Ecological Gardening

Your Safe Path to a Healthy, Beautiful Garden

MARJORIE HARRIS

RANDOM HOUSE CANADA

Also by Marjorie Harris

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For Auntie Marge
and all the other gardeners
who are serious about
our survival on this
beautiful planet

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ACKNOWLEDGEMENTS

Thanks to Chris Harris who worked incredibly hard on the research for this edition; D
Laurence Packer of York University for close reading of the bug chapter; the wonderf
writing of Bridget Stutchberry, Janet Benyus and Michael Pollan; Karen York, Sonia Day ar
Juliet Mannock who always make good suggestions on how to garden well. I'd also like t
thank the design and editorial teams at Random House Canada—Kelly Hill, Erin Coope
Amanda Lewis, Kylie Barker, Deirdre Molina, and especially Anne Collins for agreeing t
bring my book back to life.

INTRODUCTION

Things have changed drastically since I first set out to research the first edition of th book in the late 1980s. We certainly knew that something strange was going on with th planet, but it was a time of "progress" as long as it came in a package or a pill. In those day being an organic gardener seemed like a throwback to an ancient time, being a environmentalist (think tree-hugger) conjured up all sorts of ridicule and the idea of a ecological garden led to much head-scratching.

When I was interviewed on the subject, the first question was always: What on earth is a ecological garden? Explaining that an ecological garden is chemical-free was easy. Explainin that in order to create an ecological garden, you have to place the garden into the context the ecosystem you find yourself in, involved a fair amount of additional head-scratching.

At the time I wrote: We know that the earth is one vast living, breathing system whe everything relates to everything else. It fits together in a most delicate and exquisite wa The ecological garden is a metaphor for planet Earth—it is in itself an ecosystem that reflec this finely tuned, integrated whole. To be an ecological gardener means understanding bo your place in this whole and how your garden functions within its own ecosystem; that is, th relationships between the soil, light, air, every insect and microbe and the plants you choos It means being sensitive to the environment and less haphazard in your approach to the eart The more exhausted the planet becomes, the more important it is to put back almo everything we take from it.

It's exciting to figure out the composition of soil, what plants need and how to put the together for a healthy, pest-resistant garden. On top of these benefits is the delight watching how your own caretaking abilities expand. The slightest understanding of how a elements in nature mesh together adds to the pleasure of gardening.

In this book I've gathered together the relevant information you'll need to become a ecological gardener. Using the index, you can dip into sections as the need arises. Since I fir wrote this book in 1990, some things have changed, but most of the basic informatio remains the same. As I said then, and I still firmly believe: We have a choice in the way w garden. We can continue to put a strain on the biosphere or we can try, in our own sma ways, to return to a simpler form of gardening—a retrieving of wisdom. Many of the o ways are far more effective than any high-tech solutions. What's happened in the last fe years is that we've discovered how much more complicated nature is than we had former divined. We simply have no idea how these systems work, or why. What we do know is th they are interdependent and that if you kill something off, be it a plant or an inse something else is going to be affected.

There are some tough facts we have to face that can't be solved through better gardenin techniques. Climate change, with its attendant wild weather patterns, is becoming more an more evident. We now know for certain that burning fossil fuels increases atmospheric gase which lead, in turn, to increased temperatures. An increase of 1°C alters the architecture

some plants, which affects all other plants and animals dependent on them. The same rise i
temperature is changing the structure of ice caps, leading to rising water levels. It's a domin
effect—one thing leads to another.

James Hansen, a climate scientist at Columbia University, warned us back in 1988 an
again in 2008 that even the slightest warming in temperature can push us to dangerou
tipping points. In his article, "Global Warming Twenty Years Later", he wrote: "Glob
warming initiated sea ice melt, exposing darker ocean that absorbs more sunlight, meltin
more ice. As a result, without any additional greenhouse gases, the Arctic will soon be ic
free in the summer…. West Antarctic and Greenland ice sheets are vulnerable to even sma
additional warming. These two-mile-thick behemoths respond slowly at first, but
disintegration gets well underway, it will become unstoppable."

He talks about animals and plants becoming stressed by climate change; how polar an
alpine species will be pushed off the planet; and the potential of ecosystem collapse. This ha
happened before, as Hansen points out, and recovery took hundreds of thousands of year
Climate change has accelerated in the past two decades. Desertification continues to expan
in the southern U.S., Australia, southern Africa and the Mediterranean. Forest fires ar
becoming more intense. And the drying up of lakes will increase if carbon dioxide emissio
are not halted.

