Environmentally Responsible
Gardening in the RDN

Regional District of Nanaimo
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INTRODUCTION

You may be in contact with curious composters and gardeners as part of your job, or you may want to teach organic gardening and waste reduction in your school, apartment building, or community. Either way, this manual is designed to help you field questions or give presentations about composting, water-wise gardening and natural lawn care. It is important people know a few basics about the process and practices if their efforts are to be successful.

If you work with people who are interested in gardening or environmental issues, you’ll already know that composting is enjoying a newfound popularity. More and more people are using backyard or worm composters in their homes. Unlike compost enthusiasts of the past, however, many of these people aren’t composting primarily to produce a garden nutrient – they are interested in learning how to reduce their household’s solid waste. Fortunately, with the magic of composting, they can do both!

Because composting can reduce a typical household waste stream by about 30%, municipal, regional and provincial governments have embarked on a number of programs to encourage backyard composting. The public has responded with enthusiasm and, as a result has a great deal of interest, and questions about the composting process.

In the summer months much of our Region’s water is used on lawns and gardens. In backyard ecosystems water conservation is naturally integrated with waste reduction. Many chores and tools that decrease household waste also conserve water. A prime example is leaving grass clippings on the lawn, known as grasscycling, which serves to reduce garbage, reduce fertilizer requirements and conserve water.

This manual has been designed to help residents of the Regional District of Nanaimo to connect with nature in their backyards, by practicing responsible and ecologically sustainable gardening. It also provides interested individuals with the tools to aid in waste reduction efforts, by becoming leaders in the movement towards composting in their communities.

All the sections of this manual will be updated as the need arises. If you have comments or questions about the manual that might help improve it in the future, we would like to hear from you. Please contact RDN Environmental Services at 390-6560 or toll free at 1-877-607-4111.

OVERVIEW OF COMPOSTING IN THE RDN

The Regional District of Nanaimo, along with other regional districts in B.C., were mandated by the province to reduce per capita garbage disposal by at least 50% by the year 2000. This goal has been achieved in the year 2001.

Composting yard and kitchen trimmings is a key component in reducing household waste and the RDN will continue to promote backyard composting. Studies indicate that in a typical single-family home, lawn clippings, plant trimmings and kitchen scraps account for over 30% of the waste generated. It’s only common sense to tackle such a significant portion of the waste stream!

Cutting Down on Waste

There are over 130,000 residents in the RDN, and each one produces approximately 1.05 Kilograms of garbage each day. This amounts to in excess of 50,000 tonnes of garbage a year. While citizens have enthusiastically responded to recycling programs, it’s important to realize that recycling isn’t the primary solution to our waste woes. Recycling is important, but it’s also more expensive than reducing waste at the source, and isn’t appropriate for much of the waste we generate.

Rather than looking for ways to recycle all our waste, it’s much more efficient – and a lot cheaper – to reduce our waste at the source. If you don’t make garbage, you don’t have to figure out how to deal with it!

Of course, we may always produce some waste that will require disposal. But the amount can decrease significantly if we remember the 3 Rs – Reduce, Reuse and Recycle. First, reduce the amount of waste you generate, by bringing your own shopping bags to the store and buying minimally packaged articles. Then, reuse what you can; perhaps you could buy milk in glass bottles and return them to the store. Finally, recycle whatever materials are accepted in your local blue box or drop-off depot.
HISTORY OF COMPOSTING

Long before people inhabited the planet, composting was just something that happened. In every swamp, forest and meadow – wherever there was vegetation – there was composting. Then, sometime in the distant past one of our ancestors noticed that crops grew better near piles of rotting manure and vegetation. The discovery was passed down to succeeding generations. Composting, that perfectly natural process that just happens, became something our ancestors learned to use.

One of the earliest references to compost use in agriculture appears on a set of clay tablets from the Akkadian Empire in the Mesopotamian Valley 1,000 years before Moses. The Romans knew about compost, the Greeks and the tribes of Israel both had a word for it. There are references to it in the Bible and Talmud.

There are also references to composting in medieval church texts and Renaissance literature. William Caxton, a 15th century printer, spelled it ‘composting’. Hamlet advises, “do not spread the compost on the weeds, to make them ranker”.

The Chinese systematically applied the principles of composting. Crop wastes were laid on roads and pathways to be crushed by passing carts and then returned to the fields with human and animal manure.

In New England in the 19th century, Stephen Hoyt and Sons used 220,000 fish in one season of compost making. Their method: spread a layer of “muck” (marsh and swamp mud) one foot thick, then a layer of fish, then an layer of muck and so on. They combined 10 to 12 loads of muck to every load of fish until the pile reached a height of 5 to 6 feet. Then they turned the pile until composting was complete.

The early 20th century, and especially the post 2nd World War period, can be described as ushering in a new “scientific” method of farming. Scientific farming called for the application of nutrient-rich chemical fertilizers. Combinations of muck and dead fish didn’t look very effective beside a bag of chemical fertilizer. For farmers in many areas of the world, the new chemical fertilizers replaced compost.
Sir Albert Howard, a British government agronomist, went to India in 1905. He stayed for 29 years and experimented with different ways to make compost before settling on the Indore Method. This method calls for three parts plant material to one part manure, with materials spread in layers and turned during decomposition.

Publication of Sir Howard’s book, *An Agricultural Testament* (1943), generated renewed interest in organic methods of agriculture and gardening. Howard’s work and the research it has promoted earned him recognition as the modern-day father of the organic method. J.I. Rodale, in North America, carried Howard’s work further. He established the Farming Research Centre and *Organic Gardening* magazine. Now, organic methods in gardening and farming are becoming increasingly popular. Even farmers who rely on expensive fertilizers recognize compost’s value for plant growth and restoring depleted and lifeless soil.
THE SCIENCE OF COMPOSTING

Composting is the biological decomposition or breakdown of organic material by bacteria and other organisms. Bacteria are the primary decomposing organism, but there are many others, including fungi, actinomycetes, worms and beetles. These organisms bring about decomposition by feeding on organic material. The result is compost or humus seen as a dark, nutrient-rich soil conditioner.

While our ancestors recognized that composting was useful in building soil and growing healthy plants, they didn't know how or why it worked. Much of this how and why of composting has arisen out from the explosion of interest and research into composting which has evolved over the last 50 years. This research has produced a body of information that we call the science of composting.

Any organic material in the natural environment will decompose over time. Composting, as a science, looks at the factors that enable decomposition to proceed more quickly and efficiently by managing or controlling these factors.

Organic Material

Any organic material can be added to the compost. For our purposes organic material is everything growing in the backyard and most food waste, especially fruit and vegetable scraps. Weeds, leaves, plant trimmings, apple cores, tea bags and potato peels are organic. Wood and large twigs are organic, but may take too long to decompose to be of practical use in composting. See page 16-17.

Decomposing Organisms

Decomposing organisms are all the micro-organisms and larger organisms involved in breaking down organic material. Bacteria are the primary decomposing micro-organisms. They arrive with the organic material, and start the process by breaking down the organic material for their own food. Bacteria grow and multiply while conditions are right for them, and die off as they create...
The food web shows relationships between organisms, based upon who eats whom. Dead organic materials are first eaten by organisms like molds and bacteria. These are known as first-level (1) consumers. Earthworms, beetle mites, sowbugs, whiteworms, and flies also consume waste directly. First-level consumers are eaten by second-level (2) consumers such as springtails, mold mites, and protozoa. Third-level (3) consumers are flesh-eaters, or predators, which eat 1 and 2 consumers. Predators in a compost might include centipedes, rove beetles, ants, and predatory mites.
Bacteria use carbon as a source of energy. Nitrogen is their main source of protein.

Micro-Organisms — Chemical Decomposers

Bacteria

Bacteria are abundant. There may be millions in a gram of soil; you would need 25,000 laid end to end on a ruler to make 2.54 cm (an inch). They exist on every piece of organic matter even though you can't see them. When exposed to organic tissue, bacteria “invade” — eating and digesting the tissue, breaking it down into simpler forms for other bacteria and organisms to consume. As a group, bacteria are considered to be nutritionally diverse, which means that they can eat almost anything, living or dead.

Bacteria require both nitrogen and carbon that come from organic materials. The more variety, the greater the likelihood they will find a blend of essential nutrients. Bacteria use carbon (C) as a source of energy, and by oxidizing carbon, generate heat and carbon dioxide (CO₂). Nitrogen (N) is their main source of protein, which is needed for bodybuilding and population growth.

