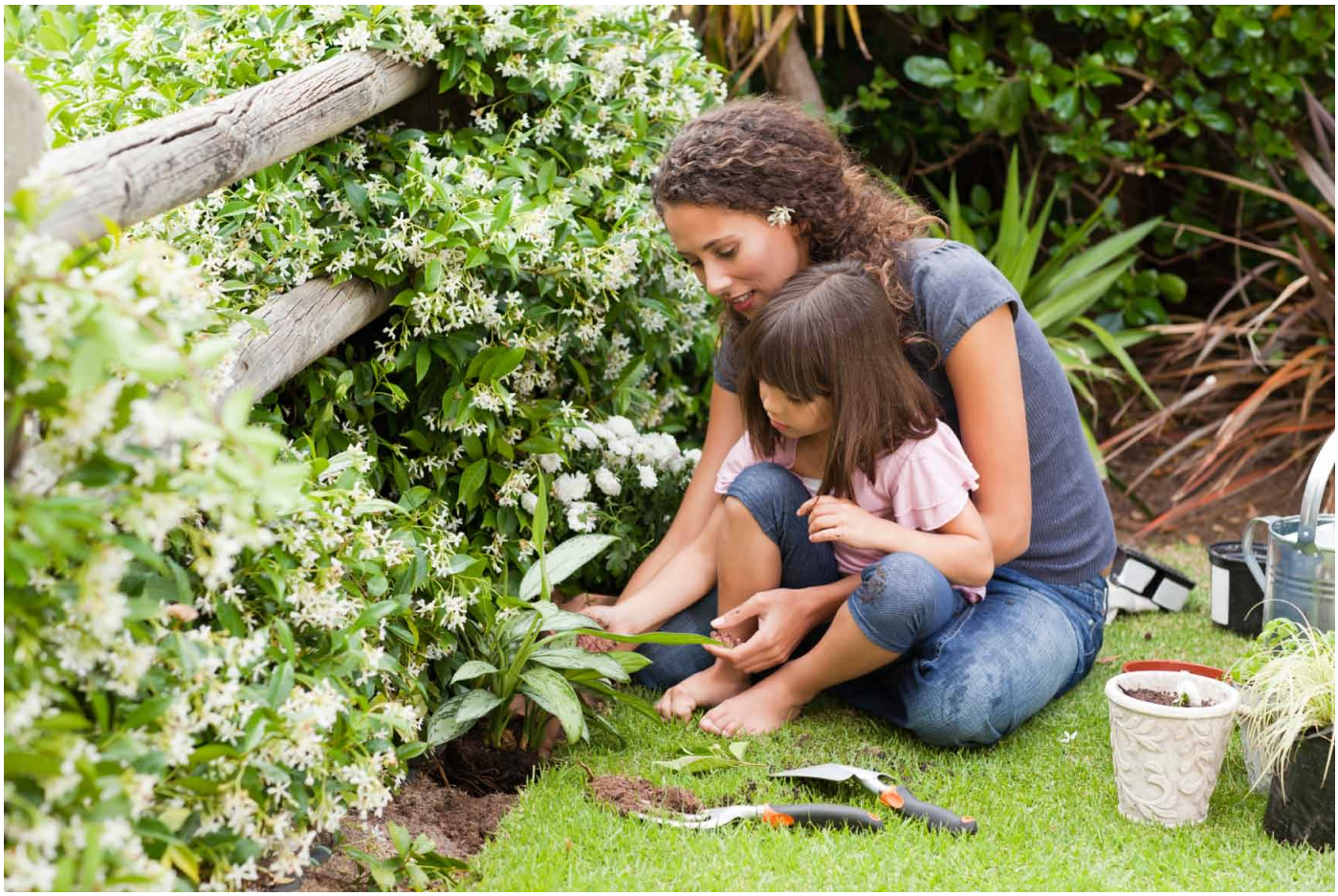
Do-It-Yourself Biodiversity



By Terry Shistar

Counteracting the threats to the biological communities that support life on Earth is a huge task, but there are also many ways in which we as individuals can make real contributions to preserving biodiversity. Conservation biologists have used the theory of island biogeography to develop strategies for preserving biodiversity. Small islands of habitat cannot support large predators, but they can provide refuges for smaller species, and many small islands can be strung together to support larger, mobile species. Almost all of us can help by creating islands of biodiversity wherever we live.