We can't just buckle under all this depressing information and give up. What we have t
remember as we try to make a difference in our own backyards is that it's not the planet w
are saving. The planet will carry on inexorably without our species and probably turn bac
into Eden. It's us—our generation, our children and our grandchildren—who are at risk. Wh
we have to save is our relationship to our only home. And we can start with the garden. Th
earth was a garden when we first began evolving, and we have a responsibility to return it t
that state.

When I wrote the first edition of *Ecological Gardening*, I was nervous about climate chang
but I thought sanity would prevail. That was then …. Now, even though politicians mouth th
platitudes, they just don't get it. Our governments, big oil companies, coal lobbies, etc
would like to carry on as though nothing is wrong. We can't be fools and let them prevail.

Things can change. Look at the banning of plastic bags and the removal of phosphates fro
some detergents. Don't give up! Start with your own garden, then move on to th
neighbourhood and then the country. You can change the way you live. If you go to the la
chapter of this book, you'll find some of the smartest ways to make a difference that I'v
found over the past twenty years. What this book will show you is how to garden wi
Integrated Pest Management; how to know your enemy and its life cycles; how to rota
plants if you need to; and how to use pest-resistant plants and natural predators. Much of it
common sense.

Here are some of the basics to get you started on your ecological garden:

1. "Treat the soil, not the plant" is the litany of all organic gardeners. Improve your so
   organically with compost and humus of your own making. It's the cheapest and best for
   of soil nutrition.
2. Get the hardiest plants—ones most resistant to disease— and concentrate on having
   basic structure of native plants. These are the likeliest to survive the assault of ou
   weather extremes.

3. Choose biodiversity for your garden. The more types of plants you have, the more goo bugs you'll attract. They'll bump off the bad ones.
4. Think of your garden as an ecosystem in which every single thing (millions of microbe thousands of insects and, you hope, hundreds of birds) is dependent on everything els Anything that is likely to damage any aspect of this fragile balance should not be allowe to enter. Your garden is your sanctuary.

Gardens make a difference because they are refuges for millions of living creatures- especially for the pollinators on whom we depend. Whether you can see them or not, the add to the biodiversity of your street and your city.

SOIL

The Real Dirt

I was an organic gardener long before I knew what the term meant. When I starte gardening decades ago, labels on fertilizer packages with 10–10–10 or 2–10–whatev baffled me. These products all seemed to be manufactured by the same big chemic companies that I was, no doubt, boycotting because of their involvement in the Vietnam Wa Since I was composting out of habit and the garden seemed healthy enough, I didn't both with synthetic fertilizers. Through laziness I was doing exactly what I should have been doi — ecological gardening by default.

The most important philosophical gardening question to ask yourself is this: What is th nature of soil? Think for a moment about how we even acquired this miraculous substanc Over millions of years, massive upheavals around the world exposed huge rocks, then glaci movements scoured them clean. In the retreat of the great ice sheets, moraines, boulders an clay were left behind. They became deposits of gravel and sand as they were pounded awa by wind and rain. Over the eons, through the action of bacteria, fungi, lichens, insects an eventually earthworms, thin layers of soil emerged.

In fact, the earth you stand on in your garden seethes with life. Imagine big anima devouring little animals, think of ancient migrations and the drama of birth and death a going on in a dark world that requires oxygen and water to survive. Sounds a lot like wh happens on top of the soil, doesn't it? Though we are very concerned about the quality of ou air, we seldom think about this other part of the biosphere.

Half the soil consists of solid material, mostly mineral particles, and half consists of th spaces between this material; and half of these, in turn, are filled with water that occurs as film around the particles. All these microscopic bits and pieces are so vital that without the we would be doomed.

What's taking place in this subterranean world is a cycle of death and decomposition, a one kind of organism becomes food for others. Eventually these death throes supply all th nutrients needed by plants. The ultimate in recycling. Every plant you add has a functio within this community: some fix nitrogen in the soil, some are deep-rooted, divi downwards for water, while others with shallow roots take advantage of limited rain.

