Introduction to Organic Lawns and Yards

Plus a Checklist for an Eco-Friendly Property

By Sarah Little, Ph. D.

NORTHEAST ORGANIC FARMING ASSOCIATION, ORGANIC LAND CARE PROGRAM

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Table of Contents

Introduction

Purpose

The purpose of this booklet is to introduce you to the concepts of ecological, sustainable and organic landscaping for your property. The booklet is like a "Quick Start" guide that will enable you to grasp and implement some organic practices right away. If you want to go into more depth or have specific problems not covered here, you'll need to hire a professional organic landscaper or consult some of the references provided. Organic land care is big topic, and a lot of good reference material exists "out there," so links to free resources will be provided wherever possible. Both those who have never heard of organic landscaping, and those who already know they want to implement ecological practices will find this booklet useful. It is geared towards the climate and soil condi-

> "Whether we know it or not, whether we wish it or not, the landscape of the world, amidst which we live and move and work and play, continually affects the state of our nerves and our state of mind – in short, affects our happiness – by its beauty or its ugliness, by its infinite varieties of character."
>
> – Frederick Law Olmsted

tions in the Northeast U.S., but the principles apply more broadly. The information it contains has been collected from peer-reviewed scientific studies, state agricultural extension services and organic landscaping professionals.

Organization

Each section will present an overview of the topic, explain how it relates to organic landscaping principles, and provide specific actions and practices. The resources for further information are all listed in the Learn More section at the end.

What You Will Learn

You will learn some basic techniques in organic landscaping that will enable you to maintain your property in good condition with a minimum of fuss. You will also learn where to find the abundant resources available to you if you would like to work towards a stunningly beautiful organic property, or if you run into specific problems not covered in this booklet. You will also come away with an idea of how your property fits into the bigger ecological picture and how your choices for landscaping can impact your local, regional, and global environment.

To care for your landscape organically, you begin with a survey of the plants and animals on your property, as well as its physical conditions, such as drainage, sunlight, wind patterns, foot traffic, etc. You follow this up with a soil test to find out what you've already got in your soil. Then you match up deficiencies in the soil with applications of soil amendments, aeration, mowing techniques and other practices to support healthy turf and plants. These methods take a little more time and patience but the results are beautiful and long lasting.

This kind of whole-picture, ecologically minded landscaping works well, saves money, and has benefits that extend well beyond your property. Your yard is physically, not just metaphorically, connected to you and billions of other living creatures. It is an ecosystem that can either contribute to or detract from your health, your neighbor's health, and your local, regional and global environment. What you do with your property matters.

The terms sustainable, ecological, and organic are closely related but not synonymous. The word "sustainable" is a general term that means meeting the needs of the present without compromising the ability of future generations to meet their own needs. Ecological landscaping refers to landscaping with a respect for natural ecosystems. Organic landscaping encompasses both these concepts and, in addition, it is guided by a specific set of ecological principles and practices, including the avoidance of synthetic pesticides and fertilizers. These principles originated in organic agriculture, but have been expanded to apply to the field of landscaping and are laid out in the *NOFA Organic Land Care Standards*, (see Learn More).

Important organic landscaping principles to be covered here include:

- landscaping for beauty, function, and nature;
- using only natural materials;
- designing to conserve resources;
- minimizing inputs of energy, water and materials;
- increasing biodiversity;

- removing invasive plants;
- encouraging native plants;
- enhancing ecosystem functions of human landscapes; and
- fostering healthy relationships between people and their natural environments.

There are plenty of examples of beautiful organic properties throughout the northeastern United States. The NOFA Organic Land Care program has trained over 1500 organic landscapers in over twenty states and maintains an on-line listing of accredited professionals. You can see examples of their work at *www.organiclandcare.net* (click on "Landscaper Search").

In a beautiful landscape the balance of colors, of shade and sun, of open space and foliage, of high and low ground, gives us an immediate overall sense of peace and wordless connection to the world outside of ourselves. Nature randomly creates such spaces, a rocky ledge overlook on a favorite hike, an open sunny meadow, a stretch of beach alongside shapely dunes. Nature's beautiful spots are all organic. There is no reason why yours can't be also.

Working with Ecosystems

> "I think having land and not ruining it is the most beautiful art that anybody could ever want to own."
>
> – Andy Warhol

Photo: Richard Houde, released under Creative Commons

What Is an Ecosystem?

An ecosystem is a biological community and its non-living physical environment. In other words, it is all of the living organisms (plants, animals, fungi, bacteria, etc.) in a given area linked together through nutrient and energy cycles with their physical environment (soil, air, water, sun, rain, etc.). Ecosystems come in all sizes: from a single oasis in a desert to hundreds of square miles of rainforest, and from your own backyard to the planet as a whole. Ecosystems can be stable, where the particular assortment of living organisms remains relatively constant over long periods of time, or unstable, where new species come and go rapidly. Ecosystems can be resilient, where changes in the physical environment or biological communities are self-repaired and the system tends to revert

back to its original composition. Or they can be fragile, where small changes to species composition or physical characteristics cause existing species to die or move away permanently. Ecosystems are a useful concept because if you want to protect a particular species, like the spotted owl, you need to understand and conserve all of the life and physical characteristics of its ecosystem, because the owl ultimately depends on the whole food and nutrient chain, not just the mice it eats. Examples of small ecosystems include your lawn, your back woodlot, a native garden, vernal pools, wetlands, and ponds. Like human communities, small ecosystems are connected to each other and can exist inside larger ones and share plants, animals, and resources with them. The ecosystems that you care for can have a healthy impact on the large ecosystems around you: the watershed, the nesting and foraging grounds of birds and animals that move through your yard, the quality of the air and water.

Organic landscapers use the concept of ecosystems in two ways. First, they believe that natural ecosystems are better for our health and the health of the planet, and therefore should be restored or emulated whenever possible. Natural ecosystems are loosely defined as ones that are similar to those that existed before we went through our period in history known as the industrial revolution in the 1800's. The second, more practical concept, is the idea of managing our properties as whole ecosystems so that they produce for us the healthiest, most stable, attractive and useful property with the least amount of effort, cost and materials. This is an incredibly powerful concept, and differs significantly from the way most landscapes are currently managed, where the focus

> Like human communities, small ecosystems are connected to each other and can exist inside larger ones and share plants, animals, and resources with them.

is on continually treating individual pest, disease, and other problems. The techniques described in this booklet all center around building a beautiful, functional, environmentally healthy, and relatively stable ecosystem in your own backyard.

Biodiversity

Biodiversity is the variety and spice of life, and science tells us that more is usually better. It is a measure of how many interacting species are in an ecosystem. Not only rare species, but every living thing in an ecosystem counts. Biodiversity can be measured in ecosystems of all sizes: in a teaspoon of dirt, your lawn, your town, your planet. As a general scientific statement, more biodiversity leads to a more robust ecosystem, one that can withstand drought, floods, toxins, invasive species, and the disappearance of isolated species without collapsing. Conversely, reducing biodiversity increases the chance that even a small change will cause an ecosystem to collapse, leading to an abrupt and complete change in the types and abundance of creatures that inhabit it. Organic landscapers seek to increase biodiversity in order to give resilience to landscapes—to make them more stable and to reduce the amount of energy and materials required to maintain them.

Native Plants

Native plants play an important role in increasing biodiversity. A native plant is generally considered to be one that occurred in a particular region prior to European settlement. Such plants have been around long enough to become adapted to the local physical and biological conditions without the need for outside human intervention. Native plants are valued for their economic, ecological, genetic, and aesthetic benefits. Using native plants can actually attract other native species and greatly increase local biodiversity. Because native plants are adapted to a particular region, they tend to resist damage from freezing, drought, common diseases, and herbivores. They need little to no watering or fertilizing. Plus, there are specific associations of living creatures—mycorrhizae (the below-ground parts of fungi) with plants; soil-dwelling creatures with woody debris; pollinators with flowers; and birds with trees and bushes—that can only be sustained by planting native plants. Native plant species provide key elements for ecosystem restoration. In the Learn More section you will find several websites that can help you locate native plant nurseries in your region. When you are thinking of what to plant, think native.

Invasive Plants and Animals

Invasive plants and animals are non-native species that have spread into an area of the landscape and caused economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those areas.

Invasive plants may also create significant changes in the composition, structure, and ecology of the natural environment, including changes in soil chemistry, biology, and structure. In addition to their ability to compete for sunlight, water, and nutrients, invasive plants usually have few or no natural enemies to keep their populations in balance with the rest of the local ecosystem. With no check on their growth or spread, invasive plants are able to form pure stands where no other plant grows, disrupting the food chain upon which insects, birds, and other animals depend. It is important not to plant invasives and to make efforts to remove them or stop their spread on your property. To name just a few of some very common invasive plants to avoid:

- Oriental bittersweet
- Japanese barberry
- Amur, Bell's, Morrow's, Tatarian and Japanese honeysuckles
- Norway and Sycamore maples
- plume grass
- winged euonymus (burning bush)
- autumn olive
- Japanese knotweed
- multiflora rose
- purple loostrife
- yellow iris

We also have some very harmful aquatic invasive plants, including:

- Eurasian milfoil
- *Phragmites*
- Water chestnut

Some invasives are such a threat that they need to be reported to the state. Examples include mile-a-minute vine, giant hogweed, hydrilla, and water hyacinth. Complete lists are compiled by state, so check your state's

agricultural or conservation website. Websites with current lists of invasives can be found in the Learn More section.

State and local authorities sometimes attack invasive species very aggressively when they first appear, in hopes of eradicating them entirely, at least locally. This is currently the case with Asian longhorned beetle, mile-a-minute vine, and giant hogweed. If an invasive becomes established in an area, it is almost impossible to eradicate, and goal of elimination turns to efforts to manage and mitigate the damage. These efforts include prohibiting the sale of invasive species, removing them from sensitive areas, initiating biological controls that will be permanently incorporated into an ecosystem, and public education to prevent planting and spreading. You may be familiar with some of our already established invasive insects: gypsy moth, hemlock woolly adelgid, lily leaf beetle, viburnum leaf beetle, and winter moth. A sampling of invasive plants that fall into this category includes winged euonymous, Japanese knotweed, Oriental bittersweet and *Phragmites*.

Ecosytems Checklist

- ☐ Encourage more native species on your property.
- ☐ Be aware of invasive plants and animals and remove them from your property if possible.
- ☐ Preserve any existing plants that attract native fauna, such as: oak, black cherry, crabapple, blueberries, huckleberries, native wild roses, red cedar, elderberry, shrubby dogwood, goldenrod, aster, sedges, native grasses.
- ☐ Learn about the water cycles, plants and animals in your local ecosystem.
- ☐ Go on nature walks and observe nature's landscaping: see how certain plants prefer sun or shade, wet or dry; the way certain plants and animals are found together; how fallen leaves and pine needles act as natural mulch and fertilizer; how seeds are spread; etc.

Precious Water

> Be praised, My Lord, through Sister Water; she is very useful, and humble, and precious, and pure."
>
> – Francis of Assisi, 1225

Photo: Copyright © Rick Darke

Natural Water Cycles

Water continually flows through ecosystems, interacting with and transporting materials below ground, in living matter, in the air (in the form of water vapor), and in streams, ponds, lakes and oceans. Water is quite literally the blood of life. From deserts to vernal pools, the composition of life in an ecosystem is entirely dependent upon water.

In the Northeast, nearly the entire population of the spotted salamander and many of the spring peeper frogs migrate to vernal pools to spawn on a single rainy night in March. Without the wet winters and spring rains, there would be no vernal pools, no migration, no reproduction, no salamanders or frogs.

On your own property, you can unknowingly interrupt natural water cycles and impact your local ecosystem. Installing pavement or other surfaces that inhibit the percolation of water into the ground prevents rainwater from adding to the groundwater that ultimately feeds rivers and streams. It also prevents the recharging of aquifers where water is naturally stored underground and serves as the source of well water. Rainwater instead runs off into storm drains, and rather than being filtered and cleaned by biological activity in the ground, it picks up contaminants from the streets and carries them into streams, ponds, rivers and, eventually, the sea.

