WASHINGTON STATE

Compost Educator's Guide

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CHAPTER 1: GUIDE OVERVIEW

"Education is not the piling on of learning, information, data, facts, skills, or abilities—that's training or instructing—but is rather a making visible what is hidden as a seed."

Thomas Moore, ed., "The Education of the Heart"

Welcome to the Compost Educator's Resource Guide

This guide is your invitation to practice and teach home composting from the world-view of sustainable living.

This document is a guide intended to give accurate facts, provide resources and inspire creativity. It is not an instruction manual promoting the best method for teaching people about composting. Composting, after all, is a creative process. Every community in Washington is unique, every county has its own challenges, every workshop holds potential for generating new ideas. Each conversation about composting can stir up enthusiasm in sync with the times as we transition from a mechanical to a biological era . As compost educators, we will continue to bring composting into its appropriate place at the center of sustainable living.

In this chapter, you'll find information about:

- The purpose of the guide
- Our vision for home composting
- The need for an active network of compost educators
- The compost educator's dilemmas
- How to best use the guide
- Guiding principles for home composting—a foundation on which to build local home composting programs—agreed upon, in principle, by the original workgroup
- Glossary terms

The purpose of the guide is to:

1 Provide consistent, science-based information about residential composting and vermicomposting for use in Washington State.

2 Assist compost educators in creating training events such as workshops.

3 Inspire a clear vision for home composting as a cornerstone of sustainable living.

4 Emphasize the network of compost educators.

Vision for Home Composting: Moving Toward a Sustainable Washington

Home composting is a near-perfect poster child for sustainability. As educators, we know this intuitively. But we haven't adopted this big-picture vision for home composting statewide yet. Why not seize the opportunity now? Consider the following:

In composting, we harness the natural process of decomposition to return organic materials to the soil. "Waste"—as a concept—is eliminated. This idea is exactly the concept promoted by two leaders in the sustainability movement, William McDonough and Michael Braungart. In their book *Cradle to Cradle: Remaking the Way We Make Things*, these two men (American architect and German chemist, respectively) describe a framework for sustainability called "eco-effectiveness".

The eco-effectiveness framework

In the eco-effectiveness framework, industries design all material goods to follow a biological life cycle or a technical life cycle. In the biological nutrient cycle, goods are produced so they will decompose when their useful life is over. Biological materials need to be free of contaminants, so they can be returned to the soil without harm. In the technical life cycle, goods are produced so they can be remanufactured into other recyclable goods at the end of their useful life. Technical materials stay in a recycling loop to be used over and over again.

A simple example of cradle to cradle

As a simple example of the concept, consider a box spring mattress that was designed and manufactured with the end of its useful life in mind, a cradle to cradle approach. First, all the materials extracted from nature to be used in making the box spring are grown and harvested using sustainable practices. Any materials (e.g. chemical inputs) used in manufacturing are themselves recycled in either the technical or biological life cycles.

At the end of its useful life, the box spring is disassembled. The steel springs are recycled in the technical life cycle, the wood is chipped for mulch, and the fibers in both the stuffing and cover material are decomposed. Both the mulch and the decomposed fibers are returned to the soil in the biological nutrient cycle. This example, of course, requires an infrastructure to carry out the recycling activities.

The healthy soil vision for home composting

When composting at home, we experience the biological life cycle as described by McDonough and Braungart first-hand. Food scraps, yard debris and other biodegradables become nutrients for a recycling system that builds healthy soil. This healthy soil vision for home composting gives us what McDonough calls an absorbing, positive image of the future.

Landfill avoidance perspective isn't enough to invoke sustainable behavior

In contrast, home composting promoted as a means to minimize waste going to the landfill relies on avoidance behavior, telling people what not to do—what to avoid. As McDonough explains, these are backward-looking images. They focus on eliminating something. Negative purposes fail to elicit [the] creative energies or passions for people to develop and maintain sustainable ways of living.

But aren't we practicing sustainability when we keep organic matter out of the landfill? You might ask. Well, it is behavior we want people to adopt, but it is not a vision. Landfill avoidance is embedded in a production system that is not sustainable.

McDonough and Braungart call this system (our current system) the "take|make|waste" model of production. It's an economic system responsible for the serious ecological and social difficulties we're experiencing.

Home composters experience sustainability

To be truly sustainable, we need to make a fundamental shift to a circular model McDonough and Brungart call, "borrow|use|return". This is a global transformation, so big and complex, it's difficult to imagine how home composting could make any positive impact at all.

"The significant problems we face today cannot be solved at the same level of thinking we were at when we created them."
Albert Einstein

Yet every time people gather food scraps or debris from the yard and compost it, they are practicing this circular model. They are experiencing core elements of sustainability. They are reinforcing the kind of fundamental shift in perspective that Albert Einstein shares in his famous quote.

If we believe Einstein, we understand how important it is to promote a deeper purpose for composting. We need to hold a clear vision for composting that says organic materials belong back in the soil, in the successive and repeated processes of birth, growth, maturity, death, and decay.

And the best way to spread this vision state-wide is through a linked network of compost educators!

Importance of the Compost Educators' Network

In Washington State, communities have been recruiting groups of volunteers to teach people to compost through Master Composter and similar programs for decades. So why is a network of compost educators so important now?

Generates energy and inspiration

The network of compost educators is important because the connection between individual programs can be a vital source of energy and inspiration to bring composting and responsible yard care into practice across the state.

Helps with information overload

The network also allows us to take full advantage of the Internet, while helping to deal with a problem we all experience: information overload. Individuals in the network of compost educators can discover important research and policy findings and distribute them to others at cyber speed. As new information comes in, it can be shared across the network with tremendous efficiency.

Maintains a forum for discussion on specific topics

Interest groups everywhere use Internet tools for discussing specific topics. List serves, blogs, chat rooms, and email chains are just some of the ways people vet ideas or questions. A discussion forum for compost educators might be the most important reason to establish and continue regular interactions between programs. One of the stated goals of this guide is to promote statewide consistency in balance with unique qualities of each local program. Information flow is critical to achieving that goal.

Keeping the Educators' Network Alive and Vibrant

Enthusiasm has an infective quality about it. Being part of a group that shares enthusiasm generates power.

Margaret Mead, famous anthropologist and writer, offers inspiration for us to work together in our pursuit of sustainable living in her famous quote:

"A small group of thoughtful people could change the world. Indeed, it's the only thing that ever has."

This power can fuel a vibrant home composting and natural yard care program in every county in Washington. And the compost educator's network can be at the center of "making it happen." Sometimes all it takes to keep enthusiasm flowing is a quick phone call to a colleague - sharing a story or an idea for a new activity to attract people's attention. Sometimes it takes a pause in the middle of a busy day to feed the worms, and remember that every little bit helps.

Networks of people parallel living systems

Information flow and sharing happens naturally when individuals in the network are aware of their identity as part of the system, as long as they keep their antennae tuned to new happenings. If this description sounds a lot like a bee hive, ant hill or school of fish, you're right. A growing number of leaders in all sectors of our society are thinking about human organizations as living systems. One of the pioneers in this field is Margaret Wheatley, author of *Leadership and the New Science*.

Margaret's new science theories represent a fascinating body of literature, worthy of study, but beyond the scope of this guide. The important message they bring is that in order to "get things done", we need to remember:

- relationships are of primary concern,

- networks "make it happen",

- context of any project or program is important (e.g. demographics, climate, social norms in your community),

- whole systems are much more than just the sum of their parts, and we need to honor the whole system. For example: a home and yard can be viewed as an ecosystem, with composting and yard care as two parts of the functioning whole.

The Compost Educator's Dilemmas

Efficiency vs. inspiration

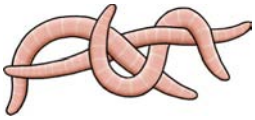
The current trend in government agencies (other than learning institutions, of course) is to discourage program money designated for education. Understandably, the public is demanding accountability and results for tax-payer investments in all programs. Performance measures are now part and parcel of government activities. Efficiency rules the day in just about every aspect of our political, social, and daily lives. Who wouldn't want to be efficient, especially when working with limited time and resources to get people composting?

Yet when we boil the how-to-compost information down to numbered steps and bulleted lists, something central to the composting process gets lost in translation. It dies. It seems we've boiled the life out of the information until we're left with nuts and bolts of this wonder-full activity. Efficient? Yes. Simple to understand? Absolutely. But will it engage people on a level likely to keep them composting for the long term? Maybe not. Nuts and bolts are great for constructing widgets. But compost is not a widget!

So how do we balance the need for clear, concise instructions (nuts and bolts) with our desire to engage people in lasting behavior change—a much more complicated prospect? Here are a few suggestions. You'll find more detail in the chapter on outreach.

- Use artwork to supplement the bulleted lists. Art activates a different side of people's brains and may engage them when facts and numbers won't.

- Use as much show-and-tell with real organic materials as possible when showing people how-to. Your intimacy with decomposition puts the soul of composting into any handout, even the lists. They'll remember how you relate to the microbes without you having to say anything specific!



- Play with the worms, especially the wiggly ones. The poor critters won't like it much, but they'll recover. And the people will remember your enthusiasm.

- Play with language, metaphor and poetry can bring life to facts and figures.

Messages: Getting people's attention vs. the complete composting story

The balance between efficient information and inspiring people to action is just one of the compost educator's dilemmas. Another dilemma is the dance between how to get people to the workshop (or booth, or whatever venue you've chosen for outreach) and then what to tell them once they're there.

As educators, we are embracing sustainable living as our vision for home composting. Yet many people may still only respond to composting as a waste management issue because that's what they're used to. So the workshop poster may say, Reduce your garbage bill or Save landfill space—compost your food scraps and yard debris, hoping to catch their attention enough to come to the meeting. Then the handout materials and presentation would include a more complete set of reasons why composting is such a good thing to do.

How To Use This Guide

How you use the guide will depend on the extent of your current program, if you have one.

The curriculum could be as simple as adopting existing brochures and answering questions at events; or as complicated as creating slide shows, demonstration sites, and a volunteer program.

Whatever the level of complexity in your program, you will need at least:

- A handout with simple how to make compost information
- A handout on how to use compost
- Use the handouts included with this guide, or create your own using background information provided in the text or in the resources.
- Most importantly, have fun introducing people to the wonderful world of composting!

Guiding principles

The following guiding principles reflect what we, as compost educators, believe at this time. These statements guide what we do. They are fundamental to the way we educate citizens about home composting in Washington State. These guiding principles are intended for compost educators to use as a compass while preparing programs for various audiences. They were not written to share with audiences as-is.

- Home composting is an art, using principles of science to control decomposition of food scraps and yard debris.

- As an art, home composting allows people freedom to choose a system that fits their needs. There is no single right way to compost.

- Home composting systems need to be simple and convenient for the user. They also must adhere to local ordinances.

- Home composting education is evolving from a focus on waste management to a focus on sustainable living and healthy soil. Soil-building is a forward-thinking framework for home composting.

- The healthy soil vision (or soil-building framework) for home composting can be summed up in this statement:

Food scraps and yard debris become food for microorganisms and the microorganisms improve the soil and provide a hospitable environment for plants to grow.

- Home composting teaches a core element of sustainability: returning biodegradable materials back into nature without harm.

- We provide technical information about home composting knowing the information is best received when delivered with inspiration.

- The network of home compost educators is vital to continued growth in number and effectiveness of home composting programs statewide. The network makes it happen!

- Composting is not a static endeavor. Composting practices can be shared via the network as they evolve.

- Home composting connects people to the microbial world, nature, and other people in their community. This connection matters. It helps drive human behavior toward protecting earth's land, air, and water for current and future generations.

Glossary Terms

sustainability: Capable of being continued with minimal long-term effect on the environment: sustainable agriculture.

eco-effectiveness: Seeks to design industrial systems that emulate the healthy abundance of nature.

Resources

Sustainability

Doppelt, Bob. Leading Change Toward Sustainability: A Change Management Guide for Business, Government and Civil Society. Sheffield, UK: Greenleaf Publishing Limited. 2003.

Contact info for Bob Doppelt. http://pppm.uoregon.edu/index.cfm?mode=faculty&page=bobdoppelt

McDonough, William, and Michael Braungart. "Cradle to Cradle: Remaking the Way We Make Things." New York: North Point Press. 2002.

Website. http://www.mbdc.com/

Description of "Cradle to Cradle Design" from the website.

"Cradle to Cradle Design is a fundamental conceptual shift away from the flawed system design of the Industrial Revolution. Instead of designing products and systems based on the take-make-waste model of the last century ('cradle to grave'), MBDC's Cradle to Cradle Design paradigm is powering the Next Industrial Revolution, in which products and services are designed based on patterns found in nature, eliminating the concept of waste entirely and creating an abundance that is healthy and sustaining. Eco-Effectiveness is MBDC's design strategy for realizing these results by optimizing materials to be food either for nature's ecosystems or for humans' industrial systems—perpetually circulating in closed systems that create value and are inherently healthy and safe."

Industry example. Herman Miller's "Mira" office chair. It's made to be disassembled and recycled at the end of use. [See www.hermanmiller.com]

Living systems theory and new science

Wheatley, Margaret J. Leadership and the New Science: Discovering Order in a Chaotic World, 3rd edition. San Francisco: Berrett-Koehler Publishers, Inc. 2006.

Website. http://www.margaretwheatley.com/

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Howard, Sir Albert. 2007. The Soil and Health: A Study of Organic Agriculture. University Press of Kentucky.

Moore, Thomas. The Education of the Heart. 1996. HarperCollins Publishers, Inc. New York, NY.

Wheatley, Margaret. 2006. Leadership and the New Science. Berrett-Koehler Publishers, Inc. San Francisco, CA.

CHAPTER 2: HEALTHY SOIL

"Humans… are truly a product of the soil and reflect in their bodies—and minds—the wealth or poverty of this land."

Dr. Helmut Kohnke, "Soil Science Simplified"

In this chapter, you'll find information about:

- Soil and human civilizations
- Benefits of healthy soil: overview of soil functions
- Basic soil science, the all-in-one resource: Home Gardener's Guide to Soils and Fertilizers by Craig Cogger, Extension Soil Scientist, Washington State University
- Soil organic matter
- The soil food web
- How soil is formed: aka the five factors of soil formation
- Outreach materials

"…soil is humanity's most essential natural resource and essentially linked to modern civilization's survival."
David Montgomery

Soil and Human Civilization

Whole books have been written about the connection between soil fertility and the success or failure of human civilizations cultivating the land. One such book is *Dirt: The Erosion of Civilizations*, by David Montgomery. As one reviewer described, Montgomery argues persuasively that soil is humanity's most essential natural resource and essentially linked to modern civilization's survival. He traces the history of agriculture, showing that when humans exhausted the soil in the past, their societies collapsed, or they moved on.

As compost educators, the importance of caring for the soil is a vital part of the sustainability message. Soil and the history of civilization may be one of the topics you choose to include in your curriculum. The reference books in the Resources section will provide several examples to share with your audience.

Benefits of Healthy Soil: Overview of Soil Functions

Soil has many functions in the world. For composters and gardeners, probably the most important function of soil is to grow plants. From a broader perspective, healthy soil gives us clean air and water, bountiful crops and forests, productive rangeland, diverse wildlife, and beautiful landscapes. Soil does all this by performing five essential functions:

- ***Nutrient cycling:*** Soil stores, moderates the release of, and cycles nutrients and other elements. During these biogeochemical processes, analogous to the water cycle, nutrients can be transformed into plant available forms, held in the soil, or even lost to air or water.

In a vintage '70s book on soils for gardeners, Gene Logsdon—long-time farm and garden writer—introduces a sport we may want to revive for the 21st century biological era: soil watching. Probably you already engage in this sport, in the privacy of your own thoughts. Now you can put a name to the activity and share the wonder of Washington soils with fellow educators in the network. And what better state than Washington, with its varied topography and climate, to revive soil watching as the best travel game going?

Soil watching—as the name implies—is a fairly straightforward activity. Along your chosen route, you observe roadside cuts, gardens, plants, forests, etc. and talk about soil health based on these varied observations. It is more than just roadside geology, though you may want to take along a copy of *Roadside Geology of Washington* to enhance your experience. Think of how much more you'll get out of meetings when you travel with an eye on soils! Caution: Carpool drivers should (obviously) forfeit the watching part of soil watching and keep their eyes on the road. Enjoy the conversation and share piloting duties so all get a chance to view the roadside beauty of soils.