The most devastating part of all this is that we are ill-informed about these relationshi and even the cleverest of scientists doesn't know the whole story. Most of us seldom thi about soil at all. Life is churning away beneath our feet and yet every move we make serv to kill it off. Our prairies once had the most fertile soil in the world, an extraordinary humu created over thousands of years. We've managed to deplete it in a century with one-cro farming (monoculture), ripping out the native grasses (polyculture) that held it in plac

leaving it exposed to the elements, and allowing humongous machinery to drive over an compact it. All this activity conspires to destroy the life below the surface. Add the assault o chemical fertilizers almost non-stop for forty years, plus pollution, fires and floods and you begin to understand what's happening to this fragile ecosystem.

The microscopic animals of the soil live a full life if they are allowed to. They brows swim, travel, have profligate sex lives, procreate and die, providing food for the big guys- arthropods and earthworms. The symbiosis among these animals is highly structured. Wh happens when we interfere chemically with all this activity is that we slowly poison the so by killing off mites, bacteria, fungi and, even worse, earthworms. The remaining speci multiply. This throws off the balance entirely as the level of chemicals steadily increases unt the soil becomes toxic to plants, animals and people.

What keeps the soil healthy are all these organisms in the perpetual process o decomposition. Dying matter breaks down into humus and, through this, releases nutrien for plants. When we put the soil in jeopardy, our very survival is in question.

Dr. Stuart B. Hill, professor of entimology and soil guru, says that rather than killing o bacteria and fungi, we should be investigating and developing management strategies fo their productive potential.

"Such strategies," he maintains, "are likely to save money, energy, and avoid damage t the support environment and to human and livestock health. This contrasts with our curre approach, which involves the removal of several dozen minerals at harvest time followed b the replacement of only a few of them as chemical fertilizers" (*Agricultural Chemicals and t Soil* [1977]).

Bioagriculturists consider pests and diseases to be symptoms of poor soil managemen Pesticides, antibiotics and drugs have generally been regarded as "magic bullets" that ca eliminate problems. "The real situation," Dr. Hill says, "is that we do not suffer from pes because of a deficiency of pesticide in the environment just as we do not get a headach because of a deficiency of aspirin in the blood." Keep that line in mind when you get into a argument with a chemical pusher.

This dependency on chemicals *is* much like an addiction. The more you use, the more yo need merely to survive. But the depletion of soil expands exponentially, and what little shor term gain there is for the private person will eventually become a huge costly public burde as we all try to recover the health of our soil.

The soil has amazing strategies of its own for dealing with harmful things. For instanc there are nematodes that are dreadful killers. They get into the roots of plants and suck the dry. To counter this, there are fungi that strangle the bad nematodes. Most other nematod are helpful to the soil; some kill off plant pests.

To give you an idea of just how complex all of this is, consider that there may be a hundre thousand protozoa in the water that surrounds a few particles of soil. The millions of bacter in each gram of soil are crucial to decomposition. To aid the process, there's the activity o earthworms.

EARTHWORMS

Aristotle referred to earthworms as the intestines of the earth and Darwin called the

nature's ploughmen. Earthworms, Darwin calculated, could move 7.5 to 18 tonnes of soil p
acre (0.4 ha) annually.

North American earthworms are thought to have been pretty much done in by the last i
age. One of the things Europeans did when they came to this continent was to bri
earthworms with them. There are now twenty-three recorded species in Canada, including
couple of native ones. Earthworms eat up fallen leaves and start the whole decompositio
process, though they won't work on fresh beech or oak leaves with the same efficiency as o
other leaves. They gobble up organic matter and leave behind castings filled with calciu
potassium and phosphorus; they stir up the soil and bring nutritional material closer to th
surface and more accessible to plants; and they aerate the soil through burrows that bri
oxygen to the bacteria that need it to survive. Their burrows also provide channels for roo
and increase the ability of water to move through the soil.

Worms aid in creating the all-important humus. They hate anything that messes with so
life—especially synthetic fertilizers. So we should be aware of worms' value. In each squa
yard (metre) of healthy soil, there will be about 300 earthworms. In anything but reall
acidic soil, if you haven't got a lot of wormy activity, you've got a problem.

KNOW YOUR SOIL

No doubt there is a platonic form that contains the perfect soil: dark loam containing enoug
balanced humus to hold just the right amount of rain but with excellent drainage. It's o
there somewhere, but the soil most of us are usually presented with has something wro
with it: too heavy, too sandy, too much clay and always, always, the possibility of past ove
cultivation. This can happen in a few seasons if nothing organic is put back into the soil. Wh
your soil probably needs is some form of conditioning.