Given the proper environmental conditions, bacteria reproduce very quickly by binary fission. The nuclei split in two and new cell walls grow crosswise over the middle of the cells. Then they do it again and again. The lifespan of one generation of bacteria is as short as 20 to 30 minutes. With sufficient food and other favourable conditions, one gram of bacteria could become 0.4536 kg (a pound) in three hours and the size of the earth in one and a half days. Of course, these conditions never exist.

There are two types of composting processes: aerobic and anaerobic. Different species of bacteria occur in each process. Aerobic composting uses oxygen. Rapid, high-temperature composting is mostly aerobic. This is the recommended method for residential composting.
Psychrophilic bacteria, mesophilic bacteria and thermophilic bacteria each operate best within specific temperature ranges.

When there is little air and high moisture, anaerobic composting is likely to result (anaerobic means without oxygen). In an anaerobic process fermentation results in the formation of ammonia-like substances and hydrogen sulfide, which smells like rotting eggs. The anaerobic process is not recommended for backyard composting.

Temperature is an important variable in composting. As temperatures rise and fall in the compost, different bacterial species will become more or less active. Psychrophilic bacteria, mesophilic bacteria and thermophilic bacteria each operate best within specific temperature ranges.

The psychrophiles are the first to go to work. They can work in temperatures below 0°C (as low as -18°C), but are most active around 13°C. They are cooler temperature aerobic bacteria that burn or oxidize carbon and generate some heat. Often they generate enough heat to make conditions tolerable for the next group of bacteria called mesophiles.

Mesophilic bacteria do most decomposition work. These are the mid-range bacteria that operate in temperatures between 15°C and 40°C, but thrive when temperatures are closest to 21°C to 32°C. Heat generated as a by-product of the mesophiles' work will raise the temperature in the pile even more, creating conditions suitable for thermophilic composting.
The thermophiles do “hot” composting. They start to take over when temperatures reach 40° to 45°C and will continue to work in temperatures up to about 70°C when their numbers start to decline. Thermophiles work quickly and don’t live long, three to five days at most. Turning the pile will provide oxygen (O2) and allow the thermophilic bacteria to continue their activity. As temperatures drop and thermophiles die off, the compost moves into a more mature stage. Mesophiles and psychrophiles, which may have been working in a reduced capacity around the cooler edges of the decomposing organic material, will become more active.

**Actinomycetes** - Actinomycetes are a higher form of bacteria, similar to fungi, and second in number to bacteria. They don’t respond well to acidic conditions (below pH5) or high moisture conditions, but operate best at medium temperature areas of the compost. Actinomycetes take over during the final stages of decomposition, often producing antibiotics that inhibit bacterial growth. They are likely to work on tough organic material and give compost its pleasant, earthy smell. They are especially important in the formation of humus. They liberate carbon (C), nitrate nitrogen (NO3) and ammonium nitrate (NH4), making nutrients available to plants.

**Fungi** - fungi are smaller in number than bacteria or actinomycetes, but larger in body mass. Fungi are simple organisms that lack a photosynthetic pigment. The individual cells have a nucleus surrounded by a membrane and they may be linked together in long filaments. Fungi live on dead or dying material and obtain energy by breaking down organic material. Like actinomycetes, fungi are present during the early and final stages of composting, when the organic material has been changed to a more digestible form. Of the major micro-organisms, fungi function best under acidic conditions.

**Macro-Organisms/Physical Decomposers** - Macro-organisms are the visible organisms involved in transforming organic material into compost. They are more active in the later, mature stages of composting, when temperatures are dropping but decomposition isn’t complete. Micro-organisms decompose chemically, while macro-organisms are higher up in the food chain and decompose physically – by digging, grinding, chewing, digesting, sucking and churning.

**Ants** - Ants are insects with six legs, a head, thorax and abdomen. Ants feed on a variety of materials in the compost. They may bring fungi and minerals such as potassium and phosphorous into the compost.
Millipedes – A millipede is thick-skinned with dark red segments. There are many segments, each with two pairs of legs, but not the thousand that “milli” implies. They eat soft decaying vegetation, and will roll up in a ball when they are in danger.

Snails and Slugs – Snails and slugs are mollusks that travel in a creeping movement. Snails have a spiral shell with a distinct head and a foot that is retractable. Slugs are without a shell and somewhat bullet-shaped with antennae on their front section. Both feed on living plant material but you find them in the compost attacking plant debris.

Nematodes – Nematodes (round worms) are the most abundant invertebrates in the soil. Some nematodes live on decaying organic matter, while others are predators on other nematodes, bacteria, algae, protozoa and fungal spores. There are also pest forms of nematodes that attack plant roots.

Fermentation mites – Fermentation mites, also called mold mites, are transparent-bodied creatures that feed on yeasts in fermenting masses of organic matter. These mites are able to withstand anaerobic conditions for moderate periods of time, and may be a good indicator of those conditions in compost. They eat plant material, such as the soft tissue of leaves.

Springtails – Springtails are small insects distinguished by their ability to jump when disturbed. They are principally fungi-feeders, though they also eat molds and nematodes and chew on decomposing plants. They vary in colour from white to blue to black.

Spiders – Spiders are eight-legged creatures and third-level consumers that feed on insects and small invertebrates.

Centipedes – Centipedes are flattened and segmented with one pair of legs in each segment. They have 15 or more pairs of legs. They are third-level consumers, feeding on soil invertebrates either their size or larger. This means they are unwelcome in a worm bin as they may attack and kill the worms.

Sow bugs – Sow bugs have a flat and oval body with distinct segments and ten pairs of legs. They are first-level consumers that feed on rotting woody materials and other durable tissues like leaf veins. Pill bugs look similar to sow bugs but roll up in a ball when disturbed.

Flies – Flies are two-winged insects that feed on almost any kind of organic material. They also act as airborne carriers of bacteria.
Whiteworms – Whiteworms (potworms) or enchytraeids (en kee tray’ id) are about an inch long. They help finish off the compost by breaking particles of material down into smaller pieces.

Earthworms – Earthworms are the most popular of all the larger decomposers in the compost pile. There are over 60 species of earthworms in North America. The one we most often find in compost or manure piles is the red wiggler (Eisenia fetida). They are about five cm long with alternating segments of buff and maroon. *Lumbricus rubellus* is another earthworm that lives in compost. They consume bacteria, fungi, protozoa and organic matter. As they digest organic material, they leave nutrient-rich castings in their path. Unlike other large decomposers, they break down material both physically and chemically. The dew worm (*Lumbricus terrestris*) and other species of earthworms will also visit your compost.

Key Factors That Affect Composting

Compost variables are the factors affecting the speed of composting. The organisms that make compost need food, air and water. Providing them with a favourable balance of food, air and water will allow them to make compost quickly. Other variables affecting the speed of composting include temperature, surface area and volume.

Food

Organic material is food for bacteria and other organisms. This organic material or food contains carbon and nitrogen. Bacteria use carbon (C) for energy and nitrogen (N) for protein to grow and reproduce.

All organic matter is composed of carbon and nitrogen. For most homes composting a ratio of 20 - 30:1 is recommended – that between 20 and 30 parts carbon to one part nitrogen. When the ratio is between 20 and 30:1, composting proceeds most efficiently. When carbon content rises above 30, heat production drops and the rate of composting slows. When the ratio drops below 20:1, excess nitrogen is lost to the air as ammonia and there is a rise in pH level, which may be toxic to some microorganisms. A blend of one part carbon-rich material and one part nitrogen-rich material is a general rule in composting.