- ***Water relations:*** Soil can regulate the drainage, flow and storage of water and solutes, which includes nitrogen, phosphorus, pesticides, and other nutrients and compounds dissolved in the water. With proper functioning, soil partitions water for groundwater recharge and for use by plants and soil animals.

- ***Biodiversity and habitat:*** Soil supports the growth of a variety of plants, animals, and soil microorganisms, usually by providing a diverse physical, chemical, and biological habitat.

- ***Filtering and buffering:*** Soil acts as a filter to protect the quality of water, air, and other resources. Toxic compounds or excess nutrients can be degraded or otherwise made unavailable to plants and animals.

- ***Physical stability and support:*** Soil has the ability to maintain its porous structure to allow passage of air and water, withstand erosive forces, and provide a medium for plant roots. Soils also provide anchoring support for human structures and protect archeological treasures.

Many soil scientists have other lists of soil functions. They can be found on the *soilquality.org* website under *Alternative Soil Functions*.

Basic Soil Science

This section contains an all-in-one resource about soils and fertilizers, WSU Extension Bulletin 1971e: *Home Gardener's Guide to Soils and Fertilizers* by Craig Cogger. The document is suitable and available as an Extension Bulletin for outreach and is included in this *Compost Educator's Guide* for your use in trainings. If you need more in-depth information, please refer to the resources for a list of soil science books.

Soil Organic Matter

Soil organic matter is often viewed as the thread that links the biological, chemical and physical properties of a soil. Though it typically amounts to only <1 to 5 percent of soils, organic matter has a big impact on soil health.

Here is a list of the ways in which organic matter affects soil quality:

1 Stores and supplies plant nutrients Nitrogen, Phosphorus, and Potassium (N, P, and K) and micronutrients; increases cation exchange capacity.

2 Stabilizes and holds soil particles together as aggregates.

3 Helps soil to resist compaction, promotes water infiltration, and reduces run-off.

4 Aids growth of crops by improving the soil's ability to store and transmit air and water, as measured by improved porosity; water holding capacity, and drought resistance.

5 Makes soil more friable and easier to work so that plant roots can penetrate the soil profile better.

6 Provides a source of carbon and energy for soil microbes which cycle nutrients and fight plant diseases.

7 Reduces the negative environmental effects of pesticides and other pollutants by binding contaminants.

The Soil Food Web

Soil organic matter is integrally tied to the soil food web. Soil biology was not widely promoted in education programs until the 1990s. Soil biology became more visible in education programs when the USDA published a popular document called *Soil Biology Primer*. The document provides a wonderful overview of life in the soil, with photographs and descriptions of each category of creatures that make up the complex food web of the soil.

The soil organisms interact with one another in a complex web, converting nutrients and energy as predator or prey depending on their feeding level. The organisms can be grouped generally into the following categories:

- Bacteria
- Fungi
- Protozoa
- Nematodes
- Soil anthropods
- Earthworms

Depending on the ecosystem, soil organisms concentrate where they can find food:

- Around roots
- In litter
- On humus

- On the surface of soil aggregates
- In spaces between soil aggregates

In summary, the *Soil Biology Primer* offers this overview of the importance of soil biology:

How the Soil Food Web Functions to Benefit the Gardener

- Fertilizer requirements may decline as a healthy food web efficiently stores and cycles nutrients.
- Nitrates do not leach into groundwater when soil organisms hold nitrogen in the rooting zone.
- Water quality is protected when organisms effectively degrade pollutants.
- More water soaks into soil, and can be used by crops as biological activity enhances soil structure.
- Less topsoil is lost to water and wind erosion where soil organisms have stabilized the soil structure.
- Pesticide use can be reduced as disease suppression improves with a healthy soil food web.

How Soil is Formed: The Five Factors of Soil Formation

Hans Jenny (1899–1992), soil scientist from the University of California, Berkley, experienced notoriety when his book, *The Factors of Soil Formation*, was published in 1941. In his book, Jenny made the connection between observations of soils in their natural state, and mathematical equations describing the forces that made them. The book is still considered one of the most important contributions to soil science, and was re-published with a new foreword in 1994, two years after Jenny died.

In simplest terms, the five factors of soil formation are:

- Topography (or relief)
- Parent materials
- Climate
- Biota
- Time

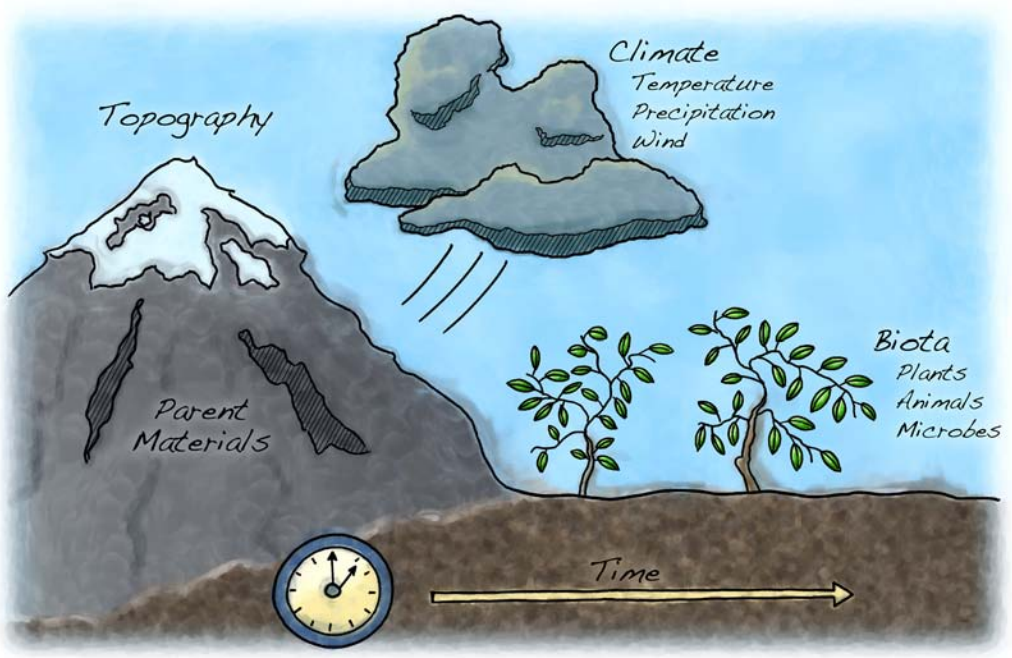

Figure 2.1. Here is an easy way to remember the five factors of soil formation.

Soil formation is a fascinating study. It adds a perspective of geologic time to a composting/yard care education program. And it may help people to relate to the nature of soils in their own yards.

Outreach Materials

For information on soils and fertilizers, the following two documents are available to distribute at outreach events:

EB 1971e. Home Gardener's Guide to Soils and Fertilizers by Craig Cogger, WSU Soil Scientist.

EC 1561. Improving Garden Soils with Organic Matter by N. Bell, D.M. Sullivan, L.J. Brewer and J. Hart, Oregon State University.

Resources

Books

Dunne, Niall (ed). 2009. Healthy Soil for Sustainable Gardens. Brooklyn Botanic Garden.

Gershuny, Grace. 1993. Start with the Soil, Emmaus, PA: Rodale Press.

Hillel, Daniel. 1990. Out of the Earth: Civilization and Life of the Soil. University of California Press.

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Magdoff, Fred, and Harold van Es. 2000. Building Soils for Better Crops, 2nd edition. Beltsville, MD: Sustainable Agriculture Network.

Smillie, Joe, and Grace Gershuny. 1999. The Soul of Soil, 4th edition. White River Junction, VT: Chelsea Green Publishing Company.

Other publications

2000. Soil Biology Primer. Ankeny, IA: Soil and Water Conservation Society.

www.swcs.org; pubs@swcs.org; or (800) THE-SOIL extension 24 or 7515.

Cooperband, Leslie. 2002. Building Soil Organic Matter with Organic Amendments – A resource for rural gardeners, small farmers, turfgrass managers and large-scale producers, University of Wisconsin, Madison.

http://www.cias.wisc.edu/crops-and-livestock/building-soil-organic-matter-with-organic-amendments/

Soil Science Society of America. Soil Science Glossary. 2008

https://www.soils.org/sssagloss/pdf/soil-science-glossary.pdf

Soils and civilization

Soil Quality Website. http://soilquality.org/home.html

The Soil Quality website has a list of books on soils and civilization. Here is a description of the most recent publication listed:

Dirt: The Erosion of Civilizations. 2007. David R. Montgomery. University of California Press. Dirt, soil, call it what you want—it's everywhere we go. It is the root of our existence, supporting our feet, our farms, our cities. This fascinating yet disquieting book finds, however, that we are running out of dirt, and it's no laughing matter. An engaging website on the natural and cultural history of soil that sweeps from ancient civilizations to modern times. *Dirt: The Erosion of Civilizations* explores the compelling idea that we are—and have long been—using up Earth's soil.

Soil testing

The Washington State University Website Soil Testing has several references including a Power Point slide presentation on testing soils and the two documents listed below the URL. The site also includes a list of laboratories where you can send soil samples. http://www.puyallup.wsu.edu/soilmgmt/SoilTesting.htm

Gardner, E.H. and J. Hart. 1995. Soil sampling for home gardens and small acreages. Oregon St. University. Extension Service. EC 628. http://extension.oregonstate.edu/catalog/pdf/ec/ec628.pdf

Marx, E.S., J. Hart, and R.G. Stevens. 1998. Soil test interpretation guide. Oregon St. University. Extension Service. EC 1478. http://extension.oregonstate.edu/catalog/pdf/ec/ec1478.pdf

Other Washington State University soils links

The URL listed below has a Power Point slide of soils in the Puget Sound area. It also links to several USDA sites that provide a wealth of information on soil types, classifications, maps, soil quality, state soils, soil uses, etc. http://www.puyallup.wsu.edu/soilmgmt/Soils.htm

Other soil links: Activities to inspire soil stewardship

The Soil-net website has lots of fun activities to download and use in the soils part of your curriculum. http://www.soil-net.com/

Soils.org is a website associated with the Soil Science Society of America. It has good links to other websites with soils activities. It also has a pdf file of the well-known apple demonstration to show how much soil on the earth is capable of supporting agriculture. https://www.soils.org/lessons/plans/

References

Kohnke, Helmut, and D.P. Franzmeier. 1995. Soil Science Simplified. Long Grove, IL: Waveland Press, Inc.

National Soil Quality Team. 2008. University of Illinois; Iowa State University; USDA Agricultural Research Service, National Soil Tilth Laboratory; USDA Natural Resource Conservation Service. http://soilquality.org/home.html

Montgomery, David. 2007. Dirt: The Erosion of Civilizations. San Francisco: University of California Press.

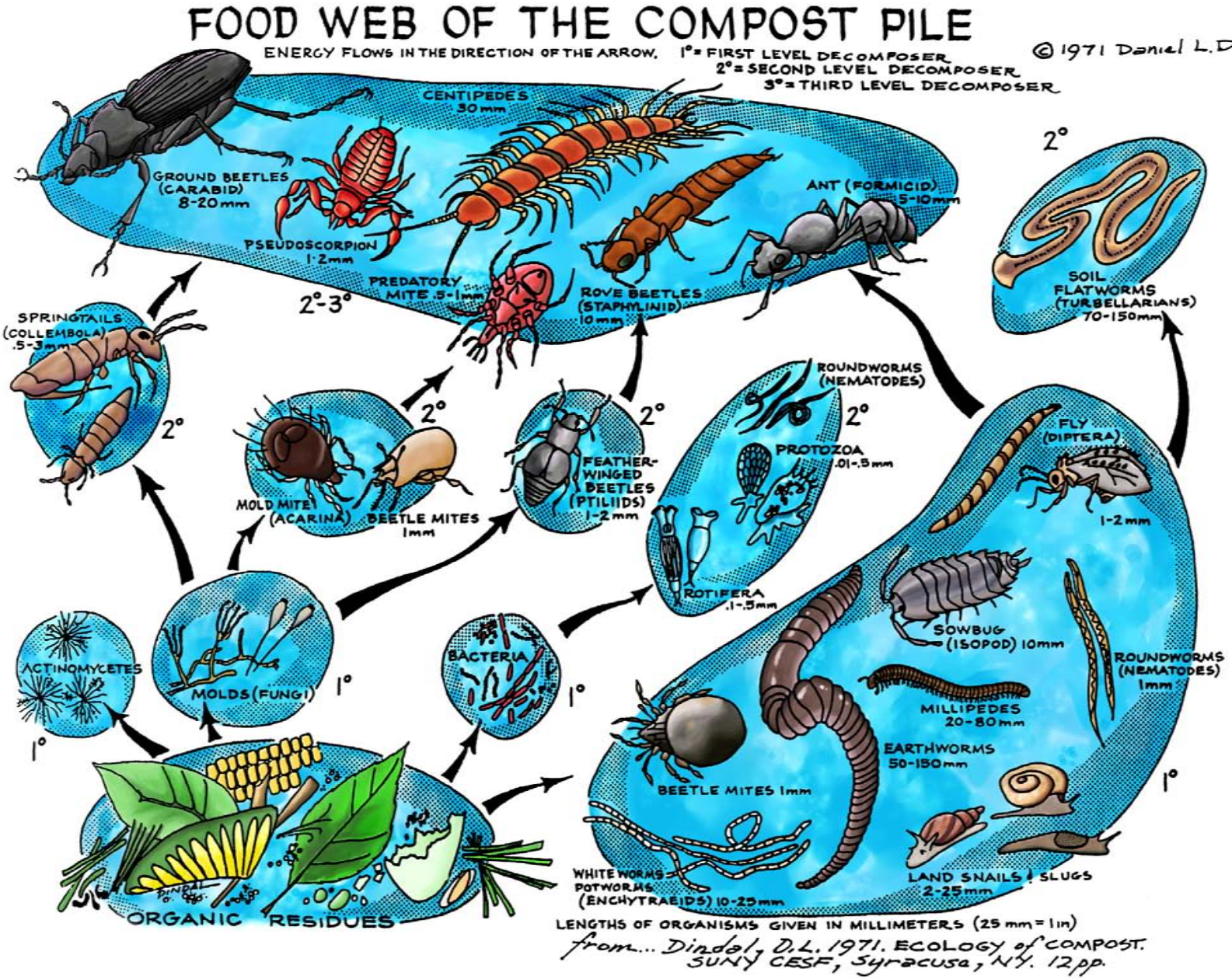
CHAPTER 3: HOME COMPOSTING

"…the basis [of composting] is always the same, namely, to allow or induce microbial action by means of air and of moisture. It must never be forgotten that living organisms and not human beings, are the agents which make compost."

Sir Albert Howard, "Soil and Health", 1945

In this chapter, you'll find information about:

- The basic process of decomposition, or how microbes make compost happen
- An overview of the microorganisms involved; including a brief discussion of other critters in the compost
- The nature of compostable materials
- The important factors involved in composting, specifically, balanced nutrients (carbon to nitrogen ratio), particle size, moisture, oxygen, temperature, pile size and how these factors relate to one another
- How to translate the needs of the microbes into the practice of composting at home
- How to choose the best system based on local conditions/requirements and individual needs and resources
- Outreach materials for home composting


FOOD WEB OF THE COMPOST PILE
ENERGY FLOWS IN THE DIRECTION OF THE ARROW. 1°= FIRST LEVEL DECOMPOSER
2°= SECOND LEVEL DECOMPOSER
3°= THIRD LEVEL DECOMPOSER
© 1971 Daniel L. Dindal
CENTIPEDES 30 mm
GROUND BEETLES (CARABID) 8-20 mm
PSEUDOSCORPION 1-2 mm
PREDATORY MITE .5-1 mm
ROVE BEETLES (STAPHLINID) 10 mm
ANT (FORMICID) 5-10 mm
2°-3°
2°
SOIL FLATWORMS (TURBELLARIANS) 70-150 mm
SPRINGTAILS (COLLEMBOLA) .5-3 mm
MOLD MITE (ACARINA)
BEETLE MITES 1 mm
FEATHER-WINGED BEETLES (PTILIIDS) 1-2 mm
ROUNDWORMS (NEMATODES)
PROTOZOA .01-.5 mm
ROTIFERA .1-.5 mm
FLY (DIPTERA) 1-2 mm
SOWBUG (ISOPOD) 10 mm
ROUNDWORMS (NEMATODES) 1 mm
MILLIPEDES 20-80 mm
EARTHWORMS 50-150 mm
BEETLE MITES 1 mm
WHITE WORMS = POTWORMS (ENCHYTRAEIDS) 10-25 mm
LAND SNAILS & SLUGS 2-25 mm
1°
ACTINOMYCETES
MOLDS (FUNGI)
BACTERIA
ORGANIC RESIDUES
LENGTHS OF ORGANISMS GIVEN IN MILLIMETERS (25 mm = 1 in)
from... Dindal, D.L. 1971. ECOLOGY of COMPOST. SUNY CESF, Syracuse, N.Y. 12 pp.