Fertile soil is the result of a cumulative process of continuous improvement. Two things a
required: humus and finely ground rock particles. The latter make up the mineral portion
the soil. But it is the humus or organic matter that is most important. Dr. Hill refers to th
humus-creation process as a primitive form of farming that's been going on for 400 millio
years. What keeps the farm thriving is the decomposition of organic matter.

Organic matter is comprised of living matter, such as leaves, in the process of decay. T
break down, leaves need many different fungi, each with a special function, to attack then
Then there are mites and other arthropods that come next. If you destroy any of these wi
pesticides, you can upset the balance needed for proper decomposition. Since most of thes
creatures are beneficial, it seems unnecessary to go on a chemical rampage for the few th
might be malevolent. You might also destroy their natural predators, thus reducing any shor
term good that the chemicals might provide.

Some organisms, such as mycorrhizal fungi, perform Herculean tasks in the soil. They n
only improve plant health, they also help plants absorb phosphorus, so essential to growt
and assimilate trace elements, which assist plants in withstanding the stress of drough
Experiments in how to use these fungi as an inoculum are now under way. And what do the
need in order to prosper? Aerated soil with lots of organic matter. But they won't co-opera
if pesticides and herbicides have been used.

The more intimate you are with your soil, the better handle you'll have on dealing with an problems that arise. To feed the soil, you need to know what the menu should be.

THE STRUCTURE OF SOIL Soil comes in layers. Depending on how great your soil is, eac layer will be from a few inches (centimetres) to a few feet (metres) thick. Arising from th bedrock of the earth, soil is like a thin skin on its surface. It takes about 500 years to create inch (2.5 centimetres) of soil through weathering.

The texture of soil depends on the sand, clay and silt content. The ideal loam is 25 percen water and 25 percent air, with the balance made up of organic matter—all the animals an tiny organisms that live there plus minerals. In this same ideal soil, micro-organisms release pounds (1.3 kilograms) of nitrogen a year, which is about the equivalent of a 50-pound (2 kilogram) bag of 6–10–4 commercial fertilizer. All of the nitrogen and sulphur, and one-thir of the phosphorus and other nutrients are supplied by organic matter.

Humus: The top layer of organic matter, decayed and in the process of decaying, is humu It helps the soil absorb water, provides air spaces critical to plant development and is fille with the nutrients plants need for survival.

Topsoil: This is where the life of your soil is found. Earthworms, bacteria and a multitud of other animal organisms live here. It contains minerals and organic matter ranging from 4 percent to 1 percent, depending on the location. The depth could be from a fraction of a inch (a few millimetres) to 18 inches (45 centimetres) or more.

Subsoil: There are fewer nutrients at this level. The material here is pulverized and there no humus. But soil conditioning can help improve a shallow subsoil.

Hardpan: This is self-descriptive. Clay and silt make it almost impermeable. At this lev there is little or no drainage. The closer to the surface you find hardpan, the more shallow rooted the plants will be.

Bedrock: There is no soil below this level.

TYPES OF SOIL To evaluate your soil, dig out a chunk of earth approximately 12 inches (3 centimetres) deep. Now pull a fistful from the centre of the batch. Moisten it slightly an then squeeze it in your hand to figure out what type of soil you have.

Heavy: If the moistened soil holds the shape of your hand, you've got heavy—or clay- soil. Clay has very few spaces between the tiny particles. That means it has poor drainag and is slow to warm up in the spring. It needs to be lightened up with organic matter, such a humus or compost, plus sand, for improved drainage.

Perfect: The best soil, loam, is 40 percent sand, 40 percent silt, 20 percent clay. It's gre stuff, perfectly balanced. When you squeeze it, it makes a ball that falls apart easily. It drain readily, which is what, ideally, you are aiming for. Once you have loam, keep addin compost or humus to keep it up to scratch.

Light: Mainly sandy, light soil won't hold together in your fist. It's very gritty stuff wit large particles that let water drain away far too quickly. This kind of soil needs an underlyin level of humus or organic matter such as well-rotted leaves.

Mixed: Silty loam feels smooth and holds its shape. Sandy loam is gritty and forms a ba
If you have a soggy mess of mucky peat soil that just sort of plops in the hand, it nee
serious amending.

SOIL TESTING If you're unsure whether you have acid or alkaline soil, have it tested at
garden centre, agricultural station or soil laboratory. There are also kits available that a
relatively efficient.

