removed or revised at the discretion of the OLC Program Manager. The site will be eligible to claim management under OLC practices one year after the last non-organic application, if all other program requirements have been met during that period, or at the discretion of the OLC Program Manager.

# The Do's and Don'ts of OLC Landscape Maintenance

- ✓ Use least impact practices by taking an integrated pest management or plant health care approach to maintain landscape health.
- ✓ Keep a maintenance record showing cultural activities and material inputs.
- ✓ Use organically grown seeds, seedlings and planting stock, with the following exceptions:
  - Non-organically produced, untreated seeds and planting stock may be used when an equivalent organically produced variety is not commercially available. The practitioner must document three attempts to locate organic seeds or planting stock before using non-organic materials.
  - Seeds, annual seedlings and planting stock treated with prohibited substances may be used in an organic application when required by Federal or State phytosanitary regulations.
- ✓ Conserve water through the application of measures to increase natural deep rooting in landscape plants.
- ✓ Supply water in sufficient quantity to prevent damage to plant.
- ✓ When it is necessary to source compost off-site, it is preferred that the OLC practitioner us qualified compost where it is available.

- ✗ Surface drainage into sensitive sites or onto neighboring property without permission.
- ✗ Over-watering.
- ✗ Draining or filling wetland habitat without jurisdictional consent.
- ✗ Use of fungicide-treated seeds and genetically-modified organism (GMO) seeds.
- ✗ Mulch blankets and anchoring materials containing substances prohibited by these standards.
- ✗ Installation of plants on the local "Invasive Plants" list for the area.
- ✗ Use of two-cycle gasoline-powered equipment, except for chain saws.
- ✗ Installation of plants considered to be invasive by the local soil and water conservation district.
- ✗ Use of synthetic herbicides not allowable by the NOP.
- ✗ Application of processed organic fertilizers unless deficient as determined by a soil chemistry test.

## RESOURCES


Plant Health Care, Trees are Good Tree Care Information, International Society of Arboriculture *http://www.treesaregood.com/treecare/phc.aspx.*

Plant Health Care, Pesticide Education Program, Washington State University *http://pep.wsu.edu/factsheet/phc.html*

Plant Health Care. Arbor Day Foundation, Nebraska City, Nebraska *http://www.arborday.org/treeinfo/treehealth/planthealthcare.cfm*

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Trees, Pruning Mature Trees, International Society of Arboriculture *http://www.treesaregood.org/treecare/treecareinfo.aspx*

Oregon Invasive Species Council *http://www.oregon.ogov/OISC*

Washington Invasive Species Council, Washington State Recreation and Conservation Office *http://www.rco.wa.gov/invasive_species/default.htm*

Invasive Plant Council of British Columbia *http://www.invasiveplantcouncilbc.ca/*

Conservation Alliance's Alien Plant Working Group *www.nps.gov/plants/alien/index.htm*

Missouri Botanical Garden, draft voluntary codes of conduct pertaining to invasives *http://www.centerforplantconservation.org/invasives*

The Nature Conservancy, Wildland Invasive Species Team *http://tncweeds.ucdavis.edu*

National Agricultural Library, for the National Invasive Species Council *http://www.invasivespecies.gov/council/main.shtml*

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Pacific Northwest Nursery IPM: Slugs and Snails *http://oregonstate.edu/dept/nurspest/mollusks.htm*

Bio Integral Resource Center. Berkeley, California *www.birc.org*

National Center Sustainable Agriculture Information Services. Fayetteville, Arkansas *www.attra.org*

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Sustainable Agriculture Handbook Series Book 4. Sustainable Agriculture Publications, Burlington, Vermont . 230 pp.

*The NOFA Organic Lawn and Turf Handbook*. 2007. 103 pp.

*NOFA Standards for Organic Land Care* (4TH edition) January 2008 86 pp.

Pears, Pauline (ed.). 2005. *Rodale's Illustrated Encyclopedia of Organic Gardening: the Complete Guide to natural and Chemical-Free Gardening*. New York, New York. DK Publishing. 416 pp.

Alternative Farming Systems Information Center *www.nal.usda.gov/afsic*

National Agriculture Library for research journals, Appropriate Technology Transfer for Rural Areas (ATTRA) *www.attra.org*

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# List of Abbreviations/Acronyms

APLD: Association of Professional Landscape Designers
ASLA: American Society of Landscape Architects
ASSE: American Society of Safety Engineers
FSC: Forest Stewardship Council
GMO: Genetically Modified Organism
IAPMO: International Association of Plumbing and Mechanical Officials
IFOAM: International Federation of Organic Agriculture Movement
IPM: Integrated Pest Management
LID: Low Impact Development
NOFA: National Organic Farmers Association
NOP: National Organic Program, United States Department of Agriculture
OISC: Oregon Invasive Species Council
OLC: Organic Land Care
PHC: Plant Health Care
PVC: Polyvinyl Chloride
WSDA: Washington State Department of Agriculture

# Background on Authors

**Bruce Nelson** is a Horticulture instructor at Clackamas Community College, a certified Arborist and a long time organic gardener.

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