Carbon and nitrogen levels vary with each organic material. The table on the following page gives examples of the Carbon/Nitrogen ratios of certain materials. See Section 4 for more practical advice.
## Carbon/Nitrogen Ratios for Composting Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>C:N Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>12:1</td>
</tr>
<tr>
<td>Corn stalks &amp; cobs</td>
<td>50-100:1</td>
</tr>
<tr>
<td>Fern (green only, no spores)</td>
<td>43:1</td>
</tr>
<tr>
<td>Food waste</td>
<td>15:1</td>
</tr>
<tr>
<td>Fruit Waste</td>
<td>35:1</td>
</tr>
<tr>
<td>Grass</td>
<td>19-20:1</td>
</tr>
<tr>
<td>Hay, green</td>
<td>25:1</td>
</tr>
<tr>
<td>Newspaper</td>
<td>170:1</td>
</tr>
<tr>
<td>Manure with bedding</td>
<td>20-23:1</td>
</tr>
<tr>
<td>Paper</td>
<td>170-500:1</td>
</tr>
<tr>
<td>Leaves</td>
<td></td>
</tr>
<tr>
<td>Alder</td>
<td>40-80:1</td>
</tr>
<tr>
<td>Ash</td>
<td>21-25:1</td>
</tr>
<tr>
<td>Aspen</td>
<td>63:1</td>
</tr>
<tr>
<td>Beech</td>
<td>51:1</td>
</tr>
<tr>
<td>Birch</td>
<td>50:1</td>
</tr>
<tr>
<td>Black elder</td>
<td>22:1</td>
</tr>
<tr>
<td>Douglas fir</td>
<td>77:1</td>
</tr>
<tr>
<td>Elm</td>
<td>28:1</td>
</tr>
<tr>
<td>Larch</td>
<td>113:1</td>
</tr>
<tr>
<td>Linden</td>
<td>37:1</td>
</tr>
<tr>
<td>Maple</td>
<td>52:1</td>
</tr>
<tr>
<td>Oak</td>
<td>47-50:1</td>
</tr>
<tr>
<td>Pine</td>
<td>66:1</td>
</tr>
<tr>
<td>Spruce</td>
<td>48:1</td>
</tr>
<tr>
<td>Manures</td>
<td>15-25:1</td>
</tr>
<tr>
<td>Sawdust, rotted</td>
<td>208:1</td>
</tr>
<tr>
<td>Sawdust, raw</td>
<td>511:1</td>
</tr>
<tr>
<td>Seaweed</td>
<td>19:1</td>
</tr>
<tr>
<td>Straw</td>
<td>80:1</td>
</tr>
<tr>
<td>Vegetables</td>
<td></td>
</tr>
<tr>
<td>beans</td>
<td>15:1</td>
</tr>
<tr>
<td>cabbage</td>
<td>12:1</td>
</tr>
<tr>
<td>carrots</td>
<td>27:1</td>
</tr>
<tr>
<td>tomatoes</td>
<td>12:1</td>
</tr>
<tr>
<td>onions, peas, pepper</td>
<td>15:1</td>
</tr>
<tr>
<td>potato tops</td>
<td>25:1</td>
</tr>
<tr>
<td>turnip tops</td>
<td>19:1</td>
</tr>
<tr>
<td>turnips, whole</td>
<td>44:1</td>
</tr>
<tr>
<td>trimmings</td>
<td>25:1</td>
</tr>
<tr>
<td>Weeds</td>
<td></td>
</tr>
<tr>
<td>buttercup</td>
<td>23:1</td>
</tr>
<tr>
<td>clover</td>
<td>27:1</td>
</tr>
<tr>
<td>general</td>
<td>25:1</td>
</tr>
<tr>
<td>Wood Chips</td>
<td>700:1</td>
</tr>
</tbody>
</table>

### What to Compost

Anything organic can be composted but some materials are more appropriate for backyard composting than others (see Page16/17). Material that would otherwise go out in your garbage, like food waste and leaves, can go in the compost. The wider the variety of material the better. Variety increases the chances of achieving a balance of carbon and nitrogen and widens the range of elements that will be returned to the soil.

### Balancing the Mixture

This balance of carbon and nitrogen is known as the carbon/nitrogen ratio. The carbon/nitrogen ratio describes how much carbon a material contains in relation to nitrogen. The ideal C:N ratio is approximately 20 to 30:1 (20 to 30 parts carbon to 1 part nitrogen). When bacteria are fed organic material in this ratio they grow and reproduce quickly. Too much carbon and material will break down very slowly. Too much nitrogen and your nose will tell you. The compost will smell of ammonia and may turn slimy.

When selecting materials you should try to maintain a balance between the numbers of N with the numbers of C indicated in the chart.
The recommended water level is between 40 and 60%.

Air

Proper aeration is a key environmental factor. Oxygen is required by many micro-organisms, especially aerobic bacteria. With sufficient oxygen they produce energy, grow quickly, consume more material and make nutrients available for plant growth. When oxygen is not available, aerobic bacteria die off and anaerobic bacteria take over. They will break down the material, but more slowly, and they produce an unpleasant odour.

Moisture

Aerobic bacteria require water to live. A sufficient quantity of water must be provided that will lightly coat the materials to be composted. Less than 40% moisture in the compost and bacterial activity slows down. More than 60% and water will replace air in the pockets amidst the organic material causing aerobic bacteria to drown and anaerobic bacteria to take over. Straw and wood will need more moisture than leaves, while food wastes or lawn clippings may not need any added moisture. Water forms a film of moisture on the materials, allowing the bacteria to do their work. Simply, the compost should feel as moist as a wrung-out sponge.

Temperature

As temperatures rise in the compost, decomposition speeds up. As temperatures drop, composting slows down. Outside temperatures also play a role. Warmer outside temperatures in the summer months stimulate bacteria and speed up composting. Colder temperatures in the winter slow it down.

Surface Area and Particle Size

Smaller particles of organic material provide more surface area for microbes to attack and speed up composting. Material that is reduced to two inch pieces is ideal, exposing lots of area for the critters to work and allowing air spaces.

Volume

Volume is a factor in retaining heat in the backyard compost bin. The more volume of material in the bin, the more self-insulating it will become in retaining the heat. For backyard composting in the Region one cubic metre is the maximum recommended volume for a compost bin. One cubic metre easily retains heat and moisture, but it is not so large that material will become too heavy and compacted, or too unwieldy for turning.
MAKING COMPOST

What to Compost

Anything organic can be composted but some materials are more appropriate for backyard composting than others (see page 16-17). Material that would otherwise go out in your garbage, like food waste and leaves, can go in the compost.

Balancing the Mixture

This balance of carbon and nitrogen is known as the carbon/nitrogen ratio. The carbon/nitrogen ratio describes how much carbon a material contains in relation to nitrogen. When bacteria are fed organic material in this ratio they grow and reproduce quickly. Too much carbon and material will break down very slowly. Too much nitrogen and your nose will tell you. The compost will smell of ammonia and may turn slimy.

Nitrogen-rich materials are known as “greens” and include fresh grass clippings, plant trimmings, manure and food waste, such as vegetable and fruit peelings, coffee grounds, tea bags and rinsed out egg shells.

Carbon-rich materials are known as “browns” and include dry leaves, sawdust, straw, woody stems and dead plants, and coffee filters.

“GREEN” AND “BROWN” MIX

Most materials don’t fit the ideal 20 to 30:1 ratio but you can balance the mix. When adding carbon-rich materials (browns), make sure you add equal amounts of nitrogen-rich material (green). Seasons change and available ingredients will change. Collect leaves in the fall and save them in a bag or box by the compost. You can reduce the volume of leaves for storage by running a lawn mower over them or put leaves in a garbage can and use your weed eater. Through the winter when you dig food waste (high N) into the centre of the compost, cover with leaves (high C) or soil. When short of greens in the winter, add a few ounces of nitrogen-rich materials such as blood meal, canola seed meal or manure. This will keep up temperatures and activity.
# Materials for Composting