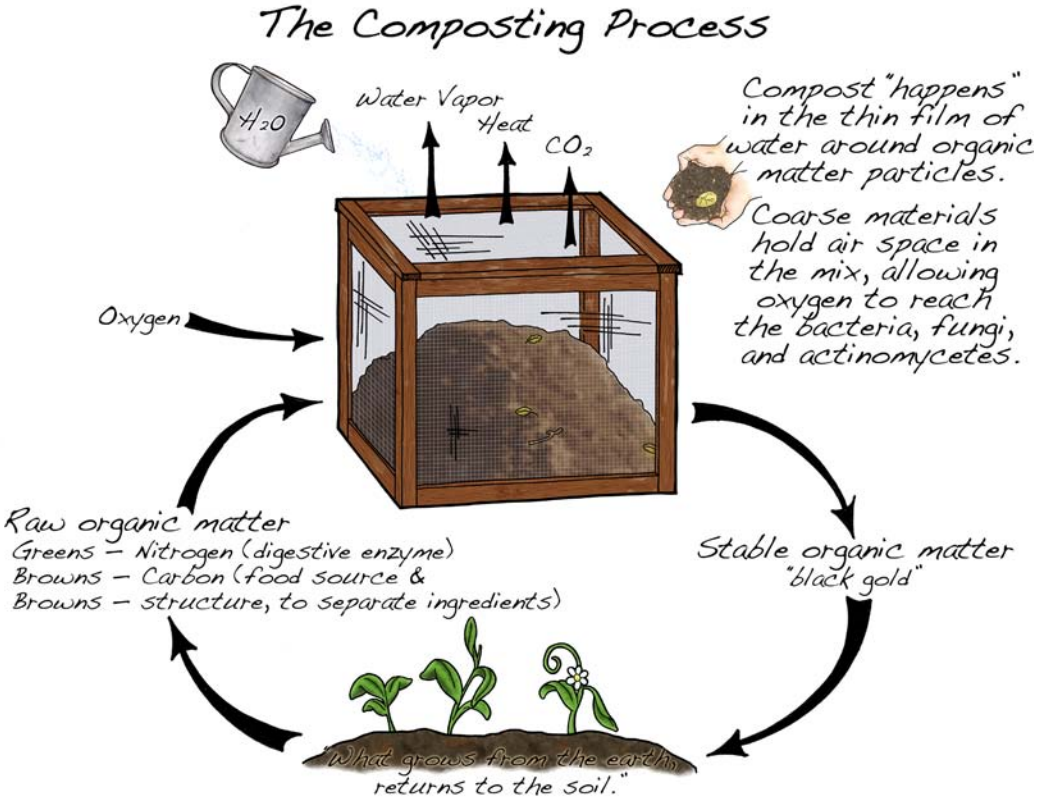
The Basic Process of Decomposition

Composting happens because microorganisms use raw organic matter as a source of food and energy to grow and multiply. They live and work in the thin films of water surrounding particles of food scraps, yard debris and other raw organic matter. In big picture terms, the process generates heat, carbon dioxide and water. Over time microorganisms use up the food and the result is finished compost: a mix of stable organic matter (humus-like material), minerals, water, and microorganisms.

What Really Happens During Decomposition?

This section gives a simplified explanation of what happens during decomposition. Microorganisms produce enzymes and release them into the compost. Enzymes are proteins (nitrogen-rich macro-molecules made up of amino acid building blocks).

Enzymes latch onto microscopic bits of organic matter particles, breaking apart carbon bonds. This carbon-bond-breaking releases energy and yields smaller carbon compounds. Some of the energy is used to transport these smaller carbon compounds and nutrients into the microorganism's cell. Some is used for cell growth. And some energy is released as heat. As the heat accumulates, populations of thermophilic (heat-loving) microbes become more active and take over. Excess carbon in the compost forms carbon dioxide and is released to air spaces in the pile (along with water vapor) and then into the atmosphere.



Opposite: Figure 3.1. Food Web of the Compost Pile.

Figure 3.2. The Composting Process.

During decomposition multiple reactions (both biological and chemical) are occurring at the same time. When enzymes break apart the organic matter particles, many intermediate compounds are formed, such as organic acids and ammonia. These intermediate compounds eventually become food for the microorganisms or get locked up in complex humus-like material. It's a dynamic process—not just a straight line reaction from organic matter to carbon dioxide and water.

The production of humus-like material (humification) is an important process that occurs during composting. No one is sure how humification occurs, but we can think of it as a construction process that goes on in the midst of decomposition. Humus may be formed partly through polymerization processes, which turns simple molecules into more complex ones. As the organic material in the compost pile decomposes, some of the simple compounds produced can react with each other to form large polymers that resist further decomposition. Another way that humus may form is through the partial breakdown of complex compounds such as lignin, cellulose, fats, and proteins, which then are able to associate with each other, forming complex supra-molecular structures.

Overview of the Microorganisms (and Other Critters) Involved in Composting

Microorganisms present in a compost pile fit into three main groups: bacteria, fungi, and actinomycetes. They can also be divided according to the temperatures at which they live and are most active.

Bacteria

Of the three main types of composting microorganisms, bacteria are the most abundant. They are the work horses of the compost pile. Researchers estimate that 80 to 90% of the microorganisms in an active compost pile are bacteria. (Goluke 1991)

Bacteria are single cell organisms that don't have a nuclear membrane. Think of them as bags of enzymes. (Coyne 1999) They have many different shapes and a great diversity in their metabolism (the way they get energy and food). As composters, we're most interested in the numerous kinds of bacteria that decompose organic matter, and the few types that pose disease threats to plants, animals and humans.

Bacteria have a semi-permeable cell membrane. This membrane lets in some materials from their environment and leaves out other materials. Bacteria also have a cell wall which helps them keep their shape. Understanding a little about the physical structure and functioning of these work horses of decomposition helps us understand the importance of water and air in the composting process. Without sufficient water for composting, the surrounding bits of organic matter, bacteria will become dehydrated. At low enough moisture levels they will die or move into a dormant phase until moisture returns. At the other extreme, too much water in the mix fills up the air spaces (or pore spaces), resulting in anaerobic (without

oxygen) conditions. Anaerobic conditions favor different populations of bacteria that can live without oxygen (anaerobic bacteria) and create objectionable odors.

Actinomycetes

Actinomycetes, like bacteria, are prokaryotes, or single celled organisms that don't have a nuclear membrane. Though they look a lot like fungi in compost, actinomycetes are closer to bacteria in the most recent taxonomy groupings. Think of them as bacteria with an identity crisis. (Coyne 1999)

When I was young and learning to grow veggies, my grandfather told me, "Don't spread wood ashes in the garden where you want to plant potatoes next year. It'll give 'em scab." What Gramps didn't tell me is that scab is caused by one of the actinomycetes, *Streptomyces scabies*. Wood ash applied to the garden raises the pH, giving *S. scabies* a competitive edge in the soil. With fewer competitors, they attack potatoes and we end up with scabby spuds!

Actinomycetes are aerobic organisms (with just a few exceptions) and don't survive in areas without oxygen. You'll see them in the warm zones of a compost pile with good air flow. The filaments in actinomycetes are much smaller and more delicate than fungal filaments. They will disappear if you put pressure on them when poking around in the pile.

Actinomycetes are responsible for that earthy smell in soil, compost, and old basements. The smell is actually a by-product of the decomposition process known as geosmins (meaning earth smell, released when actinomycetes die).

Some actinomycetes play a life-saving role in providing antibiotics for fighting diseases in both animals and humans.

Fungi

Fungi are higher life forms than both bacteria and actinomycetes because they have a nucleus bound by a membrane; thus they are known as eukaryotes. The nucleus in fungi stores genetic information of the cell as chromosomes, which are composed of DNA. (Coyne 1999)

Fungi tolerate wide ranges of temperatures and pH. Though fungi play a role in the thermophillic phase of composting, most fungal activity occurs toward the latter part of composting when temperatures return to the mesophilic range

Fungi are important decomposers of woody materials. Unlike bacteria, they produce specific enzymes that can break apart the complex carbon bonds in cellulose and lignin, structural components of wood that are difficult to break down.

Other critters in the compost pile

Home composting systems also host many other creatures. They come and go from the pile or bin, depending on their immediate environmental conditions (especially heat and moisture). These creatures—along with bacteria, fungi and actinomycetes—form the *Food Web of the Compost Pile*. (Daniel Dindal 1971, p. 18)

Worms Eat My Garbage by Mary Appelhof has a wonderful chapter describing the various critters that may inhabit both your worm bin and your compost pile, once things have cooled down. The best way to learn about them is to read the descriptions in *Worms eat My Garbage* and then spend time observing them carefully.

A good hand lens will help with your observations. It opens up a whole new world.

Carbon compound	Generally found in	Specific examples	Comments
Carbohydrates	Sugars and starches	Fruits and vegetables	Easiest to decompose.
Proteins	Plant and animal. Made of amino acids. Contain nitrogen and sulfur.	Meat, fish, nuts, legumes, dairy products	
Fats/oils	Plants and animals	Beef tallow, soybean oil	
Hemicellulose	Plant cell walls		
Cellulose	Wood, leaves, stems, straw	Paper	
Chitin	Animal and insect structural components	Crab shells, insect exoskeletons	
Lignin	Complex compound in wood	Tree trunks	Hardest to decompose. Broken down by fungi.

Table 3.1. Carbon compounds, arranged with easily decomposed materials at the top.

The Nature of Compostable Material

Compostable materials are made up of carbon molecules in various states of complexity, from the very simplest sugar—glucose—to extremely complex molecules such as those found in wood (lignin). Remember, carbon is the basic building block of life. As described in previous sections, decomposition breaks apart the carbon bonds in organic matter, releasing energy. The simplest carbon compounds break down easily; the more complicated ones require more time and more enzyme action. You will find a list of carbon compounds arranged with easily decomposed materials at the top in Table 3.1.

Understanding the nature of the materials you put into the compost pile is one of the most important aspects of composting! In addition to carbon compounds themselves, composters need to pay attention to the balance of carbon to nitrogen or C:N ratio in the materials. This and other important factors are discussed in the next section.

Important Factors of Composting

This section covers the factors of composting that we need to pay attention to when composting at home. If you look at the various reference books, research papers and how-to brochures, the number of factors that authors call out varies. But they all include the basic life support factors for the microbes to do their work:

- Nutrient balance or carbon to nitrogen ratio (C:N)
- Moisture
- Oxygen

- Porosity and particle size
- Pile size
- Temperature

C:N ratio

It's helpful to think of the carbon and nitrogen as part of a balanced diet and having the correct amounts of each makes your diet, in this case compost, work better.

- C:N ratio is the relationship between the amount of carbon in a material compared to the amount of nitrogen.
- The nitrogen number is almost always expressed as 1, so C:N means amount of carbon per unit nitrogen.
- A high C:N ratio means there is lots of carbon per unit of nitrogen. Ex: C:N ratio of 200:1 means there are 200 parts carbon for every 1 part nitrogen in the material.
- The target range for C:N ratio in a compost pile is 20:1 to 40:1.

Since many people are intimidated by trying to figure out the right ratio, remember this quote by Gene Logsdon, long-time farm and garden writer:

"Building a successful compost heap is just as much art as science, and experience will teach you more than tables of numbers."

Greens, browns and bulking materials are one common way to describe the carbon and nitrogen makeup of composting materials. Greens provide the nitrogen source, browns provide the carbon source. Bulking materials (or agents), provides

Coffee grounds are a good material for the initial mixture in composting. They have a C:N ratio of 20:1 and have been found too work well with other materials for composting as 25% (volume) of the total mix.

Selected Raw Material	Typical C:N Ratio	Selected Raw Material	Typical C:N Ratio
Grass clippings	9–25	Broiler litter	12–15
		Horse manure	20–50 (~30)
Sheep manure	13–20	Laying hen manure	3–10
Coffee grounds	20	Food scraps	14–16
Corn cobs	56–123	Wheat straw	100–150
Corn stalks	60–73	Legume hay	15–19
Cotton seed meal	7	Corrugated cardboard	563
Fish scraps	2.6–5	Bark, softwood	131–1285
Fruit scraps	20–49	Newsprint	398–852
Potatoes, cull	18	Sawdust	200–750
Soybean meal	4–6	Leaves, deciduous	40–80
Vegetable scrapes	11–13	Blood meal	3

Table 3.2. Table of C:N Ratios.

the needed pore space in the compost pile by separating materials that tend to mush together. Bulking agents are usually considered browns in that they have a high C:N ratio.

Table 3.2 contains a list of common compostable materials and the corresponding C:N ratios from the *On-Farm Composting Handbook*. The numbers were derived from many sources, and represent typical ranges of C:N ratios.

Moisture

Microorganisms cannot survive without enough moisture to carry out their life functions. Compost piles need to have 50 to 60% moisture (by weight) to maintain good biological activity. In practical terms, this means the materials need to have enough moisture to resemble a wrung-out sponge.

Home composters need to have a source of water. Especially in areas of the state with low precipitation, water can be the most important ingredient for successful backyard composting. In theory well managed compost piles contain a thin layer of water around each particle to help microbes decompose organic matter efficiently. Water should be added as needed when building the compost pile or when the compost is turned.

Oxygen

Composting materials need to have at least 5% oxygen content in the pile to maintain predominantly aerobic conditions. For home composters, a person's sense of smell is the best tool for determining whether or not the microbes are getting enough oxygen.

Of the most common materials composted at home, grass clippings and food scraps are the materials that are most likely to become anaerobic. If left alone to decompose, both materials will compact as the cells break down and begin to release liquid. With no structure in the pile to maintain pore space, the material ends up looking (and smelling) like a heap of slime.

Porosity and particle size

Porosity, the amount of air space in the composting materials, is a function of the size and structure of individual particles and the amount of moisture in the pile. Smaller particles have more surface area for the microbes attack (increasing overall decomposition), but they also pack together more tightly (decreasing airflow). The best way to get enough porosity in the pile is to have different particle sizes that pack together in ways that leave space for air; and to maintain the right moisture level so water isn't saturating air spaces in the pile.

Pile size

Compost pile size is important if the goal is to generate and maintain a hot composting process. (See the section on choosing a system). Most books and brochures give a standard size: at least 3 ft × 3 ft × 3 ft or one cubic yard. It takes

that much material for self insulation over the period of active composting. Many commercially available bins hold smaller quantities than a cubic yard. However, depending on how they are managed, they can still heat up somewhat in the middle and be used for slow composting.

Temperature

One by-product of decomposition is energy in the form of heat. As microorganisms grow and multiply, pile temperature increases. The process goes through a mesophilic stage (50°F to 113°F) in which mesophilic bacteria dominate. Then as the temperature increases, thermophilic bacteria dominate. (Fewer fungi are thermophilic. Most fungi become active when the pile returns to the mesophilic stage as the pile begins to cool down and begins to cure.)