Soil

In land-based ecosystems, biodiversity begins with the soil. Recent science has shown that J.I. Rodale and other organic pioneers were right –the soil is a living organism, and synthetic fertilizers and pesticides do kill the soil. The growth of all the plants we see above ground –from lettuce seedlings to redwood trees– results from a symbiosis between the plants and the fungi, bacteria, insects, and other soil-dwelling organisms. For a greater understanding of the microbial life in the soil, see *Teaming with Microbes: The Organic Gardener's Guide to the Soil Food Web* by Jeff Lowenfels and Wayne Lewis.

Some plants prefer soils dominated by fungi; others prefer soil dominated by bacteria. Soils dominated by bacteria are found in farms, gardens, and prairies, where bacteria keep nitrogen and other nutrients available for plants by storing them in their own bodies. Soils dominated by fungi are found in forests, where leaves and wood are relatively resistant to bacterial degradation, but provide carbon-rich nutrition that is perfect for fungi. Bacteria and fungi are the basis for the soil food web, which also includes arthropods, earthworms, and other larger organisms.

Building Biodiversity in the Soil

The foremost method for building biodiversity in the soil is composting. Composting breaks down organic matter, while growing the organisms necessary for a healthy food web. Compost can be made in different ways, depending on the soil where it will be used. Compost made predominately from wood chips, sawdust, or dry leaves ("browns") and turned infrequently favors fungi. Compost made largely from kitchen scraps, grass cuttings, green plant residues, and/or manures ("greens") and turned frequently

DIY Biodiversity

#1 Compost nurtures populations of soil food web organisms.

#2 Organic Gardens exclude toxic fertilizers, increase biodiversity, protect biological communities, and fight climate change.

#3 Mulch provides food for soil organisms and shelter for predators.

#4 Plant and Save Heirloom Seeds to preserve genetic diversity and promote locally adapted varieties.

#5 Plant a Chestnut Tree for the future.

#6 Grow Saprophytic Mushrooms to increase fungal biodiversity.

#7 Disperse Mycorrhizal Fungi to promote symbiotic relationships that help forest health.

#8 Seed Bombs distribute seeds with soil food web organisms.

#9 Plant for Insect Diversity and encourage "beneficial" insects.

#10 Pledge your yard as a Pesticide Free Zone/ Honey Bee Haven to protect pollinators.

#11 Nesting Places for Insects preserve pollinators and predators.

#12 Nesting Places help conserve bird populations.

#13 Encourage Insectivores and bring balance to the garden.

#14 Water is necessary for life.

#15 Feed animals through lean times.

#16 Brush Piles provide shelter and habitat.

favors bacteria. Composting should be an aerobic process favoring aerobic organisms.

Soil life creates soil structure and nutrients. A diverse soil food web maintains a balance that controls disease and protects mycorrhizal fungi. The soil organisms raised in a compost pile may be introduced to the soil by applying the compost directly to the soil or by making compost tea.

Information about composting can be found in any book about organic gardening and the article "Compost is the Key" on the Beyond Pesticides website, www.beyondpesticides.org. *Teaming with Microbes* describes the value of composting from the viewpoint of inoculating the soil food web.

Plants

Organic gardening uses the soil food web to produce plants for our use. When you garden organically, you can increase biodiversity in several ways:

- The soil food web grows and diversifies.
- You can grow varieties adapted to your tastes and location, thus creating more diversity within each species.
- Successful organic gardens are diverse polycultures, supporting populations of pollinators, predators, and parasites that create a healthy and balanced garden community.
- Organic gardens do not use synthetic fertilizers and pesticides that kill soil organisms and disrupt biological communities.
- Organic soils sequester carbon, thus reducing global climate change and its adverse impacts on biodiversity.

There are many informative and entertaining books available about organic gardening. Also, see the organic gardening section of the Beyond Pesticides website.