<table>
<thead>
<tr>
<th>Material</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alfalfa</strong></td>
<td>good nitrogen source.</td>
</tr>
<tr>
<td><strong>Apples</strong></td>
<td>source of phosphorous and potash (potassium).</td>
</tr>
<tr>
<td><strong>Banana skins</strong></td>
<td>source of phosphorous (P) and major potassium (K), decay quickly.</td>
</tr>
<tr>
<td><strong>Best wastes</strong></td>
<td>source of magnesium, calcium and nitrogen.</td>
</tr>
<tr>
<td><strong>Blood meal</strong></td>
<td>good nitrogen source (12%); helpful to add when material to be composted is carbon-rich.</td>
</tr>
<tr>
<td><strong>Bone meal</strong></td>
<td>good nitrogen source (2-12%), major phosphorous source (20-25%).</td>
</tr>
<tr>
<td><strong>Citrus waste</strong></td>
<td>minor P, high in K, nutrient source.</td>
</tr>
<tr>
<td><strong>Coffee grinds</strong></td>
<td>nutrient source for the compost or can be used as mulch.</td>
</tr>
<tr>
<td><strong>Corn Cobs</strong></td>
<td>will take a long time to break down unless finely shredded.</td>
</tr>
<tr>
<td><strong>Food waste</strong></td>
<td>vegetables and fruit – nitrogen-rich material, decompose faster when they are chopped into smaller pieces. Dig into center of material and cover with carbon-rich material or soil.</td>
</tr>
<tr>
<td><strong>Grapes</strong></td>
<td>stalks and leaves minor nutrient source, adds bulk promoting aeration, cut into smaller pieces.</td>
</tr>
<tr>
<td><strong>Graas clippings</strong></td>
<td>best left on the lawn where they directly return the nutrients to the grass, excellent source of nitrogen in compost bins but be sure to mix them with brown materials like leaves so they do not turn smelly and mat. Caution: avoid use of clippings from grass treated with pesticides until after 3-4 cuts. Compost treated grass for one year before using on vegetable garden.</td>
</tr>
<tr>
<td><strong>Hair</strong></td>
<td>good source of nitrogen, mix with other materials. Do not use if hair has been chemically treated.</td>
</tr>
<tr>
<td><strong>Hay and straw</strong></td>
<td>high in carbon, chop or shred and wet for faster composting. Straw is better for air circulation as the stems are hollow and stiff.</td>
</tr>
<tr>
<td><strong>Leaves</strong></td>
<td>an excellent free source of carbon material. Collect in the fall for use during the gardening season. Mix with nitrogen-rich material.</td>
</tr>
<tr>
<td><strong>Manures</strong></td>
<td>(horse, sheep, cow, chicken and guinea pigs) – good source of nitrogen and other nutrients. Best to compost before use as some manure will burn plants.</td>
</tr>
<tr>
<td><strong>Mushroom manure</strong></td>
<td>excellent soil builder, low in nutrient value. Possible source of pesticides. Check the source.</td>
</tr>
<tr>
<td><strong>Newspaper</strong></td>
<td>best to recycle, contains no nutrients but shredded can serve as carbon material.</td>
</tr>
<tr>
<td><strong>Sawdust, wood shavings</strong></td>
<td>good carbon-rich material for composting. Takes longer to break down.</td>
</tr>
<tr>
<td><strong>Weeds</strong></td>
<td>good nutrient source. Best to use when green and no seed heads. Pernicious/perennial weeds should be dried before adding to compost.</td>
</tr>
<tr>
<td><strong>Wood ashes</strong></td>
<td>excellent source of potassium. Sprinkle directly into garden soil.</td>
</tr>
</tbody>
</table>

---

**N = Nitrogen**  
**P = Phosphorous**  
**K = Potassium**
Materials NOT for Composting

**Barbecue ashes/coal** – contain sulphur oxides; bad for garden. There is also concern with the chemicals applied to the barbecue bricks to assist ignition.

**Cooked food** waste – may contain fats that will attract animals.

**Crab grass or other grasses with a rhizomatous root system** – require thorough drying before adding to compost bin or they will grow again.

**Dairy products** (butter, cheese, mayonnaise, salad dressing, milk, yogurt, sour cream).

**Dishwater** – most dishwashing soaps contain perfumes, greases, and sodium.

**Dog, cat feces** – may contain disease organisms. Cat droppings may contain *Toxoplasma gandii* or *Toxocara cati*, a roundworm. Both can cause blindness, particularly in children.

**Fats, grease, and oils** – putrefy and smell bad as they break down.

**Fish scraps** – attract animals, fish scrap contains a lot of fish oil and breaks down more slowly.

**Grains** – may contain fat which can give off an odour in their breakdown and attract rodents or other pests.

**Kitty litter** – likely to contain disease organisms.

**Meat, bones** – attract animals.

**Weeds that have gone to seed** – compost unlikely to reach temperatures high enough to kill off the seed.

**Weeds like morning glory and buttercups** – may live on the compost unless thoroughly dried.

**Note**: There is much controversy around the possible problems associated with composting rhubarb leaves. A safe assumption is that they are perfectly safe to compost when mixed thoroughly with other materials.
Composting Systems

There is no one best system for managing compost. Instead, there are many ways, each offering advantages and benefits. Systems can range from mulching leaves on a path to gathering a batch of organic matter for a three-week hot compost. To determine which system is most appropriate for you, consider such factors as how much time you want to devote to composting, how much garden space is available, how much organic waste you have and how much money you want to spend.

1. Backyard Composting in Containers

Backyard composting in containers has changed dramatically over the past 10 years. Previous generations used heaps or containers largely open to the elements and neighborhood pests. Residents weren't concerned about rodents because the combination of people, composts and rodents in one area was not great enough to cause a problem.

That's not the current situation in the RDN. To prevent rodents from turning you compost into a home and food source, use a rodent-resistant container. Existing containers can be made rodent-resistant by lining top, bottom and sides with one-quarter inch galvanized wire mesh. Wire mesh is also called hardware cloth and is available at most building supplies stores. It is important that the compost bin has a secure base to prevent entry of rodents, and a secure full lid to prevent materials from becoming saturated from the heavy rainfall in our Region. A lid that is secured with a latch or locking device will deter raccoons.

"No Fuss Method"
This is the easiest way to do backyard composting. Drop yard wastes in the unit as they become available. Dig food waste into the center of existing materials and cover with a layer of soil or leaves. The compost bin stores yard and kitchen waste until the materials break down. Keep adding materials and decomposition will continue.

This method will take from one to two years to produce finished compost. The finished compost will be near the bottom. To harvest the compost, open the container, set aside the un-decomposed material and remove the finished compost. Return the unfinished material to the container.
Two compost bins can handle more material. Use one bin for fresh wastes while the material in the other unit is maturing for use.

**"The Some Fuss Method"**
This is the system that most composters will settle on. With “Some Fuss” composting you spend more time composting in the spring, summer and fall when you are gardening. Your compost heats up intermittently, perhaps soon after adding a layer of fresh grass clippings. You turn the compost or aerate the material with an aerating tool to mix the material and make sure the composting organisms are getting enough air.

Your compost should be as moist as a wrung-out sponge. It’s about right if you can form a ball with the material in your hand but not wring any water droplets out. If it’s too wet, add dry material to absorb moisture. If it’s too dry, add green, wet materials like food waste. Or, add water from the hose or watering can so that materials will be dampened gradually and thoroughly. Ideally, chop or shred everything into chunks of about two inches to increase the surface area for the organisms to work on.

**“More Fuss”**
This system is a fast, hot, active system and requires more management. The work is “turning” or mixing the organic material. Regular turning (once a week) ensures that bacteria get the air they need to do their work.

This composting method is most efficiently accomplished in batches. Stockpile organic material until there is enough to fill the compost bin – usually a cubic metre (approx. 3’x3’x3’). Kitchen waste can be saved and stored in a sealed plastic garbage can with sawdust or soil to control odours and pests. Chop or shred all material to maximize surface area. Add the material in layers from two to three inches thick. Moisten layers as necessary. Alternate with layers of carbon-rich material (browns) with nitrogen-rich material (greens). Fill the compost bin full with material.

Within 24 hours the temperature will rise to 60°C-70°C. This is the hot composting system and you should monitor the process. These temperatures are maintained for four to seven days. When temperatures drop it is time to aerate the materials. Transferring the materials into a second bin can do this. Try to get material from the top into the bottom of the unit to achieve complete destruction of weed seeds and pathogens. If you have only one unit, probe the material with an aeration tool getting the air into the mass of material.
Mulching discourages weeds, keeps plants cool and moist, protects plants from frost, prevents soil erosion and compaction and conserves water.

This temporarily interrupts the heat cycle but the temperatures will quickly rise for another four to seven days. The material will cool. Compost managed this way should be left to mature for three months.

2. Mulching

Mulching is another form of composting. A layer of organic material is added on top of soil. It mimics what happens on the forest floor where leaves and needles drop to the ground, break down over time and are taken back up into the plants as food. It is a very slow but efficient way of composting.

Mulching has many benefits. Gardeners mulch with organic materials for many reasons, such as:
- To discourage weeds, to keep plant roots cool and moist,
- To protect plants from frost,
- To prevent soil erosion and compaction
- And to reduce the need for watering in the summer.

Spread the organic material on top of the soil around plants and on garden paths. Wood chips, leaves from deciduous trees and shrubs, lawn clippings and sawdust are suitable mulch materials around perennial plants. Around vegetable and annual flower gardens, it is best to use nitrogen-rich materials (green) like lawn clippings, weeds and other green garden trimmings.

Problems and Solutions

For heat loving plants, pull the mulch back from the planting bed and allow the sun to warm the soil in the Spring, before planting and re-mulching.

To deal with possible nitrogen shortage, add an additional source of nitrogen, such as blood meal or cotton meal.