Consider the ideal hot compost pile where materials are mixed and moistened to optimum conditions. The microorganisms begin to grow and the process goes

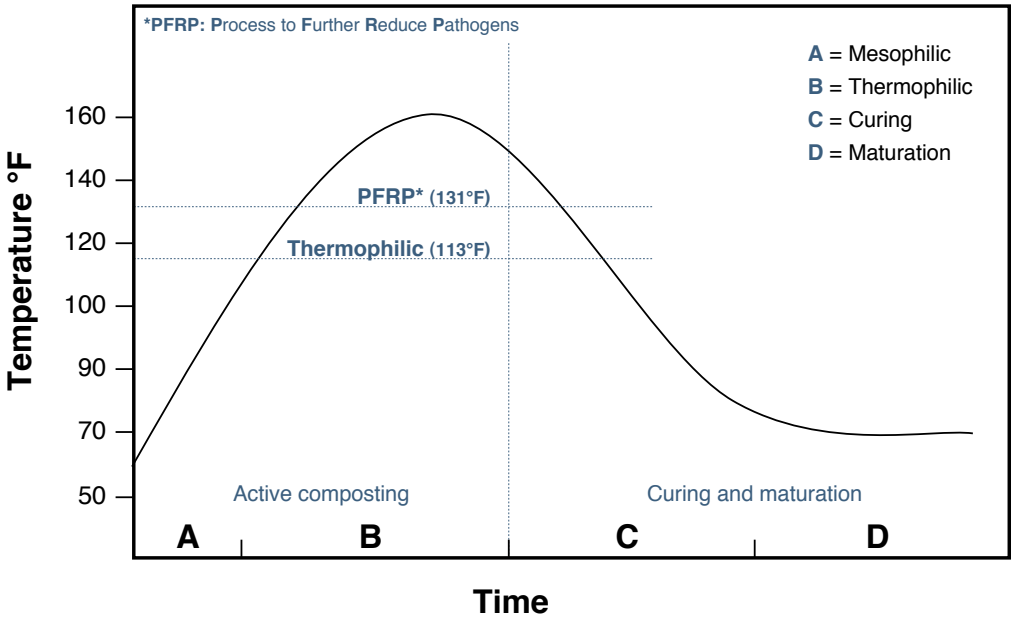


Figure 3.3. Temperature changes in a typical compost pile.

through phases with different groups of microorganisms dominating each phase.

Psychrophilic:	50°F to freezing or below
Mesophilic:	50°F to 113°F
Thermophilic:	Above 113°F

How to Translate the Needs of the Microbes Into the Practice of Composting

Microorganisms (the aerobic ones) need the same basic three substances for life functions that we humans need:

- Food

- Water
- Air (oxygen)

Traditionally, we have taught people to compost by focusing on the factors of composting to maintain the right conditions for the microbes. (See previous section.)

Another approach is to focus on:

1 The mix or the look and feel of materials combined together with enough water.

2 Personal experience as the primary compost educator.

Focus on the Mix

No matter what system people choose, the mix will dictate whether or not microbes get the right combination of food, water and air for optimum composting. The art of composting is in creating the mix and tending to the pile. Here are some rules of thumb to share, or better yet, demonstrate when teaching people how to compost.

- Harvest deciduous leaves. They are a staple ingredient in home composting.
- Combine equal parts greens, browns, and bulking agent together as a basic recipe. (See the next section for more recipes.)
- Check particle size of the materials. It's good to have varied sizes (e.g. coarse sawdust and 2" twigs). Chop materials as needed.
- Mix materials before they go into the bin or pile. Mixing is better than placing materials in layers. This is why chopping ingredients helps a lot.
- Add water during the mixing if materials are dry. Water can also be sprinkled evenly between additions to the pile.
- Observe the mix. It should be somewhat spongy when poked with a shovel.
- Remember, eventually, compost happens whether or not we start with an optimum mix (but it may take a year or more).

Many people like to have specific information about what should and should not go into a compost pile.

Another Look at Ingredients

The Washington State University Extension Bulletin (EB 1784e) *Backyard Composting* has another way of grouping raw materials. The three categories listed are bulking agents, energy materials, and balanced raw materials. Some people may

get a better idea of how to mix ingredients by thinking of these three categories. (EB 1784e can be handed out at workshops or other outreach events.)

Sample Recipes

Composting is like cooking in many ways. Some people will enjoy having a recipe to follow—at least until they get more experience. Here are a few sample recipes to share at a workshop:

For one-liner recommendation to home composters, advise them to start with equal parts greens and browns for your compost pile.

Overgrown grass and leaves

Mix equal parts fresh grass clippings with dry leaves to make one cubic yard.

Garden party gatherings

2 parts chopped green garden weeds; 3 parts dry leaves; 1 part food scraps.

Big party compost

4 parts food scraps (mixed with enough sawdust to coat the pieces); 3 parts fresh grass clippings; 6 parts dry leaves.

Latte land compost

1 part coffee grounds; 2 parts green garden debris; 2 parts chipped woody yard trimmings (tree and shrub limbs).

Personal Experience is the Best Teacher

Hands-on demonstrations are a good first step for people who have never composted at home. Ultimately, they will learn the most from combining materials and tending their own compost piles. As educators, the challenge is to communicate the importance of personal experience to the process.

Here's an anecdote that illustrates the point:

Andy Bary, Soil Scientist at WSU-Puyallup, evaluated compost quality from several Earth Tub composting systems across the state in 2006. Andy found a close connection between the operator's activities and the quality of the end product as it initially came out of the Earth Tub. This observation was not part of the study and it wasn't discussed in the final report. However, Andy created a new slogan for small scale composting based on these unpublished results. A composter has to pay close attention to the organic matter being composted and make adjustments as needed.

Adopting this motto for composting at home, we could say:

"You have to be 'one with the pile'".

Choosing a System to Meet Human Needs

"There are many ways of making compost and it is a fact that, even when imperfectly prepared, a heap of decaying organic material will, in course of time, turn into compost of a sort."

Sir Albert Howard, "Soil and Health", 1945

Choosing a system for composting may be confusing for a beginner. A good approach to helping them choose a system that fits their needs (and budget) is to present choices that match the amount of time and effort they want to invest. The following presents some criteria for making the decision.

Criteria for Selecting a Composting System

Materials

Types of organic materials to be composted, particularly food scraps or problem wastes.

Cost

Amount of money required to buy or build a particular system.

Labor

Amount of time and energy needed to maintain the compost system.

Aesthetics

Types of materials and construction that are attractive and fit into the garden. How neatly the system organizes the compost.

Efficiency

Amount of time and space required to make compost, related to the desired quality and quantity of the finished product.

Pest control

What level of pest exclusion is required based on materials composted and local pest situation.

Systems for Composting Food Scraps

Many existing programs have separate instructions for composting food scraps and yard debris. Some cities have local ordinances that prohibit adding any food scraps to yard debris compost bins. When creating your curriculum, be clear about the options available in your community. The graphic illustration *Choices for Food Scrap Recycling* outlines the possibilities, depending on your local requirements. Some municipalities only allow three options for food scrap recycling: indoor worm bins, food scrap digesters and garden burial. Handouts are available for a homemade food scrap digester, and instructions for using a Green Cone. Instructions for garden burial should include a minimum depth of cover material.

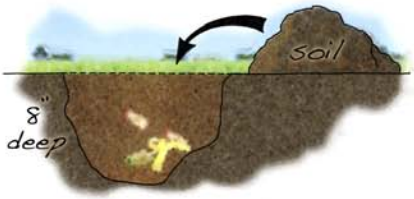
Opposite: Figure 3.4. Choices for food scrap recycling.

Choices for Food Scrap Recycling

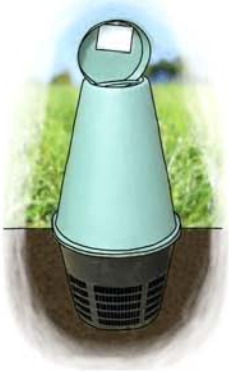
Feed food scraps to your worms.

Collect it for curbside pickup where service is available.

Bury food scraps in the garden.



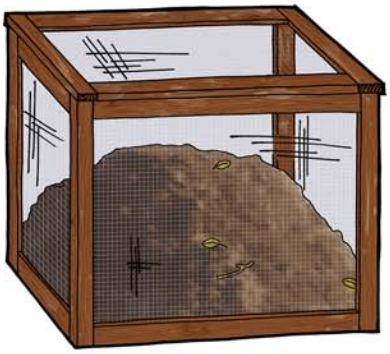
Use a food scrap digester.



Your food scrap recycling system needs to:

- Keep out pests (rodents, flies, etc).
- Prevent odors.
- Fit your lifestyle.
- Follow local regulations.

Practice "continuous composting".



Systems for Composting Yard Debris

Composting yard debris can either be accomplished by slow composting, or by the hot and fast method. In addition to the rules of thumb in the section above, the Extension Bulletin (1784e) *Backyard Composting* provides instructions for both methods.

Outreach Materials

There are several handout materials related to composting included to share with your audience:

WSU Extension Bulletin EB 1784e. Backyard Composting

Homemade Food Scrap Digester

Wood and Wire Stationary 3-bin System

Compost Holding Units

Compost Pile Ingredients: Yes or No

Compost Troubleshooting

Composting Questions and Answers

Green Cone operation

Compost Users Guide

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CHAPTER 4: VERMICOMPOSTING

"It may be doubted whether there are many other animals which have played so important a part in the history of the world as have these lowly organized creatures."

Charles Darwin, "The Formation of Vegetable Mould Through the Action of Worms with Observations on their Habits", 1881

In this chapter, you'll find information about:

- Why composting with worms should be part of the home composting curriculum
- Two important suggestions for teaching others about worms
- Composting with worms
- *Worms Eat My Garbage* reference
- Outreach materials
- Resources

Why Should Composting with Worms Be Part of a Home Composting Curriculum?

Vermicomposting offers an important choice for home composters in managing food scraps. Some communities do not allow residents to compost food scraps in any kind of outdoor bins, other than food scrap digesters.

Vermicomposting attracts attention at fairs and other outreach events. There is nothing like saying. Would you like to see the worms? To gather a group around you.

Perhaps most importantly, vermicomposting adds a special element of fun to any curriculum. Having visible creatures that respond to stimuli really livens up a demonstration. Worms are great ice-breakers; their presence almost guarantees good discussion.

Two Important Suggestions for Teaching Others About Worms

1 Practice vermicomposting on a regular basis: at home or work—or (better yet) both places.

2 Keep your favorite references handy.

No amount of reading or even talking to experts about vermicomposting will replace the need to experience regular encounters of the vermi-kind for yourself. Direct experience is important for teaching all kinds of composting, but working with worms has an added element of creature care that calls for more hands-on involvement. Maybe it's because you can't see microbes crawl away in retreat if you feed them something they don't want to eat. Or maybe the range of worm behavior gives us more to learn about. However you choose to think about it, successful teaching will require regular worm-time at home, at work, or both!

Most workshop attendees want the abridged version of how to compost with worms. Simple handouts showing how to get started are fine. But as educators, we need a more complete reference to answer questions that go beyond quick troubleshooting.

Composting With Worms

Introduction

Worm Box Basics

Worm Box Management

Commonly Asked Questions

More worm Composting Information

Composting with the help of worms

You can easily turn kitchen scraps into a rich compost by using composting worms.

Proper home composting of organic kitchen scraps can reduce the volumes at the landfill or incinerator. Volunteer home composting is a cost effective method of dealing with compostable kitchen scraps.

Composting is an efficient way to divert organic materials from your County's solid waste stream.

Which kitchen scraps could be food for worms?

- Vegetable leftovers
- Lettuce and cabbage
- Coffee grounds
- Spoiled food out of the refrigerator
- Fruit rinds
- Teabags

What not to put in a worm box

- Non-biodegradable materials
- Pet litter
- Vegetable oils
- Meats
- Fat

Worm Box Basics

Where to place a worm box

Put the worm box where the temperature and the moisture can be controlled. The ideal temperature range for composting worms is from 55 to 77°F. Worms slow down at temperatures below 50°F and are harmed or killed at temperatures below freezing or above 85°F.

Worm bins are easy to construct and require minimal care.

Worms also need a moist environment. Air circulation is a must in and around the worm box.

Chose a shady, protected location that is convenient for maintaining the box.

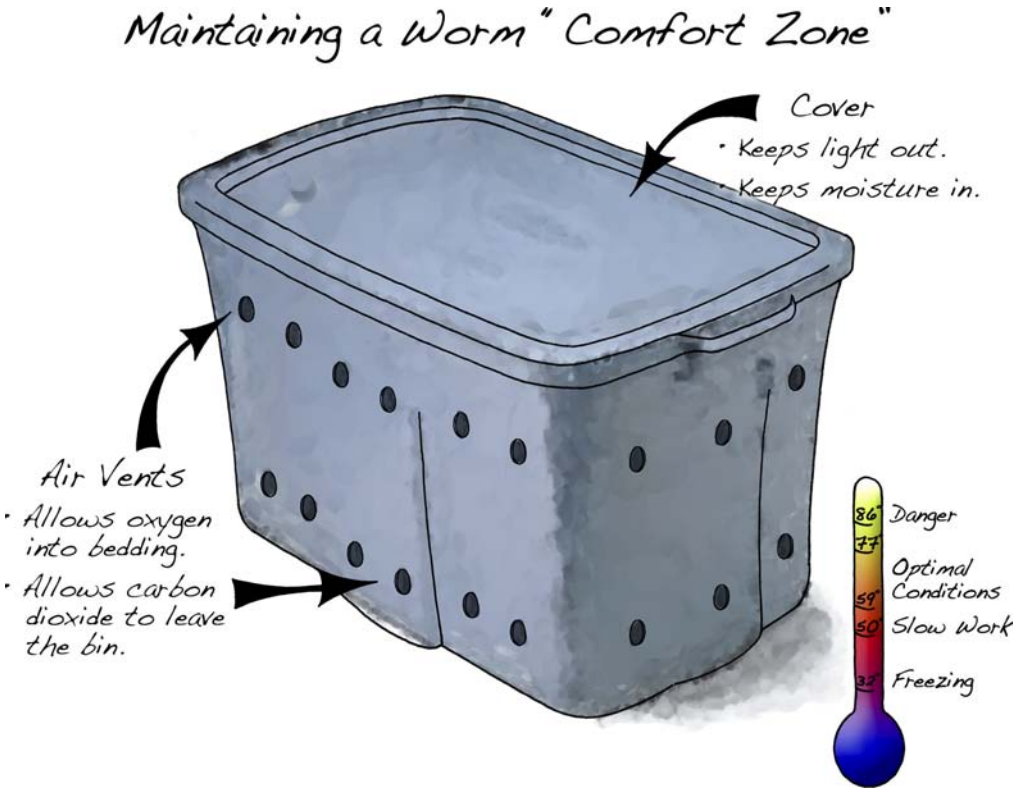

Figure 4.1. Maintaining a worm "comfort zone."

Worm box size

The size depends on the average pounds of scraps per week. A box measuring 1'(L) × 2'(W) × 3'(D) can handle six pounds of kitchen scraps per week, which is the average for a family of four to six persons. One pound of worms is recommended for this amount of scraps under ideal conditions.

Starting a worm box

Usually wooden boxes made of plywood are used. If you are using a plastic bin, be sure to add both drainage and aeration holes. Never use a container which has been used for storing toxic chemicals. Start by putting bedding in the worm box. Soak and wring out shredded strips 4"(L) × 1"(W) of corrugated cardboard and newspapers.

The worms need some grit for breaking down their food. Add a handful of topsoil for this purpose. Put the worms on top of the bedding.

Moisture

The worm's body and the bedding should have the same amount of moisture content. In order to survive, worms require 75 to 90% moisture content (about 3 parts water to 1 part dry bedding).

An easy way to check the moisture content of your bedding is to squeeze some in your hand. If a few drops of moisture are released by squeezing the bedding, the bedding is sufficiently moist. If five or more drops are produced the bedding is likely too wet.

What kind of worms do I use?

There are two varieties of red worms which adapt to a box environment.

1 Red worm (*Lumbricus rubellus*).

2 Red worm (*Eisinia foetida*).

Figure 4.2. These red worms feed on the surface of organic matter. Red worms rapidly convert kitchen waste into usable compost.

What kind of worms should not be used?

Night crawlers and other garden earthworms are very important for soil improvement, but won't survive in a worm box. Earthworms only live in burrows in the soil.