Irrigating your yard also alters your local water cycle. Irrigation makes your property wetter than it ought to be, and, if the water comes from your municipality's wells or your own, also removes water from groundwater flows. Irrigation enables you to grow moisture-loving plants, but it also promotes a fungal and insect life that might not otherwise thrive in your yard. It reduces stream flow to nearby rivers by drawing on subsurface water that would otherwise flow to the rivers. Landscape irrigation is now so pervasive, even in the relatively water-rich Northeast, that more than 75% of the major river basins in Massachusetts (to cite one example) are suffering from low water and damaged natural ecosystems. During the summer when rainfall is low and irrigation use is high, many public drinking water supplies experience shortages and institute watering bans to protect water supplies and avoid the risk of contaminating aquifers.

When planning your landscape, take note of the natural water flows on your property (e.g. streams, vernal pools, springs), and in your neighborhood, and create designs to protect them. Work to minimize runoff by using permeable materials such as brick or gravel for driveways and walkways instead of solid surfaces, and designing landscaping to capture or slow the movement of water so that rainwater seeps into the ground. The rule for rainwater is: "Let it soak in." Rain that pours off roofs, pavement and hard-packed or bare soil causes flooding, erosion, polluted streams and rivers, and fouls the water for fish and wildlife. Limit run-off by:

- directing downspouts out into lawns, low areas, drywells, rain barrels (for later use in garden areas);
- using compost and mulch to reduce erosion;
- planting dense vegetation near streams and ponds;
- using gravel or brick instead of asphalt.

Minimizing Water Use

The rule of thumb for watering is to keep it to the absolute minimum. It is possible to design a landscape that requires no watering at all. The idea is to establish an ecosystem on your property that is adapted to your soil types and rainfall patterns. The exception to this rule is establishing young plants. When first planted, most plants are susceptible to drought and need intermittent watering to become established. For annual vegetable gardens and some perennial fruit gardens, regular watering may be required during dry periods to ensure a good harvest.

The key to reducing watering to a minimum is planting the right plant in the right place at the right time. Planting species that are native or adapted to your region, planting them where they will receive the right amount of light and in soil that suits them, and planting them at

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the ideal time (e.g. perennials in the fall), will eliminate the need for ongoing irrigation. Incorporating compost into the soil and covering the soil with organic mulch will increase water retention in the soil and reduce the need for watering. These practices are an extension of xeriscaping, a series of techniques developed in the drought-prone West, that includes all of the following: planning and design, analyzing the soil, selecting suitable plants, minimizing turf areas, efficient irrigation, using mulches, and low maintenance.

If you have irrigation already installed, ensure that it is leak-free and properly adjusted. You need also a functional rain shut-off valve to prevent overwatering and waste. Learn how to reprogram the system to match seasonal water needs and do so regularly to minimize water use and, if possible, wean plants from irrigation entirely.

Improving Water Quality

Water that runs off of your property and into storm drains can carry pollutants into streams, rivers, lakes and the ocean. There are some simple things you can do to help keep these water bodies clean. The most important is to make sure that rain that falls on your property seeps back into the ground on your property and doesn't run off to the street, storm drain or create erosion channels in the dirt. It is also important to stop using toxic materials like herbicides or insecticides on your lawn and gardens and avoid allowing oil and solvents to contaminate your property. A drop of oil on a driveway or garage floor will soon be washed away, eventually finding its way into ground water or streams and ponds. If you do spill oil, solvents, fertilizers or pesticides, clean up the spill with paper or absorbent material and dispose of it in the trash. If there is a lot of material to dispose of, for example an open a package you don't want to use, take it to a municipal hazardous waste pickup.

Water Checklist

- ☐ Choose natives and species adapted to your property and your climate.
- ☐ Mix compost into the soil to improve water retention. Cover bare soil with mulch, compost, or plantings to reduce evaporation.
- ☐ If watering becomes necessary, do so only in the early morning to reduce evaporative losses and to avoid encouraging fungal diseases.
- ☐ Water only new grass and plants and wean them from irrigation as soon as they become established. Allow mature grass to go dormant during dry spells.
- ☐ Turn off automatic sprinklers, and water only when plants require it. In no case should you water more than once per week or you will encourage shallow rooting, weed germination, and fungus. Exact schedule would depend on weather conditions, plant types and age, soil condition and regional water conservation requirements (such as watering bans)
- ☐ Allow runoff to infiltrate into the ground on your property by diverting roof runoff into low-lying areas or dry wells, or into rain barrels for later use.
- ☐ Maintain natural vegetation buffers next to wetlands and watercourses to filter chemicals from runoff.
- ☐ Prevent contamination of stormwater by minimizing the use of cleansers, oil, solvents, and other pollutants. Use cardboard or other absorbent materials to catch oil and chemicals when working on your car and dispose of such materials in the trash. Do not allow rinse water containing chemicals to flow directly into the street.
- ☐ Never apply excess amounts of fertilizers or soil amendments (follow the instructions on the bag; more is NOT better). Never allow fertilizers or soil amendments to remain on a street, sidewalk, driveway or other hard surface. If you use a spreader (drop or broadcast), brush all material from pavement or walkways back onto turf or plant beds.
- ☐ Never dump anything down a storm drain.

Energy Conservation

> What's the use of a fine house if you haven't got a tolerable planet to put it on?"
>
> —Henry David Thoreau

Photo: Reto Stöckli, Nazmi El Saleous, and Marit Jentoft-Nilsen, NASA

Landscaping for Energy Savings

We all know time is money, but energy is money too. Furthermore, awareness is growing of the dramatic impact on both the local and global scale of the persistent, heavy use of fossil fuels. In addition to pollution, environmental degradation due to drilling and mining, and the geo-political ramifications of depending on these sources of energy, there is now the specter of climate change appearing on the horizon and all that that implies.

Landscaping choices have a big impact on energy use, from lawn mowing to fertilizer choices to shade trees. Most landscaping installation jobs use copious quantities of petroleum for transportation and heavy power

equipment. Landscaping maintenance also uses petroleum, for lawn mowers, blowers, hedge trimmers and weed whackers. Less obvious is the "embodied" energy found in landscaping materials. Embodied energy is the energy used to create a product, move it to the point of sale or use, and if necessary dispose of it at the end of its life cycle. The production of synthetic fertilizers requires the burning of fossil fuels, and trucking the heavy bags requires yet more. Synthetic nitrogen fertilizer is particularly damaging, contributing to carbon dioxide (CO_2) emissions in its production and transportation, facilitating the release of the potent greenhouse gas N_2O (nitrous oxide) with its use, and contributing to the disruption of the global nitrogen cycle (see Learn More under Fertilizers). Even tap water embodies energy, whether it is pumped from the ground or delivered under pressure through an intricate system of pipes—after being treated with chemicals that also embody energy.

There are some simple things you can do to reduce the energy needs of your home and yard. To start with, fill your landscape with plants. Having more cool green trees, shrubs and grass rather than hot dry pavement, cement, rubber, plastic, brick, gravel, etc. will help cool your house in summer and make your yard much more pleasant. Give some thought to plant location. In the Northeast, place evergreen trees like pines and hemlocks on the north side of your house, and deciduous trees like maple and oak on the south side. The evergreens give your house protection from the cold north winds in the winter and reduce your heating costs, and since they are on the north side of your house, they don't block the weak winter sun. The deciduous trees fully leaf out and give your house shade and reduce your cooling costs in summer, while in winter they drop their leaves and let the sun shine fully on your house to warm it.

Reducing the embodied energy of materials is as simple as using locally produced materials. See if you can get plants from a local nursery, or use locally grown natives. Make compost using leaves and trimmings from your own property, or pick it up at your town composting facility. Seaweed (rinsed) makes excellent mulch if you live near the shore. Grow vegetables or perennial fruits in your landscape to reduce food transportation costs (and to have delicious fresh produce). Use perennials and long-lived trees and shrubs rather than buying and planting annuals every year. Fertilize and water sparingly so that you have to prune and mow less. Use hand tools (keep the blades sharp to save your energy!). If your lawn is small, get a push reel mower or a rechargeable electric mower. If you hire a landscaper, choose someone local to reduce the energy required to get trucks and machinery to your house.

Energy Checklist

- ☐ Plant evergreens to the north of your house, deciduous trees to the south.
- ☐ Buy local materials and plants.
- ☐ Make your own compost.
- ☐ Minimize fertilizer and water use.
- ☐ Consider having a lawn small enough for a push-reel mower!

Secrets in the Soil

> A person's a person,
> no matter how small."
>
> —Dr. Seuss
> (Horton Hears a Who!)

Photo: Globular Springtail (*Sminthurinus henshawi*)

Soil Is Alive

The foundation of organic land care is knowledge of and proper care for the soil. A healthy soil supports a large and active population of tiny, beneficial organisms; is free of compaction, pesticides and other toxins, as well as salt buildup; and contains a proper balance of organic matter and nutrients. The community of organisms that inhabits the soil is known as the soil food web. The soil food web consists of worms and insects, which you can see, but also billions of microscopic creatures that inhabit every spoonful of soil. A healthy soil food web:

- forms protective layers around roots;
- helps plants obtain nutrients from the soil;
- breaks down toxic compounds that inhibit plant growth;

- improves disease suppression; and
- improves the soil texture, making it easier for roots to grow and obtain nutrients and water.

In natural systems, organic matter is provided by decaying roots and stems, animal droppings, and, in forested areas, the autumn leaf drop. This organic material decays in place and is reused by living plants and animals. A thriving microbial community digests and breaks down this organic matter, releasing nutrients back into the soil. Organic landscapers strive to recreate these living, natural soils that actively support healthy plant life and require very little extra fertilization. They do this by maintaining an optimum organic content in the soil, monitoring the balance of nutrients, pH and soil biology, and working to ensure a thriving, living soil system.

Soil and Planting Principles

There are two basic approaches to preparing the soil before planting. The first is to not amend the native soil at all. This requires great care in selecting plants that match the soil types and site conditions on a property. This process requires fewer inputs and is less expensive, but requires more knowledge. The second approach is to amend the existing soil with compost or organically approved minerals and nutrients to match the plants you want to grow there. In either case, you need to have a soil test (see below) done beforehand to learn what kind of soil you have.

Make sure the plants you choose are not invasive and are well adapted to your specific site, preferably natives, but in any case suitable for your sun, moisture, temperature, soil type, and wind conditions. Avoid using one or two species; the more variety, the more likely some or all will thrive on your property.

> Organic landscapers strive to recreate living, natural soils that actively support healthy plant life and require very little extra fertilization.

When planting trees and shrubs, dig a hole 2-3 times the diameter of the root spread, and only deep enough so that the top of the root ball (where the trunk flairs out to start the root system) is at ground level. Amend the soil according to the needs of the particular shrub, but it is best if your native soil type matches the shrub's needs already. Water the new plants thoroughly and then as needed during the first growing season. Thereafter, gradually reduce watering frequency in order to wean the shrub off irrigation altogether. Apply compost or mulch 1"-3" deep around the newly planted tree or shrub. Make sure to keep the mulch/compost 2"-3" away from the trunk or stem of the plant. Do not allow mulch to touch the bark of the trees and shrubs. For links to informative guides for planting trees and shrubs see the Learn More section.

Soil Testing the Easy Way

The first step when working on your landscape is to take a soil test, although it's never too late to do a test. A soil test will tell you exactly what your lawn or garden needs so you can add only those nutrients that are necessary and in just the right amounts. The test results provide essential information about levels of

minerals, nutrients, organic matter, and other essential components. A standard soil test is used to determine soil pH (an indication of acidity); the percentage of organic matter in the soil; and any nutrient or mineral deficiencies, excesses, or imbalances. A more comprehensive soil bioassay can evaluate the presence and numbers of soil organisms such as fungi, bacteria, nematodes, and protozoa. You can find a list of soil testing laboratories in the Learn More section.

Taking soil samples and preparing them for shipment to a lab is not difficult and does not require special tools. The lab you choose will provide you with complete instructions. After testing your soil samples, the lab will send you a report on the chemistry of your soil and give you specific recommendations of what types of fertilizers and nutrients to add to optimize the soil for the plants you want to grow. It is important to note that a soil test will yield meaningful results only when a representative sample is collected and prepared for each area of interest (the vegetable garden, the lawn, the perennial bed, around a tree, etc.).