You may experience an increase in the snail and slug populations, especially if the weather is wet. Pull back the mulch, pick the slugs into a container, freeze and add to your compost.
Making backyard Compost – A Simple Summary

1. Buy or build a rodent-resistant bin.
2. Locate the bin on well-drained, level soil.
3. Use coarse organic material such as straw or prunings on the bottom few inches.
4. Chop material into smallish pieces.
5. Add green nitrogen-rich material (moist) and brown carbon-rich material (dry) in equal amounts.
6. Dig food waste in the center and cover or layer with dry carbon materials
7. Aerate the material as often as possible, ideally once a week.
WORM COMPOSTING

Worm compost is made in a container filled with moistened bedding and redworms. Add food waste and with assistance from microorganisms, the worms will convert bedding and food waste into compost. Worm composting can be done year-round, indoors in schools, offices and homes. It is a natural method for recycling nutrients in food waste without odour. The resulting compost is a good soil conditioner for houseplants, gardens and patio containers.

How You Do It

Buy or build a box with holes in the bottom. Fill the box with moistened bedding. Add the redworms. Pull aside some of the bedding, bury the food waste and cover it up with bedding. Add one cup of soil or sand to provide grit for worms’ digestive process.

What You Need

1. A container (made of wood or plastic)
2. Worms (500-2,000 redworms)
3. Bedding (shredded newspaper, corrugated cardboard and/or leaves)
4. Food waste (fruit and vegetable waste)

1. The Container

Buy or build a container or use an old dresser drawer, trunk or barrel. Wood containers are absorbent and good insulators for worms. Plastic containers do work but compost tends to get quite wet.

The container should be between 20 cm and 30 cm (8-12 inches) deep and provide 0.09m² (1 square foot) of surface area for every 0.45 kg (pound) of food waste per week (e.g., 2.72 kg [6 lbs] of waste requires a bin 0.6m x 0.9m [2 feet by 3 feet] or 2 bins 0.3m x 0.9m [1 foot by 3 feet]).

Depending on the container’s size, drill 8 to 12 holes 3mm-6mm (3/16-1/4") in the bottom for aeration and drainage. A plastic bin may need more drainage – if contents get too wet, drill more holes. Raise the bin on bricks or wooden blocks for air circulation. Place a tray underneath to capture excess liquid, which can be used as liquid plant fertilizer. Some newer containers replace drainage holes in the bottom with a
When temperatures drop below 4°C, bins should be indoors, heated or well insulated.

Redworms are best suited to composting.

Warning: aged manure is so well-liked by the worms that they may ignore the food waste

Worms like a moist, dark environment. Their bodies are 75 to 90% water and worms’ body surfaces must be moist for them to breathe. Cover the bin to conserve moisture and provide darkness. Indoors, place a sheet or dark plastic or burlap sacking on top of the bedding. Outdoors, use a solid lid to keep out unwanted scavengers and rain.

Worm bins can be located in the basement, shed, garage, balcony or kitchen counter. They need to be kept out of the hot sun, heavy rain and cold. When temperatures drop below 4°C, bins should be indoors, heated or well insulated. The container can be heated with an electric heating cable placed in the bottom third of the container. To insulate, surround the container with 2-3” rigid styrofoam.

2. The Worms

Redworms are best suited to composting. They are often found in aged manure, compost heaps, and piles of leaves. They are also known as red wiggler, brandling and manure worms. Their official names are Eisenia foetida and Lumbricus rubellus. Redworms are best suited for composting because they thrive on organic material, such as food waste. Dew-worms, on the other hand, are better suited to life in the soil and shouldn't be used in a worm bin.

You can get worms from a compost bin, purchase them or find a horse stable or farmer with an aged manure pile. Local Compost Demonstration Gardens can help you find local sources of red wigglers.

For one pound per day of food waste, you'll need two pounds of worms (roughly 2,000). If you are unable to get this many worms at the start, reduce the amount of food waste until the population increases. And the population will increase. Redworms mature sexually in 60-90 days and can then produce cocoons, which take 21 days to hatch baby worms. Once they start breeding they can deposit two to three cocoons per week with two baby worms in each cocoon. The limits on their reproduction include availability of food and room to move and breed. So worm populations don't usually exceed the size of the container.

3. The Bedding

Provide damp bedding. Suitable bedding material includes shredded newspaper and cardboard, shredded fall leaves, chopped-up straw and other dead plants, seaweed, sawdust, dried grass clippings, aged manure and peat moss. Peat moss is quite acidic and should be well
soaked and combined with other bedding material. Vary the bedding in the bin to provide more nutrients for the worms and to create richer compost. Two handfuls of sand or soil will provide the necessary grit for worms’ digestion of food.

Fill the bin with a mixture of damp bedding so the overall moisture level is like a “wring-out sponge”. Lift the bedding gently to create air spaces. This maintains aerobic activity, helps control odours and gives the worms freer movement.

4. The Food Waste

Your worms will eat food scraps such as fruit and vegetable peels, pulverized eggshells, tea bags and coffee grounds. To avoid potential rodent problems do not compost meats, dairy products, oily foods or grains. No glass, plastic or tin foil.

Pull aside the bedding, bury the food waste deep and then cover it up with the bedding again. Divide the bin into three or four imaginary sections (larger bin, more sections) and bury successive loads in different locations in the bin. Keeping a chart of burial sites can be helpful. Weekly food waste will help determine the size of bin and number of worms you’ll need. Collect food waste in a container and weigh it. Do this for two weeks to get an estimate of average food waste. Your bin should provide one square foot of surface area for every pound of food waste per week. And you will need two pounds of worms for every pound of food waste per day.

Harvesting Your Compost

After six weeks, the bedding will be noticeably darker with worm castings. After two and a half months have passed, there will still be some of the original bedding visible in the bin plus brown and earthy-looking worm castings. Although food waste is being added regularly, the bedding volume will gradually decrease. As more bedding is converted into castings the worms will begin to suffer. It is time to decide whether you want to do “some fuss” or “more fuss” worm composting.

“Some Fuss” Harvesting

Some fuss worm composting involves moving the finished compost over to one side of the bin, placing new bedding in the space created, and placing food waste in the new bedding. The worms will gradually move over to the fresh bedding and food waste, and the finished compost can be harvested. Fill the space created with new damp bedding.
“More Fuss” Maintenance

If you want to use all of the compost at once, dump the bin’s entire contents onto a large plastic sheet and make piles of material. Use sunshine or a hundred watt light bulb to drive the worms to the bottom of the piles. Worms don't like bright light because the single cells on the epidermis (skin) react to light. Scoop off the tops of each pile until all you have left is the worms. Most children love to help! Watch out for the tiny, lemon-shaped worm cocoons that contain the baby worms. Mix a little of the finished compost in with the bedding of the next bin.

Show a Little Respect

We must act responsibly if we take worms out of their natural environment and place them in containers. They are living creatures with their own unique needs, so it is important to create and maintain a healthy habitat for them to do their work. If you supply the right ingredients and care, your worms will thrive and make compost for you.

Common Problems

Unpleasant Odours

Unpleasant odours may waft from your bin when it is overloaded with food waste. If this occurs, gently stir up the contents to allow more air in. Stop adding food waste until the worms and micro-organisms have broken down what food is already in the bin. Check the drainage holes to make sure they are not blocked and add more holes if needed. If the moisture level seems right, the bedding may be too acidic from citrus peels and other acidic foods. Adjust by adding a little dolomite lime and cutting down on acidic wastes.

Fruit Flies

Fruit flies aren’t harmful, but they are a nuisance, and a very common problem with worm bins. Discourage fruit flies by always burying the food wastes and not overloading the bin. Keep a plastic sheet or a piece of old carpet or a lid on the compost's surface in the bin. Mary Appelhof, author of Worms Eat My Garbage, acknowledges that she hasn’t found the perfect solution to fruit flies. Adding a spider or two helps reduce fruit flies. In flies persist, move the bin to a location where flies will not be bothersome.
LOCAL SOURCES OF WORMS AND CONTAINERS

The ‘red wigglers’ or redworms are known by the scientific names of “Eisenia fetida” and “Lumbricus rubellus”. Both types of earthworms are found in nature within compost, manure piles, by streambeds and under decaying logs.

Carolyn Dyment
Parksville, Vancouver Island
Tel: (250) 248-1074   E-mail: cdyment@home.com
Custom orders, Contact for details.

Dave Greig
Victoria
Tel: (250) 598-8220
½ pound $12.50

Nanaimo Recycling Exchange
Tel: (250) 753-3070
Starter bag for a $5.00 donation

Victoria Compost Ed. Centre
Victoria
Tel: (250) 386-9676
1 pound for $10
Section 6

USING COMPOST

Your compost should be ready for use anytime between four months and two years from when you began composting.

The final stage of composting is using the finished product. The next stage is wishing you had more of it. Your compost should be ready for use anytime between four months and two years from when you began composting. You know you have finished compost when it is dark in colour, crumbly but not powdery and smells earthy. These are indications that the compost has stabilized – or matured – and that the original raw organic material has been converted into nutrient-rich humus. If you wish, a simple pH test kit can give you an indication of maturity. Finished compost is in the neutral range.

Compost is classified as a soil conditioner rather than a fertilizer. To be classified as a fertilizer it would have to have higher levels of nitrogen, potassium and phosphorous. Finished compost does add these elements, and others, but tends to release them over a longer period of time than chemical fertilizers.

As well, compost adds organic material to the soil, increases permeability of clay soils and increases water-holding capacity of sandy soils, promotes root growth and creates spaces for air and water.

Finished compost is usually found at or near the bottom and centre of the compost bin. For many applications it is desirable to screen the compost through a one-half inch mesh before using it. Material that doesn’t fall through the screen can be thrown back into the bin for further composting or used as mulch.

The early spring is the best time to add large volumes of compost to the garden. It can be dug into the top six inches of the soil. By mixing the organic matter with the slowly warming earth, it supplies nourishment just in time for planting. Screened compost can be used with an equal volume of soil and sand for a seedling mixture. Use it straight up for a top dressing on potted plants and patio container gardens. For containers and hanging baskets use one-third compost, one-third potting soil and one-third vermiculite or perlite.
Ways to Use Compost

**Top Dressing**
Top dressing is placing compost on the soil around the bottoms of flowers, vegetables, shrubs, and trees, leaving the stem free for air to circulate. With larger trees, the compost can be placed on top of the soil six inches from the tree’s trunk to just beyond the drip line. Aerate the lawn in the spring by pulling cores (machine or hand tool) then rake 5 cm of screened compost over the lawn surface.

**Mulching**
Mulching is similar to top dressing. The compost or other organic material is placed on the soil to finish breaking down. Aside from adding organic material, mulching helps retain moisture in the soil, smothers weeds and inhibits soil compaction. Be sure to remove the weeds before mulching. Grass clippings left on the lawn as mulch, will help retain moisture and provide nutrients.

**Transplanting**
Dig a hole twice the size of the root ball, mix compost with an equal part of topsoil and fill in around the root ball, tamping the mixture just enough to eliminate air pockets. Water gently.

**Compost Tea**
Fill a cloth bag with a litre of compost. Tie the bag and soak in a garbage can full of water. Let it steep overnight and pour the “tea” into the soil for your plants. If you let the compost steep longer than overnight, the water may need to be diluted before pouring.
WATERWISE GARDENING

Why Conserve Water?

Despite the mid-Island’s apparently high rainfall throughout most of the year, we still have to worry about water conservation. Until recently we have assumed that our supply of water is unlimited. We pride ourselves on our lush gardens and lawns that stay green all year. The result is a rate of water consumption that is among the highest in the world.

Although we receive a lot of rain, most of our rainfall occurs during the winter. In the summer, when demands are highest, rainfall is limited. In addition, population growth over recent years has resulted in increased demand. Up to 25% of our consumption of water is for outdoor uses like gardening. On hot summer days, water use for lawns and gardens can cause consumption rates to double. That’s why in recent years residents of the RDN have experienced lawn-sprinkling restrictions.

The good news is that we don't have to give up on gardening to save water. With waterwise gardening it is possible to continue to enjoy beautiful gardens and save water too.
A waterwise garden reflects compatibility with local ecosystems. It takes advantage of natural rainfall patterns and water availability on site. Waterwise gardeners choose plants that are able to thrive under existing site conditions with little or no supplemental water. The requirements of a plant for soil, sunlight, and water determine its placement within the garden. Native plants are ideal because of their natural adaptations to local growing conditions. Because waterwise landscapes reflect local climatic patterns, a waterwise landscape will vary from region to region.

The term “waterwise garden” might conjure up visions of yuccas and rock. In fact, waterwise gardens encourage a diversity of plant material. Planting a variety of plants encourages beneficial insects, birds, and other wildlife, making your garden more vibrant and resistant to pest or diseases.

Planning a Waterwise Garden

Creating a waterwise garden requires careful planning. Through design it is possible to plan ahead for the water requirements of your plants and create the conditions that allow you to grow a wide assortment of plants for year round beauty. Learning about waterwise gardening can be an ongoing experience. At the end of this section you will find a list of demonstration gardens.

Start From the Ground Up

Healthy soil is the building block of all gardens. The key is to know what type of soil each plant requires. Some plants thrive in free draining sandy soil while others prefer soil that can retain moisture.

Begin by analyzing your existing soil. A simple hand test will help you determine what type of soil you have. Take a handful of soil and squeeze it together. Now gently touch it to see if it breaks apart. Soil that forms a tight clump that does not break apart is primarily clay. Particles in this type of soil are very small and tightly packed.

There is little room for the movement of air and water within clay soils. If your sample falls apart and does not hold any shape, you have a sandy soil. Sandy soils are composed of large particles that drain quickly and do not hold water for any length of time. A good loamy garden soil will hold a loose shape, but will break apart into chunks if gently disturbed. This type of soil tends to be moisture retentive, promoting plant growth for the widest range of plants.
Compost increases the water holding capacity of your soil.

Once you have determined the type of soil you have, research the needs of the plants you want. Many drought tolerant species are native to areas with little rainfall year round. While these plants thrive on limited water, they resent winter wet. To grow these plants, it is necessary to provide areas of excellent drainage on site. Retaining some areas of relatively sandy soil can help them survive our west coast winters.

Most garden plants, however, appreciate a moisture retentive loamy soil. For these plants, you will want to improve both clay and sandy soil types through the addition of humus, in the form of compost of other organic matter. Organic matter improves the ability of the soil to retain moisture, helps condition clay soils so that water can penetrate, and increases the nutrient content of the soil. In addition, organic matter encourages the population of soil organisms to go to work aerating and recycling nutrients for long term soil health. Most soils will benefit from the addition of compost when preparing planting areas.

Soil acidity (pH) is another factor influencing the selection or placement of plants on site. Plants in soil without the correct pH may be unable to take up nutrients. Plants vary in their preference for soil pH, with the widest range of plants preferring a slightly acidic soil (6.0 - 6.5 range). However, some plants including heathers, arbutus, and rhododendrons prefer soils as acidic as 5.0 while other plants, such as lilacs, like alkaline soils of 7.0 or higher. Once again, testing is the answer. Simple soil test kits or pH meters are available from local nurseries and garden centres. In selecting plants for your garden, choose plants that prefer the conditions you can provide on site, or amend the soil in selected areas to accommodate other requirements. Dolomite lime is used to reduce soil acidity.

**Be Creative With Water**

Drainage patterns are as important as soil conditions in the waterwise garden. Study your garden. Is it well drained or does moisture collect in certain areas after a period of rain? Look at the contours and drainage patterns. Is it possible to take advantage of existing contours and drainage patterns to provide conditions for plants with different needs? Plants vary in their requirements for drainage just as they do for soil. Low lying areas can be a home for wetland plants while areas with good drainage can be saved for drought tolerant species.
Build water-saving features into your design. A pond makes an attractive focal point for your garden, and attracts beneficial insects, birds, and frogs. It can also be used to collect rainfall and supplement water for small areas in the summer. Design your pond to accommodate moisture-loving plants around its edges. Extending a liner below the soil at the edge of a water feature helps hold moisture for bog plants.

Another way to save water is with rainbarrels. Rooftop runoff can be collected in compact barrels that fit snugly along the side of a house. Rainbarrels are useful for watering containers, vegetable gardens or other high water use areas in the summer.

**Group Plants**

Group plants according to their needs for soil, water, and sunlight. Plants with similar requirements for soil should be grouped so that compost and other amendments can be incorporated into an entire area at the time of planting.

Plants with the highest water needs should be grouped together. These plants are easiest to grow if their needs have been met through site design - as marginal plantings by a water feature or in a specially designed bog garden, for example. Otherwise, high water use plants should logically be grouped close to the planned water source - rainbarrels or hose bibs. Do not plan to plant more of these plants than you can look after with the water available to you.

Plants with low water needs should also be grouped, with special attention to their requirements for drainage. Such plants are typically planted on higher ground with free draining soil. Sunny exposures, which dry out quickly, are best reserved for drought tolerant species.

A plant's tolerance to sun or shade is particularly important, reflecting its adaptation to its native environment. Too much sun causes wilting and discoloration while too little sun reduces flowering and promotes weak growth. Be aware of the requirements of the plants you are selecting and place them accordingly.