How many worms are needed?

The amount of worms required in a box depends on the daily weight of food scraps to be disposed of. Under ideal conditions, worms can eat their own weight in food in 24 hours, so worm weight is used instead of number.

Assuming conditions may not be ideal, we suggest that two pounds of worms are required for each pound of kitchen scraps generated per day; that is a ratio of 2:1.

For example: if you produce 3½ pounds of kitchen scraps per week, you should use one pound of worms.

3½ lbs. kitchen scraps per week ÷ 7 days a week = ½ lb. waste per day (average)

Since you require two pounds of worms for each pound of daily scraps, you need one pound of worms in your box.

Red worm sources

- Check with the Master Recycler Composters or Master Gardeners at your local WSU Extension Office.

- The Tilth Organization in Seattle.

Worm Box Management

Burying kitchen waste in the worm box

It is a good practice to choose a different spot each time you bury the kitchen scraps in the worm box. A 2' × 2' worm box has approximately nine locations where you can bury kitchen scraps. So that gives you nine feedings before you have to repeat to bury at the first location.

Should food wastes be ground?

Grinding is not necessary because kitchen scraps break down in a very short time. Egg shells should be pulverized.

What if you are going on vacation?

Just feed the worms a little extra and leave them undisturbed. They can go for longer than three weeks or a month. If you go for a longer time arrangements should be made with a worm loving person.

Population control

Worms multiply very fast. While worms tend to self-regulate their population, extra worms could be used to start a new worm box. Give your extra worms to people starting their own worm composting box.

Odor and pest control

Odors can be controlled by removing excess or inappropriate food scraps and by adding fresh bedding to the top of the bin. In a worm bin, do not overload the bin with too many food scraps until the worm population is established. Never add cheese or other animal products in any type of compost systems.

Fruit flies are more of a nuisance than a serious problem. Minimize fruit flies in a worm bin by fully covering fresh food waste with several inches of bedding, and by covering the bedding with a sheet of newspaper, cardboard or plastic tucked in around the edges.

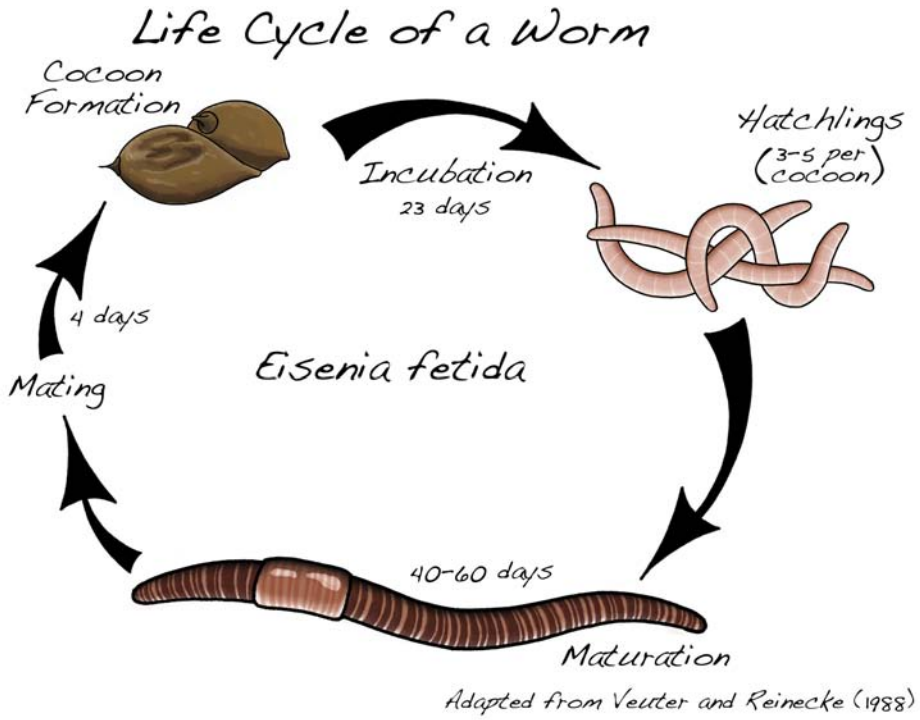

Figure 4.3. The life cycle of a worm.

Rodents can be a problem. The easiest way to keep animals from entering a worm bin is to keep the lid shut and meat scraps out. If there are signs of animals around the worm bin, place a sheet of wire mesh over the bottom of the bin with ¼" holes or smaller. Keep the worm bin lid latched or well secured if opossums or raccoons are a problem.

Commonly Asked Questions

Can a worm see?

No, worms don't have eyes. However, they are very sensitive to light, and they try to hide as soon as they are exposed to light.

Where is the worm's mouth?

The worm's mouth is in the first anterior segment. There is a small protruding lip just over the mouth. When the worm is foraging this lip will be stretching out for sensing food.

Does a worm have teeth?

Worms have no teeth for chewing their food. They grind their food in their gizzard by muscle action.

How does a worm grind his food?

Worms can only take a small particle of soft moistened food in their mouth. Worms have a muscular gizzard. Small parts of food mixed with some grinding material such as sand, topsoil, or limestone is ingested. The contractions from the muscles in the gizzard compress those particles against each other, mix it with fluid, and grind it to smaller pieces.

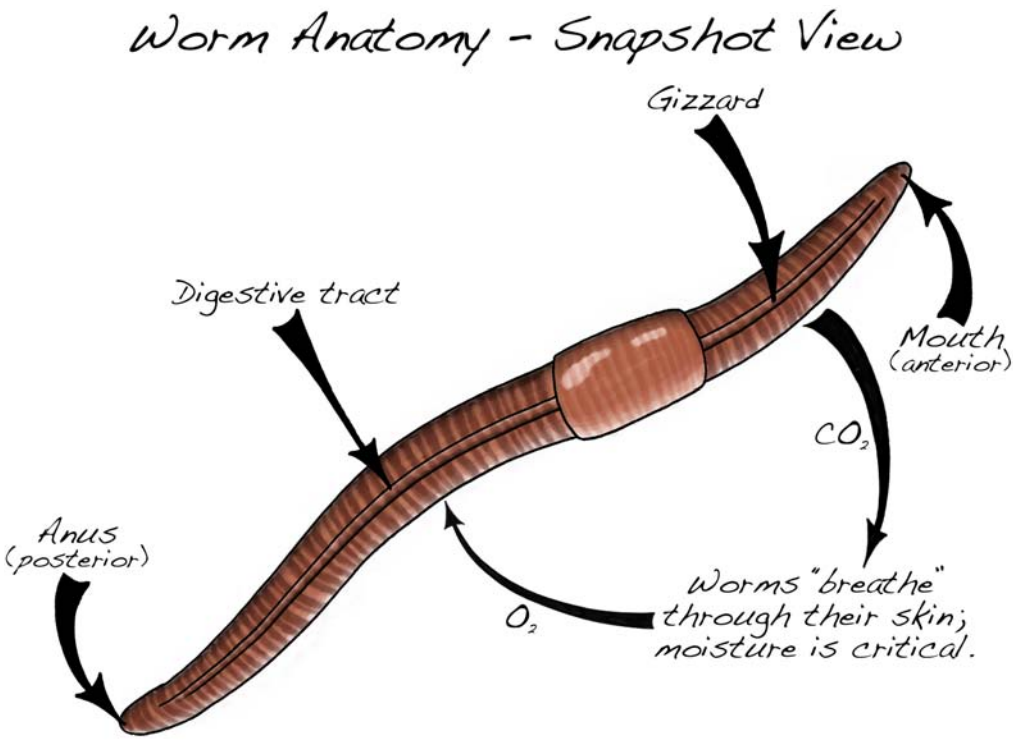

Figure 4.4. A brief overview of worm anatomy.

Do worms need air?

Worms need gaseous oxygen from the air. The oxygen diffuses across the moist tissue of their skin, from the region of greater concentration of oxygen (air) to that of lower concentration (inside the worm). A constant supply of fresh air is needed by the worms.

How to use worm compost?

Worm compost can be used like any other compost that is very rich! Small amounts can be added around the base and out to the drip line of plants, then covered with soil or mulch. Once worm compost dries out, it is almost impossible to re-wet. So worm compost is best used by digging it in to the soil.

More Worm Composting Information

At one time people raised worms only as bait for fishing. I have never speared one of my worms with a fish hook, but I wouldn't want to be without a worm bin. Provided with food scraps from my kitchen and some recycled newspaper, the worms make beautiful, rich compost for my garden.

Worms eat fruit and vegetable scraps, coffee grounds and tea leaves (paper filters and bags go in, too), grains, pasta, and breads, that aren't polluted. Worm bin pollutants include oils and animal products: meat, fish, butter, cheese, and sauces.

Too often these organic scraps are sent out with the garbage. Some people put fruit and vegetable scraps into their regular compost piles, but this isn't recommended.

Food in open compost bins can attract pests, such as rats. Because they are enclosed, worm bins are rodent-proof.

I hope some of you will be interested in trying a worm bin. Use any weatherproof box with a tight lid. Drill air holes in it. You will need about one square foot of surface for each pound of food waste you generate each week.

Here's the process, from bedding the worms to harvesting the vermicompost.

1 The bedding for your worm bin can be a mixture of corrugated cardboard brown leaves, wood shavings and crumpled news paper. You don't need to worry about newspaper ink, even on colored sheets, since toxic heavy metals are no longer used in the ink.

2 Fill a wheelbarrow or big tub with shredded newspapers and wet them down. After they have soaked a few minutes, squeeze out the paper and drop it in a pile next to the bin. Let it drain while you wet down the next batch of paper. When the shredded paper is damp, but not dripping, put it into the worm bin.

3 Invite a friend who has a worm bin to dinner. When he or she asks what they can bring, casually mention that a pound or two of worms would be nice. (Assuring them that the worms are intended for you new bin, not the dinner table, is very important at this point.) If this fails, check out commercial sources of worms.

For vermicompost, you need red worms and not earthworms, so you can't just dig them. Earthworms need a mineral soil; red worms or manure worms like a moist, organic muck. Bait shops do sell red worms, but you need a lot to get your colony going, and that could get pricey.

4 Start burying your food scraps in the wormy, bedding-filled bin. Rotate your burying spots to distribute the food evenly. Covering the food with bedding will help control flies and smells. Keep a small bowl or jar next to the kitchen sink to collect worm food.

5 When the worms have broken most of the bedding and food into a dark crumbly compost, push the compost over to one side of the bin. (It will have shrunk in volume.) Fill the empty side with new bedding and start burying your food scraps there. As the worms finish decomposing the old stuff, they will migrate over to the new feeding ground. After a month or two most of the worms will be out of the old compost, so you can remove it from the bin for use in the garden.

If many worms still appear in the finished compost, use their love of darkness to help you return them to the bin. Pile the compost on a tarp or plastic sheet in full sun. After about 15 minutes, scrape off the top worm-free inch or two. Keep doing that until you have a very wormy bottom layer that can go back

into your bin or use them to get an invitation to dinner from a new, would-be worm composter.

Source: James A. Kropf, Extension Faculty, Horticulture, Small Farms and Farm Marketing. (1998) Updated by Dave Pehling, Snohomish Co. Extension Analyst, 05/08.

Source: Publication PC305. Home Composting With Worms, Washington State University and Pierce County WSU Extension, derived from material provided by Whatcom County WSU Extension.

Source: The Gardener, Vol. 7 No. 1, Spring 1996, Holly S. Kennell, WSU Extension Agent, King County.

Get a Copy of *Worms Eat My Garbage* (2nd Edition)

The most well-known reference to date is still Mary Appelhof's *Worms Eat My Garbage*. First published in 1982 and then revised in 1997. Mary's little book with hand-drawn illustrations was the first manual to make vermicomposting easy and fun for everyone at the home scale. Though Mary didn't live to see her dream of a worm bin in every home in person, her dedication and commitment to vermicomposting still inspires worm workers into the current era of global greening.

Worms Eat My Garbage should be a reference for all home composting programs. Rather than repeat background information for educators in this text, we suggest reading *Worms Eat My Garbage* and referring back to it as a primary resource.

Worms Eat My Garbage covers all the basics of planning, setting up and maintaining a worm bin, worm biology; other critters in the bin; record keeping; questions and answers and many resources.

Outreach Materials

For basic information to get people started composting with worms, the following documents are available for distribution at outreach events:

Composting with worms. Information from WSU's Stewardship Gardening website, compiled into a handout.

Tilth Worm Composting Bin

Seattle Tilth O.T.S. (Off the shelf) Worm Composting Bin

Resources

Worms Eat My Garbage has a list of resources included in Appendix B. Here is a list of additional Internet resources you may want to investigate.

Seattle Tilth. http://www.seattletilth.org/resources/compost

City Farmer website. http://www.cityfarmer.org/wormcomp61.html

Cornell Composting pages. http://www.css.cornell.edu/compost/worms/basics.html

Red Worm Composting Website. http://www.redwormcomposting.com/quick-facts-about-worm-composting/

Washington source for Red Worms. http://www.wormswrangler.com

CHAPTER 5: COMPOSTING CONUNDRUMS

"co·nun·drum" \kə-'nən-drəm noun *origin unknown*
1: a riddle whose answer is or involves a pun; 2 a: a question or problem having only a conjectural answer; b: an intricate and difficult problem.

Merriam-Webster Online Dictionary
Retrieved November 4, 2008, from
http://www.merriam-webster.com/dictionary/conundrum

In this chapter, you'll find information about:

- Tricky composting topics that always seem to generate questions at a workshop or other event, including:
- Pet waste
- Sod
- Pesticides

This chapter provides background information and resources to use incorporating these tricky topics into your curriculum.

Pet Waste: A Difficult Problem

Here are several reasons why pet waste is such a problem:

- Increasing pet populations. The number of dogs and cats living among humans in the United States is surprising. A 2007 pet census by the American Veterinary Medical Association revealed 82 million cats and 72 million dogs (up from 71 million cats and 62 million dogs in 2001). Nearly 60% of all homes in the United States have one pet and 21% of homes have five or more.

- The material itself. Pet waste smells bad, it's unpleasant to handle, and it can harbor parasites and other organisms that may cause disease in humans and other animals. And it's generated non-stop, day in and day out.

- Water quality issues. Pet waste, specifically dog poop, is a surface water quality problem because stormwater carries nutrients and pathogens from the waste to surface and ground water.

- Lack of peer-reviewed research data. There are only a few studies available with actual test results for small scale composting of pet waste. Most information in brochures for the public presents advice based on the potential for disease associated with pet waste, but not actual data involving home composting situations.

- Contradictory advice. Currently there is no consensus about how pet waste should be managed. To illustrate, this *Compost Educator's Guide* contains a number of different perspectives in the Resources and References section in this chapter. Some are based on facts, some are based on personal opinions and some are based on a desire to sell pet-related goods and services.

The Debate about Pet Waste

Figure 5.1 frames the debate about managing pet waste. Until recently, each county's or municipality's officials weighed the options and formulated their own approach to the problem and created outreach materials accordingly. Now we have a statewide recommendation developed as part of the Washington Waters campaign. This campaign provides a framework to help people change some of their behaviors that pollute Washington's lakes, rivers, wetlands, and marine waters. The core of the campaign is the website-based tool kit for local governments, organizations and citizens working on water quality projects.

Recommended Practice for Managing Dog Poop

The campaign to protect water quality in Washington State sends a consistent, statewide message: "Scoop the poop. Bag it. Trash it."

The campaign is sponsored by Washington State Departments of Ecology and Health; WSU Mason County Extension; Washington Conservation Commission;

Opposite: Figure 5.1. The debate about pet waste.

The Debate About Pet Waste

Anecdote for Future Dog Poop Research

For an inspiring example of future dog poop research ideas, here's an experiment using spent coffee grounds from Starbucks' recycled grounds program. Chery Sullivan (Olympia resident and Organics Specialist with the Department of Ecology) took an off-the-shelf plastic worm bin with holes drilled in the bottom, and sunk the bin a few inches into the ground. She put a two-inch layer of bulking material in the bottom of the bin and started added the dogs' daily contributions. Chery added spent coffee grounds after each addition to keep the smell down. Indigenous worms populated the new doggie doo café, along with some red wigglers from an active bin thrown in for good measure. The results were amazing! Little to zero odor, and no-fuss, easy operations!