The report lists the pH and organic matter content of your soil, and how much available nitrogen (N), phosphorus (P), and potassium (K) the soil has. Soil can also be tested for the minor (but important) nutrients magnesium (Mg), calcium (Ca), sulfur (S), boron (B), manganese (Mn), and zinc (Zn), as well as toxic heavy metals like lead (Pb), arsenic (As), and cadmium (Cd). The report will offer suggestions that may include increasing or decreasing the pH of your soil, or adding some of the above nutrients, usually in the form of fertilizers or compost. The recommendations will specify how many pounds of each nutrient to add per 1,000 square feet. Always follow the soil test recommendations, substituting organic materials for synthetic recommendations if necessary. Don't fall into the habit of adding a little more nitrogen or phosphorus to increase growth. More is not better. Over-fertilizing can cause water pollution, pest outbreaks, and a range of problems in the landscape.

Soil Checklist

- ☐ Contemplate, for a moment, the 1 billion organisms living in a handful of dirt from your backyard and the great wealth of services they provide to your landscape, free of charge.
- ☐ Protect your soil and the creatures who live there from toxins and salts.
- ☐ Recycle all the organic debris produced by your landscape back into the soil by leaving grass clippings on the lawn, mulching with leaves, woody debris and other plant material, and composting. This will help to maintain a thriving population of soil organisms.
- ☐ Have your soil tested before planting trees or shrubs or renovating a lawn.
- ☐ Have your soil tested before adding fertilizers or soil amendments.
- ☐ If you hire a landscape professional, ensure that he or she performs a soil test before applying anything to your yard.

Compost, Fertilizers, Mulches and other Soil Amendments

Use In Moderation, and After a Soil Test

Fertilizers and soil amendments are tools that enable us to modify existing soil conditions. The "feed the soil" principle is used to benefit plant health, not artificially stimulate plant growth. Unnecessary applications of any fertilizer, compost, or soil amendment can cause nutrients to build up to excessive levels in the soil. At such levels, nutrients may adversely affect the plants and pollute local water resources. Nitrogen and phosphorus are the nutrients most involved in eutrophication of water bodies (nitrogen in oceans, phosphorus in fresh water lakes and ponds), causing excessive aquatic plant growth and toxic algae blooms that can kill native plants and animals. Nitrates are also a hazard to human

> "My whole life has been spent waiting for an epiphany, a manifestation of God's presence, the kind of transcendent, magical experience that lets you see your place in the big picture. And that is what I had with my first compost heap. I love compost and I believe that composting can save not the entire world, but a good portion of it."
>
> – Bette Midler 1996

Photo: Homemade compost. Copyright © Sarah Little

health when they pollute drinking water supplies. The abundance and availability of mineral elements in the soil depends on factors specific to each site. A soil test will be able to give an accurate picture of the soil make-up and chemistry, how it affects mineral availability, and help you determine exactly what to apply.

Soils with an organic matter content of 5% or more generally will not need any additional fertilizer – the nutrients released by the organic matter are adequate for most landscape plantings. You can maintain this level of organic matter in your soil by returning organic matter to the soil in the form of mulch (leaves, prunings, grass clippings, etc.) and compost.

If a soil tests indicates a deficiency, consider that there are many product options. When choosing a product, it is preferred to use renewable materials that are locally and sustainably produced, such as from your own property. Many nutrient amendments are mined or harvested from natural sources that are not renewable, and transported over long distances. We do not want to deplete these resources for our short-term benefit. Mining and processing some nutrients, such as phosphorus, also causes local environmental damage. We should not damage the environment elsewhere for our short-term benefit, either.

Organic fertilizers are defined here as having no synthetic materials in the formulation. A balanced organic fertilizer will add the major plant nutrients: nitrogen (N), phosphorus (P) and potassium (K) along with micronutrients and trace minerals. All these nutrients are important for plant growth and a healthy soil, which helps plants develop strong roots, stems and leaves, and helps them resist disease and insect damage. Organic fertilizers will often have an N-P-K ratio in the range of 4-3-3 (which means 4% by weight nitrogen, 3% by weight phosphorus, and 3% by weight potassium) or lower, which is a relatively low percentage compared to available synthetic fertilizers. If an "organic" fertilizer contains N, P, or K near the 10% range, chances are it contains a substance prohibited in an organic program, and you risk run-off of excess nitrogen. Study the label carefully. Avoid synthetic ingredients such as superphosphate and harmful "natural ingredients" such as nitrate of soda that contains excess sodium.

The main drawbacks of using synthetic chemical fertilizers, which can be formulated to be quick or slow release, are the risk of excess soluble nutrient pollution, that their high salt content can damage soil organisms, and that they create acidic reactions in the soil. In addition, their manufacture requires the burning of fossil fuels, and from a regional and global perspective, their current usage on landscapes adds significantly to phosphorus and nitrogen excesses in lakes, rivers and oceans.

Quality compost is a wonderful soil amendment and adds valuable organic matter and beneficial organisms along with nutrients. Read labels carefully and avoid any product that contains sewage sludge (also referred to as biosolids), which may contain harmful heavy metal contaminants. Wetting agents (synthetic polymer additives) in compost should also be avoided. The soil testing laboratory in your state can analyze compost samples using the same testing as for soil samples. Organic compost can be purchased at local garden centers and sometimes obtained for free from your town's munici-

pal recycling facility. You can also make your own with leaves, yard clippings, and kitchen waste.

Good quality compost should have the following characteristics: a pleasant, earthy smell, a dark brown or black, not grey color, the consistency of crumbled chocolate cake (not feel sandy or slimy). A simple test for the presence of weed seeds is to put some of the compost in pots, water it, and see if any weeds germinate over the course of a few weeks. A simple test for the presence of herbicide residues is to plant legume seeds such as peas or beans in pots of compost. Legumes and sunflower seeds are very sensitive to herbicide residue and will exhibit "leaf curl" after the 2nd set of leaves emerges if herbicide residues are present.

Compost, Making and Using It!

Compost has many advantages as a soil amendment and it is less likely to cause pollution of the local and regional environment than fertilizers, even organic ones. Incorporating compost improves turf, shrub and shade tree performance especially in marginal or poor soils. Good quality compost improves soil structure, reduces runoff and compaction, enhances biodiversity, increases water and nutrient retention, increases microbial activity, supplies nutrients, helps suppress and prevent plant diseases, detoxifies certain pesticides, and inactivates and kills potential human pathogens. The benefits to the plants are: improved establishment of turf, ornamentals and shade trees; improved color; increased root growth; and reduced need for fertilizer, pesticides, and irrigation.

Composting is easy. For home use, buy or make a compost bin that is about 3' x 3' x 3'. Put about 1' of leaves, hay or dry grass in the bottom. As you start putting in your kitchen scraps, add three parts "browns" to one part "greens" and away you go! Browns are materials high in carbon, like fall leaves, straw, salt marsh hay, shredded paper, paper towels, cardboard, chipped brush, sawdust, pine needles etc. Greens are materials high in nitrogen, like fresh grass clippings, weeds (not seeds, vines or roots), vegetables, fruits, seaweed, eggshells, coffee grounds and filters, tea bags, manure (horse, cow, rabbit, chicken, goat, guinea pig etc.). You can layer these materials as you add them, and/or turn the pile every few weeks to keep it oxygenated. Add a bit of soil or finished compost to increase microbial diversity now and then. Keep it damp. If you turn it regularly, it should be ready in a few months. If you layer it and leave it, it might take a year. In the end, you'll have beautiful finished compost you can use in your gardens, as mulch, or sprinkle on your lawn. It can be applied to your lawn in early spring and late summer by top-dressing to 1/4" depth.

> Soils with an organic matter content of 5% or more generally will not need any additional fertilizer – the nutrients released by the organic matter are adequate for most landscape plantings.

Compost tea is a liquid made from adding a relatively small amount of finished compost to water, pumping air through it to aerate it, and adding a source of "food" to increase the numbers of beneficial bacteria and fungi. It is becoming very popular with professional organic landscapers, especially for maintaining established organic

lawns and athletic turf because it is relatively easy to apply and they are happy with the results. While compost tea may be easier to apply than compost, and typically provides some nutrients and an abundance of beneficial microbes to the soil, it does not substantially increase the organic content of the soil, as compost does. There are few scientific studies on its use, and it is tricky to make properly. Since it is still more an art than a science it's hard to recommend to the homeowner just now. If you want to learn more, especially as it applies to lawn and turf, check out the link to Harvard University, listed in Learn More, where it is part of their lawn maintenance program.

Nitrogen, Phosphorus, Potassium (NPK)

Nitrogen (N) is an essential plant nutrient required to create amino acids and proteins, genetic material, chlorophyll, and other important biochemical molecules. Nitrogen is the most abundant gas in the atmosphere (78%), but the gaseous form (N_2) is inert and unavailable for use by animals and most plants. Use of nitrogen fertilizers has an adverse affect on local and global nitrogen cycles. Turning N_2 into biologically available nitrogen, or "fixing" it, requires breaking the bond between the nitrogen atoms, which requires energy. Under natural conditions nitrogen is "fixed" by lightning strikes through the atmosphere or by the work of a few naturally occurring species of bacteria. The amount of new, naturally "fixed" nitrogen being produced at any time is quite small compared to the amount already fixed and cycling through an ecosystem. Human activities have almost doubled the amount of fixed nitrogen entering the global cycle through the industrial production of fertilizer, selective cultivation of nitrogen-fixing plants, and the burning of fossil fuels. These activities have affected natural systems by increasing greenhouse gases in the atmosphere, creating overgrowth of algae followed by oxygen depletion and "dead zones" in marine estuaries, depleting the ozone layer, increasing acid rain, creating smog, and changing ecosystem balances by favoring nitrogen-tolerant plants over other species while creating deficiencies in other nutrients (calcium, potassium, and magnesium).

Phosphorus (P), in the form of phosphate, is an essential nutrient for every living organism. It enters soils in natural systems by rock weathering, and surface runoff removes it from soils and carries it through aquatic systems to lakes and oceans, where it settles into deep water sediments. Use of phosphorus comes with two problems. First, because of the length of time involved in natural cycling, phosphorus is, for all practical purposes, a nonrenewable resource. Humans get phosphorus from very limited sources around the world by mining phosphorus bearing rock and guano (excrement of bats, birds, and seals). Most of this phosphorus is turned into fertilizers and applied to soils. Recent studies have indicated that global supplies of phosphorus are running low, and remaining supplies are high in the toxic element cadmium (see Learn More). It is essential to avoid wasting phosphorus by over-applying it to soil, and it is important to retain phosphorus by composting plant and animal materials and using the compost on site. The second problem is that excess phosphorus, not bound in the soil or used by the plants, is carried into aquatic ecosystems. In ponds and lakes, excess phosphorus can substantially increase plant productivity and lead to eutrophic conditions such as increased algal and phytoplankton growth, loss of dissolved oxygen, and loss of animal life.

If a standard soil test gives a rating of medium or above for phosphorus, then no additional phosphorus should be applied. In this case, grass clippings, compost, and soil available phosphorus can supply all the plant's phosphorus needs. Organic fertilizers and compost, made with plant and animal nitrogen sources, also contain phosphorus; therefore, their use should be limited by the requirements for phosphorus as determined by a soil test.