To prepare a soil test, dig a sample from every 100 square feet (9 square metres) to
depth of 6 to 12 inches (15 to 30 centimetres). Mix the sample in a bucket and send about
pint (1/2 litre) of this mix to be tested. If you describe what you want to plant, the soil ca
be tested for that purpose. You will be given the nutrient content, pH and a description
texture. On the pH scale of 0 to 14, acid soil is below 7, neutral soil is 7, and alkaline soil
above 7. Most plants—and soil organisms—like a pH between 6.5 and 7.

ACID SOIL—BELOW 7.0 pH A fast way to figure out if you have acid soil is to take a sma
amount and add a bit of vinegar. If the vinegar sizzles, you've got alkaline soil. If not, th
means there's acid in it and the vinegar (itself an acid) won't react with it. Weeds will also l
you know if you have acid soil: meadow foxtails, daisies, mouse-ear hawkweed, co
marigold or corn chrysanthemum, corn spurry, sheep sorrel, sow thistle, coltsfoot, nettles a
masses of Johnny-jump-ups all indicate acid soil.

FOR PLANTS NEEDING ACID SOIL If you don't have acid soil but want to grow acid-lovi
plants such as rhododendrons, azaleas and heaths, which like a pH of 4.5 to 6.0, try th
following:

- Dig out a bed 18 inches (45 centimetres) deep and fill with a mixture of sharp sa
and garden loam to 3 parts coir, or sawdust from pines or oak. Add 5 pounds
kilograms) of sulphur per 100 square feet (9 square metres).
- Once the acid-loving plant is in place, add 2 teaspoons (10 grams) of powdered sulph
every square foot (.09 square metre).
- To acidify the soil in a small area, you can also try adding vinegar and coffee groun
a little bit at a time.

Maintenance

- Don't use peat moss. Though over time it will acidify the soil, it's a non-renewab
resource and is sterile. If you insist on peat moss, soak it with hot water and let it si
this will help it to add moisture-retention qualities to the soil. Dig it in and allow th
bed to winter over before planting.
- Don't use bone meal or wood ashes—both contain lime and will reduce the acidity
the soil.
- Check out the rainwater. In many cities, rain is becoming increasingly acidic due

pollution. Collect rainwater in drums and use it to water acid-loving plants.

- Mulch with leaf mould from oaks and pines.

To Reduce Soil Acidity

- Lime will reduce acidity. Dolomitic limestone contains magnesium and calcium, th fertilizing the soil at the same time. It is the recommended form. Apply in the fall aft the ground is dug or ploughed, to give it a chance to break down—which it does ve slowly.
- Wood ashes are about 20 to 50 percent calcium carbonate and thus will act quickly reduce acidity. They are high in phosphorus. The best time to apply is late winter early spring, but never apply them near germinating seeds.

NEUTRAL SOIL—7.0 pH Most plants like to grow in slightly acid to neutral soil (6.5 to pH), which can be maintained with proper mulching and fertilizing (see chapter 3).

ALKALINE SOIL—ABOVE 7.0 pH Some soils are too alkaline for plants. Weeds indicati alkalinity include white mustard, clustered bellflower, musk thistle, black knapweed, Quee Anne's lace, salad burnet and henbane.

To Reduce Soil Alkalinity

If soil is too alkaline, try the following:

- Add sulphur to lower the pH if it's too high for what you want to plant.
- Try adding other materials that will lower the pH, such as calcium sulphate a aluminum sulphate.
- Add compost, about 2 to 3 inches (5 to 7.5 centimetres) a year, which will make so more neutral.

WHAT'S IN SOIL The three major elements that plants require in large quantities of soil a nitrogen, phosphorus and potassium. These are the NPK numbers on fertilizer bags—if th number is 21–7–7, that means it contains 21 percent nitrogen, and 7 percent each phosphorus and potassium. There are vital interrelations between all the elements in the so Once again, it's your job to maintain the delicate balance.

The other major elements in the soil are carbon, hydrogen, oxygen, calcium, magnesiu and iron. Then there are the trace elements: boron, copper, manganese, zinc, molybdenu sulphur and zinc. These are the hardest to manipulate, so concentrate on the major elements

Nitrogen is released when soil organisms decompose. When a plant dies, most of th nutrients taken out of the soil are returned to the soil. This in turn is transformed into humu which contains the acids that make other nutrients available to plants. Nitrogen productio

increases under warm, moist conditions and slopes off under cool conditions. Nitrogen needed for vegetative plant growth.