By planting or retaining trees on site, you can provide conditions for both sun loving and shade loving plant communities. Trees make it possible to grow a wide variety of woodland plants, greatly adding to the diversity and beauty of your garden, and attracting birds and other wildlife. Trees
Western bleeding heart and sword ferns tolerate dry shade under trees.

Native plants are great for waterwise gardens and provide habitat for wildlife.

cool the soil, reducing water loss through evaporation. Moisture retentive soil, rich with organic matter, helps reduce the watering requirements of shade gardens. In choosing trees for your garden look for small to medium sized varieties that will not outgrow their space or compete for moisture with other plants when they are mature. If you have large trees existing on your site make sure that the plants you select to grow at their base are adapted to dry shade.

The right plant for the right place is a gardening fundamental. Unhappy plants, poorly located, are more susceptible to pests and diseases. Paying attention to your plants requirements makes maintenance easier, reduces watering chores, and gives you a healthier, better-looking garden.

**Cover the Ground - With Plants!**

Waterwise gardens are rich in plant material. Trees, shrubs, perennials and groundcovers emulate the layered structure of natural plant communities. Plantings of this type prevent erosion and help slow run-off from urban areas. Urban run-off is a problem that can create flooding and pollution of our waterways. Layers of trees, shrubs, and perennials deflect the impact of rainfall so that water enters the ground slowly where it can recharge naturally. This also means that more water is available for plants rather than running off into storm sewers.

In designing your waterwise garden, avoid the use of impervious paving such as concrete or asphalt that accelerates run-off. Carefully analyze your landscape to determine how much hard surface you require, especially for vehicles. In selecting surfaces for driveways, walkways, and patios choose materials that allow rain to soak into the ground rather than running off. Paving stones, decking, or gravel are some examples. For patios try interplanting bricks or flagstones with groundcover for maximum permeability.

Waterwise gardens make use of dense plantings of perennials and groundcovers to act as living mulch, cooling the soil and slowing evaporation. Once established, these plants reduce maintenance by helping to crowd out weeds and add to the diversity of your garden.

**Select Waterwise Plants**

In planning a waterwise garden, choose plants that are adapted to survive in your climate with little or no supplemental water. For the lower mainland, there are many plants to choose from that fall into that category. The term "xeric" is an ecological term that refers to plant communities...
that have adapted to survive extreme drought. These plants may be native to arid regions of the world, or to local sites that receive or retain minimal moisture. Plants that can survive in the crevices of rocks, for example, are termed xeric even if they are growing in the middle of a rainforest!

In selecting waterwise plants for your garden, it is helpful to research where the plant grows in the wild. Plants that are native to western coast of BC and Vancouver Island are ideally suited to survive our summers without supplemental water once established. Observe plants growing in wild areas near your home to get an idea of plants that might do well in your garden, and note where they are growing. Remember that like all plants, native species have specific preferences for water, sunlight, and soil that must be met in your garden.

Plants from mediterranean climates, such as southern Europe and northern California, experience mild wet winters and very dry summers similar to our own. Many plants native to these regions are extremely drought tolerant and include such familiar garden plants as lavender, California lilac, and many culinary herbs. Keep in mind that these same plants also like good drainage year round. Other drought tolerant plants come from meadow plant communities of western North American. These plants are usually quite hardy and include such favourites as blanketflower, coreopsis, and butterfly gaura.

Sometimes the adaptations plants make to drought provide clues in selecting waterwise plants. For example, plants with silvery leaves have adapted to drought by developing tiny hairs on the leaf surface which act as insulation. The thick fleshy leaves of the stonecrop family reflect the ability of the plant to retain water in its leaf. Small or needle like leaves have less surface area for evaporation and are frequently an indicator of drought tolerance.

Spring flowering plants that grow from bulbs are adapted to thrive in areas with wet springs and dry summers, like our own. The bulb stores moisture and nutrients available to the plant in the spring and allows dormancy throughout the hot dry summer.

**Get Off to a Good Start**

Get your garden off to a good start by selecting healthy plants at the nursery. Look for a full plant with healthy leaves and good colour, and top growth proportionate to the pot size.

Plan how you will water your plants until they become established. Even xeric plants require frequent watering during the first two seasons
of growth. The root systems of young plants have not had a chance to
develop and will be located near the surface where they can dry out
quickly. You may need to establish a temporary system of soaker
hoses to provide weekly water during this period of establishment.
Mulching with a layer of newspaper and 7 - 8 cm (3") of compost will
also help retain moisture in the soil during establishment. Plant during
the fall if possible, fall plantings encourage root establishment before
the onset of the first dry season.

You can see from this discussion that selecting waterwise plants offers
plenty of choices. The list on page 49 offers some suggestions for
waterwise plants suited to coastal B.C.
### COMMON DROUGHT-TOLERANT SHRUBS & CLIMBERS

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Mature Size</th>
<th>Evergreen</th>
<th>Sun</th>
<th>Part Shade</th>
<th>Shade</th>
<th>Well-drained Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Height x Spread</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arbutus unedo</td>
<td>Strawberry tree</td>
<td>8m x 8m</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Arctostaphylos uva-ursi</td>
<td>Kimkinnick</td>
<td>10cm x 2m</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Buddleia davidii</td>
<td>Butterfly bush</td>
<td>3-5m x 3-5m</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Camellia species</td>
<td>Camellia</td>
<td>1.5-2.5m x 1-2m</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ceanothus species</td>
<td>California lilac</td>
<td>1-3m x 3-4m</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Chaenomeles species</td>
<td>Japanese quince, japonica</td>
<td>1.5-2.5m x 2-3m</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotinus coggygna</td>
<td>Smoke bush</td>
<td>5m x 5m</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Euonymus species</td>
<td>Euonymus</td>
<td>60-120cm x 2-5m</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ilex species</td>
<td>Holly</td>
<td>5-25m x 4-8m</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Juniperus species</td>
<td>Juniper</td>
<td>20cm-20m x 4-7m</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Mahonia aquifolium</td>
<td>Oregon grape</td>
<td>1-3m x 1m</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nandina domestica</td>
<td>Heavenly bamboo</td>
<td>2m x 1.5m</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osmanthus species</td>
<td>Osmanthus</td>
<td>2-5m x 2-5m</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Philadelphus species</td>
<td>Mock orange</td>
<td>1-2m x 2-5m</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pyracantha species</td>
<td>Firethorn</td>
<td>3-5m x 3-5m</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rosa rugosa</td>
<td>Rugosa rose</td>
<td>1-2.5m x 1-2.5m</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symphoricarpos species</td>
<td>Snowberry</td>
<td>2-2.5m x 2-2.5m</td>
<td>X</td>
<td>X</td>
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</tr>
</tbody>
</table>

### COMMON DROUGHT-TOLERANT TREES

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Mature Size</th>
<th>Evergreen</th>
<th>Sun</th>
<th>Part Shade</th>
<th>Shade</th>
<th>Well-drained Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Height x Spread</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elaeagnus angustifolia</td>
<td>Russian Olive</td>
<td>6m x 5m</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Gleditsia triacanthos</td>
<td>Honey locust</td>
<td>8-18m x 6-8m</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Picea species</td>
<td>Spruce</td>
<td>8-30m x 4-6m</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Pinus species</td>
<td>Pine</td>
<td>6-25m x 3-7m</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Quercus species</td>
<td>Oak</td>
<td>8-25m x 6-15m</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Robinia pseudoacacia</td>
<td>Black locust</td>
<td>10-25m x 8-15m</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Sciadopitys verticillato</td>
<td>Japanese umbrella pine</td>
<td>10-20m x 6-8m</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Thuja plicata</td>
<td>W. red cedar</td>
<td>20-35m x 9m</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tbody>
</table>
# COMMON DROUGHT-TOLERANT PERENNIALS