Potassium (K) is essential for plant photosynthesis, plant metabolism, and the vascular system that moves water and chemicals inside the plant. In order for soil potassium to be available to plants, it must be in a form that can move easily through the soil. This depends on pH, moisture, temperature, oxygen, and mineral composition of the soil. Soil with high organic content is good at holding potassium and making it available to the plants. Compost and grass clippings returned to your lawn can supply most potassium needs of native plants and biologically diverse lawns.

pH Adjusters

One of the most important characteristics of soil is its pH, which is an indicator of the soil's acidity or alkalinity. pH ranges from 1 - very acid, to 14 – very alkaline with a pH of 7 being neutral. The pH determines the availability of most nutrients in the soil. Nutrients may be present, but if the soil is too acidic (pH below 6) or too alkaline (pH above 8), the nutrients will become less available to the plant. pH should be adjusted based on a soil test and the specific material you use depends on calcium/magnesium ratio in the soil. Well-composted, neutral pH (6.0-6.5) compost can be used to reduce acidity slowly over time. (Unfinished or acidic compost can increase acidity.) For faster results, you can use: aragonite, calcitic limestone (calcium carbonate), dolomitic limestone (calcium magnesium carbonate, if your magnesium is low), or wood ash (make sure it is not from pressure treated wood or other toxic materials). To reduce pH to make soil more acidic, you can use granulated sulfur. Lawns and many, but not all, plants like a pH between above 6.0 and below 7.0, and are most happy at around pH 6.5. Some plants prefer acid soil, blueberries for example, and should not be limed.

Micronutrients and Microorganisms

It is generally not necessary for the homeowner to fine-tune the micronutrients such as manganese, zinc, boron, copper, iron, molybdenum, chlorine because most soils have these already present. It is more useful to make sure the soil is at a proper pH so that these micronutrients are available to the plants. Changes in the pH can dramatically affect availability to plants. Using compost also helps ensure a neutral pH. Compost will also help ensure that the soil has an active microorganism population that contributes to making nutrients biologically available to the plants. You can learn more about micronutrients and microorganisms in the Learn More section at the end.

Mulches

Mulch is a layer of material—either organic (wood or bark chips, leaves, seaweed, etc) or inorganic (gravel, sand, etc) —applied to the soil surface. The natural state of soils in this bioregion is to be covered with plant material—whether alive, dead, or both. This layer performs many functions that are vital to plant and soil health.

Organic mulches such as decomposed leaves, compost, seaweed or other decomposed plant matter mimic this natural cover by adding organic matter, humus, and nutrients to the soil; providing a substrate for beneficial microorganisms; retaining moisture; controlling erosion; moderating soil temperature fluctuations; and helping to suppress weeds. Inorganic mulches, such as stone, gravel, plastic or weed barrier fabrics are less desirable because they do not contribute to soil or plant health and are usually more ecologically harmful to produce and transport, but they can sometimes be reused and do not need to be replenished as often as organic mulches.

The proper application of mulch is very important. Too much mulch (more than 3" in depth) can inhibit the movement of air and moisture into and out of the soil. Mulch piled up against the trunks of plants can cause the bark to rot, leaving the cambium layer under the bark vulnerable to damage. Dormant buds at the base of the trunk can be forced to sprout into surface roots (adventitious roots) that have no alternative but to grow in the mulch layer where there is little or no food or protection. Lastly, rodents can cause serious damage to trunks by tunneling through the mulch and feeding on the bases of plants.

It is important to note that mulches that are high in carbon, such as fresh wood chips, can also be detrimental to plants. The microbes that break down carbonaceous materials are able to out-compete plants for nitrogen, and when these microbes are active in large numbers they effectively tie up the available nitrogen in the soil. As decomposition slows, the microbes die off and release the nitrogen in their bodies back into the soil, but in the short term, plant growth, especially of seedlings and annual transplants, may be slowed.

Beware of commercial mulches: they may be made from undesirable source materials like construction debris, or have undesirable additives like dyes or even pesticides. Make sure you know what you are buying, where it comes from, and what has been added. Even mulch from pure wood chips can become toxic to plants if stored where it does not stay dry and get enough air (see Learn More). Simple leaves or seaweed (rinsed) if you live near the shore, make excellent, and free, mulch.

Fertilizers, Etc. Checklist

- ☐ Make a compost bin for your leaves, garden debris, and kitchen vegetable scraps. Feed your compost bin.
- ☐ Leave grass clippings on the lawn to replenish nutrients and organic matter.
- ☐ Get a soil test.
- ☐ Mulch your gardens and shrubs; use materials from your yard such as leaves, pine needles, and chipped brush.
- ☐ Don't put mulch against the bark of trees and woody shrubs.
- ☐ Read the label carefully and understand what is in any soil amendment before you buy it.
- ☐ Match the soil to your plant, and match your plant to your soil.

Lawns

Lawn Alternatives

A lawn is an area of land covered with closely cropped plants, usually grasses. Most lawn grasses used today in the Northeast are sun-loving, sod-forming, cool-season species of European descent. Their genetic predisposition is to grow tall, produce flowers and seed, and become dormant during the heat and relative dryness of summer. Lawn maintenance that consists of continuous mowing close to the ground, removing the grass clippings, and fertilizing and watering throughout the warm, dry summer season - puts lawns under constant stress, causing a chronic dependence on water, fertilizer and pesticides to keep them green and lush.

> "In London, October had begun with a week of brilliant Indian summer, and the noise of the mowers came up from Regent's Park and in through the wide open window of M's Office. They were motor-mowers and James Bond reflected that one of the most beautiful noises of summer, the drowsy iron song of the old machines, was going forever from the world... At least the cut grass would smell the same."
>
> – Ian Fleming, 1960, (For Your Eyes Only)

The energy and resources required to maintain a weed-free, summer-green, vast grass carpet cause a great deal of collateral environmental damage. The manufacture and use of machinery for installing and maintaining lawns require huge amounts of energy and create air, water, soil, and noise pollution. The manufacture, transportation, and application of pesticides and fertilizers demand yet more energy and releases pollutants into the environment at every stage. Limiting broad stretches of the cultivated landscape to a handful of grass species and varieties reduces biodiversity. Quite simply, conventional suburban lawns, as a rule, are not ecologically sustainable.

Fortunately, there are many beautiful, low-maintenance, alternatives to conventional lawns including organic lawns, native flower gardens, perennial ornamental gardens, meadows, woodland gardens, perennial food gardens, wildlife habitats and "freedom lawns" (lawns that are free to grow whatever survives the lawn mower). You can also convert part of your lawn into a vegetable garden and reap the benefits of fresh organic vegetables.

In sunny areas, low-growing plants and grass-like species that are drought-tolerant, nutrient efficient, and disease resistant can be used. Incorporating certain leguminous (nitrogen-fixing) broadleaf plants such as clovers and trefoil with native grasses adds diversity and durability and provides a supply of natural nitrogen to the lawn. For sunny areas that will not be mowed frequently, mixtures of native grasses like sedges and fescues as well as wildflowers can be planted as a meadow garden. The "no mow" grass mixes, composed of fescues that are naturally compact and require infrequent mowing (though mowing at least once a year to discourage woody perennials), are another alternative. In areas too shady for any grass to grow, shade-tolerant, low-maintenance natives such as ferns, moss, wildflowers or perennials, shrubs, and trees can add beauty and increase the biodiversity of the landscape. Special attention should be given to plants that are native to the region to increase local biodiversity. In marginal areas of the landscape, just allowing the lawn that already exists (free of invasive species) to grow "wild" will provide an economical, ecological, and sustainable alternative to the high-maintenance lawn, and provide food and cover for wildlife. The Learn More section provides a website with more information on lawn alternatives and using native grasses in lawns.

A Shout for White Clover

Thousands of biological, chemical and physical elements above and below ground make up the particular ecosystem called your yard. These players will do most of the nutrient recycling, water conservation, and pest control for you, if you let them. Use of synthetic chemicals can suppress a variety of these natural chemical and biological processes. A simple example of this is white clover.

White clover was considered an attractive and necessary component of healthy turf until the 1950s, and was often included in grass seed mixes. Though not a native, it helps to deliver the essential nutrient nitrogen to enrich the growth of grass. Clover does this without dominating grass because it is easily managed with mowing and fertilizing: mowing at 3" and withholding fertilizer will favor a reasonable grass-to-clover ratio of about 60/40. Higher mowing or using fertilizer will reduce the amount

of clover. (Keep in mind that clover flower heads will attract a variety of bees. Trimming regularly with a mower during flowering season can minimize this.) It is drought tolerant when not thickly planted, so the lawn looks greener without watering when cool season grasses have gone dormant in the summer. Plus, white clover has no serious pests. The advent of herbicides made it possible to selectively eliminate all non-grass plants, and clover, though not previously considered a weed, suffered collateral damage. Ultimately, it fell out of fashion, became classified a weed, and is now considered an aesthetic annoyance. Ecosystem-minded land managers, though, realize that clover helps turf and reduces a lawn's nitrogen needs. This simple plant can save the organic homeowner hundreds of dollars each year in material and labor costs by reducing the need for additional nitrogen applications and reducing aesthetic lawn watering requirements.

Your Organic Lawn

Organic lawns can provide beauty, function, cost savings, pest resistance, drought tolerance, ecological services and minimal health risks. All these benefits are maximized if you maintain a lawn dominated by dense, deeply rooted, site-adapted turf grasses.

An established organic lawn is quite simple to maintain, there are really only two things you must do, 1) set your mower as high as it will go (3" to 4"), and 2) leave the grass clippings on the lawn. That's it. With at least 6" deep of good soil, you can go on for years like that. If you lawn doesn't have 6" of good soil, you will need to add topsoil to maintain a healthy organic lawn.

However, if your lawn experiences stressors such as increased traffic, compaction, insect damage, if you have a particularly dry summer, or simply as a precaution, do the following annually: Based on a soil test's recommendation, you can fertilize with an organic fertilizer or spread 1/4" organic compost in early fall and early spring. Add lime only if the pH is below 6.0 and gardener's sulfur if it is above 7.0 (which is unlikely in the Northeast), in accordance with soil test lab recommendations. Every fall and spring add seed to any thin or bare spots with a grass seed mix suited to your area, spread 1/4" compost over them, and water lightly until the grass is established.

Organic lawns, with their emphasis on diversity, will almost always have some non-turfgrass species mixed in, for example clover, yarrow, mosses and numerous other plants that can live in the understory of high-mown grasses. Usually these plants increase the resilience and beauty of your lawn while staying in the background. However, if they begin to dominate your lawn in a way you are unhappy with, there are further steps you can take. 1) Fertility levels and soil pH can be maintained annually to favor turf grasses by the judicious use of soil amendments and fertilizers, as determined by soil testing. 2) The organic matter and beneficial bacteria and fungi in the soil can be increased by mulching shredded leaves into the lawn in the fall, using nitrogen-fixing plants in the lawn mix, and applying compost. These biologically active additions will also help alleviate thatch problems. 3) Mow using a well-maintained mower with a sharp blade. No more than one-third of the grass blade should be removed at one time, and remember to allow the grass to grow to a height of 3" to 4". The taller grass has

a larger and deeper root system and is more effective at crowding out unwanted weeds.

Different plants thrive in different soil conditions, and the presence of a plant in a given location can tell you about the soil conditions. By looking at the weeds, you can get an idea of why your grass isn't growing there. Examples include:

- plantain is an indicator of shallow, poor, or compacted soil;
- moss prefers low pH and shade (though it can grow in a wide variety of conditions);
- sedges like wet soil;
- crabgrass grows in compacted, drought and heat-stressed soil and where grass is thin;
- and violets thrive in the shade.

There are many others indicator weeds, see Learn More.

On healthy, established turf, systematic watering is generally not needed and is not recommended. Generally, one inch of water per week is adequate for turf, and in New England, rainfall often provides a good share of that throughout all but the driest times of year. Water is a precious resource requiring large amounts of energy and infrastructure to deliver. In general, overwatered lawns are prone to disease and have shallow root systems that make them less tolerant of traffic and more prone to a variety of pest problems. If watering an established lawn becomes necessary, it should be watered deeply (to a depth of 6" or more) and infrequently (no more than once per week). The soil needs to dry out partially between waterings to allow gas exchange between the soil and the atmosphere and reduce the risk of fungal diseases. Too much water will suffocating roots and soil life and reducing the health of the grass plants. Watering should be measured and/or timed and the saturation depth checked with a shovel to determine how long to water a particular area. You can measure 1" of both rainfall and irrigation easily with a simple rain gauge or empty tuna can.

If you chose not to water your lawn, and there has been a dry summer, plan on a late summer-early fall seeding plus a fertilization to enhance the recovery of the plants and encourage the rapid establishment of the new seedlings.