Organic matter in the soil is crucial for soil micro-organisms to release nitrogen. Le mould, compost, manure, dead roots and plants, insects and animals and the minutiae of th soil—including bacteria and fungi—are all organic matter. The ultimate goal of this decayin process is the production of humus—the most superb type of organic matter you can build fo your soil. When you walk through the woods, lift some moss or rotting leaves. Th marvellous sticky black stuff under them is humus. The process of decomposition has bee completed and it is feeding the soil. This is the material that will heal your soil if it's sick.

GREEN TIPS

SOURCES OF NITROGEN INCLUDE:

- Fish emulsion.
- Blood meal, which has a nitrogen content of 8 to 13 percent.
- Sheep manure—if you use manure to bump up the nitrogen content of your soil, I recommend sheep manure, which has a higher nitrogen content than other types. Use manure that's been composted for at least six months (the heating process will kill off any weed seeds). Manure will also improve soil texture.
- Finished compost is an excellent source of nitrogen.

The beauty of these products is that they release nitrogen slowly and naturally—usually a the plants need it. They aren't going to burn the plants or you.

On the other hand, synthetic forms of nitrogen have a much higher nitrogen conten Anhydrous ammonia is about 82 percent nitrogen. If you breathe it, you can die. If it gets to close to the root system of a plant, it causes damage. Urea has 45 percent nitrogen; if it mishandled, plants will die. Most chemical fertilizers with high nitrogen content are taken u so quickly by a plant's root system that the plant produces initial lush growth, which watery and weak, more susceptible to disease and easily broken off by the wind.

Phosphorus is needed for fruit development and root growth. It also helps plants resi disease and withstand the stress of drought and pollution. Mix any of the following sources phosphorus with manure and dig in in the spring. This nutrient doesn't leach out easily and released into the soil slowly.

GREEN TIPS

SOURCES OF PHOSPHORUS INCLUDE:

- Colloidal phosphate—18 to 25 percent phosphoric acid. Use every four years.
- Rock phosphate and greensand have long been recommended, but if they come from North America they'll contain uranium, which might contaminate the soil.
- Bone meal.
- Superphosphate is a rock phosphate processed with sulphuric acid. I try to keep away from products that require a lot of energy in their production. It also comes from great distances (Togo and Morocco). Find something else.
- Rock and colloidal phosphate will raise the soil pH, making it less acid.
- When you are using rock minerals, use them in a natural form. By doing this, you will avoid getting into the problem of excessive mineralization or the leaching of soluble elements, which could affect groundwater.

Potassium is needed for growth. It helps plants resist disease and protects them from co and from excessive loss of water. Too much magnesium in the soil will lead to a potassiu deficiency.

GREEN TIPS

SOURCES OF POTASSIUM INCLUDE:

- Wood ashes (from the fireplace, not the barbecue), but be careful—they can boost the pH, and if it gets too high, you'll kill off your acid-loving plants.
- Manure—sheep and goat manure have the highest potassium content (3 percent).
- Add straw.
- Bananas; bury banana skins near rose bushes.

Micronutrients such as manganese, iodine, zinc, iron, copper, boron and molybdenum a all in the soil and if they aren't, your plants will let you know that something is wrong. Lo of organic matter settled on top of the soil and allowed to work itself in slowly will corre any imbalances. It contains these trace elements and is the simplest, safest way to a healt soil.

Balance is everything. When the temperature rises and the soil is moist, all these nutrien will become available to the plants much more quickly.

SOIL AMENDING

Create self-sufficient soil by making it healthy. You don't want to provide tempora solutions to any problems. Manure and organic matter aren't necessarily interchangeable ecological gardening. Organic matter is the most important: leaves, plant waste, garde detritus, straw, hay. Straw, alas, encourages mice.

Another method of enriching the soil is to dig down and fill the hole with layers of age leaves and manure. Earthworms do most of the work of breaking down these materials in compost.

Build up the soil with compost or make your own organic fertilizer as recommended b garden writer Eliot Coleman: 4 parts blood meal, 2 parts bone meal and 1 part kelp or roc phosphate.