Mulching consists of covering the soil with a layer of organic or inorganic material, and is useful to gardeners because it inhibits unwanted plants and conserves soil moisture. Organic mulch also helps build biodiversity. It feeds soil organisms at the soil-mulch interface. Fine, greener mulches promote bacterial growth; coarse, dryer mulches promote fungal growth. Mulch provides shelter for a variety of animals, including the insectivorous toads, spiders, and ground beetles.

Conventional farming methods have resulted in a huge loss of diversity in crop varieties –90% of the fruit and vegetable varieties once grown in the United States are now extinct– and many of the rest are patented by a few seed companies. You can help preserve biodiversity of domesticated plants by choosing open-pollinated types and saving your own seed. Saving seed also enables you to select for local adaptations, which is important in these days of changing climate. *Seed to Seed* by Suzanne Ashworth is an excellent introduction to seed saving.

The American chestnut was the dominant tree in the eastern United States before it was wiped out by blight. An extensive breeding project has produced resistant trees. Anyone with enough space for a couple of trees can be part of the effort to bring back the American chestnut. Seeds and seedlings are available from several sources, including The American Chestnut Foundation and commercial nurseries.

Fungi

Saprophytic fungi break down dead plant material and turn it into soil. Since some of the saprophytes produce edible mushrooms, a delightful way of producing fungal compost to feed soil around trees and shrubs is growing edible mushrooms. *Mycelium Running* by Paul Stamets gives some basic techniques for raising mushrooms. Kits are also available. A simple technique involves propagation of fungi from the stem butts of mushrooms. These cultures can be "released" into appropriate environments, or the spent substrate can be used as an addition to fungi-rich compost.

Mycorrhizal fungi form symbiotic (mutually beneficial) relationships with plants –sometimes involving cooperation among plant species. For example, three distinct tree species (Douglas fir, paper birch, and western red cedar) share sugars through mycorrhizae growing in the soil, with trees in the sun giving up nutrients to those in the shade.

One simple way of dispersing mycorrhizal fungi is practiced by morel mushroom hunters, who often put their finds in a net mesh bag as they continue the hunt, which allows spores to filter into the air and spread to new locations. More deliberate methods include making spore prints –put the mushroom cap spore side down on a piece of paper– to collect spores (which can be released in new habitats), and making seed bombs.

Propagating Mushrooms from Stem Butts

- Clip off the base of the mushroom just above the root-like filaments (rhizomorphs).
- Soak a square of plain corrugated cardboard in water until it is saturated.
- Pull the cardboard apart to expose corrugations.
- Place one stem butt on a 4-inch by 4-inch square and sandwich the layers together.
- Soak the sandwiches in water and cover with a shallow layer of wood chips.
- Keep on the ground in the shade up to 8 months before transplanting to a food source —wood chips in burlap sacks, bales of straw, etc.

Mycelium Running provides a list of species known to regrow from stem butts. Try starting with oyster mushrooms, which may be available at your grocery store. You can experiment with wild mushrooms growing on wood, but be careful what you eat!

Seed Bombs

Masanobu Fukuoka, the author of *The One Straw Revolution*, is credited with the invention of seed balls or "seed bombs." The seed bomb incorporates compost and seeds in a packet held together with clay. The compost provides the germ of the bacterial and fungal components of the soil, while the seeds introduce the plants. The two components are introduced together to facilitate the development of symbiotic relationships. Seed bombs can be tailored to the environment in which they are distributed. I make three main kinds of seed bombs (you can tailor this to your region):

- Seeds of native woodland plants with a fungal compost including mycorrhizal

mushrooms I collected over the previous year,

- Seeds of native prairie species with a bacterial compost that may be enriched with spores of prairie species of mycorrhizal fungi (purchased from a company specializing in prairie seeds) or prairie soil, and
- Seeds of plants that will grow fast, hold the soil, and help build the soil (mostly annuals and legumes) with a bacterial compost.

Seed bombs should be scattered fairly densely –ten per square meter is suggested– on bare ground. When used to enrich existing habitat, density is not important.

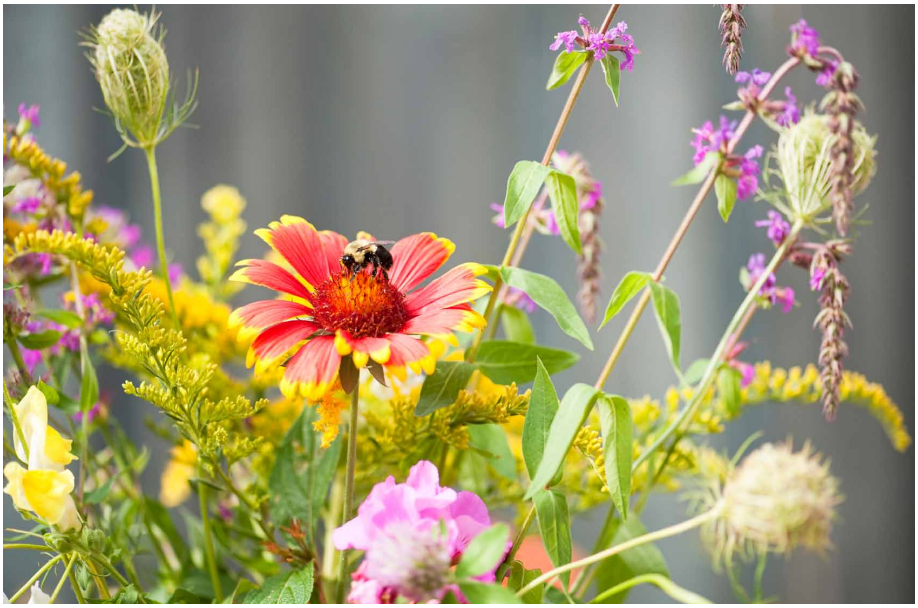
Recipe for Seed Bombs

Mix thoroughly:
1 part (by volume) seeds. (I collect most of my seeds, but usually enrich the mixture with others. Fukuoka recommends including 100 kinds of seeds. None of mine have reached that level of diversity.)
3 parts dry compost, appropriate to the seeds and site where the seed bombs will be scattered.
5 parts dry clay, powdered. (I collect clay that settles out of the high water along a river or creek. When it dries, it curls up. Sand can be brushed off. Terra-cotta clay is appropriate if you are buying it.) Add enough water to make a workable mixture. Break off marble-sized balls of clay and roll them in your hands until you feel the clay "set up." (Unless your mixture is very dry or very wet, you will feel a difference.) Place on a newspaper or tarp to dry. Dry for at least a day before using. Keep cool and dry, not in plastic bags.

Insect Biodiversity

Most people do not think of encouraging bees and wasps around their homes. But the family *Hymenoptera*, which includes ants, bees, and wasps, contains many species considered "beneficial" to the farm or garden. These include the solitary parasitoids that lay eggs in host insects, solitary nesting species, and social species like honey bees and paper wasps. Solitary species are not usually aggressive, and can nest without harm near human activity. Social species are more likely to sting when someone approaches the hive or nest. We can protect *Hymenoptera* by keeping honey bees and providing other nesting opportunities. Paper wasps, which can be hazardous when they nest around a doorway, can be encouraged to nest near the garden –where their consumption of caterpillars will be appreciated– by providing a small sheltered box (with a roof and three sides) a few feet off the ground. Orchard mason bees, leaf-cutter bees, and others will nest in holes in blocks of wood.

Nectar sources are important for pollinators and parasitic wasps. Seed companies offer mixes to attract "beneficial" insects. A small patch of one of these blends can bring a remarkable variety of insects. One day last June, I saw at least seven species of bees, including bumblebees and domesticated honey bees, plus at least three kinds of wasps, and two or three beetles in a couple of minutes on some parsnip flowers. Some plants commonly included in insectary mixes are listed in the box on the next page. Of course, you should pledge your yard as a Pesticide Free Zone/Honey Bee Haven. For more about bees, see "Backyard Beekeeping" and "Pollinators and Pesticides" on the Beyond Pesticides website.



Various Vertebrate Insectivores

Conventional wisdom says that the most effective biological controls are parasitoids, whose population growth quickly tracks the population of the host. Nevertheless, many vertebrate insectivores are important in regulating prey populations. Anyone who has lived around swallows has probably seen mosquito populations build before the swallows arrive in the spring, drop as the swallows raise their young, and then rise again in the fall after the swallows leave. House sparrows and house wrens are other insectivores that like to live in and around homes. I watched one house wren deliver 25 caterpillars in 43 minutes to the nest.

Supplying housing or housing sites helps birds, especially when the habitat lacks their natural nesting sites. Purple martins prefer apartment-style housing with multiple units. A small shelf on the underside of a beam on a porch or in a barn will help support the nest of a barn swallow or phoebe. Ample information is available about the bird houses that attract various birds. Some people are successful

in attracting bats to bat houses. Ground-dwelling insectivores like frogs, toads, small snakes, and lizards welcome a little shelter, too. Toads appreciate a flower pot turned on its side in the garden.

All animals need water, and a small pond or even a pan of water may be essential to the habitat in your yard –for drinking, as well as a place for frogs and toads to lay eggs. By providing moving water or insectivores (fish, toads, or aquatic insects), mosquito breeding can be avoided.

Some animals need an extra food source to bridge the gap between natural food sources, such as the gap between nectar sources for hummingbirds. A number of insectivorous birds depend on seeds and berries over the winter, and winter feeding or planting shrubs with winter berries can ensure that they will be around in the spring.

Brush piles provide cover for all sorts of animals –from birds to snakes to rodents. If you have the rodents, you need the snakes, but if you don't want the rodents, you can make the brush pile less attractive to them by raising it off the ground on cinder blocks. As the pile rots, it feeds fungi and contributes to the fungal portion of the soil. To make a brush pile, pile the small to medium-sized woody trimmings from trees and shrubs into a big heap.

Some Insectary Plants

Umbellifers: carrot, dill, coriander, fennel, parsnip Composites: sunflower, yarrow, coreopsis, cone flower, blanket flower, asters
Legumes: berseem clover, sweet clovers, purple prairie clover, Dutch white clover
Others: alyssum, buckwheat, cleome, mustards

Is it enough?

Our efforts at growing biodiversity in our backyards will not be enough by themselves. We need to protect all species from habitat destruction and poisoning. But our own personal efforts can be significant. The proliferation of bluebird houses was able to reverse a downturn in bluebird populations caused by factors including the lack of suitable nesting cavities, the loss of open field habitats, and pesticide use. Some animals are mobile enough that a number of bits of habitat can add up to enough. By building biodiversity in small places, we increase the resilience of biological communities and decrease their susceptibility to "invasive species," thus reducing the likelihood that someone will decide that poison is needed to solve a problem.

Resources

Beyond Pesticides website: Organic gardening webpage, www.beyondpesticides.org/organicfood/gardening, including "Grow Your Own Organic Food," www.beyondpesticides.org/infoservices/pesticidesandyou/Spring%202010/grow-organic.pdf, and "Compost is the Key," www.beyondpesticides.org/infoservices/pesticidesandyou/Fall%2007/compost.pdf; "Backyard Beekeeping," www.beyondpesticides.org/infoservices/pesticidesandyou/Fall09/backyardbees.pdf; and, "Pollinators and Pesticides," www.beyondpesticides.org/pollinators/protect;

Other online: From Audubon, http://birds.audubon.org/faq/where-can-i-get-plans-build-bird-house-what-are-correct-dimensions-each-species for birdhouse plans; Fungi Perfecti, http://fungi.com for mushroom kits.

Books: *Wildlife in the Garden* by G*ene Logsdon; The Earth Manual* by Malcolm Margolin; *Teaming with Microbes: The Organic Gardener's Guide to the Soil Food Web* by Jeff Lowenfels and Wayne Lewis; *Mycelium Running* by Paul Stamets; *Seed to Seed* by Suzanne Ashworth; *How to Have a Green Thumb without an Aching Back* by Ruth Stout; *The Medicinal Herb Grower* by Richo Cech; *The Resilient Gardener* by Carol Deppe; *Four-Season Harvest* by Eliot Coleman.