Renovating an Existing Lawn

If you are really unhappy with your current lawn, either because of the way it looks or because you want to get it off conventional pesticide management, or both, and you are in a hurry to build a functioning organic ecosystem supporting healthy turfgrass, you might consider hiring an organic lawn professional. A professional will be able to address such underlying problems as too little topsoil, widespread and pernicious weeds, drainage problems, compaction, light problems, and salt and insect damage. He or she will help identify the proper soil amendments to balance the soil nutrients and biology to be ideal for turf grass.

It may be three years before a functioning organic turf ecosystem is fully established. In fact, until the process of building up soil organic matter and soil biology and encouraging the grass plants to develop healthy root systems has been completed, lawn or turf may be susceptible to more weed infestation and insect damage than you are used to under a conventional synthetic

management program. In the long run, an established organic lawn will deliver function and beauty while requiring minimal maintenance.

New Lawns From Scratch

Generally, rather than tear up your yard, you will be more successful if you renovate and keep some of your existing plants that have already adapted to your yard. Of course, there are cases where you need to install a new lawn from scratch. You might have just had construction done, or had some other major damage to your lawn. You will probably need to hire a professional for all or part of a new lawn installation. Proper installation can make or break a lawn. It will determine the long-term beauty and health, and can greatly reduce the need for routine inputs like fertilizer and water. Here are some things to consider when you talk to your landscaper about a lawn installation.

Installation of a new lawn is best undertaken in late summer or early fall when temperatures and rainfall are optimum for cool season grasses. If you must install a lawn in the spring, consider using an annual rye grass. Then in early fall, till it in and seed two weeks later with a perennial cool season grass mix or native grasses. The annual rye will germinate quickly, give you a nice lawn for the summer, and hold the soil until fall when cool-season turf grasses are best planted.

One of the key elements of a successful new lawn is properly prepared soil. Soil amendments, as specified by soil test results, are incorporated into the seedbed, with the pH adjusted to about 6.5. Topsoil should be at least 6" deep and 3-5% organic matter. All weeds should be

> Proper installation can make or break a lawn. It will determine the long-term beauty and health, and can greatly reduce the need for routine inputs like fertilizer and water.

removed. The surface needs to be graded with careful consideration to maintain drainage away from house and avoiding steep drops or the creation of erosion channels. Use a seed mixture that is adapted to, and tolerant of, the particular growing conditions of the site. There are many insect- and/or disease-resistant, sun- or shade-tolerant, species and cultivars, as well as native fescues and sedges to choose from. See Learn More for websites with information about grass seeds. Endophytically enhanced grass seed contains a naturally occurring fungus that discourages insects from eating the grass blade. It protects the grass from surface-feeding insects but should not be used where animals graze, or where the grass may be used as food for domestic animals or wildlife, as it will sicken them. Always use several different species and cultivars in the mix to enhance diversity and increase the chances of success. Consider using some white clover (roughly 1 part clover seed to 15 parts grass seed, sown separately), which will greatly enhance the functioning and reduce the maintenance requirements of your lawn.

Ensure good seed-to-soil contact by lightly rolling or dragging the seed into the soil. Use a thin mulch that is

Lawn Checklist

- ☐ Consider using native fescues and sedges.
- ☐ Reduce area of lawn.
- ☐ Mow high 3"-4".
- ☐ Leave clippings on lawn.
- ☐ Get a soil test.
- ☐ Adjust pH of soil, if needed according to the soil test recommendations; anytime of year.
- ☐ Use natural fertilizers, such as compost, according to soil test recommendations; apply in fall.
- ☐ Avoid the use of toxic materials.
- ☐ Water infrequently, if at all, and do not apply more than 1" of water per week, including rainfall.
- ☐ Seed with a mixture of grasses suitable to your site conditions, in the fall and spring.

as weed-free as possible, such as sterilized straw or salt marsh hay, to enhance germination and control erosion. The seedbed should be watered frequently but shallowly. The ideal situation is to maintain a "uniformly moist" seedbed during germination and establishment. Watering should increase in duration but decrease in frequency once the root system has become established. After several mowings and in the absence of hot, dry weather, watering should gradually be decreased. Watering should be eliminated when not necessary.

Sodding is a form of lawn establishment that provides instant coverage and looks impressive right away. Unfortunately, most sod is composed of high-maintenance grass species that have been given large amounts of synthetic inputs and water in order to grow quickly. Sod arrives with a minimal amount of soil and shallow roots, so careful preparation of the bed and regular deep watering is essential for the survival of the sod. Adding organic matter that has active microbial populations, such as humates, compost, and compost teas, is recommended to help with quick rooting. A sodded lawn often costs several times more, requires greater inputs, and is no more reliable than a lawn properly installed and maintained from seed.

Pest Control

Is it a Pest?

Over 97% of the insects you might find in a grassy area are beneficial or innocent bystanders. They perform, free of charge, such essential services as pest control, pollination, and soil aeration. They keep things tidy by removing and recycling nutrients found in dead material, both plants and animals. These beneficial insects as well as other arthropods, fungi, nematodes, bacteria and even slugs are essential to your local ecosystem. So, when managing a pest outbreak, remember to protect your many existing beneficial creatures by avoiding the broadcasting of pesticides, including organic ones, whenever possible.

> "A man can't be too careful in the choice of his enemies."
> – Oscar Wilde

Photo: Multicolored Asian Lady Beetle (larva of *Harmonia axyridis*). This one is beneficial as a larva, but the adult of this invasive beetle is a bit of a nuisance when it overwinters indoors. Copyright © Sarah Little

Even plants and animals that are considered pests can be beneficial in certain conditions, and it is only when their numbers get out of hand that they become pests. Consider the carpenter ant, who is a major nutrient recycler in the natural environment, but can cause damage to your house if a queen chooses to make a nest there. Many times the number that is "too many" depends simply on your perspective or comfort level, and not on a fundamental problem with your landscape. If you feel you have a pest problem, don't panic! Follow some simple steps to resolve the issue.

Integrated Pest Management

Integrated Pest Management (IPM) is a way of managing pests with the least harmful effect to people, pets and the environment. In an IPM approach, considerable effort is put toward preventing pest problems by controlling conditions and practices that may attract and support pests. Management of pests begins with a five-step process:

1. Identify the pest.
2. Learn about the pest's biology.
3. Determine tolerance levels.
4. Modify the habitat to deter the pest.
5. Monitor pest abundance and damage, if any.

Many times a pest is not present in numbers high enough to warrant control. Other times a natural control (a predator, antagonist, etc.) may be present, preventing serious damage without requiring intervention. You do not need to initiate a pest control measure unless pest numbers exceeds economic, esthetic, or management thresholds. If you are unsure of how many is too many, check with your local cooperative extension publications for specific pests and their thresholds. If control is warranted, oftentimes you can get rid of the immediate pest problem with simple handpicking, vacuuming, water sprays, traps, exclusion, or judicious pruning. Only if the pest remains above tolerance levels after these steps have been followed is chemical control to be considered. Since pesticides can kill beneficial and non-target life forms, it is very important to first accurately identify the pest, know its life cycle, understand how it damages the plant, and determine tolerance thresholds. As a long-term response, cultural methods such as planting different varieties, improving air circulation, addressing drainage problems, installing barriers, or amending the soil based on a soil test should be implemented to prevent future pest outbreaks. By using your knowledge of the pest, the plant, and the local ecosystem; of the natural enemies that limit pest populations; and of the biological and cultural methods that can be used to prevent conditions favorable to disease, you can foster an ecosystem in which pest outbreaks are uncommon.

Pesticides

The federal government defines pesticides as any substance (natural, organic, or synthetic) that kills, repels, or mitigates any pest. This includes insecticides, herbicides, fungicides, rodenticides, and microbicides, etc. Before applying any pesticide, read, understand, and follow all the label instructions and warnings. For pesticides, the label is the law. If the label has an EPA pesticide registration number on it, then it is a pesticide and you must follow the direction on the label for use and disposal. An increasing number of pest management products that are classified as "minimum risk pesticides" and are

thus exempt from EPA registration have come onto the market in recent years. These are often referred to as "25b" pesticides, after the section of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) that created this exemption from Federal registration. The criteria for exemption from registration are that all active and inert ingredients are on the respective EPA lists of materials considered to be demonstrably safe for the intended use. Note that manufacturers of 25b materials for general use are not currently required to demonstrate the efficacy of their materials against pests, so let the buyer beware. These products may not have an EPA registration number on them but may be registered at the state level, and their labels must list all of their ingredients.

Organic pesticides are generally non-synthetic, and the few exceptions use only synthetic ingredients allowed under the USDA National Organic Program (NOP). Lists of organic pesticide products approved by the Organic Materials Review Institute (OMRI) or Baystate Organic Certifiers as being compliant with the NOP are available online (see Learn More).

Organic does not mean non-toxic, and there are two organic pesticides ingredients currently available on the market that are of concern. The first is rotenone, whose use has been associated with Parkinson's disease. The EPA has reclassified this as a restricted use pesticide unavailable to homeowners, but it is still possible to buy products containing rotenone on the open market. The second is pyrethrum, which is banned on school grounds in Massachusetts because it is classified as a carcinogen. Pyrethrins are the organic insecticidal compounds derived from the plant extract pyrethrum.

> Since pesticides can kill beneficial and non-target life forms, it is very important to first accurately identify the pest, know its life cycle, understand how it damages the plant, and determine tolerance thresholds.

If you are choosing an organic pesticide, remember to maximize the effectiveness of the material so that the amount and the number of applications can be kept to a minimum. For example, using a bait to eliminate an ant nest is preferable to spraying them. Using biological agents, called biopesticides, for control of pests can be effective and much less hazardous to the environment than using organic chemical pesticides, if the biological control agent is carefully chosen and its use is well tested. For example, products derived from the bacterium *Bacillus thuringiensis* (*B.t.*) are proteins that have specific binding to the gut of particular groups of insects. So, products from *B.t.* are effective in controlling caterpillars, but have very little effect on other insect groups, other non-target creatures, or on human health. Another example is the beetle *Galerucella calmariensis*, which is reared and released to control the invasive plant, purple loosestrife.

Invasive Plants

It is important to distinguish between nuisance weeds in the yard and invasive plants causing havoc in natural ecosystems. It is strongly recommended that invasive and potentially invasive plants be removed from your prop-

erty if possible. First be sure to correctly identify a plant as invasive (see Learn More) and then determine the best way to remove and dispose of it. Certain invasive plants may be pulled or dug, but care must be exercised to prevent further plant propagation from root or stem fragments, or dislodged seeds. Disturbance of the soil by digging may also bring additional invasive plant seeds to the surface where they can germinate. The best organic removal methods are still being studied but the basic strategies are similar to any organic weed control methods (see below).

After invasive plants are removed, it is important to cover bare areas with mulch or a cover crop so that seeds brought to the surface during the removal process will be less likely to sprout, and also to replant with native species as soon as possible to prevent re-colonization by invasive plants.

Common Weeds

A weed is defined as a plant out of place, one whose desirable attributes have yet, perhaps, to be discovered. A diversity of plants is ideal for your property and many plants can live in your lawn without dominating it. Some plants, though, remain stubbornly in the wrong place.

The key to weed control is to understand your weeds and time your intervention for maximum effect. Careful observation of weed populations and weed seedling emergence patterns after disturbance will help you develop an appropriate weed control program. See the Learn More section for weed identification guides. Staying on top of weed problems through regular monitoring and prompt removal prevents the formation of large weed populations. Many common lawn weeds can be kept in check by simply mowing high, 3"-4", which allows the grass to shade out the weeds, doing a little hand pulling of early seedlings, removing weeds before they set seeds, and filling in the subsequent bare spots with mulch or desired plants. Remember you can adjust soil chemistry, biology, depth, composition and aeration to favor desired plants over weeds. You can also install permanent vertical edging between lawn and garden to prevent grass from creeping into beds.

Prevent weeds before they happen by avoiding conditions that favor weeds. In particular, do not:

- mow too often or too low
- mow during hot, dry weather
- compact soils
- overwater
- apply excessive or ill-timed nitrogen fertilizers (e.g. fertilizing your lawn in late spring or summer encourages annual weeds)

Corn gluten meal is sometimes used as an organic weed preventative (pre-emergent) in the spring, particularly for crabgrass, which is an annual plant, since it prevents the germination of seeds. A better option for lawns in early spring is to spread a perennial grass seed mix in any bare patches or thin spots and sprinkle ¼" compost on top. If you do want to use corn gluten as a pre-emergent, use one application per year of 20 pounds per 1,000 square feet. Note: This is less than the recommended rate due to the high nitrogen content of corn gluten - one application provides 2 lbs. of nitrogen per 1000 square feet. Extra precautions against run-off are required and additional nitrogen fertilization must be reduced accordingly. Make sure you follow up in the fall

by seeding any bare spots with a grass seed mix suitable to the location.

Weed Removal Methods

All organic weed control methods work on the principle of either removing the whole plant, repeatedly killing the leaves, smothering to kill the whole plant, or minimizing the amount of weed seeds allowed to develop. Timing is key – always try to remove weeds before they flower – it is easier when the plants are small and, more importantly, seeds will be prevented from forming and dispersing. "One year's seeding makes seven years weeding" is the old English adage. There are a variety of specialized

Weed Removal Methods To Try

- ☐ Hand pulling, including using hand-powered tools (e.g., dandelion diggers, or Weed Wrench, a tool designed specifically for removing invasive woody plants). This is easiest when the soil is damp and the weeds are small. This is also the best time for harvesting edible weeds, such as dandelion greens. (There is great satisfaction in eating weeds.)
- ☐ Repeated mowing.
- ☐ Repeatedly cutting down woody plants after each flush of growth to draw down root energy reserves, eventually causing death by starvation.
- ☐ Mechanical cultivation (not useful for weeds that propagate via their roots or shoots).
- ☐ Mulching with a thick layer (more than 4") of weed-free mulch, paper mulch under a thick layer of organic mulch, or a temporary covering of PVC-free plastic sheeting.
- ☐ Solarization, which involves covering a low-growing invasive plant with clear plastic sheeting and letting it "cook" in the sun. This technique can also kill beneficial microorganisms in the soil; after the plastic is removed, the area may benefit from applications of compost.
- ☐ Pouring boiling water directly over roots.
- ☐ Animal grazing/browsing (in some places you can hire these, check your local community farm).
- ☐ Flame weeders.
- ☐ Biological control of invasive plants, using carefully selected natural insect enemies or pathogens.
- ☐ Pruning flowers to prevent seed formation, if the plant cannot be removed.
- ☐ Organically approved herbicides. These will kill the leaves. For woody plants, repeated applications are necessary to kill plant. Caution: All herbicides are pesticides; read the label and follow the directions.

tools and some organic herbicides available to the homeowner. Remember to mulch or replant the bare spots after removal to prevent more weeds from sprouting.

Poison Ivy

Poison ivy fruit is an important food for birds and is a native and ubiquitous plant. Poison ivy leaves, stems, roots and berries contain the oil urushiol, which can cause allergic skin rashes, sometimes severe, in many people. For these reasons, poison ivy is best left unmolested whenever feasible. If you want to remove it from an area where humans will have contact with it there are some precautions to consider. Do not burn it as this can make the urushiol airborne and injure your lungs. There are organic herbicides available to kill poison ivy, however, they kill the leaves and require repeated applications to weaken and eventually kill the plant itself. There are lotions available you can apply to your skin before and after working in your yard that are designed to block and remove urushiol. If you plan to hand-pull it, make sure you protect your skin and clothes from coming in contact with any part of the plant by covering them with non-absorbent gloves, boots and suit. Be very careful not to touch with your bare skin any item that has come into contact with any part of the plant. Hand-pulling is not a good idea if you are sensitive to poison ivy. It is, however, an effective way to keep it controlled. If you are sensitive, engage someone else to hand pull it in early spring and fall. As with all weeds, it is easiest to control when small. When hand pulling, be sure to remove as much of the root as possible. Do not let poison ivy climb, because that is when it flowers (and spreads seeds). If it has gotten established in trees, cut it off at the base and do so repeatedly until it is weakened enough to be pulled. Be sure that whoever does this job wears adequate protection.

Photo: Poison Ivy (*Toxicodendron radicans*)

Invasive Insects

A large proportion of the common insect pests of lawns, landscapes and gardens that we now monitor and manage originated from some other part of the world and could be considered invasive species. Just look at the names of the common species of white grubs: Japanese beetle, European chafer, Oriental beetle, and Asiatic garden beetle. Some species are still under quarantine to avoid moving them to other parts of the U.S. Hemlock woolly adelgid and winter moth are examples of invasive

pests of trees and shrubs that are now common in parts of the Northeast.

New invasive species of insects are still arriving. The Animal and Plant Health Inspection Service (APHIS), a part of the U.S. Department of Agriculture, has the mission of intercepting potential pests as they arrive at seaports and airports, and also coordinates surveys for certain target pests in each state. See the links in Learn More for lists of current pest alerts.

Many of the new pests in recent years have been wood-boring insects, such as the emerald ash borer, Sirex wood wasp, and the Asian longhorned beetle. These insects are believed to have arrived originally in wooden packing materials at seaports, but once they arrived, the most important pathway of spread in the U.S. has been from movement of firewood. So, to keep from spreading these serious pests, don't move firewood. Buy firewood locally and burn it locally.

See the alerts for other pests to watch for and report to authorities. In Connecticut and Massachusetts, important pests to report include the emerald ash borer, a devastating pest of ash trees, and brown marmorated stink bug, which overwinters inside buildings, but also damages many fruiting crops during the growing season. The distribution of different invasive insect species varies across the region, so check the pest alerts for your own state.

Asian Longhorned Beetle

A very serious threat is the Asian longhorned beetle (*Anoplophora glabripennis*). This beetle has recently been causing havoc with various deciduous trees including maple species in various parts of the U.S., including the

Photo: Asian longhorned beetle (*Anoplophora glabripennis*)

Northeast. A major outbreak occurred in Worcester, MA in 2008 that resulted in the removal of 25,000 trees. Adult beetles are 3/4" to 1 1/4" long, with jet-black body and mottled white spots on the back. The long antennae are 1 1/2 to 2 1/2 times the body length with distinctive black and white bands on each segment. The feet have a bluish tinge. Currently, the only effective means to eliminate Asian longhorned beetle is to remove infested trees and destroy them by chipping or burning. To prevent further spread of the insect, quarantines are established to avoid transporting infested trees and branches from the area. Early detection of infestations and rapid treatment response are crucial to successful eradication of the beetle. If you see this beetle, report it to your state department of agriculture or local university cooperative extension office (see Learn More).

Photo: Woolly Adelgid (*Adelges tsugae*)
Copyright © Christopher Evans, River to River CWMA, *Bugwood.org*

Woolly Adelgids

Hemlock woolly adelgids (*Adelges tsugae*) invaded the Northeast in the 1950's and are also abundant from southern New England south and west into the mid-Atlantic states. These tiny insects feed on the sap of hemlock trees. They are small, oval, and black, and produce white wooly masses near the base of the twigs for their eggs. They mainly feed during the winter and go dormant during the summer. In large enough numbers and over the course of 3-7 years they can kill trees that are growing in stressful sites such as poor drainage or drought conditions. It is important to support the health of infected trees with mulch, and water during dry spells. There are natural predators, and several species of lady beetles that are being researched as long-term controls for hemlock woolly adelgids.

The most common and highly effective organic treatment method is to spray the affected trees with horticultural oils during the insect's growing season (late March through mid-April). A landscaper who has the spray equipment necessary to reach up into the tree usually does this. Vegetable based, rather than petroleum based, horticultural oil is available, generally through organic landscapers. Make sure you don't inhale the mist from the spray during application, as it is a respiratory irritant. If you do it yourself, read the label and follow the precautionary statements.

Two important notes about this pest: Do not apply nitrogen fertilizer to your hemlocks as research has shown that woolly adelgids thrive on hemlocks that have received nitrogen fertilization. Woolly adelgids can be dispersed by birds, so avoid setting up birdfeeders in or near hemlocks.

Winter Moths

Winter moth (*Operophtera brumata*) is a recent invader of the Northeastern U.S., abundant in Eastern Massachusetts and Rhode Island, and just recently spreading into Connecticut. The small, light brown moths emerge and fly around in the evenings in late November to December. Early in the spring, the greenish, inchworm-like caterpillars from these moths feed on developing buds and foliage of deciduous trees, in some years defoliating the tree entirely.

First, support the health of the affected trees, shrubs and perennials with proper care. Then, your two choices are either to let nature take care of them, or treat the trees and plants, usually by hiring an organic landscaper.

Individuals may choose to treat small trees, shrubs and perennials themselves. A defoliated tree may be able to put out a second flush of leaves, but may need extra watering to handle the stress. Nature's tools for pest control include harsh weather, wind, natural predators, birds, diseases and the trees' own defenses. There is ongoing work to establish a parasitoid tachinid fly in Massachusetts that has successfully and permanently controlled winter moth outbreaks in Nova Scotia and the Pacific Northwest. Until this fly becomes established, if you have an individual specimen tree you are concerned about, and the winter moth populations are expected to be high, there are several effective organic options available to the professional landscaper. *B.t.k.* (*Bacillus thuringiensis kurstaki*) is a bacterium specifically targeting butterfly and moth caterpillars. It is applied in a foliar spray in early spring after the buds have expanded into leaves. *B.t.k.* works best on the younger stages of the caterpillar. Female winter moths are wingless and can be handpicked or trapped as they climb trees to lay their eggs in November-December. The second option is spinosad which is a chemical derived from a bacterium via a fermentation process. This works on all stages of the caterpillar. It is highly toxic to bees when first applied. Some of these materials are available to homeowners for use on smaller trees and shrubs.

White Grubs

White grubs are famous for being a pest in well-manicured lawns and turf. They are the pale, crescent-shaped larval stage of scarab beetles. They have a dark head, six small legs near the head, pale or white body, and a darker, hairy area at the back end of their abdomen. They pass through three larval stages in the soil where they eat the roots of a variety of grasses and sometimes other plants. There are eleven different species of white grubs in the Northeast. The most common are Oriental beetle, Japanese beetle, Asiatic garden beetle, green June beetle and European chafer.

> Many of the cultural practices for maintaining your organic lawn also, coincidentally, discourage white grubs.

Most lawns and turf have some grubs as part of their working ecosystem and this is perfectly normal and harmless. Too many grubs, however, and you will begin to see problems with your lawn. Symptoms of grub damage in a lawn are brown patches in the fall and spring where the grass is dead and easily comes up in your hand because the roots have been eaten. If this happens, you can dig several inches down into the soil at the edges of a bare patch to see if you find active grubs. Occasionally you will find mole tunnels in active grub infestations. Crows and other birds like flickers, as well as skunks, raccoons and opossums will sometimes search lawns in spring looking for grubs. It may appear as though they are eating your lawn but, in fact, they are eating the grubs that they find. If the turf they have disrupted is green and alive, tamp it back into place to allow it to recover.

Many of the cultural practices for maintaining your organic lawn also, coincidentally, discourage white grubs. Soil moisture and timing is a major factor in determining grub density in any given year. All white

White grub species, left to right: Japanese beetle (*Popillia japonica*), European chafer (*Amphimallon majalis*), and June bug (*Phyllophaga sp.*)
Photo © David Cappaert, Michigan State University, Bugwood.org

grub species require moist soil for their eggs to hatch and young grubs are very susceptible to desiccation. Watering during adult beetle activity in the early summer attracts egg-laying females. The different species have somewhat different life cycles, but most eggs are laid in June or July. Because organic lawn management minimizes watering, egg-laying females tend to be less attracted to these lawns. However, once the larvae begin to eat and grow in late August, the grass becomes more susceptible to drought and the larvae become more resistant to it. Usually the soil moisture increases in September as the weather cools. If not, some watering may be warranted. Higher moisture at this time is helpful for any grass that might be damaged, but it also increases biological activity in the soil. At this time of year, there are moisture-loving organisms that help fight grubs, a kind of fungus (*Metarhizium anisopliae*) that they avoid, and several kinds of nematodes that infect and kill them. Interestingly, the fungus, while repelling the grubs, actually attracts egg-laying female adult Japanese beetles, another reason to keep your lawn dry when the beetles are flying.

White grubs are very fond of turf grasses so having a diversity of plants in your lawn not only improves your ecosystem, but also discourages damaging grub outbreaks. Having a wide diversity of species in your lawn, including clover, yarrow, mosses, sedges, fescues, and wildflowers goes a long way towards preventing grub damage.

Studies have shown that simply setting your mower blades to their maximum height reduces Japanese beetle grub and masked chafer populations in tall fescue and Kentucky bluegrass.

One study noted that applying organic fertilizer such as composted manure in May or June just prior to beetle flight (and egg laying) increased June beetle grub numbers, but not so with the lower nutrient bark compost.

Grubs have many natural enemies living in the biodiverse ecosystem called your organic lawn. If your soil is alive and healthy, it's a tiny jungle out there for them. Ground beetles, rove beetles, and the lowly ant are effective predators of grub eggs. There are parasitic wasps and flies that attack older grubs and adult beetles. In addition, there are naturally occurring organisms such as parasitic nematodes, fungi, bacteria and protozoa that can kill or weaken grubs.

If you do find you have a grub infestation you can't ignore, and you'd like to kill them, you need to identify which kind of grub you have. Your local extension office can help with that. Once identified, you can select the appropriate organic materials to kill the grubs. The most effective are a group of organisms called entomopathogenic (insect-killing) nematodes that look like tiny worms that take about 3 days to kill the grubs. The trick is that different grubs respond to different species of nematodes, they need to be obtained from a reliable source, kept fresh, applied to soil that is above 50° F, applied late in the day and out of the sun to avoid desiccation, and properly watered in. Species that can be used are *Heterohabditis zealandica* and *Heterorhabditis bacteriophora*. One of the most promising species of nematode that is effective against most white grub species is called *Steinernema scarabaeia* but it is not yet commercially available. See Learn More for a list of nematode suppliers. You may see a new organic pesticide for grub control on the shelves, based on cedar oil, which is classified by the EPA as a 25b ingredient, but there are no efficacy studies yet. In addition, it is a broad-spectrum pesticide so will potentially kill beneficial organisms as well as grubs.

Michael Nadeau, co-founder of the NOFA Organic Land Care program and professional organic landscaper, has this to say about managing grubs in organic lawns: "I can tell you reliably that my established organic lawns do not have infestations of grubs, only little patches here and there, and rarely. We treat them with nematodes and under the right conditions, with good results."

Grub Control Checklist

- ☐ Mow high, 3"-4".
- ☐ Abstain from watering in warmer months (June, July) when beetles are flying.
- ☐ Fertilize or sprinkle with compost only in fall.
- ☐ Encourage a diversity of plant species in your lawn.
- ☐ Protect your beneficial insects and microorganisms from salts (e.g. synthetic fertilizers) and toxins (e.g. synthetic and broad-spectrum pesticides, solvents, and oils).

Ticks

The biggest problem with ticks is not the tick itself, but the diseases it carries. Although there are eleven tick-associated diseases in the U.S., in our area Lyme disease, babesiosis and anaplasmosis (human granulcytic ehrlichiosis) are the most notable diseases, transmitted by the blacklegged tick (Ixodes scapularis), also called a deer tick. The lone star tick (*Amblyomma americanum*), a pest in some areas of the northeast, can carry the pathogen causing erlichiosis (human monocytic erlichiosis). *The Tick Management Handbook* by Kirby Stafford at the Connecticut Agricultural Experiment Station (see Learn More) is a helpful resource for dealing with tick problems in the landscape.

Photo: Blacklegged tick, aka deer tick, female (*Ixodes scapularis*)

Tick Checklist

- ☐ Check yourself and your family members for ticks every time you are likely to have been exposed.
- ☐ Adopt xeriscape, native and low water, landscaping techniques.
- ☐ Use gravel pathways and create a 3' or wider wood chip, mulch, or gravel border between lawn and woodlot or areas with low groundcover.
- ☐ Keep grass mowed near woods and stonewalls. Alternate your customary high mowing (3" - 4") with low mowing (2") to discourage ticks.
- ☐ Remove leaf litter, brush and weeds at the edge of the lawn, around stonewalls and wood piles.
- ☐ Discourage rodent activity. Clean up and seal stonewalls and small openings around the home. Move firewood piles and bird feeders away from the house.
- ☐ Use plantings that do not attract deer or exclude deer through various types of fencing.
- ☐ Move children's swing sets and sand boxes away from the woodland and shrubs into drier, sunnier areas.
- ☐ Trim tree branches and shrubs around the lawn edge to let in more sunlight.
- ☐ Widen woodland trails.

If you live in an area where there are blacklegged ticks that carry Lyme disease, there are some basic preventative measures you can take to greatly minimize your risk of contracting it. In the Northeast, this tick ranges from southern Canada to northern Virginia. This is a small tick, ranging in size from tiny nymphs at 0.05" to 0.07" to adult females at 0.12" to 0.15". The ticks do not jump, fly or drop from trees, but grasp passing hosts from grass, twigs and fallen leaves. A good method to help prevent Lyme disease is to make regular tick checks on your body. If a tick is removed after less than 24 hours it is unlikely to have transmitted the disease, even if it was a carrier. If you find a tick embedded in you, remove it with tweezers by grasping it as close to your skin as possible, then wash the area with soap and water or rubbing alcohol. Do not squeeze or put alcohol or heat on an embedded tick as it may regurgitate the Lyme disease vector into your body. As for your clothes, ticks can survive a wash cycle but will not survive if clothes are washed and then fully dried in a dryer.

One biological control (*Metarhizium anisopliae*) has shown good efficacy against blacklegged tick, and may be brought to market as early as next year. Also, garlic sprays were shown to be surprisingly effective against ticks in preliminary testing. Unlike the more broad-spectrum chemical controls (including pyrethrum, which is organic), these products will not harm many beneficial insects such as honey bees, green lacewings, lady beetles, parasitic wasps or earthworms.

These ticks and Lyme disease use white-tailed deer and white-footed mice to complete their life cycles, so wooded areas and the transition between woodland and open meadows usually have the highest numbers of deer ticks. Very few of this kind of tick are found in lawns and meadows, and those few ticks are found mostly within 3 yards of woodlands, plantings, or stonewalls. Ticks avoid dry areas, which provides you with several management techniques to keep them out of areas you frequent, like your lawn.

> Mosquitoes are most easily controlled by removing their breeding sites.

Mosquitoes

Mosquitoes are annoying, and in our area can carry West Nile Virus and Eastern Equine Encephalitis, and are responsible for transmitting heartworm to dogs. We will never eradicate mosquitoes, though people certainly have tried. They are one of the most resilient creatures on this earth and are famous for being able to develop resistance to pesticides. There are more than 50 species of mosquito in the Northeast alone, and each one has specific feeding, breeding and biting behaviors. We can't eliminate them, but there are some very effective techniques for keeping them away from us.

Mosquitoes are most easily controlled by removing their breeding sites. Your first and best strategy is to rid your property of areas of standing water where mosquitoes can breed. Watering cans, tires, buckets, bird baths, children's toys, blocked gutters, plastic bags, and wheelbarrows all collect water during a rain and can serve as nurseries for mosquitoes. They should be cleaned up, removed, turned upside down, or left with standing wa-

Mosquito Checklist

- ☐ Eliminate standing water on your property.
- ☐ Fix screens.
- ☐ Use *B.t.* in areas with unavoidable standing water.
- ☐ Experiment with garlic spray on your lawn and shrubs near the house.
- ☐ Wear long sleeves.
- ☐ Avoid being out at dawn and dusk when mosquito populations are the highest.
- ☐ Wear personal mosquito repellent.

ter for no more than four days. The next most effective method is larval control. If you have unavoidable standing water, for instance in a pond or wetland on your property, you can use a larvicide containing a bacterium called *B.t.i.* (*Bacilllus thuringiensis* var. *israelensis*) which is very effective and specific to mosquitoes and gnats. These are often sold in the form of a donut shaped cake, which you toss into the standing water and get 30 days of larviciding.

Once they reach the adult stage, the best strategies are repellents, screens, long sleeve clothing, and avoidance. On a personal note, I have found landscape garlic spray repellents to be extremely effective at mitigating mosquito bites, but not as a personal repellent applied to your body nor sprayed directly on mosquitoes. The products work by repelling mosquitoes from your property when you spray your lawn and the vegetation around your house. The mosquitoes prefer not to land on garlic treated vegetation, and they will vacate the sprayed areas of your property. There are several commercial products available to the homeowner that are classified as 25b pesticides. Follow the directions on the label for application. The garlicky smell dissipates after about 24 hours. I have found it to be fully effective for about 3 weeks. There are no independent studies of efficacy available to date, but I would say that it is worth experimenting with.

The primary mosquito carrier of West Nile Virus, the *Culex pipiens*, (northern house mosquito) often enters houses, resting on walls, and then biting people when they are relatively motionless or sleeping. For this reason, it is very important to patch any holes you have in your window or door screens to prevent them from coming in your house. If you have a porch and you like to sit out on summer evenings, getting it screened will help reduce the number of mosquito bites.

You can use personal mosquito protection in the form of mosquito repellents you apply to your skin or clothing. There are a variety of herbal repellents on the market and their efficacy varies in both duration and type of mosquito you are trying to repel. Several references in Learn More compare efficacy of herbal repellents.

Learn More

Finding Resources

The principles and concepts of organic landscaping cover many, many disciplines, from agriculture, ecology, soil science, water conservation, geology, chemistry, biology, entomology and plant science, to horticulture, art, design and urban planning. It's hard to find all the answers in one place! There are hundreds of books, courses, and websites to choose from. I've decided to list here just the places you can get free information on the web from either non-profits, government, university or extension services. The NOFA Organic Land Care website has more resources, including courses you can take in the Northeast, and books you can buy. All the resources listed below can be accessed via the NOFA OLC website, *www.organiclandcare.net*. Go ahead, pick a topic and start learning more!

> "Experience is the best teacher, but a fool will learn from no other."
>
> – Benjamin Franklin

Photo: Flowering Dogwood, Copyright © Sarah Little

Organic Landscaping

Northeast Organic Farming Association Organic Land Care Program, website
www.organiclandcare.net

Northeast Organic Farming Association Organic Land Care Program, standards, *NOFA Standards for Organic Land Care, Practices for the Design and Maintenance of Ecological Landscapes*, 5th Edition, 2011
www.organiclandcare.net/accreditation/standards

Garden Rant, website of current resources and discussions of eco-minded gardening enthusiasts
www.gardenrant.com

National Sustainable Agriculture Information Service, clearinghouse for information on organic techniques
attra.ncat.org

Working with Ecosystems

US. EPA ecosystem educational page
www.epa.gov/highschool/ecosystems.htm

US. EPA, native plants FAQs
www.epa.gov/greenacres/faq.html

New England Wildflower Society
www.newenglandwild.org

The Center for Biodiversity and Conservation
cbc.amnh.org

National Park Service, plants
www.nps.gov/plants

University of Rhode Island, choosing sustainable plants for the landscape
www.pse.uri.edu/maynard_susplants/html_spl2000/index.htm

Cornell University, community forestry
www.hort.cornell.edu/commfor/resources/index.html

Water

U. S. Geological Survey, natural water cycles
pubs.usgs.gov/circ/circ1139/htdocs/natural_processes_of_ground.htm

Maryland Cooperative Extension, conserving water in the landscape
www.dnr.state.md.us/ed/xcape.pdf

EPA, our waters
water.epa.gov/type

EPA, learn about your local watershed
cfpub.epa.gov/surf/locate/index.cfm

Energy Conservation

US Department of Energy, conserving energy in landscaping
www.energysavers.gov/your_home/landscaping/index.cfm

Secrets in the Soil

U.S. Department of Agriculture, soil biology primer
soils.usda.gov/sqi/concepts/soil_biology/soil_food_web.html

U.S. Department of Agriculture, soil quality
soils.usda.gov/sqi/index.html

Virginia Cooperative Extension, planting shrubs
pubs.ext.vt.edu/426/426-701/426-701.html

Virginia Cooperative Extension, planting trees
pubs.ext.vt.edu/426/426-702/426-702.html

University of Massachusetts Extension, factsheets on planting and plant maintenance
www.umassgreeninfo.org/fact_sheets/plantculture.html

Soil Testing Labs

Here is a partial listing of soil testing labs in the Northeast. The National Sustainable Agriculture Information Service also maintains a list of "Alternative Soil Testing Laboratories" across the country. *www.attra.org/attra-pub/soil-lab.html*

Commercial Labs

Agri Analysis, Inc.
Leola, PA
www.agrianalysis.com

Harrington's Organic Land Care
Bloomfield, CT
www.harringtonsorganic.com

Soil Foodweb New York
Port Jefferson Station, NY
www.soilfoodweb.com

Woods End Research Laboratory, Inc.
Mt. Vernon, ME
www.woodsend.org

State University & Agricultural Experiment Station Labs

Agricultural Analytical
Services Laboratory
Penn State University
University Park, PA
814-863-0841
aaslab@psu.edu
www.aasl.psu.edu/Default.htm

Connecticut Agricultural
Experiment Station
Slate Laboratory
New Haven, CT
203-974-8521
www.ct.gov/caes/cwp/view.asp?a=2836&q=378206

Connecticut Agricultural
Experiment Station
Valley Laboratory
Windsor, CT
860-683-4977
www.ct.gov/caes/cwp/view.asp?a=2836&q=378206

Cornell Nutrient Analysis Lab
Ithaca, NY
607-255-4540
cnal.cals.cornell.edu

Rutgers Soil Testing Laboratory
Rutgers, The State University of New Jersey
New Brunswick, NJ
732-932-9295
soiltest@njaes.rutgers.edu
njaes.rutgers.edu/soiltestinglab

Soil Nutrient Analysis Laboratory
University of Connecticut
Storrs, CT
860-486-4274
soiltest@uconn.edu
soiltest.uconn.edu

University of Delaware Soil
Testing Program
Newark, DE
302-831-1392
11462@udel.edu
ag.udel.edu/other_websites/dstp

University of Maine Soil
Testing Service Analytical Lab
Orono, ME
207-581-2997
anlab.umesci.maine.edu

University of Massachusetts
Soil Testing Lab
West Experiment Station
University of Massachusetts
Amherst, MA
413-545-2311
soiltest@umext.umass.edu
www.umass.edu/plsoils/soiltest

University of New Hampshire
Cooperative Extension
Soil Testing Program
Durham, NH
603-862-3200
soil.testing@unh.edu
extension.unh.edu/agric/agpdts/soiltest.htm

The University of Vermont
Agricultural and Environmental
Testing Lab
Burlington, VT
802-656-0285
www.uvm.edu/pss/ag_testing

Compost, Fertilizers, Mulches and other Soil Amendments

Harvard University, organic landscaping with compost tea
www.uos.harvard.edu/fmo/landscape/organiclandscaping

Maryland Cooperative Extension, basic principles of soil fertility, plant nutrients
www.growingforyou.com/images/SoilFertility.pdf

Maryland Cooperative Extension, basic principles of soil fertility, soil properties
extension.umd.edu/publications/PDFs/FS640.pdf

U.S. Environmental Protection Agency, compost
www.epa.gov/osw/conserve/rrr/composting/

Massachusetts Department of Environmental Protection, composting information for homeowners
www.mass.gov/dep/recycle/reduce/composti.htm

U.S. Environmental Protection Agency, global nitrogen cycle
www.epa.gov/owow/watershed/wacademy/acad2000/nitroabstr.html

Sustainable Phosphorus Futures, peak phosphorus report
phosphorusfutures.net/peak-phosphorus

Virginia Cooperative Extension, mulching
pubs.ext.vt.edu/426/426-724/426-724.html

Cornell University, toxic mulch
www.gardening.cornell.edu/factsheets/mulch/toxicmulch.html

Lawns

Brooklyn Botanical Gardens, native grasses in lawns
www.bbg.org/gardening/article/planting_a_native_grass_lawn/

www.bbg.org/gardening/article/sedge_lawns/

www.bbg.org/gardening/article/low_slow_fescues/

University of Massachusetts Extension, selecting grasses, soil management, cultural practices for lawn
www.umassturf.org/publications/online_pubs/lawn_landscape_bmp.pdf

Versicolor.ca, establishing white clover in lawns
versicolor.ca/lawns/docs/clover.html

Cornell University, lawn care without pesticides information bulletin
nysipm.cornell.edu/publications/lawn_care/files/Lawn_Care_without_Pesticides.pdf

Lawn Alternatives, website with current resources and discussions on eco-friendly lawns and yards
www.lawnreform.org

Pest Control

Organic Pesticides

Organic Materials Research Institute, lists of approved organic materials
www.omri.org

Baystate Organic Certifiers, list of Northeast U.S., local, approved organic materials
www.baystateorganic.org

University of Massachusetts Extension, organic methods used in agriculture
www.extension.org/organic%20production

Cornell University, resources for organic pest and disease management
web.pppmb.cals.cornell.edu/resourceguide

Plant and Insect Identification

University of Massachusetts Extension, identifying weeds
www.umassgreeninfo.org/fact_sheets/weed_herbarium/common_name_list.htm

University of Massachusetts Extension, identifying weeds, insects and diseases of woody plants
www.umassgreeninfo.org/news_events.html#guide

Connecticut Agricultural Experiment Station, plants and pests lists
www.ct.gov/caes/cwp/view.asp?a=2823&q=377514

Invasive Plants and Insects

Regional and National Pest Alerts – U.S. Department of Agriculture
www.csrees.usda.gov/nea/pest/in_focus/ipm_if_pestalert.html

Invasive Plant Atlas of New England
nbii-nin.ciesin.columbia.edu/ipane/ipanespecies/current_inv.htm

Invasive Aquatic Plants
www.mass.gov/dcr/watersupply/lakepond/publications.htm#factsheets

Eastern Forest Environmental Threat Assessment Center
threatsummary.forestthreats.org/index.html

Grubs

Ohio State University Extension, identifying grubs
ohioline.osu.edu/hyg-fact/2000/2510.html

Ohio State University, Insect Parasitic Nematodes, list of suppliers
www.oardc.ohio-state.edu/nematodes/nematode_suppliers.htm

Woolly Adelgids

University of Massachusetts Extension, factsheets
www.umassgreeninfo.org/fact_sheets/piercing_sucking/hwa_faq.pdf

www.umassgreeninfo.org/fact_sheets/piercing_sucking/hemlock_woolly_adelgid.html

Winter Moths

Massachusetts Department of Agricultural Resources, fact sheet
www.massnrc.org/pests/pestFAQsheets/winter%20moth.html

University of Massachusett Extension, fact sheet
www.umassgreeninfo.org/fact_sheets/defoliators/wm_id_man.html

Ticks

Connecticut Agricultural Experiment Station, tick handbook
www.ct.gov/caes/lib/caes/documents/publications/bulletins/b1010.pdf

Mosquitoes

American Academy of Pediatrics, DEET alternative mosquito repellents
www.aap.org/family/wnv-jun05.htm

University of Florida Extension, efficacy and duration of mosquito repellents
edis.ifas.ufl.edu/in419

Other Pests

Northwest Center for Alternatives to Pesticides, online resources for pest management
www.pesticide.org/solutions/home-and-garden-toolbox

Checklist For An Eco-Friendly Property

- ☐ **Keep pesticides off your lawn and gardens.** Using only non-toxic materials on your property reduces the health risk to yourself, your family, your neighbors and your local environment. See "Why Organic?" at *www.organiclandcare.net/about/why-organic*

- ☐ **Use non-synthetic fertilizers from natural sources.** Synthetic fertilizers are made in a chemical process that uses fossil fuel and contributes to global warming. Use of synthetic nitrogen fertilizer greatly increase the amount of nitrogen entering the global nitrogen cycle which has a serious negative impact on the organization and functioning of the world's ecosystems, including accelerating the loss of biological diversity and decline of coastal marine ecosystems and fisheries. Visit www.epa.gov/watertrain/nitrogen.html for more information. The use of synthetic phosphorus fertilizers has its own set of problems, in particular its contribution to the eutrophication of fresh water lakes and ponds, and the limited global supply of phosphate rock. For more information, visit *phosphorusfutures.net*

- ☐ **Reduce water use.** In many cities in the Northeast, 50% of the drinking water goes to lawns and landscapes. Over 75% of Massachusetts' rivers are flow stressed because of water withdrawals for these residential uses. *www.mass.gov/dep/water/resources/stresmap.htm*

- ☐ **Remove invasive plants.** Invasive plants grow quickly and spread easily and often reduce the biodiversity of whole ecosystems. Learn about invasive plants, how to avoid spreading them, and how to remove them from your own property. In the U.S., a good place to start is at the National Invasive Species Information Center, *www.invasivespeciesinfo.gov*

- ☐ **Garden with native plants.** Native plants are site adapted and usually require little to no watering, fertilizing or pesticides. Stunning gardens can be made from entirely native plants. Since native plants are, well, native, it's best to find a local conservation group who works with natives. If you live in the Northeast U.S., a good place to start is the New England Wildflower Society, www.newfs.org/learn. They have a listing of Native Plant Societies in the US and Canada, *www.newfs.org/publications-and-media/resources/nps.html*

- ☐ **Grow food.** Organically raised fruits and vegetables, grown close to home, will become more valuable as current trends in climate change, energy cost and availability and human health play out in the future. Organic practices allow edible and decorative plants to be grown together. There are many ways to incorporate food plants and vegetable gardens into your landscape. Blueberry bushes are native, decorative and delicious. Many fancy lettuces are as pretty as annuals. More and more land care professionals offer vegetable garden installation as a service. Learn more at *cce.cornell.edu/Ag/Horticulture/Pages/Gardening.aspx*

- ☐ **Make and use compost.** Compost has many advantages as a soil amendment and it is less likely to cause pollution of the local and regional environment than fertilizers, even organic ones. Incorporating compost improves turf, shrub and shade tree performance in marginal or poor soils. Good quality compost improves soil structure, reduces runoff and compaction, enhances biodiversity, increases water and nutrient retention, increases microbial activity, supplies nutrients, helps suppress and prevent plant diseases, detoxifies certain pesticides, and inactivates and kills potential human pathogens. To learn more about compost, you can start at EPA's site: *www.epa.gov/osw/conserve/rrr/composting/*

- ☐ **Test your soil.** If you want your property to look its best, to save money, and to protect the environment even more, do an easy soil test before you apply anything at all. A soil testing lab will help you figure out how much of which fertilizers and nutrients to apply for optimum results. Learn more at *www.organiclandcare.net/green-room/olc-articles/soil-testing-and-labs*

- ☐ **Increase biodiversity.** Biodiversity is the key to a healthy ecosystem on any scale, from backyard to global. Biodiversity increases the stability of ecosystems, reduces the need for intervention, and makes them, from an aesthetic viewpoint, much more interesting. The earth is currently losing species at a ou rate that rivals mass extinctions in our geologic record. You can use the American Museum of Natural History's site as a starting point to read about why biodiversity is important, http://cbc.amnh.org/. You can look at the National Wildlife Federation site to learn how to increase biodiversity in your own back yard. Visit *www.nwf.org/Wildlife/Wildlife-Conservation/Understanding-Wildlife-Conservation/Biodiversity.aspx*

- ☐ **Care for your lawn...** Mow high, 3"-4"; leave grass clippings on lawn; water infrequently, if at all; encourage a bit of white clover; fertilize with compost; and overseed bares spots in fall and early spring. Rake your lawn, but not your woods: let leaves, nature's own mulch, stay and compost in place. Learn more at *www.urimga.org/fact_sheets/Organic%20Lawn%20Care.pdf*

Northeast Organic Farming Association,
Organic Land Care Program (NOFA OLC)

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