Here's a good soil food recommended in the book *Organic Gardening for the Pacif Northwest: 4* parts seed meal (or 2 parts fish meal), 1 part dolomitic limestone, 1 part roc phosphate or 1/2 part bone meal, 1 part kelp.

If you add bone and blood meal to coir, it will act as a fertilizer. Coir products are mad from coconut fibre (from outer husk) and are used as an alternative to peat moss. Though realize coir products have to be shipped long distances, that's better than destroying pe bogs.

Leaf mould is an excellent amendment. Bag leaves and place them in a corner to brea down, or dig them into a big hole and let them rot, or shred them and add to the compo heap. One thing you don't do with leaves is throw them out.

Maple leaves tend to mat if you put them on the ground without letting them break dow first. Since the leaves of Norway maples contain alkaloids, they should be well composte before you add them to the soil. Oak and beech are acidic and will take longer to break dow than other leaves. But they are great if you are building up acid areas in your garden. Blac walnut leaves contain juglone, which is toxic to many plants, so you should probably not us these leaves as soil amenders.

Extremely sandy soil is too porous and it won't support earthworms. Add masses compost and keep adding as often as possible. Over time the soil will improve.

SOLVING SOIL PROBLEMS

If you have soil with poor texture or density, try the following:

Double dig: Dig a trench as wide as your spade, and as deep. Pile the soil from this fir trench on a sheet of plastic. Loosen and amend the soil in the bottom of the trench to anoth spade depth. Dig another trench directly beside the first trench and put the excavated soil the first trench; continue until you hit the last trench and then put the soil on the plastic she from the first in it. In all my years of gardening I have never done this, but some peop swear by it.

Raised beds: Double dig the soil and add enough moistened coir and compost or manure raise the soil at least 8 to 10 inches (20 to 25 centimetres) above ground level. Always m coir with other soil amenders; on its own it's sterile.

LEAD IN THE SOIL: Though lead hasn't been used in paint or gasoline for some time, there still the possibility that it might have built up in the soil, especially if you live near a parki lot or busy road. By adding lots of compost and manure, you can decrease lead absorption. B maintaining neutral soil of pH 6.5 to 7, you'll also be able to limit the build-up of lead in th soil.

ROCKY SOIL: If you have a lot of rocks on your property, you can use them in the garde Position plants that like hot, dry conditions near large rocks. Place smooth, flat rocks nea plants that like cool, moist conditions—put rocks over the roots of clematis, for instance.

BUYING SOIL

If you must buy topsoil, be careful. Try to find out where it came from. If it's from a fie that was planted with corn, it may be filled with toxic chemicals. In that case, don't buy it. C course, it is likely to have come from the nearest housing development. The valuable topso is removed and sold, leaving new homeowners with nothing but subsoil and clay. If you're this situation, bump up the soil first before you go through the heartbreak of putting in garden and watching it struggle. Use huge amounts of compost and manure to create health soil and keep it that way. Don't be tempted by quick solutions.

Instead of buying soil, you can prepare your own potting soil mix—particularly if you hav fears about vermiculite, which may contain asbestos, in commercial mixes. A combination clean soil, sand (builder's or horticultural sand is very gritty) and compost is a very goo growing medium.

I don't mess around with soil by cultivating it once it's been planted. I like to think I'm n disturbing the complex life or delicate root systems that exist down there. After all, the mo beneficial life in the soil is in the top inch (2.5 centimetres).

To create a healthy, balanced soil in your ecological garden, use every alternative cultivating that you can find. Be sure to mulch and otherwise keep the soil covered. (If yo want to see what will happen when you fail to protect the soil, take a chunk of bare ear and aim your hose at it.) Return what you take from the garden *to* the garden (leaves, dea and dying plants—unless they are diseased). Feed with organic matter. Compost, compos compost.

GREEN TIPS

SOIL LESSONS:

- Make sure you know what kind of soil and drainage you have, and work with it or amend it to accommodate the plants you want to grow. Find out what was added to your soil before you took possession. If the area has been stripped of

topsoil or if chemicals have built up in the soil, you will have to improve the soil over a period of time.

- Plant when pests are less evident.
- A handy way to inoculate your soil against diseases is to plant marigolds, and then rotate them from year to year. An added bonus: rodents don't like them.

Learn to treasure the soil and approach it as a living creature rather than some dead stu you clunk plants into. The more you are aware of the symbiosis between yourself and th soil, the more careful you will be with this miraculous substance.