According to Chery, here's how the experiment ended up: I stopped adding dog poo in the winter and let the worms do their thing. In the spring, the whole entire works looked like coffee grounds, the worms were still happy as clams at high tide (or worms in a manure pile) and there was still no odor! After at least another full year of curing, Chery used the compost to mulch some ornamentals in a back corner of the yard.

Puget Sound Partnership; U.S. Environmental Protection Agency; Thurston County Stream Team.

More Research Needed

Even with the scoop-bag-trash campaign, avid composters know that composting and vermi-processing dog poop is a viable solution if done carefully and responsibly. Dog poop is decomposable. It is transformed just like other biodegradable residues. However, until we have more research involving pathogen reduction in home composting systems, the recommendation to "Scoop the poop. Bag it. Trash it." is the most reliable approach to protect water quality and human health.

What about Cat Waste?

The conundrum we encounter managing cat waste involves two topics: the disease organism *Toxoplasma gondii* and kitty litter.

Toxoplasma gondii is a protozoan parasite that infects human populations around the globe. Luckily, not all cats carry the parasite. Human infections in healthy adults require no treatment: flu-like symptoms go away after about three weeks. Infection in pregnant women, or women who become pregnant while infected can pass the parasite on to the fetus with severe consequences. Infection in immuno-compromised people can cause severe symptoms. So caution in dealing with cat feces is extremely important.

Several researchers are also studying the connection between *T. gondii* and disease in marine mammals, especially sea otters.

Kitty litter is another part of the cat waste conundrum. Regardless of manufacturers' recommendations, kitty litter should never be flushed down the toilet. And green kitty litter should not be used for mulch until more research confirms safe practices.

For now, the recommendation is to "Scoop it. Bag it. Put it in the trash."

Resources and References

The following resources and references give background information about managing pet waste in Washington State. These references are included because they give facts and opinions that represent the debate on the subject. They are not intended to be a thorough literature search, but rather a framing of the topic for discussions among compost educators. References 1 through 3 have additional detail included following the list. This section gives you background on the pet waste debate but the recommendation is still to "Scoop it. Bag it. Put it in the trash."

The references for pet waste include:

1 City of Eugene, OR. Description of a 2004 informal study on pathogens in composted pet waste (from United States Composting Council (USCC) list serve message in 2004 by a Compost Specialist at the City of Eugene. Entire entry included below).

2 Natural Resources Conservation Services (NRCS) guidance document on hot composting dog waste in Alaska. Composting Dog Waste is available as a PDF file from the NRCS website. http://www.ak.nrcs.usda.gov/compost.html

3 Snohomish County recommendations on the Public Works website (November 2008). http://www1.co.snohomish.wa.us/Departments/Public_Works/Divisions/SWM/Services/Water_Pollution/Pet_Waste.htm

4 Diseases from dogs – Information quoted from the Center for Disease Control (CDC), National Center for Infectious Diseases. http://www.cdc.gov/healthypets/animals/dogs.htm

5 Cat litter debate. Article from SFgate.com (online site for the San Francisco Chronicle) that gives a journalist's summary of issues regarding cat litter.

6 Cornell fact sheet recommending no pet waste in regular small scale composting (based on a 70+ page report of pathogen testing in home composting systems in New York State). Both the fact sheet and report are available under Small Scale Composting at the Cornell composting website. http://cwmi.css.cornell.edu/composting.htm

7 Pollution Prevention Fact Sheet: Animal Waste Collection – Published by the Center for Watershed Protection, Inc. a non-profit 501(c)3 located in Ellicott City, MD. The fact sheet is available from the Stormwater Manager's Resource Center (SMRC). http://www.stormwatercenter.net.

8 Pet waste removal services (such as http://www.poopbutler.com/states-washington-pooper-scooper).

Here are the three of the references in more detail:

City of Eugene informal study (2004)

The following entry appeared on the USCC list serve in 2004. It appears here just as it was posted on the website (except for changes to formatting.)

The City of Eugene Solid Waste and Recycling program very informally looked into the possibility of promoting pet waste composting a couple years back in part to address the issue of pet waste accumulation at several of our city dog parks. Earth Tub in-vessel composters were a possible solution, but that meant transporting pet waste from each park to a central location. We also had doubts about asking any worker or volunteer to take on the awful task of transporting and loading that material into the Earth Tub.

Then, an avid backyard composter explained she'd been composting her pet waste for years, and used the resulting pet waste compost around trees and shrubs. This was not a hot pile, but a simple plastic bin filled with leaves, some worms and regular deposits of dog feces. She mixed it with a winged compost turner that she dug into her compost pile several times each time she added pet waste. When her composter got full, after loading it for six months to a year, the material was transferred to another large plastic planting pot and there it matured for another year. Finally, she decided she could use the soil-looking material around trees and shrubs, and occasionally around her raspberry beds.

We took a sample of this one-year old soil-looking material and had it tested at BioVir Laboratories, Inc. for *Helminth Ova* Assay, *Salmonella* Assay, *Fecal Coliform* Assay and Total Solids Assay. We then allowed the material to sit for another six months and tested it again, hoping time and microbial competition would bring the material into the safe level. It didn't.

We knew most backyard compost enthusiasts rarely make hot piles, and even more rarely turn those piles to bring all parts of the pile into the pathogen reducing temperature zone. We hoped a 'best practices' could be developed that didn't include temperatures and turning, but simply time. This one compost pile was added to for a year, left to mature for a year, tested, left to mature for six more months, and tested a final time.

Here is what we found. At one year: *Helminth Ova* Assay: 8 viable *Helminth Ova*/4 grams total solids. At 18 months: *Helminth Ova* Assay: 2 viable *Helminth Ova*/4 grams total solids.

At one year: *Salmonella* Assay: 2.4 MPN / 4 grams total solids. At 18 months: *Salmonella* Assay: less than .84 MPN / 4 grams total solids.

At one year: *Fecal Coliform* Assay: 330,000 MPN / gram total solids. At 18 months: *Fecal Coliform* Assay: 620 MPN / gram total solids.

At one year: Total Solids Assay: 46.1% At 18 months: Total Solids Assay: 36.2%

In short, while *Fecal Coliform* and *Salmonella* levels decreased over time, and even viable *Helminth Ova* numbers decreased from 8 to 2, that is still 2 too many for me to feel comfortable recommending backyard composting of pet waste.

We have not done any further testing. We don't recommend composting pet waste to the public based on this information. I include picture of viable *toxocara* ova found in our pet waste compost when I teach Composting 101 to our new Master Composters. The risks are real. More testing certainly needs to happen before best practices recommendations can be made to the public. For now we recommend burial, and landfilling.

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***Natural Resources Conservation Service guidance document* Composting Dog Waste**

This document, published in 2005, gives how-to information on composting dog waste based on a project started in Fairbanks, Alaska in 1991. Some of the suggestions in the brochure either directly contradict more recent recommendations, or are not as strongly worded. For example, the authors don't recommend waiting one year to use the finished compost. And the importance of restricting use of the finished compost to ornamental plants is not stressed. This NRCS document is intended for managing dog waste from 10 to 20 dogs housed in one location. The document is available in PDF form on the NRCS website:

http://www.ak.nrcs.usda.gov/compost.html

Snohomish County Public Works (Surface Water Management Division) recommendations

Snohomish County recommends bagging and landfill disposal as the preferred method of managing pet waste. The reasons cited are human health and water quality. The website explains:

- Composting at home doesn't reach high enough temperatures to destroy pathogens in the pet waste;
- Commercial yard debris composters aren't required to follow the process to further reduce temperatures or PFRP (prescribed process, time and temperatures needed to destroy pathogens);
- Burial and digesters are water quality hazards;
- Flushing may be OK in municipal sewer systems but would likely overload a septic system.

The website concludes the pet waste topic with this statement: *"Composting is good for yard waste and bad for pet waste."*

http://www1.co.snohomish.wa.us/Departments/Public_Works/Divisions/SWM/Services/Water_Pollution/Pet_Waste.htm

Sod

Composting sod and weeds that reproduce by rhizomes is not difficult. But it takes a different approach than regular composting and some additional patience. Many people need convincing that sod and grass roots need separate treatment from the rest of your compostables in your yard. Adding these materials to a compost pile invites grass takeover.

Solar Sod-busting

The solar sod-busting method involves allowing summer sun to desiccate grass roots and runners that would otherwise take up residency in a compost pile. It takes more surface area than the sod pile method, but it also serves more than one purpose: It will smother unwanted grasses and weeds growing underneath while the solar action is taking place above.

Solar sod busting involves shaking excess soil off grass roots and placing them in a single layer on a piece of black plastic. Punch several holes in the plastic so that rain water will drain out. Depending on the dryness and sunlight in your area, it will take a few weeks for the roots to be dry enough to add to the compost pile. If you get some rain during the process, it will encourage earthworms to come through the holes in the plastic, and their activity will create the base for a great potting soil.

Use the fact sheet *Composting sod and weeds that spread by roots*, to teach people how to treat these materials. The fact sheet is included in outreach materials for this chapter.

Pesticides

Many people ask the question, what happens to pesticides in the composting process? To answer the question, documents often refer to a literature review by Rynk, R. et. al., that appeared in two parts in *Compost Science & Utilization* in 1999 and 2000. The literature review, titled *Occurrence, degradation and fate of pesticides during composting*, looked at studies conducted in Portland, Oregon; Westchester County, New York; Seattle, Washington; Illinois; Massachusetts; and New Jersey.

In a review of the subject, the literature review was summarized as follows: Based on these studies, pesticide residues in compost do not appear to be a concern. Many of the detected compounds (chlordane, dieldrin and DDT, for example) have been banned in the U.S. for many years. Their occurrence in these studies suggests that it is difficult to cleanse the environment of these old pesticides. The absence of organophosphates, carbamates and most herbicides in composting feedstocks implies that these classes of pesticides are well degraded, diluted or lost to the environment before the feedstocks were collected for composting.

In more recent studies, researchers have begun to use new analytical techniques to trace pesticide degradation in the composting process. A 2005 study confirms the findings of the Rynk et.al., that most pesticides degrade to very low concentrations during the composting process.

The important exception to this general statement about pesticide degradation is a class of herbicides that were formulated to be long-lasting. Herbicides containing the active ingredients clopyralid and picloram, caused grave concern for the composting industry in 2001–2002 in Washington State and other parts of the country. As a result, the Washington State Department of Agriculture restricted clopyralid-containing herbicides from use on lawns and turf, except golf courses (when used at golf courses the clippings cannot leave the golf course). Clopyralid can still make its way into compost via feedstocks coming from the agriculture sector where clopyralid herbicides are still in use.

Luckily, few instances of clopyralid contaminated compost have occurred since people have become more aware of potential sources of the herbicide, and it is no longer used for residential lawns and turf. For more information about clopyralid in compost, see Washington State University factsheet listed in the resources section of this chapter.

Resources on Pesticides

WSU links/fact sheets regarding clopyralid. http://www.puyallup.wsu.edu/soilmgmt/Clopyralid.htm

Clopyralid and other pesticides in compost. Doc# AEX-714-03 from Ohio State University Extension Fact Sheet. http://ohioline.osu.edu/aex-fact/0714.html

Kohnke, Helmut, and D.P. Franzmeier. 1995. Soil Science Simplified. Long Grove, IL: Waveland Press, Inc.

References

Frenich, Garrido, et. al. 2005. A study of the disappearance of pesticides during composting using a gas chromatography-tandem mass spectrometry technique. Pest Management Science, Volume 61, Number 5. pp. 458-466(9).

Rynk, R. et. al. 1999. Composting, Pesticides and Pesticide Degradation Literature Review: Part I. Compost Science & Utilization. Volume 7, Number 4. pp 66-82.

Rynk, R. et. al. 1999. Occurrence and Fate of Pesticides in Compost and Composting Systems Literature Review: Part II. Compost Science & Utilization. Vol 8, Number 1. Pp61-81.

CHAPTER 6: NATURAL YARD CARE

The previous chapters of this guide have focused on making compost and on how compost benefits the soil, providing detailed information and references as background for a Master Composters educational program. This chapter is an overview of a broader topic, providing an introduction to natural yard care and guidance for finding, interpreting, and using reference materials and local expertise to incorporate into the Master Composter program.

In this chapter, you'll find information about:

- The big picture: Planning your yard to serve your needs and meet the goals of natural yard care.
- Scientific background into soil building, fertilizers, and integrated pest management
- A 5-step approach to natural yard care
- Natural yard care applications for home gardens, lawns, and landscape plantings.

The Big Picture

Whether you are starting a new landscape, or living with a well-established one, it is good to ask how you want to use and enjoy your yard. Do you want fresh, home-grown food from a fruit and vegetable garden, a place for recreation and relaxation for yourself and your family, a naturalized landscape that is attractive to birds, the beauty of ornamental plants and flowers, a landscape that is resistant to wildfires, or some combination of these? What mix of landscapes will meet your desires and reduce inputs of water, energy, and fertilizers?

A vegetable garden provides the freshest of food grown at home, a connection between ourselves and the land, and an education for our children about growing food. But, a garden also requires a high level of inputs, including compost to build the soil, fertilizers and irrigation to support the rapid growth of garden plants, and labor for preparation, planting, weeding, thinning, pest management, and harvesting. We need to know how to manage our garden to make the best use of these inputs while protecting the environment.

A home lawn provides a resilient surface for recreation, it builds organic matter in the soil, and it is often the best landscape over a septic system drainfield. Lawns also require a high level of inputs for peak visual quality and resistance to wear. Lawns can be grown with lower levels of fertilization and irrigation, resulting in lower quality, but still acceptable for most uses.

Woody and perennial ornamental plants can provide beauty, attract wildlife, and be pockets of wild spaces within our yards. Because these plants grow more slowly than annuals or turf, they have lower nutrient needs, and in many cases need few or no nutrients after they have been established in a compost-amended bed. Water requirements vary among species, and choosing and grouping drought tolerant plants can reduce irrigation needs. Even when mulched, some hand weeding will be needed during establishment and maybe beyond, and some ornamentals are prone to pest damage.

Pavement doesn't need weeding or watering, but it has none of the benefits of planted landscapes, often traps unwanted heat, and contributes to runoff. One goal of natural yard care is to keep paved areas to the minimum needed. When your budget permits, consider removing pavement or switching to porous pavement alternatives as part of a landscape makeover.

It is important to remember that natural yard care involves trade-offs. A lawn grown with less fertilizer will look different from a high-input lawn, you may not be able to grow some plants successfully in your garden or landscape, and some natural yard care practices will involve more labor (but others will involve less).

Scientific Background

Understanding Organic Materials

The carbon to nitrogen (C:N) ratio plays a key role in the suitability of organic materials for different landscape uses. Remember that a material with a low C:N ratio is rich in nitrogen, while a material with a high C:N ratio is rich in carbon. (Review Chapter 2 handouts *Home Gardeners Guide to Soils and Fertilizers* and *Improving Garden Soils* for more details).

When an organic material is added to the soil, the soil organisms use some of the carbon as an energy source, releasing it as CO_2. They use the remaining carbon to grow and multiply, incorporating the carbon into their bodies, along with nitrogen and other nutrients to make proteins, DNA, etc. If the organic material has a low C:N ratio, the organisms will have more nitrogen than they can use for growth, and they excrete the extra nitrogen as ammonium, which is available to plants (see nitrogen cycle in Chapter 2 handouts). If the material has a high C:N ratio, there is not enough nitrogen in the material to meet the bodily needs of the growing organisms, and the organisms then take available N from the soil, reducing the amount available to plants, a process called immobilization. Organic materials with intermediate C:N ratios slowly immobilize and/or release nitrogen, having only a small effect on the nitrogen supply to the plants.

Organic materials with low C:N ratios are fertilizers, applied in small quantities to supply N to plants. Materials with high C:N are best used applied to the surface as mulches. Surface-applied mulches do not immobilize much nitrogen in the underlying soil, and thus have little effect on nutrient availability. Materials with intermediate C:N ratios (including most composts) are soil amendments, and can be applied in relatively large amounts to increase soil organic matter without supplying an excess of available nutrients.

Organic and processed fertilizers

The Chapter 2 handout *Home Gardeners Guide to Soils and Fertilizers* compares the properties and sources of organic and processed fertilizers. Some points regarding these fertilizers that are often not well understood.

- Organic fertilizers are often not the main source of organic additions to garden and landscape soils. Because organic fertilizers are applied in relatively small amounts, their contribution of organic matter is relatively small compared with soil amendments such as composts.

- Processed fertilizers in and of themselves do not kill microorganisms or make soil compact or sterile. Rather it is a lack of organic matter that leads to degradation of soil physical properties and reduction of biological activity.

- Excess application or improper timing of application of either organic or processed fertilizers can lead to leaching or runoff of nutrients.

- A key difference between organic and processed fertilizers is in their source. Most organic fertilizers come from recycled or renewable sources, while processed fertilizers are produced from non-renewable resources (such as minerals for phosphorus and potassium or natural gas used to fix atmospheric nitrogen).

Integrated Pest Management

The U.S. Environmental Protection Agency defines Integrated Pest Management (IPM) as "an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment."

The basic components of IPM are to 1) know your pests, 2) set action thresholds, 3) prevent pests from becoming a threat, and 4) suppress pests when needed, using the least risky methods first.

- We can identify pests in our gardens and estimate the intensity of pest infestation through observation of the pests themselves or the evidence they have left behind. Understanding the life cycles of the pests helps us assess their potential of becoming a threat, implement appropriate prevention steps, and know when to intervene with suppression measures.

- We set action thresholds based on the life cycles of the pests, and our tolerance to damage. Tolerating some damage by pests can greatly reduce the need for pesticides to suppress the pests.

- Prevention involves practices such as rotating crops, selecting resistant species and varieties, growing a complex mixture of plants, planting them in environments that favor the plant over its pests, avoiding alternative hosts, and creating habitat for predators.

- Suppression includes mechanical steps such as weeding, trapping and handpicking, using pesticides only when necessary, and then choosing the least risky pesticides and following label instructions.

A 5-step Approach to Natural Yard Care

The Seattle Public Utilities *Natural Yard Care* bulletin outlines a 5-step approach to yard care:

- Build healthy soil

- Plant right for your site

- Practice smart watering

- Think twice before using pesticides

- Practice natural lawn care. (In the sections below we expand this to garden and landscape care)

The *Natural Yard Care* brochure is found at: http://www.ecy.wa.gov/biblio/0807064.html

The sections below provide additional information the to supplement the *Natural Yard Care* brochure.

Build healthy soil

Soil and soil building is the focus of Chapter 2 and associated handouts, with additional information provided under the Scientific Considerations section in this chapter. These provide a basis for teaching about soil management for natural yard care.

Right plant for your site

The Big Picture section of this chapter provides a framework for considering what kinds of landscapes serve best to meet your needs and work well with natural yard care practices. Choosing individual plants and plantings involves choosing those that are appropriate to our region, and also those that are appropriate to specific microclimates and sunlight levels within our own yard. We know that a northern exposure provides a far different environment for plants than a southern exposure, and the same is true for eastern and western exposures, with unshaded western exposures receiving the most intense summertime heat. We may also have wet areas and drier areas in our yards that provide different microenvironments for plants. Grouping plants with common environmental needs together and choosing ornamental plants that require less water are important steps toward effective natural yard care. Resources for identifying and choosing plants are included in the section on Home Landscapes below.

Practice smart watering

Because the Northwest has dry summers, seasonal irrigation of plants with a high water demand (such as in a vegetable garden) is necessary in most yards. The amount and timing of irrigation depends on the texture of the soil, the stage of growth and the rooting depth of the crop, water needs of the crop, and the rate of water loss through evapotranspiration. A basic principle of traditional irrigation is to supply water when the soil moisture drops to 50 to 70% of field capacity in the root zone. Table 6.1 provides guidelines for checking your soil to estimate when you need to irrigate.

Drip irrigation was developed for crop production in arid regions to prevent plant moisture stress while conserving water. Drip irrigation works well on a garden scale, and is compatible with garden fruits and vegetables and landscape plants. Under drip irrigation, plants are watered more frequently than for traditional

How Soil Feels and Looks

Soil Moisture Level	Coarse (sand)	Light (loamy sand, sandy loam)	Medium (fine sandy loam, silt loam	Heavy (clay loam, clay)
No available soil moisture. Plants wilt. Irrigation required. (First Range)	Dry, loose, single grained, flows through fingers. No stain or smear on fingers.	Dry, loose, clods easily crushed and flows through fingers. No stain or smear on fingers	Crumbly, dry, powder, barely maintains shape. Clods break down easily. May leave slight smear or stain when worked with hands or fingers.	Hard, firm baked, cracked usually too stiff or tough to work or ribbon* by squeezing between thumb or forefinger. May leave slight smear or stain.
Moisture is available, but level is low. Irrigation needed. (Second Range)	Appears dry; will not retain shape when squeezed in hand	Appears dry; may make a cast when squeezed in hand but seldom holds together.	May form a weak ball** under pressure but is still crumbly. Color is pale with no obvious moisture.	Pliable, forms a ball; ribbons but usually breaks or is crumbly. May leave slight stain or smear.
Moisture is available. Level is high. Irrigation not yet needed (Third Range)	Color is dark with obvious moisture Soil may stick together in very weak cast or ball.	Color is dark with obvious moisture. Soil forms weak ball or cast under pressure. Slight finger stain but no ribbon when squeezed between thumb and fore finger.	Color is dark from obvious moisture. Forms a ball. Works easily, clods are soft with mellow feel. Stains finger and has slick feel when squeezed.	Color is dark with obvious moisture. Forms good ball. Ribbons easily, has slick feel. Leaves stain on fingers.
Soil moisture level following an irrigation. (Fourth Range)	Appears and feels moist. Color is dark. May form weak cast or ball. Leaves wet outline or slight smear on hand.	Appears and feels moist. Color is dark. Forms cast or ball. Will not ribbon but shows smear or stain and leaves wet outline on hand.	Appears and feels moist. Color is dark. Has a smooth, mellow feel. Forms ball and ribbons when squeezed. Stains and smears. Leaves wet outline on hand.	Color is dark. Appears moist; may feel sticky. Ribbons out easily; smears and stains hand; leaves wet outline. Forms good ball.

Table 6.1. Estimating soil moisture content.

*Ribbon is formed by squeezing and working soil between thumb and forefinger.

**Cast or ball is formed by squeezing soil in hand.

Source: Efficient Use of Water in the Landscape and Garden. J. Parsons et al. Texas A&M Department of Horticultural Sciences.

overhead systems, but the water is confined to the root zone. This reduces the potential for moisture stress on the plants while reducing water loss by evaporation and overall water use.

Garden drip irrigation systems include a series of components, tubes, fittings, and emitters, but are generally simple enough to install that most gardeners can do it themselves once they become familiar with the components and their operation. Many publications on drip irrigation are available on the web from university

extension sources and suppliers of drip equipment. The following resources from the University of Rhode Island and Colorado State University provide a good introduction to drip irrigation.

http://www.uri.edu/ce/healthylandscapes/dripirrigation.htm

http://www.ext.colostate.edu/pubs/garden/04702.html

The next link is to a publication from Texas A&M that is somewhat old, but provides detailed information on drip irrigation strategies.

http://aggie-horticulture.tamu.edu/extension/homelandscape/water/water.html

Regardless of the type of irrigation, knowing how much water to add and when is critical to conserving water. You will need to understand your soil texture (see Chapter 2), root depths and water needs of plants (the Texas publication and others are useful guides), and how to estimate how much water is in the soil (see Table 6.1), or how big a moist zone your drip irrigation system is maintaining.

Think twice before using pesticides

The key to pesticide reduction is making IPM an active part of your garden and landscape management. Basic principles of IPM are described in the section on Scientific Background above and in the Natural Yard Care brochure.

IPM is ideally suited to garden pest management, because effective prevention and low-risk suppression methods are already a natural part of most garden practices. The WSU *Hortsense* website provides IPM guidance for a wide range of garden pests in Washington State and the WSU Organic Gardening extension bulletin provides a good overview of garden IPM for disease and insect pests. Local Master Gardener clinics are also a good source of information on pest identification and IPM. Websites from states such as California, Pennsylvania, and Illinois also contain useful IPM information describing pests, their life cycles and prevention and suppression techniques. These are good supplemental resources, but it is important to remember that they cover pests specific to their own states, not all of which are relevant to Washington.

Links to references include:

WSU Hortsense. http://pep.wsu.edu/Hortsense/

WSU Organic Gardening. http://cru.cahe.wsu.edu/CEPublications/eb0648/eb0648.pdf

University of California IPM. http://www.ipm.ucdavis.edu/

University of Illinois IPM. http://ipm.illinois.edu/

Penn State IPM. http://paipm.cas.psu.edu/

Practice natural garden, lawn, and landscape care

- The annual vegetable garden is the most productive and intensively managed part of most home landscapes, with the greatest need for inputs, including nutrients, water, organic amendments, and labor. To protect water quality and conserve resources while growing healthy plants it is important to pay careful attention to your management of the soil, pests, and irrigation.

- The annual garden can benefit from frequent additions of organic matter to replenish what is lost through working the soil. This is a great place to use your home compost—apply an inch or more a year to new gardens. Old, well-amended gardens are often already enriched in organic matter and don't need as much compost, but they still can benefit from less frequent or lighter compost applications.

- Use soil tests to track pH levels and determine nutrient needs. Many well-established gardens may have built up high levels of nutrients such as phosphorus and potassium, and soil testing would tell us that we can reduce inputs of those nutrients. A soil test is only as good as the sample that you collect. For information on soil sampling for yards and gardens, see *Soil sampling for home gardens and small acreages* from Oregon State University Extension.

  http://extension.oregonstate.edu/catalog/pdf/ec/ec628.pdf

- Growing winter cover crops is a great way to protect your garden soil from runoff and erosion during the winter, add fresh organic matter to your soil, and capture nitrogen that would otherwise leach during the winter. Cover crops are easy to grow, but the key is planting them early enough that they develop good root systems and good cover before winter hits. It's too late to plant cover crops after crops you harvest in mid or late fall (such as fall spinach, kale, carrots, etc.), but you can fit them into areas of your garden that you finish harvesting by early to mid September. Areas that you harvest late can benefit from a mulch of well-aged home compost, and you can also try planting cover crops between rows of fall crops, giving them time to get established while your vegetables are still growing. Some gardeners grow kale and other hardy crops all winter long, and these serve as a type of cover crop, taking up nutrients and offering some protection to the soil. They don't provide as much organic matter as a traditional cover crop, but you can enjoy the fresh produce during the winter and into the next spring. The WSU Extension Bulletin *Cover Crops for Home Gardens in Western Washington and Oregon* is a good resource for information on cover crops for gardeners west of the mountains.

  http://cru.cahe.wsu.edu/CEPublications/eb1824/eb1824.html

  A revised version covering both sides of the mountains will be available by early 2010. Oregon State University has a series of cover crop bulletins designed for farmers, but they are useful for gardeners as well.

  http://extension.oregonstate.edu/catalog/details.php?sortnum=0124&name=Cover+Crops

- A vegetable garden is a natural place to practice IPM. Most vegetable gardens are complex ecosystems, giving us an advantage in managing pests. It's not hard to use IPM techniques in a garden to reduce or eliminate the need for pesticides. This saves money and reduces any risks from pesticide application, storage, disposal, leaching, or runoff.

- Drip irrigation can be a way to reduce and target water use, and drip systems can be conveniently set up for annual gardens and perennial fruit crops such as raspberries. See the section above for information and links on drip irrigation.

Home lawns

Lawns perform important functions in many yards, providing an inviting green area for picnics and play, a preferred landscape for septic system drainfields, or as part of fire resistant landscape in areas prone to wildfires. Turfgrasses will respond to high levels of water and nutrients (particularly nitrogen and potassium) and require frequent mowing, but lawns of acceptable quality for most people will grow with reduced levels of inputs. Frequent mowing will still be important to maintain turf quality in a reduced-input lawn.

Washington State University and Oregon State University have extension publications focused on home lawns. The WSU publication *Home Lawns* is a good source of information on soil preparation for healthy lawns and lawn maintenance, proper mowing, aeration, thatch removal, fertilizer types (slow and fast release formulations), timing of fertilizer applications, and turf pests and diseases. It describes turf varieties for east and west of the Cascades, and their adaptation to shade, drought, traffic, and inputs. Fertilizer recommendations are focused on high-quality lawns. This type of lawn requires more inputs, but tends to be more resistant to wear and more competitive against weeds than turf with fewer inputs. An OSU bulletin *Fertilizing Lawns* provides fertilizer guidance for high visual quality, medium quality, and utility quality turf west and east of the Cascades, and discusses fertilizer types. A second OSU bulletin, *Maintaining a Healthy Lawn in Western Oregon* describes how turf ecosystems change over time, and how this affects mowing and fertility management. This bulletin also provides fertilization and watering recommendations for high, medium, and low levels of inputs. Low to medium levels of inputs are adequate for natural yard care, as long as the lawn does not receive high levels of wear. All three of these bulletins are good references for a natural yard care education program.

Links to these bulletins are:

WSU Home Lawns. http://cru.cahe.wsu.edu/CEPublications/eb0482/eb0482.pdf

OSU Fertilizing Lawns. http://extension.oregonstate.edu/catalog/pdf/ec/ec1278.pdf

OSU Maintaining Healthy Lawn. http://extension.oregonstate.edu/catalog/pdf/ec/ec1521.pdf

One way to reduce inputs to lawns is to reduce the area of lawn itself. Slopes that are difficult to mow, wet spots, and excessively shady areas are good candidates for alternative landscape plantings. Alternative landscape plantings could reduce fertilizer and water inputs and labor, and potentially provide bird habitat or an aesthetically pleasing backdrop to the remaining lawn. Some people may want to reduce their lawn to a size that can be mowed with a push mower, eliminating the fuel inputs needed for a power mower.

It is important to keep the following in mind for turf management and natural yard care.

- Mowing height and frequency is critical to maintaining a healthy lawn, but appropriate height varies widely depending on the species of grass growing in the lawn. Mowing heights can range from less than 1" to as much as 3" depending on the type of grass and the environment (see *Home Lawns* and *Maintaining a Healthy Lawn*) for details on mowing height). Turf experts agree that mowing should not remove more than about 30% of the grass blade. They also agree that returning clippings back to the lawn is an important way to reduce fertilizer needs.

- Although proper soil preparation is essential to establishing a healthy lawn, adding large amounts of compost may be detrimental to turf establishment. This is because too much compost can lead to settling of the seedbed resulting in an uneven lawn, or clogging of pores in coarse-textured soils, reducing permeability. Also, the roots of turfgrass build soil organic matter over time as they go through cycles of growth and decomposition, reducing the need for organic amendments.

- Research has shown that nutrient runoff and leaching from turf is usually low (newly established turf can be an exception), and a greater risk of runoff is from fertilizers inadvertently spread or spilled on pavement. Sweeping pavement after fertilizing is an important way to protect water quality.

Home landscapes

Natural landscape care starts with selecting plants and groupings of plants that are well adapted to the soils and microenvironments in your yard. There are many choices for landscape plants, both native and non-native, that will thrive on natural rainfall and natural soil fertility once they are established, and will have relatively few serious problems with pests and diseases. Some will have fruits and flowers that attract birds to your yard, and some are well adapted for fire resistant landscapes. Be aware of how large the plants will grow, and whether they will shade your house (a good thing on hot summer afternoons, but not when you want solar benefits during the winter). Choosing plants from the many possibilities can seem overwhelming, but many helpful resources are available. Among these are:

Seattle Public Utilities list of landscape plants adapted to western Washington.
http://www.seattle.gov/util/stellent/groups/public/@spu/@csb/documents/webcontent/spu01_003855.pdf

WSU Native Plants. http://cahedb.wsu.edu/nativePlant/scripts/webShowClassification.asp

OSU Department of Horticulture Landscape Plant List. http://oregonstate.edu/dept/ldplants/

These sources provide photos, information on adaptability, and in some cases information on propagation of the plants. Other resources include the *Sunset Western Garden Book*, local native plant groups, local Master Gardeners, and demonstration landscapes and gardens developed by Master Gardeners and other groups. It is valuable for Master Composters to become familiar with these sources of web information and local expertise.

It is important to know the properties of your soil, including texture and depth, so that you can choose plants that will do well in your soil. Most of these plants will benefit from beds amended with compost, but it is important to amend the entire bed, rather than just the planting holes. Amending only the planting holes may lead to restricted root systems and increased stress on the plants as they grow larger. If you cannot amend the entire planting area with compost, it is best to plant directly into the unamended soil.

Research at WSU has shown benefits from both surface application and incorporation of compost before transplanting landscape plants, although compost incorporation provides greater improvement in soil quality.

Mulching landscape beds with bark or arborist chips benefits the plants and soil and reduces labor. A 3" thick woody mulch conserves water for the plants and greatly reduces weeds. Water infiltrates best through medium and coarse textured mulches.

Well prepared soil, proper plant selection, and mulches go a long way toward establishing a sustainable landscape. You will probably need irrigation the first year or two after planting, and you will need to weed the beds until the shade of the canopy provides a natural weed deterrent.

Resources

This chapter provides links to a number of publications that assist with understanding and implementing natural yard care and sustainable landscapes. More resources exist in your community, such as Master Gardeners, native plant groups, and landscape professionals. Use these resources as a way to get hands on experience with natural yard care, by visiting demonstration gardens, meeting with practitioners, and learning from their knowledge and experiences.

CHAPTER 7: OUTREACH

"Arouse the emotions, for the foundation of learning is in what we love."

Rachel Carson, "A Sense of Wonder"

In this chapter, you'll find information about:

- Outreach defined: What it is, why we need it
- Two basic ingredients for successful outreach (from Margaret Wheatley's work on leadership)
- The Community Based Social Marketing approach to outreach (from McKinsey-Mohr's work)
- Outreach programs: Program components, creating a program for your county/community
- Effective communication: How to create and deliver a powerful message (from Patricia Fripp's work)
- Keeping the educators' network alive and vibrant

Outreach Defined

What is outreach?

In the context of this guide, outreach includes all the activities for motivating people to change to more sustainable practices in yard care and organic materials management. Whether it's presenting at a workshop, staffing a booth, or engaging individuals in a conversation, outreach has this same goal of encouraging behavior change.

Outreach programs can be as simple as occasional workshops, taught by an invited instructor from another county. Or outreach can be a comprehensive program using community-based social marketing as a framework as discussed later in this chapter. A comprehensive outreach program might include dedicated staff, volunteers, an array of resource materials (e.g. displays, slideshows, permanent demonstrations sites, etc.) and a program tracking and evaluation process. Regardless of the complexity of your outreach program, compost educators will benefit from learning about what makes a successful program. The rest of this chapter provides resources to help.

Why do we need outreach on composting and natural yard care practices?

As educators, our goal is to get people to recycle their organic residuals and incorporate both activities as part of sustainable living. Outreach, as opposed to public information campaigns, has proven to be an effective way to get people to adopt the kind of behavior changes we're looking for.

Farmers Markets and the Relationship Factor: A Model for Home Composting?

Local farmers markets are on the rise in the U.S. According to the United States Department of Agriculture, the number of farmers markets has increased from 1,755 in 1994 (when they first started tracking) to 4,685 in August 2008. In Washington State, farmers market numbers have increased from 56 in 1997 to over 100 in 2007.

"More and more consumers are discovering the wide array of fresh, locally grown produce available at farmers markets," says USDA's Lloyd Day, Administrator of the Agricultural Marketing Service. "Another reason for their popularity is food buyers like the opportunity to interact with the producers."

Washington State Department of Agriculture echoes this idea in the beginning of the recently published *Washington State Farmers Market Manual*: "…people seem to treasure the experience of shopping at farmers markets. In an era of big box stores, shopping malls, and convenience food chains, markets offer a rare opportunity to be out in the fresh air, discovering tasty fruits and vegetables; meet the farmers, learn how the food was grown, and gather with friends and family.

One outreach strategy used by many Washington state and local government agencies in the past few years is called community-based social marketing (CBSM). CBSM uses a specific set of tools to motivate people to change their behavior. These tools are described in more detail later in this chapter.

CBSM promotes the kind of outreach strategy that is already practiced by existing home composting and natural yard care education programs. The two important characteristics of this approach are:

- Personal contact
- Modeling of desirable behavior

Other experts in social science agree with the importance of personal interactions and leading by example. Using different terminology, the following section describes the ingredients for successful outreach from the work of Margaret Wheatley, author and leader in the social change movement.

Two Basic Ingredients for Successful Outreach

Ideas and information, combined together, are one of the key ingredients for successful outreach. The other key ingredient is the interaction between you and other people, as you engaged them in an activity that you love.

As Margaret Wheatley, author of *Leadership and the New Science* explains, ideas and information are only half of what is required to evoke reality. The other half of the requirement is relationship with those you share ideas and information.

Ultimately, the most important relationship to cultivate is the one between the composter and the compost pile. In an outreach setting, you will inspire that relationship by example; by the way you explain the process to people and get their enthusiasm stirred up.

The two basic ingredients for successful outreach are:

- Ideas and information
- Relationships—between you and your audience; between event participants; between your audience and their own composting and natural yard care projects

The Community-Based Social Marketing Approach

Community-based social marketing (CBSM) is a public education strategy founded by Doug McKenzie-Mohr and William Smith, described in their book *Fostering Sustainable Behavior*. CBSM is based on extensive research and field studies that show people are more likely to change behavior when presented with solutions to the concerns they have. Many state and local government agencies in Washington

Garden Party

Could the desire for social interactions or relationship factor of farmers markets serve as a model for home composting outreach activities? Mikal Heintz of Yakima County Public Services thinks so. Mikal, Solid Waste Program Coordinator has already started planning "Natural Gardening" parties as part of the education program in her county. Volunteers host a party and invite friends to come over and learn about natural gardening and composting in the host's back yard. Master Gardeners provide instruction, and the party activities include a bin give-away to a lucky few in attendance. Even the name "party" gives the gathering an atmosphere of fun. It could be just the right ingredient to create a good learning environment.

State are using a CBSM approach. The following table presents a summary of useful tools described in Fostering Sustainable Behavior

Community Based Social Marketing Tools

This table is a list of general strategies for overcoming barriers to change. It summarizes the tools in the book *Fostering Sustainable Behavior: An Introduction of Community Based Social Marketing* by Doug McKenzie-Mohr and William Smith. The summary table was compiled by Seattle Tilth for the *Natural Soil Building Resource Manual*.

Commitment: Pledging to try small changes makes us more likely to follow up with broader actions. We all want to appear consistent with our stated beliefs.

Tools	Practical examples
Promising to try a new practice makes follow through more likely	Ask for verbal commitments: "So you will try to leave clippings on the lawn the next few times you mow?"
Written commitments are more holding than verbal.	Get people to sign a petition, or initial specific recommendations that they will try on a handout.
Involvement in an activity invests people and makes them more confident to repeat it on their own.	Use hands-on educational activities and encourage audience participation.
Conduct informal hands-on demonstrations with neighbors.	
Public or group commitments are especially effective—like exercising with a friend.	Get neighbors to commit to making starting composting or to compost all their yard trimmings.
Ask if a person might like to be included in a profile of people who adopt sustainable practices. This is effective even if you have no means of following through.	
When people identify themselves as environmentalists (or concerned about any issue) they are likely to adopt behavior that is consistent with this image.	Recognize a measure the resident has already taken, and praise them for it (starting composting). Ask resident if they are concerned about a specific issue, such as water conservation.
Providing a free or discounted tool makes people feel obliged to use it.	Encourage people to purchase low-cost compost bins or thermometers. Emphasize the city or county may subsidize these tools.

Prompts: Reminders help break habits that may overwhelm our plans to change. It is easier to follow an old routine than to remember good intentions to try a new way.

Tools	Practical Examples
Visual cues are useful reminders to break habits.	A sticker that says "turn your compost pile before adding"
Effective prompts must be specific and self-explanatory.	Saying "Water the lawn one inch per week during dry summer weather" is more effective than saying "Water wisely."
Effective prompts must be noticeable and near to where the action takes place.	Printing a reminder to water effectively on a plastic hanger placed on the hose spigot will be more effective than putting it on a refrigerator magnet.
Positive prompts are more effective than threats.	Stick with prompts for specific behavior like "Put in compost pile instead of putting in trash can." Avoid negatives like

Norms: Most of us want our behavior to fit in with community values. We are likely to use sustainable practices if our neighbors do it, even if it seems less convenient than another method.

Tools	Practical Examples
Make people aware that many people in their neighborhood are adopting sustainable practices.	Mention how many people have purchased compost bins from the county, or how water conservation has kept demand level as population has increased over the past decade.
Model the behavior you want others to adopt. Offer to help others change.	Convert lawn on a parking strip to a low maintenance herb bed. Offer plant divisions to a neighbor who expresses interest in what you've done. Use tuna cans to check how much you water the front lawn or garden. Offer to help a curious neighbor do the same.
Make conservation behaviors visible.	Put a sign on the lawn saying "Mow it high and let it lie—I grasscycle."
Publicizing involvement makes norms visible, and goads people to follow through so they are seen as consistent.	Suggest that you may profile a customer's sustainable practices in a local news story or use their name on a list.

Outreach Programs

Outreach program components

Conceptually, community outreach for home composting and responsible yard care has four basic components: a program leader, handouts, events and support materials. A fifth component would be a volunteer training program like Master Composters if you choose to include it.

Program leader

Every program needs someone "on first." Even if your program is the most basic, someone needs to keep things organized and answer questions as they come up. For more complex programs, there might be an additional leader to organize a cadre of trained volunteers in a master composter-type program. Regardless of

the number of people involved, the quality of interaction with your audience is the important factor.

Handouts or take-home information

Many people like to take home information that summarizes an activity they've just learned about. These can be ready-made brochures or custom-made for your program, depending on personnel and resources in your community. The basic take-home information should include at least two brochures: how-to compost; and using compost. Each of these topics are covered in a separate statewide brochure as part of this guide.

Outreach events: Venues for getting the message across

The list of outreach events to get the home composting message across could be lengthy for your program, depending on your community. Here are some opportunities in which existing programs participate to get the word out:

- Fairs, festivals and farmers markets: Set up a booth with handouts and demonstrations; be available to answer questions.
- Community gardens: Set up a demonstration site and hold workshops.
- School programs: Work with teachers to fit composting into the daily life of students; help with integrating composting into the curriculum, if possible; give presentations to adults at parent association meetings.
- Community group meetings: Give a slide presentation at public libraries, garden clubs, other group meetings (e.g. Rotary Club, Lions Club, etc.)
- Garden centers and nurseries: Give workshops in late winter/early spring to share people's excitement about the coming season.
- Bin distribution events: Share information when residents come to pick up subsidized bins.
- Garden parties: Start a trend in your community to add composting tours to your community activities.
- Lead by example: Teach neighborhood kids and adults to make worm bins.
- Other events: Opportunities to raise awareness about home composting and natural yard care are everywhere people gather together for work or play. The list is only limited by your imagination.

Support materials

Slide shows, display boards and demonstration bins are just three examples of additional materials to support your outreach program. The more you can include

hands-on activities or show-and-tell, the more you will engage your audience. Active worm bins are a great demonstration tool for use at just about any event. To demonstrate regular composting, bring a galvanized garbage can with partially composted food scraps in a good mix of leaf mold and sawdust. You'll attract lots of attention if you stand at a booth and work the compost with a compost turner. Show off some compost; have bins of finished compost for people to see and touch.

Tips for planning the program

Initiate the first step of planning your program by tapping into the compost educators' network. Washington State is home to some of the most experienced home composters in the country, and to some of the oldest home composting programs. Check with Washington State University Extension offices in your county to find out about active composting programs (http://ext.wsu.edu/locations/).

Consider collaborating with other local and state agencies and organizations. Many programs combine expertise from different groups, sharing resources for more efficient administration.

Find out how your program can benefit from state funding through the Coordinated Prevention Grant (CPG) program. Contact information is in the Resources section of this chapter.

Decide whether or not your program will include training volunteers to teach others how to compost.

Check local ordinances for any restrictions or requirements for home composting in the communities in your area. Some city requirements may have specific restrictions that county governments do not have.

Check with your local health district. State regulations exempt home composting from solid waste regulations. However, it is always good to keep local health officials in the loop regarding new or revised programs.

Tips for setting up a Master Composter-type volunteer program

If you choose to include volunteers to teach citizens about composting and responsible yard care, you will probably want to set up a training program as part of your outreach efforts. There are a number of elements you will probably want to include:

1 Training materials, providing technical information about composting.

2 Program description. Most existing programs train volunteers then ask them to participate in 40 hours of outreach events over the next year. After completing the required hours of volunteer work, the person receives a certificate.

3 A list of outreach venues for your community.

4 A list of outreach materials or resources available for volunteers to use (e.g. display boards, slide shows, etc.)

5 Instructions on how to schedule events and material rental, including policies for event cancellation.

6 Outreach Report Forms, including information that will help keep track of outreach activities. The forms are sometimes needed for funding agencies, and good records will help improve the program over time. The forms should include at least the following information:

- Volunteer name(s).
- Location and type of outreach activity.
- Type of presentation.
- Number of volunteer hours spent.
- Number of contacts made.
- Comments about the event. These are particularly helpful for continual improvements to the program.

A word about contacts made at an outreach event

How do you know what to count as a contact? As experienced Master composters will attest, keeping track of contacts can be tricky especially at busy events. The Seattle Tilth training program describes the following encounters as contacts:

- People you talk with at an outreach event. This includes others listening to the conversation, even if you don't speak to them directly.
- All people listening to a presentation.
- People who take handout information, even if you don't talk to them.
- People who interact with hands-on demonstrations or displays.

One way to manage counting contacts is to make hash marks on the reporting form.

Measuring the success of your program

Several municipalities have taken the initiative to survey compost bin users before and after a distribution event. The results are promising that bins are still in use at least a year after they were distributed. You can find the link to the results of a survey in La Grande in the Resource Section.

Effective Communication: How to Create and Deliver a Powerful Message

At the very core of effective communication about composting is *YOU*, engaging people in an activity that you love. All the techniques and tips on public speaking will fall into place once you begin to experience yourself being:

- Committed to the practice of composting and natural yard care. You will be a credible resource when you share your own personal experiences from actively composting at home (and hopefully at work, too). You become an active explorer, just like those in the audience, admitting when you don't know something, answering with self-knowledge when you do.

- Present with your audience. Being present means listening carefully, asking clarifying questions, and addressing concerns with acceptance and understanding. It helps to give people kudos for any action they are currently taking.

- Enthusiastic. Remember, enthusiasm is contagious. People will understand more if they are emotionally involved with the subject matter. Hands-on demonstrations are a wonderful way to engage people.

These three states of being will go a long way in effectively communicating how to compost at home and take care of a beautiful yard naturally.

Expert Advice on Public Speaking

One source of information about effective communication is Patricia Fripp, an award-winning keynote speaker, executive speech coach and sales trainer. Patricia's website offers free articles that will help you prepare presentations, overcome jitters, and avoid common pitfalls of outreach activities. This guide includes four articles from the website, reprinted with permission, to get you started. It might be helpful to remember one of Patricia's quotes as you prepare for outreach activities: "A presentation is just a conversation in business clothes."

Resources

Measuring the success of your program

Follow up survey on compost bin usage after a disbursement from La Grande, OR.

http://www.deq.state.or.us/lq/pubs/docs/sw/compost/LGSurveyReportComplete.pdf

Coordinated Prevention Grant (CPG) information

To find out the CPG contact for your county, please refer to the chart on the Department of Ecology website.

http://www.ecy.wa.gov/programs/swfa/grants/cpg.html#How_to_Contact_Us

Public speaking assistance

Toastmasters International. This as a good group to contact for assistance in becoming a better public speaker. They have local classes in many areas and a good selection of free resources.

http://www.toastmasters.org

Community Based Social Marketing. http://www.cbsm.com/