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Mature Size Height x Spread</th>
<th>Evergreen</th>
<th>Sun</th>
<th>Part Shade</th>
<th>Shade</th>
<th>Well-drained Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achillea species</td>
<td>Yarrow</td>
<td>25-150cm x 25-150cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arabis species</td>
<td>Rock cress</td>
<td>5-10cm x 20-30cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Armeria maritima</td>
<td>Thrift</td>
<td>20-50cm x 30cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Bergenia cordifolia</td>
<td>Bergenia</td>
<td>20-60cm x 45-75cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Bulbs and corms</td>
<td>Daffodil, crocus, etc.</td>
<td>10-100cm x 10-50cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Cerastium tomentosum</td>
<td>Snow-in-summer</td>
<td>5-8cm x indefinite</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Euphorbia species</td>
<td>Spurge</td>
<td>10-120cm x 30-100cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Festuca glauca</td>
<td>Blue fescue grass</td>
<td>30cm x 25cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Gaillardia species</td>
<td>Blanket flower</td>
<td>30-90cm x 45-60cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Gaia lindheimeri</td>
<td>White gaura</td>
<td>120cm x 90cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Helleborus species</td>
<td>Hellebore</td>
<td>30-100cm x 45-90cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Lavandula angustifolia</td>
<td>English lavender</td>
<td>20-45cm x 30-50cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Lupinus species</td>
<td>Lupine</td>
<td>50cm – 1m x 30-50cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Paeonia lactiflora</td>
<td>Peony</td>
<td>50-70cm x 50-70cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Pennisetum species</td>
<td>Fountain grass</td>
<td>60-150cm x 60-100cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Pervovskia atriplicifolia</td>
<td>Russian sage</td>
<td>150cm x 100cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Saxifraga umbrosa</td>
<td>London pride</td>
<td>25cm x 60cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Sedum species</td>
<td>Stonecrop</td>
<td>5-50cm x 30-60cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Stachys byzantina</td>
<td>Lamb’s ears</td>
<td>45cm x 60cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Tanacetum coccineum</td>
<td>Painted daisy</td>
<td>45-75cm x 45cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Yucca species</td>
<td>Yucca</td>
<td>60-120cm x 80-100cm</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Planning a Waterwise Lawn

It takes a lot of water - and work- to keep a lawn green all summer. Is it necessary? Lawns are adapted to drought. During the heat of summer, lawns enter a period of dormancy, stop growing, and turn brown. This is a perfectly natural response of a healthy lawn, and when rain returns in the fall, growth soon resumes and the grass becomes green again. Consider allowing your lawn to go dormant during the dry months of late summer. A deep soaking once a month will speed greening in the fall.

Even if you plan to water your lawn in the summer you can still reduce your overall water requirements by reducing the amount of lawn. Evaluate how much lawn you really need. Mixed plantings of trees, shrubs, and groundcover offer more habitat value than lawn and can survive with less water.

Make sure that the soil in the area where lawn is to be located is at least 15 cm (6") thick, well aerated, and well drained. To improve soil conditions, dig 6 -8 cm (2-3") of compost into the top 15-18 cm (6-8") of soil before planting.

Plan to locate your lawn with respect to water needs. Plan ahead for watering requirements so that the lawn is easily accessible to the water source. Although lawns like a sunny location, a few hours of light shade during the hottest part of the day will keep your lawn greener longer.

If you plan to install an automatic sprinkler, make sure the system is well designed and properly installed by a certified irrigation specialist. Choose systems that emit water rather than mist that evaporates quickly. Automatic systems should have a rain sensor so they don't operate if it rains. Test sprinkler heads to make sure that they are not also watering walkways, patios, and driveways.

Grass seed is usually sold as a blend of different species. Some are more drought tolerant than others. By selecting a blended mixture, species that are adapted to the water regime of your garden will eventually predominate in the mix. Tolerate the presence of some weeds in your lawn. Some turf mixes on the market today contain such plants as clover, yarrow and English daisies. Mixes containing these plants stay greener during the summer and provide the added benefit of flowers.

Consider the amount and type of use for your lawn. If your lawn will receive frequent high use, consult with a turf grass professional regarding the selection of an appropriate seed mixture. For high-use lawns, dormancy is not recommended.
Maintaining a Waterwise Garden

Planning a garden with fewer watering needs cuts down on maintenance chores. All gardens require some maintenance, however. The way you maintain your garden can reduce watering needs even more.

Mulch, Mulch, Mulch

One of the most effective maintenance practices for waterwise gardens is mulching. Mulch refers to a layer of coarse material placed on the soil around plants. Mulch reduces soil temperature, slowing evaporation and retaining moisture in the soil. Mulching also helps prevent erosion and run-off so that moisture seeps into the soil where it can be used by plants. Mulch insulates the roots of plants so that they are less likely to be damaged by extremes of temperature. As an added benefit, mulching garden beds helps prevent the growth and establishment of weeds.

Mulches can be classified as organic, made from living materials, or inorganic, such as river rock or gravel. Organic mulches have the advantage over inorganic mulches in that they help condition the soil, provide food for soil organisms, and return nutrients to the soil over time. Among the best organic mulches are compost, leaf mould, pine needles and wood chips. All of these mulches can be made at home to take advantage of organic material you may have on hand. Leaves or pine needles that fall from your trees in the autumn can be spread over garden beds as mulch. (Note: do not use cedar droppings in the same way, as some plants react negatively to them). If you have a shredder or chipper, you can make your own wood chips from pruning clippings. Other organic mulches include well-composted manure, sawdust, and bark mulch.

Apply mulch 5 - 10 cm (2-4" thick), but keep it away from the stems at the base of the plants. Organic mulches eventually decompose and should be topped up yearly.

Water Wisely

Only water when your plants are thirsty. An occasional deep soaking develops strong, deep roots that not only make your plants more drought tolerant, but promote overall health and hardiness as well. Monitor your garden during the summer to become familiar with the water requirements of your plants. If you’re unsure whether to water, check the soil an inch below the surface. If the plants look healthy, and the soil is still moist, wait until water you water.
Water in the cool of the morning or evening so the water soaks into the soil rather than evaporating.

Apply water directly to the roots. Soaker hoses release a slow steady stream of water that seeps into the soil, minimizing run-off and evaporation. They are an efficient and inexpensive means of watering garden beds. Watering the earth instead of the foliage puts water where it's needed, reduces evaporation, and prevents disease.

**Waterwise Lawns**

Remember that brown is beautiful! A dormant lawn is part of a waterwise landscape.

If you want your lawn to stay green all year, just 2.5cm (1") of water per week is all it needs. Too much water is actually bad for your lawn, promoting shallow root development and the spread of pests and diseases. The best time to water your lawn is during the cool hours of early morning. Maintain the efficiency of your sprinkler system with proper maintenance.

Mow high and keep your clippings on the lawn this is also known as grasscycling. Grass clippings act as natural mulch, and are a free source of fertilizer. Remove only 1/3 of the blade at a time. The recommended lawn height is 7 - 10 cm (3-4"). This longer length keeps the root zone cooler so your lawn stays greener longer in the summer heat. Do not use quick release chemical fertilizers on your lawn. These products promote top growth at the expense of root growth and reduce the ability of your lawn to withstand periods of drought.

Make sure your lawn is well drained. Standing water after periods of rainfall can indicate a problem with soil compaction. If this problem exists, improve the absorption capacity of your soil by aerating spring and fall. This will help make water more available to the roots.

**Maintain a Natural Balance**

Waterwise gardening offers us an opportunity to create beautiful gardens based on an understanding of the natural systems that sustain us. In caring for our gardens we work with nature to support the interaction between plants, wildlife, and environment that is part of a vital garden ecosystem. We encourage resiliency by building the soil and planting a diverse variety of plants. Pesticides and herbicides work against the long-term health of our gardens by harming the soil organisms and beneficial insects that work to maintain a natural balance. These chemicals are not only harmful to human health, they can enter our waterways and destroy fish and other wildlife. When our gardens reflect our understanding of available resources and the requirements of our plants, we can have beautiful, dynamic gardens that sustain a healthy environment.
LOCAL COMPOST AND GARDEN AND CONTACTS

Demonstration Gardens

Green Communities
(250) 754-2554
E-mail: ecoconnections@island.net

Community Gardens
Nanaimo (250) 753-3070
Parksville (250) 248-3026

Victoria Compost Ed. Centre: 1216 N.Park St. Victoria
(250) 386-9676

Organizations and Garden Clubs

Earthbank Resources – Fish Composting
Parksville
(250) 954-0118

Rhododendron Society
Ward Porter  (250) 758-2494

Mt. Arrowsmith Rododendron Society
Kay Burgoyne  (250) 752-6263

Orchid Society
Mike Miller   (250) 248-3478

Eaglecrest Garden Club
Brenda Moore  (250) 752-5931

Mid-Island Community Garden Association
Donna MacPherson  (250) 248-3788

Nanoose Bay Garden Club
Pamila Hart    (250) 468-9684

Qualicum Beach Garden Club
Joan Elrick    (250) 954-0651
Nanaimo Horticultural Society  
David Michell  (250) 245-5601

Victoria compost Ed. Centre  
(250) 386-9676  
Compost Demo. Wed-Sat. 10am – 4pm

Compost Council of Canada  
(416) 535-6240  
E-mail: ccc@compost.org

Naturescape British Columbia  
1-800-387-9853

Native Plant Society of British Columbia  
(604) 255-5719