SOIL TESTING

To find out where there are accredited soil testing labs in your area, Google "soil testing" plu your province or state, and you'll get an up-to-date address. When sending soil off to the la be sure to ask for organic solutions to any problem they find.

COMPOSTING

Garden Gold

My family always had a compost pile of some sort, however primitive, and I wa astonished to find that this was not a universal practice. I built my first one when w bought this house in the 1960s—just as soon as we'd pulled the 2,300 square feet (213 squa metres) of thigh-high weeds out of the back yard. My neighbour, objecting to what he terme "throwing out garbage and making flies," called city hall. When the health inspector arrive he hooted with laughter, "About the only thing you're making is a lot of worms." Th compost pile kept Steve and me at odds for years. We were like two politically oppose people—neither one of us could understand the other's point of view.

The value of composting has become increasingly clear. It cuts down on garbage to a hug degree. It puts back what you take out of the environment—an ideal form of recycling. An you can start any time of the year. The more I work with and read about compost, the more realize how much I have to learn. It's worthwhile refreshing the facts on an annual basis.

Without going on and on about its virtues, remember this: compost is even better tha well-rotted manure. Manure will, of course, amend your soil beautifully, but it isn't complete fertilizer. Compost is a much more nutritious hit for your soil. The micro-organism that build up in it supply what is comparable in humans to an inoculation against disease o to an antibiotic if you've got a disease. Compost will improve both the aeration and drainag of your soil as it supplies nutrients. And it's free. Need I go on?

What is compost? It's organic matter broken down by bacteria and other organisms into dark material called humus. It feels like the most perfectly wonderful soil imaginable.

To give you an idea of how easy it is to compost, consider that when you mow a lawn an leave the clippings in place, you are composting; when you let leaves stay on the ground t rot, you are composting. But to compost on a more sophisticated level, it takes a bit of effor

- You need some form of container.
- Layer what you put into it.
- Keep it relatively moist (not wet).
- Turn it occasionally.

If you follow these simple rules, you will have good compost and it won't smell. Wh creates a stink is throwing in all of one thing: nothing but kitchen waste, nothing but leave nothing but grass clippings. Gases build up, ergo, nasty smell. By layering, the stack heats u and cooks the smell out. I can get quite intoxicated by compost odour. When it has a slig earthy smell, which I love, that means it's a success. It's a sensual pleasure to let the lovel stuff run through your fingers.

The scientific basis of all composting is that organic matter is valuable only while decayin and even finished compost still has a way to go in that process. It's this decompositio process that provides nutrients to the soil. Microscopic bacteria and other minuscu organisms continually assimilate organic material, releasing the nutrients plants nee Bacteria alone are 60 percent protein, and they provide food for the munchers you can se worms, insects such as sowbugs, nematodes, mites and so on. They eat, digest, excrete an die. As this happens, more and more nutrients are released. All that life, the visible an invisible, the creepies and crawlies in your compost—talk about teeming with life— working for you.

The red worms that develop in compost heaps are special worms that don't live in th earth. They are smaller and live only in compost, creating air passages and providing th environment for the oxygen-loving organisms. When compost heats up during th decomposition process, they won't die or scurry away. And they seem to appear like mag once you provide the right kind of environment for them.

There are two types of decaying processes: aerobic and anaerobic:

Aerobic composting is when there's enough air to feed oxygen-loving bacteria and spu them on with the work of decomposition.

Aerobic is the best and most efficient, but it means you need to get oxygen into the heap b turning it. Leave a post in the centre to wiggle, or use any ingenious method you can think o to stir up the mix.

Anaerobic is without air; decay is slower; gases are formed and probably the pile will en up smelling like rotten eggs. Anaerobic composting is primarily carried on in closed bins o silos.

LOCATION

A compost heap needs good drainage, so don't build it on top of concrete or in an area whe water won't run off. Give it a shady spot so it won't dry out, but place it where the sun migh hit it at some time, though this is not terribly important. Use a cover to keep animals ou and keep the heap as damp as a squeezed-out sponge—neither soggy nor dry.

An excellent place to locate a compost bin or pile is about 6 feet (2 metres) away from birch or elder tree. Worms adore both these trees.

HOW TO GET STARTED

Use the container that suits the size of your garden best. I have a relatively small garden, so have a double-sided affair like the one illustrated. You can buy plastic composters but ca also build your own unit cheaply with used materials in the following way: