

LANDSCAPE FOR LIFE™

Based on the principles of the Sustainable Sites Initiative™

Developed by the Lady Bird Johnson Wildflower Center and the United States Botanic Garden

Shared by Suzanna MacIntosh

“A true conservationist is a man who knows that the world is not given by his fathers, but borrowed from his children.”

– John James Audubon

Sustainability is important to us all, to our families and coming generations. Fresh air to breathe, pure water to drink, access to the beauty and the restorative values of a natural unspoiled environment are foundations of the American experience. When National Audubon issued a “Wakeup Call” in 2007 it was in response to the newly-released State of the Birds Report, <http://www.audubon.org/news/disappearing-common-birds-send-environmental-wake-call>, which showed steep declines in a significant number of common birds over the preceding 40 years. A leading cause was attributed to habitat loss and degradation. These statistics are important to us not only because of the alarming decline of many common birds, but because birds also act as barometers and reflect the health of our environment. What we do in our own yards and gardens can have an important far-reaching impact on the environment, our lives and the birds and wildlife we love.



The **Landscape For Life™** program developed by the Lady Bird Johnson Wildflower Center and the United States Botanic Garden provides common sense ways we can add beautiful as well as functional sustainable landscape and garden elements to our own yards that will help restore some of the balance that has been lost. The Landscape For Life is based on the principles of the Sustainable Sites Initiative™ (SITES™). SITES is the nation’s first rating system for sustainable landscapes (www.sustainablesites.org) and it is an interdisciplinary collaborative effort by the American Society of Landscape Architects, the Lady Bird Johnson Wildflower Center at The University of Texas at Austin, and the United States Botanic Garden along with a diverse group of stakeholder organizations. We are indebted to the Lady Bird Johnson Wildflower Center, www.wildflower.org, the United States Botanic Garden, www.usbg.gov, and Landscape For Life, www.landscapeforlife.org, for sharing this material.

In a 5-part series based on the Landscape For Life program we’ll discuss how to enhance the beauty and function of our yards and work with nature to create and maintain a more sustainable landscape. The series will cover ways to add native plants and sustainable materials to our yards, increase the fertility of soils naturally and its ability to conserve water, minimize runoff and pollution, and use fewer pesticides and herbicides. It includes information on ways to create a natural space that enhances health and well-being not only for birds and other wildlife, but for our families and those we love in the natural sanctuary that we create.

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Sustainability is based on the ethic of stewardship and the Landscape For Life (LFL) program defines sustainability at its core “as the process of attempting to meet the needs of today without compromising the needs of tomorrow.” Here are some of the benefits a sustainable garden and landscape provide as listed by LFL:

- ✓ **CLEAN AIR:** Plants absorb pollutants from the air, sequester atmospheric carbon, and provide the oxygen we breathe. Sustainable gardens maintain healthy and established vegetation that can more effectively provide clean air benefits.
- ✓ **CLEAN WATER:** Plants and healthy soils capture and cleanse pollutants from stormwater. Stormwater runoff from developed land is the leading cause of water pollution in urban areas. As stormwater moves across roadways, roofs, driveways, and other impervious surfaces, it increases in temperature and accumulates pollutants that adversely affect water quality. Sustainable gardens help slow water, allowing much of it to soak into the ground and replenish aquifers. Design features of sustainable gardens, such as bioswales or rain gardens, capture and cleanse water on site preventing the spread of water pollutants.
- ✓ **STORE FRESH WATER:** Healthy soil serves as a natural water reservoir, which can prevent flooding and sustain vegetation in times of drought. Over-compaction and low levels of organic matter are two common factors that limit the soil’s ability to absorb and retain water. Sustainable gardens protect and restore the soil’s ability to capture fresh water and support vibrant vegetation.
- ✓ **CONTROL EROSION AND SEDIMENT RUNOFF:** Vegetation holds soil in place and decreases the likelihood of erosion and sediment runoff. Sedimentation is a major cause of polluted rivers and streams in the United States. Sustainable gardens use vegetation and mulch to protect soils from erosion and keep soil from entering water bodies.
- ✓ **MAINTAIN SOIL HEALTH AND FERTILITY:** Natural ecosystems often rely on decayed organic matter for healthy soils. Many good sources of organic matter are found in home gardens, including leaves and plant clippings. Each year, millions of tons of yard waste in the US end up in our landfills. Creating sustainable gardens can help minimize this waste by transforming plant trimmings into valuable and enriching resources such as compost or mulch.
- ✓ **MITIGATE THE URBAN HEAT ISLAND EFFECT:** Vegetated surfaces help to moderate air temperatures by providing shade and releasing moisture into the air. Urban development replaces vegetation with dark surfaces such as roofs, roads, and buildings that absorb and trap heat, causing cities to have warmer temperatures than their rural surroundings. This phenomenon, known as the “urban heat island effect”, increases the demand for cooling energy in buildings and accelerates the formation of ground-level ozone and smog. Sustainable gardens favor vegetated surfaces, shaded dark surfaces, and light-colored materials to mitigate urban heat island effects.
- ✓ **PROVIDE HABITAT:** Sustainable gardens can provide habitat for a variety of plants, animals, and microorganisms. For example, a single gram of soil can contain between 1,000 and 10,000 different species of bacteria and fungi that support the growth of associated plants species.
- ✓ **SUPPORT HUMAN HEALTH AND WELL-BEING:** Physical and visual access to natural settings can support many aspects of human health and well-being. Social scientists and psychologists have found that everyday encounters with nature, such as green views from an office window, a lunchtime stroll through a nearby park, or schoolyards with trees and other vegetation can restore our ability to concentrate, calm feelings of anxiety, and reduce aggression. Sustainable gardens seek to provide community and personal access to natural settings.

Sustainable practices recognize and attempt to balance the long-term impacts on environmental, economic, and social well-being.

A great way to get started creating a more sustainable yard is to become more familiar with your yard. One way is by drawing a base map of your property. This can be as simple or as detailed as you like. It helps as you go along to have this drawn to scale. You can use colored pencils and graph paper to draw your home and property to scale, allowing about a quarter inch per foot.

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The Cornell Lab of Ornithology also has a great new Citizen Science project, YardMap, which is designed to let you make landscape maps of your yard and other green spaces. YardMap is a great tool you may want to use to help map your yard and it also provides lots of useful information about creating habitat. Here is a link to YardMap and more information, www.yardmap.org/.

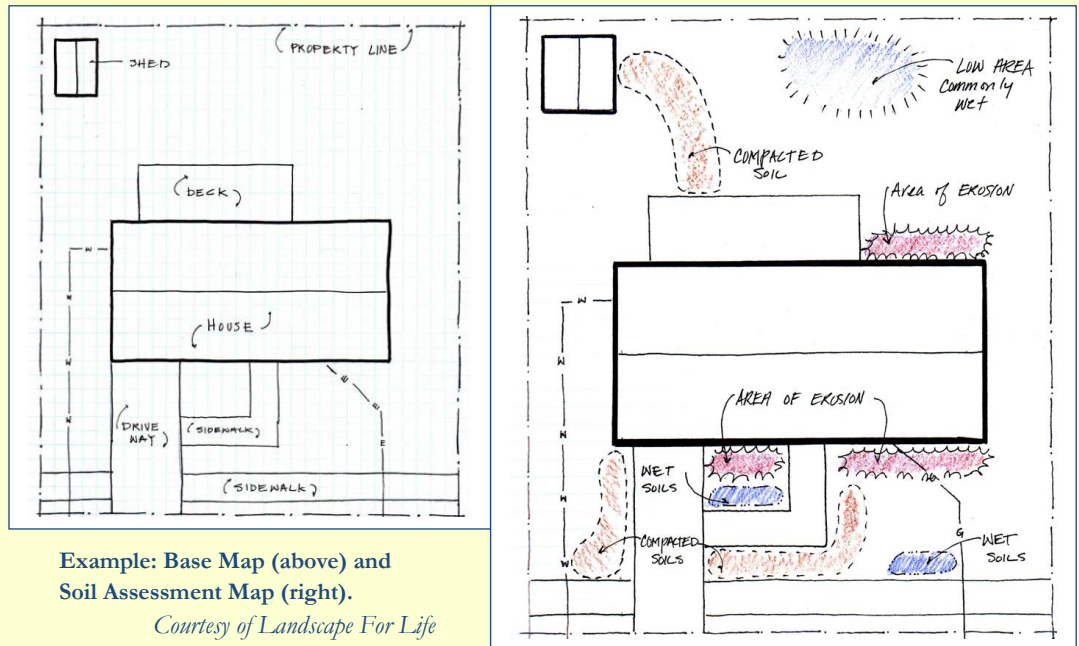
It's helpful to have a base map that includes the following:

- ✓ All paved surfaces, such as driveways, walks, and patios
- ✓ The footprint of each building
- ✓ Utility lines such as gas, sewer, and electric
- ✓ North arrow
- ✓ Scale of the base map

Make several copies of your base map or use tracing paper over the base map and add the following information on separate base map copies.

1. Add your trees and shrubs, noting if they are deciduous, and begin to watch the changes in sunlight patterns throughout your landscape and as the sun shifts across the horizon throughout the day and over the year. Notice prevailing wind direction. Mark any native plants and plant communities. Note your large trees and circle the areas they shade over the course of the day, noting areas that receive sun all day long and note those that receive morning sun, midday sun, afternoon sun only, or full shade.
2. On another copy note areas in your yard where the soil is relatively undisturbed native soil and where there is vegetation that should be protected, as well as problem areas where topsoil was removed or compacted, where it stays wet, or where it is dry and exposed. Identify and note a well-drained spot on your property shaded from the hot afternoon sun where you can locate a compost pile.
3. On a fresh copy, show where rainwater may come rushing off roofs or gutters, where it flows across your property and down paved surfaces, and where it pools during storms. Note any water features, such as a nearby stream and note the type and location of your irrigation system, if you have one.
4. On another copy note shady, protected, or private areas for relaxation or socializing. Mark areas in full sun where it would be appropriate to grow wildflowers, herbs, vegetables, or fruits.

If this seems daunting at first, you'll find as you go along it's a lot of fun. In the Tallahassee area we are fortunate that there are many great resources close at hand. Two of these are Native Nurseries, www.nativenurseries.com, which offers frequent workshops about the many facets of sustainable gardening and the Magnolia Chapter of the Florida Native Plant Society, <http://magnolia.fnpschapters.org/>, which offers a wealth of information about Florida's native wildflowers.



Example: Base Map (above) and Soil Assessment Map (right).

Courtesy of Landscape For Life

The Importance of Plants in Sustainable Gardening

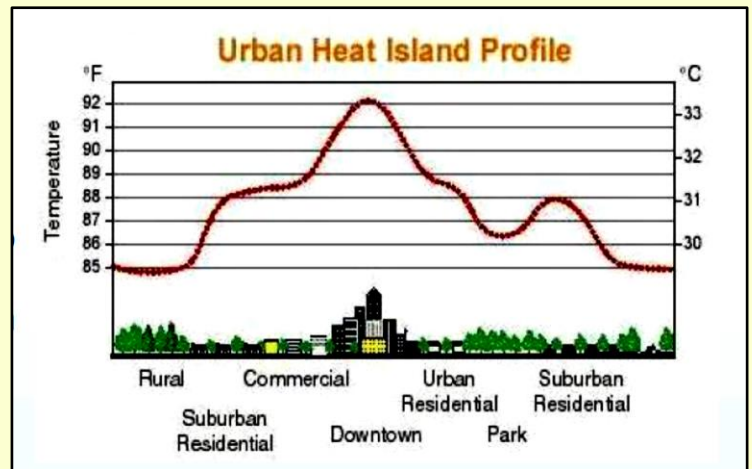
Plants provide beauty and a sense of place to the home landscape as well as many other benefits. They cool the air through evaporation (transpiration) and provide shade which also helps mitigate urban heat island effects. Properly placed vegetation can reduce energy use and costs by shading a house during summer and providing a wind break during the cold winter months. Through the process of photosynthesis, plants sequester CO₂ and release oxygen. Other benefits include controlling erosion by reducing the intensity of rainfall hitting the ground, increasing the absorption of water into the soil, and helping hold soil together with their root systems. Plants also help remove pollutants from the air and water. Gardening also has many health benefits and a beautiful garden provides a relaxing and restful setting. By adding fruit trees to your yard you can pick your own home-grown fruit and a vegetable garden can provide nutritious and flavorful food. Additionally, adding pollinator-friendly flowers to your vegetable garden increases the yield of some vegetables and adds alternative beauty to the garden. And, overall, a well landscaped yard and garden area can increase residential resale value.

Some of the most important benefits plants provide are food and shelter for birds, butterflies and other wildlife. Not too long ago, native plants were abundant in gardens, along fencerows and roadsides and in natural areas, but now often the plants and habitat that birds and wildlife depend upon for survival are in short supply. As more highways and parking lots are built and more land cleared and developed, these natural areas are becoming drastically reduced and spaced farther apart. Invasive non-native plants often choke out native plants and large lawns, which provide little sustenance or shelter for birds and insects, reduce needed habitat.

This makes it hard for many wildlife species to survive. One quarter of the birds in the U. S. are in danger of slipping into extinction with a leading cause being habitat loss and degradation caused by a loss of food, shelter and clean water. Migratory birds are especially at risk. Each of us can help by reestablishing some native habitat in our gardens to help offset the loss of critical wildlife habitat. If space is limited a window box or a few pots of plants are great additions to a home or apartment.

Shelter, food and water are essential in a wildlife garden.

The best food sources are a diverse selection of native plants. For the vast majority of native wildlife, most of the non-native plants that have been incorporated into our gardens for more than a century do not provide sufficient food.



Courtesy EPA: <http://www.epa.gov/heat-islands/heat-island-compendium>



Reducing lawn area and adding native plants help create habitat.

Photo by Suzanna MacIntosh



As native plant communities consist of vertical plant layers, to provide habitat niches for the widest array of wildlife it helps to recreate various vertical layers of vegetation—trees, shrubs, flowers, and grasses—similar to those found in nearby natural areas. Plants in the ground layer partition their environment vertically. Spring ephemeral wildflowers bloom first, typically raising their foliage only a few inches above the leaf litter. When they go dormant, taller ferns and wildflowers overtop them creating a diverse understory. The next layer, the midstory, is composed of saplings of canopy tree species as well as smaller flowering trees such as dogwoods and redbuds. The canopy, the tallest layer of a forest, is composed of mature trees. In general, the more vertical layers there are the more complex the vegetative structure and the more habitat is created for a wider array of wildlife.

In urban settings we can add ‘hedge rows’ around the perimeter of the yard; birds and butterflies depend on the shelter and food sources these provide. Leave snags (standing dead or dying trees), if they are not a danger, as they provide nesting, foraging, perching and roosting sites. By reducing your lawn area, you can provide safe corridors for birds and this also helps reduce water and chemical use. Herbicides, fungicides and pesticides can be lethal to birds and butterflies and runoff pollutes our groundwater, so they should be used sparingly. Don’t be too tidy; leaving some leaf litter for overwintering butterflies enriches your soil and provides plants protection from extreme weather. Brush piles also provide shelter and habitat for birds and other wildlife. To complete your garden, you’ll need a secure water source, and for butterflies a puddling area and basking area.

It is important to recognize that every garden is influenced by not only the regional climate but also microclimates, which are formed when the prevailing climate of a region interacts with objects in the garden. For example, planting beds located on the south side of a house or garden wall receive more sunlight and are typically warmer than those on the north side. Low areas of the garden may be cooler at night due to pockets of cold air pooling in the depressions. When the cold air drops below freezing, frost pockets will form and can cause damage to plants. Homeowners should select plants that are best suited to each particular microclimate within the site.



2011 AAS Annual Wildlife-Friendly Yards Tour

Photos by Suzanna MacIntosh



Snags – “The Wildlife Tree”

<http://wdfw.wa.gov/living/snags/>

Photo by Martha Ivey

Aside from adding beauty, distinctiveness and a sense of place to our gardens, native plants are often better adapted to the local soil and climate and more resistant to local pests and diseases. They often need less water and maintenance once established. Few people had noted the critical connection between native plants and wildlife until Dr. Doug Tallamy’s book, **Bringing Nature Home**, <http://www.bringingnaturehome.net/gardening-for-life.html>, caught the attention of many knowledgeable gardeners across the nation and caused a paradigm shift in the way many people garden. Native plants are the foundation of ecological biodiversity and each native plant provides something special no other plant can. Butterflies and other plant-eating insects evolved with native plants and they are interdependent. In the caterpillar stage, a soon-to-be butterfly needs a specific native plant to develop. This plant is called the ‘host plant’.

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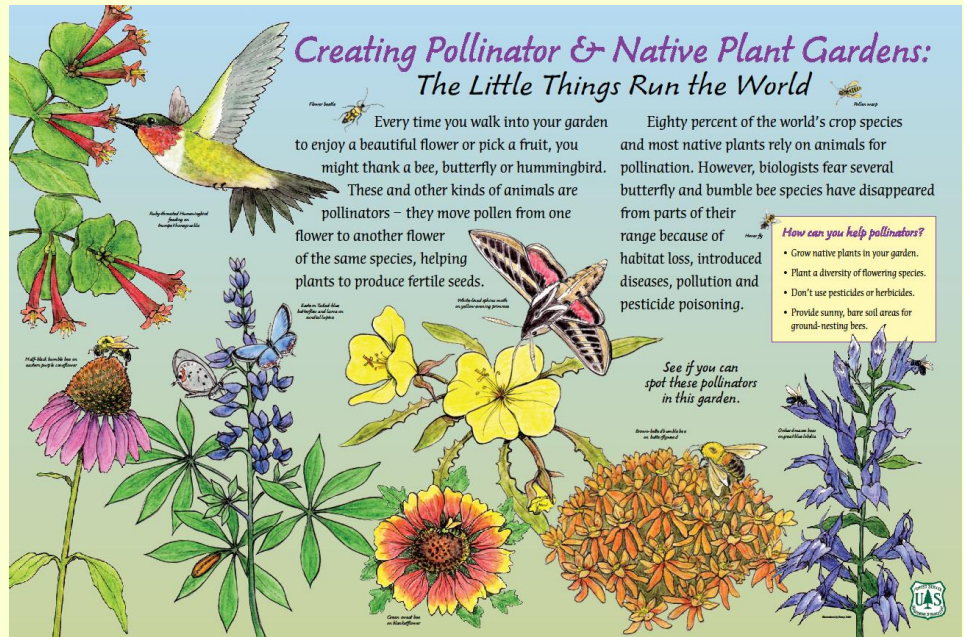
For Monarch butterflies, the host plant is Milkweed, *Asclepias spp.* A butterfly species will only lay eggs on its host plant and they can't survive in the caterpillar stage without its nourishment. Later adult butterflies and other pollinators need a variety of nectar-rich blossoms during the spring, summer and fall. And, in turn, flowering plants (including fruits and vegetables) need pollinators to produce fertile seeds and crops.

Unfortunately, native plants are disappearing at an alarming rate. Botanists are concerned about the survival of one in every five of this country's native plants, which provide critical habitat for countless other creatures. To help prevent the further loss of these plants, many can be attractively incorporated into our home gardens. Landscape For Life defines a native plant as "a species that exists *in a region* without human introduction"; another definition of a native plant is "a plant that was present in a particular location prior to European settlement". However, defining a native plant can be complicated. Over time, by natural selection, a plant species adapts almost imperceptibly to particular environmental conditions and can be considered an "ecotype" of the species. And, to mix it up more, we have hybrids of native plants, bred often for hardiness and bloom and to be "pest-free". This is sometimes at the expense of important characteristics like nectar and scent.

An important point is that a native plant has evolved as part of a greater community, an ecosystem, and it doesn't exist naturally alone in the environment. An example of this is the Longleaf Pine ecosystem. The open canopy of the Longleaf Pine forest sustains one of the most diverse animal and plant ecosystems in the world. As you add native plants to your garden, consider creating an area that incorporates features of the natural environment.

Native plants add beauty to a garden, just as they do in natural areas. The great variety of regional native plants provides gardeners with options that can support any any garden design. As with all plants, gardeners should consider the soil type, pH, sun and shade requirements, and watering needs of native vegetation before planting. Non-native appropriate plants that can be sustainably maintained without the addition of regular input or resources, like fertilizers or pesticides, and that are not invasive can add to the garden's beauty and diversity.

A few tried and true native plants to consider incorporating into your garden are Native Azaleas and Hollies, Magnolias, Cedars, Oaks, Dogwoods, Redbud, Wax Myrtle, Chickasaw Plum, and Spicebush. There are many more and it is fun to learn about the beautiful native plants of our region. Here are some great resources: Florida Native Plant Society, www.fnps.org; Florida Wildflower Foundation, <http://flawildflowers.org/>; the Pollinator Partnerships Ecoregional Planting Guide: <http://pollinator.org/PDFs/Guides/OuterCoastalrx7FINAL.pdf>; and the Lady Bird Johnson Wildflower Center: www.wildflower.org. More information about plants is also available from LFL at <http://landscapeforlife.org/plants/>.



Courtesy USDA Forest Service



Additional resources:

Audubon– Creating Bird-Friendly Communities: <https://www.audubon.org/conservation/creating-bird-friendly-communities>;

Guide to Florida-Friendly Landscaping Handbook: <http://www.floridayards.org/landscape/FYN-Handbook.pdf>;

Native Nurseries: www.nativenurseries.com

Seed Savers Exchange: www.seedsavers.org

Snags - The Wildlife Tree: <http://wdfw.wa.gov/living/snags/>

The Seed Underground: A Growing Revolution to Save Food by Janisse Ray - <http://janisseray.weebly.com/>



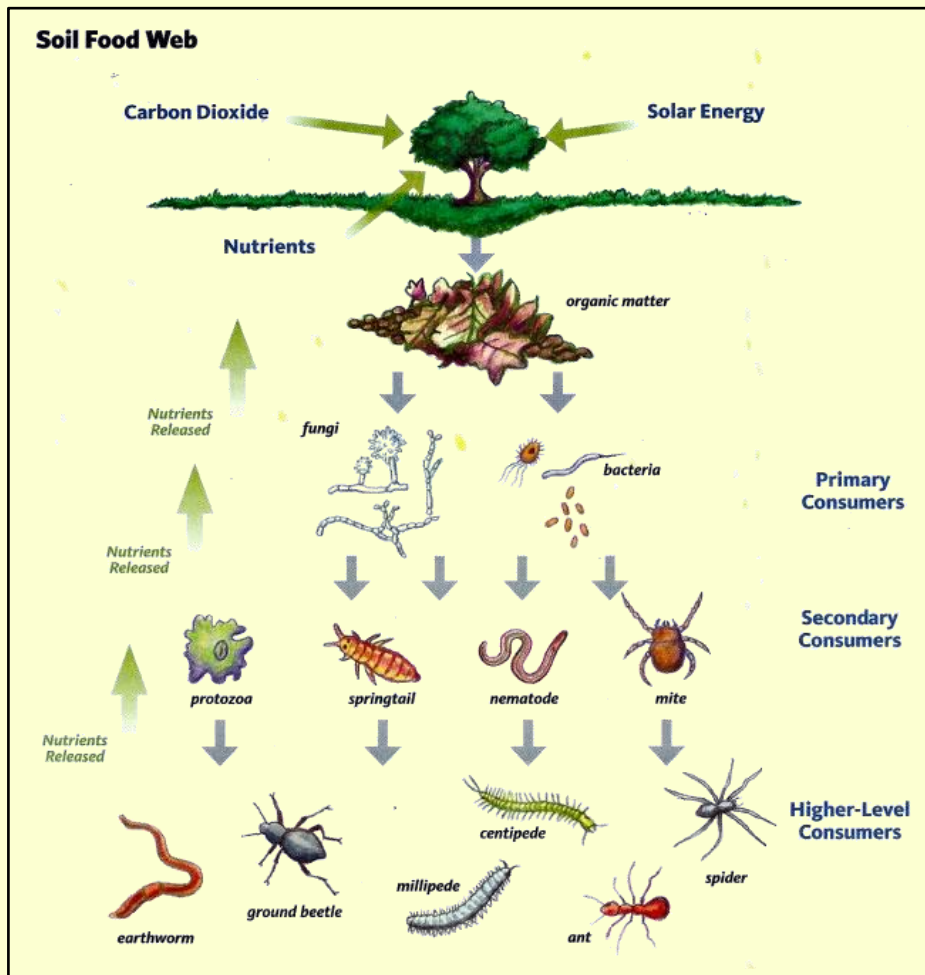
Soil in Sustainable Gardening

An Introduction to the Importance of Soil in Sustainable Gardening

A sustainable garden and landscape depends upon healthy soil. Here we'll look at the importance of the "soil food web" and at ways to increase the fertility of soils naturally, how to use fewer pesticides and herbicides, and how to increase soils ability to conserve water and minimize runoff and pollution.

Healthy soil is alive with bacteria, fungi, protozoa, nematodes, earthworms and other organisms. As the earth evolved these organisms and plants formed very complex mutually beneficial relationships. Sustainable gardening focuses on restoring and protecting this evolutionary balance and enabling these complex relationships. Because of its complexity what we know

about soil is still evolving and one of the leading voices is that of Dr. Elaine R. Ingham, an internationally respected soil microbiologist with over 40 years of experience. In Thomas Christopher's book, **The New American Landscape**, Dr. Ingham emphasizes the important relationships between plants and the organisms in healthy soil. These organisms provide nutrients and create passageways for air and water to penetrate among soil particles along with many other benefits. One teaspoon of productive soil contains between 100 million and 1 billion bacteria. There are over 5 million species of bacteria, with each species adapted to a very specific set of conditions. As the plant grows and changes different species of bacteria along with other organisms perform different functions. For instance, if the plant is attacked by a pest, the plant signals this change and a specific set of bacteria swings into action.



The soil food web is the key to fertile soil. It is made up of primary, secondary, and higher-level consumers that support each other in producing healthy, nutrient-rich soils.

Courtesy of Landscape For Life

It's important to keep in mind is the complexity and inter-dependency of these processes. A good rule of thumb is that when in doubt look at what happens

in a natural ecosystem nearby. For example, in nature leaves and other plant materials cover the soil, providing a protective mulch for roots and organisms from weather extremes, from compaction from heavy rainfall, and reduces puddling and runoff; this also helps water seep in and reduces evaporation, and over time the decaying vegetation provides additional nutrients. Your soil type, whether predominantly sand, clay or silt will determine how quickly water and nutrients travel through the soil; your local climate and rainfall will also affect your gardening selections, but understanding the importance of and the basics of the soil food web is the foundation for sustainable gardening for us all; and, although most of us have soils that have been amended or changed from their natural state in our yards, Dr. Ingham and many experts recommend that one of the most important things we each can do to help our soil is to enable the dynamics of the soil food web. By working with nature, we can find that natural processes do much of the work for us in a more efficient way. ~ SM

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The Importance of Soil in Sustainable Gardening

Soil is a complex mixture of weathered rock and mineral particles; the living organisms of the soil food web; and the decaying remains of plants, animals, and microorganisms. Soil forms the foundation of sustainable gardens and provides a variety of ecosystem services. Healthy soil is critical to the success of sustainable gardens. Using sustainable gardening practices can help restore and protect the benefits our soils can provide.

The soil food web is the key to fertile soil. This diverse community of organisms making up the soil food web can be organized into functional groups depending on how they obtain energy. Plants are producers and use the sun's energy to convert water and carbon dioxide into food (carbohydrates) via photosynthesis. Primary consumers include **decomposers** (mainly fungi and bacteria) and herbivores (mainly animals) and are capable of obtaining energy by digesting leaves and other plant matter. Secondary consumers feed on primary consumers, then they release nutrients that can be absorbed directly by plants, as well as undigested remains that become part of the organic soil matter. Higher-level consumers feed on **secondary consumers**. Their fecal pellets and undigested remains also return nutrients to soil. The production and breakdown of organic matter by organisms maintains soil fertility and in turn aids in healthy plant growth, nutrient cycling, pollutant removal, and improved soil structure.

In order to maintain these ecosystem services, we need to support the basic needs of soil organisms by providing air, water, nutrients, and a hospitable soil environment. Modern society has left much of Earth's soil eroded, exhausted, and polluted. Unsustainable gardening practices such as applying too much fertilizer or compacting soil has contributed to the problem. Here are some strategies for improving damaged soils along with stewardship practices that will support gardeners in maintaining soil health and for protecting and encouraging soil organisms:

- Limit soil disturbance and tillage
- Restore overly compacted soils to allow air and water movement
- Avoid leaving soils bare by covering soils with plants or mulch. Regularly apply layers of compost or organic mulch to the top of the soil
- Avoid pesticide use that may harm soil biota
- Plant a diverse garden to provide a variety of food sources
- Grasscycle - use a lawn mower that returns mulched lawn clippings to the soil
- Allow leaves and other plant materials to decompose throughout the garden

Having your soil pH tested is a beneficial and often cost-effective gardening practice. **Soil pH** is a measure of soil **acidity** or **alkalinity**. The pH scale ranges from 0 to 14, with 7 representing neutral. From pH 0 to 7 the soil becomes less acidic, while from 7 to 14 it becomes increasingly alkaline. Soil pH affects the availability of minerals and nutrients to plants. Before a nutrient can be used by a plant, it must be dissolved in the soil solution. Most plants prefer a slightly acidic to neutral soil, with a pH of 6 to 7, because that is the range in which most nutrients are readily available. University extension labs (check with your local county extension office) or commercial labs conduct standard soil tests for about \$25 to \$40. Knowing your soil's pH can save you money on unnecessary fertilizer and plants that are not adapted to the natural soil conditions. A lab test can help avoid nutrient imbalances from excess fertilizer that can run off and pollute waterways. It will also help determine which plants are best suited to growing in the garden. Although they can vary somewhat by state, a standard soil test result typically includes the following measurements:

- Soil pH
- Levels of potassium, phosphorus, calcium, magnesium, and sulfur
- Organic content
- Lead contamination and what to do about it
- Recommended nutrient or soil **amendments** (*Recommendations are based on the needs of agricultural crops. Unless vegetables are being cultivated, nutrient recommendations may be much higher than what is needed to support garden plants.*) *If they are not part of the standard test, levels of nitrogen and other nutrients, sodium, soil texture, and other factors can be tested for an extra charge, but must be specifically requested.*

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The elements essential to plant health are classified as **macronutrients**, which are needed in large quantities and micronutrients, which are required in minute amounts. Both are necessary for healthy plants. The primary macronutrients are nitrogen (N), phosphorus (P), and potassium (K). The relative proportions of these nutrients are listed as N-P-K on fertilizer labels. Fertilizers may be either natural or synthetic. There are advantages and disadvantages to the use of both types. Although natural fertilizers can cost significantly more, take longer to apply and see the results than synthetic, they can offer a number of benefits. Whenever appropriate, use single-nutrient fertilizers instead of complete fertilizers that contain nitrogen, phosphorus, and potassium. For example, if soil is low in nitrogen but not in phosphorus and potassium, use blood meal, fish emulsion, or other high-nitrogen natural fertilizer. Better yet, grow green manure. Growing green manures, grains, and legumes as cover crops, is a good way to increase the amount of organic matter and nutrients in soil. Cover crops reduce the need for fertilizer. They also help suppress weeds, aerate the soil, increase its capacity to conserve moisture, and protect it from being compacted by rain and eroded by water or wind.



The goal of applying fertilizer is to provide just enough to supply the needs of the plant. Too much fertilizer can run off into nearby waters, leach into groundwater, or lead to weed problems. A plant's health should be the guide. If plants suffer from a lack of vigor, retarded growth, sparse foliage, or leaf discoloration, they may be nutrient deficient, although improper drainage or inadequate aeration are also likely causes. Adding compost and mulch can help with your soils fertility naturally and alleviate compaction too over time. The help of knowledgeable staff at a local garden shop/nursery is invaluable and can save you time and money in the long-run.

"Feed the soil, not the plants." – Wendell Berry

If possible add a compost pile and/or bin to your yard and apply organic mulches to your garden. Your leaves, pine needles, and other yard clippings are valuable. To avoid diseases, place mulch an inch or two back from the base of plants. Vermicomposting is a fun activity for many and helps utilize many of your leftover kitchen scraps; though as with compost, add citrus sparingly and avoid introducing bones, dairy products, or meats.

In a sustainable garden:

- Soils are healthy, living ecosystems that provide the needed air and water flow to support plant growth and a diverse soil food web
- Soil provides habitat for a wide range of organisms such as bacteria, fungi, insects, and earthworms
- Soil absorbs rainfall and mitigates flooding
- Rainfall infiltrates soil and replenishes groundwater supplies
- Soil removes pollutants and cleanses water
- Soil stores water for plants, wildlife, and people
- Soil stores carbon
- Soils are protected by vegetation or mulch
- Soil supports vegetation that provides a variety of ecosystem services
- Vegetation is selected based on what can thrive in the existing soil type
- Organic matter from the garden is used to support the soil food web and healthy vegetation



Compost pile



Additional resources:

Soil Food Web by Elaine R. Ingham,

http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/health/biology/?cid=nrcs142p2_053868 & <https://youtu.be/x2H60ritjag>

The New American Landscape: Leading Voices on the Future of Sustainable Gardening - Thomas Christopher

<https://www.amazon.com/New-American-Landscape-Sustainable-Gardening-ebook/dp/B0051FR6HY>

TED Talks - Ron Finley: A Guerilla Gardener in South Central LA

https://www.ted.com/talks/ron_finley_a_guerilla_gardener_in_south_central_la?language=en#t-365298 *"The benefit for the city is healthier citizens, fresher air, new ecosystems. I see birds outside my house that I've never seen before. That means a lot."* – Ron Finley

The Importance of Water in Sustainable Gardening

Water plays an important role in garden sustainability. Water scarcity has been cited as one of the most pressing issues of the 21st century and clean water shortages are quickly becoming one of the most pressing environmental challenges facing humanity.

In the US, the inefficient use of water resources is a major contributor to the threat of freshwater shortages. Landscape irrigation alone consumes more than 7 billion gallons of freshwater each day. The resulting runoff can contaminate local waterways with fertilizers, pesticides, and other pollutants. Other unsustainable garden practices further degrade our limited supply of this valuable resource. We often use potable water or drinking water in our gardens without realizing the costs of treating and pumping this water source. Instead of capturing and using stormwater in our gardens, we've created an entire infrastructure of gutters, downspouts, and sewers to rapidly transport it offsite.

In healthy gardens soil and vegetation store and clean water. In developed areas, however, much of the land has been

paved over, and the soil itself is often too compacted to absorb precipitation or stormwater. Rainfall flows from our roofs to gutters and downspouts, over compacted lawns and driveways into roads, and down storm drains, picking up pollutants along the way.

Researchers have found runoff from developed land to be the leading cause of water pollution in urban areas. In many older cities stormwater can overwhelm sanitary sewers, sending raw sewage as well as runoff into nearby waterways. However residential properties can be part of the solution.

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United States Department of Agriculture
Natural Resources Conservation Service

The Water Cycle:
Nature's Recycling System 

The Water Cycle - <https://youtu.be/9qtumsvaCoc>

Courtesy of USDA - NRCS



Garden Practices that Contribute to Water Conservation

Select plants adapted to local site conditions: *Growing plants adapted to the site conditions is one of the basic principles of sustainable gardening. The following are important tips for plant selection and maintenance:*

- ✓ **Preserve Established Vegetation:** *Established plants generally require less water than newly-planted vegetation that has not yet developed deep root systems. When purchasing new plants, select regional natives that are adapted to the local climate and well-suited to the growing conditions of the site.*
- ✓ **Plant at the Recommended Time:** *To speed establishment and minimize water use, plant at the recommended time of the year for a particular species.*
- ✓ **Minimize Lawn Size and/or Select Grass Species that Require Less Water:** *Lawn size and type can have a huge impact on the amount of irrigation a garden requires. To minimize water use, choose grass species that require minimal irrigation and look for ways to reduce unnecessary lawn.*

Use water-thrifty irrigation practices: *Conventional irrigation practices waste significant amounts of water. Irrigating with traditional sprinklers or when it is hot or windy leads to water loss. Watering too quickly or in excess can lead to runoff and water waste. You can estimate the amount of water used on the landscape by looking at your municipal water bills which typically indicate all potable water usage of a property and compare municipal water bills between months of heavy irrigation and months where irrigation was not needed or was minimal and the difference is the estimated average garden water use per month.*

The following are strategies for creating water-thrifty gardens:

- ✓ **Irrigate Only When Plants Need Water:** *How often to water depends on a number of factors, including soil, vegetation type and stage of establishment, season, climate, and weather conditions. Avoid irrigating on a fixed schedule that does not reflect the needs of the vegetation. Frequent, shallow watering tends to lead to weak, shallow-rooted plants. Less frequent, deep watering encourages roots to grow deep, where the soil stays moist longer. Applying water slowly will encourage infiltration and reduce runoff.*
- ✓ **Choose the Best Time of Day to Irrigate:** *The most favorable time for irrigation is typically in the early morning hours. Sunny or windy conditions increase evaporation and water loss.*
- ✓ **Use a Rain Gauge and/or Soil Moisture Probe:** *A variety of relatively simple tools can help gardeners determine when to water. The simplest and most inexpensive tool is a rain gauge. Soil moisture probes employing different technologies are also commercially available at varying prices; these measure the moisture level of soil, giving a more precise indication of how much water plants require.*
- ✓ **Hand Water and/or Use Drip Irrigation:** *Watering with a hand-held hose has been shown to conserve more water than other irrigation methods. If in-ground systems are required, consider installing a drip irrigation system, as it uses the least amount of water of any automatic system.*
- ✓ **Use “Smart” Irrigation Technology:** *To maximize efficiency, so-called “smart” or weather-based irrigation controllers take into account a range of factors, including temperature, rainfall, humidity, solar radiation, and soil moisture levels to determine when supplemental water is necessary.*
- ✓ **Closely Monitor the Irrigation System:** *Regularly check irrigation equipment for leaks or breaks. Adjust irrigation equipment and schedules to address changes in the garden and seasons.*

Water Reuse and Conservation Strategies: *With a little ingenuity, gardeners can utilize non-potable water from a variety of indoor and outdoor sources to irrigate their garden. Non-potable water is not safe for drinking, but can be a great resource for watering vegetation. On-site alternative water resources, such as rainwater runoff, air-conditioner condensate, and greywater, are typically considered waste products in unsustainable gardens and quickly removed from the site. Sustainable gardens capture this water. Doing so protects nearby ecosystems from pollutants commonly carried in stormwater. In addition, the volume of water going to storm sewer systems is reduced, lessening the likelihood of flooding and combined sewer overflows.*

Rainwater collection has been used for centuries to support households and grow beautiful, productive gardens. The practice typically falls into two categories, passive and active.

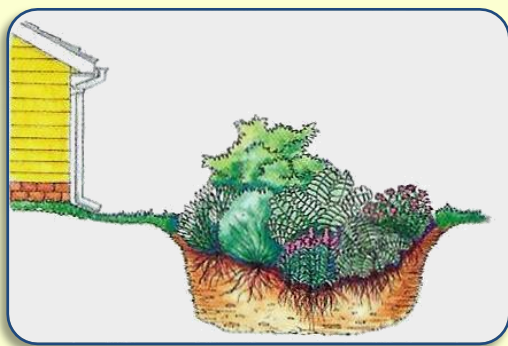
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Water Reuse and Conservation Strategies: *With a little ingenuity, gardeners can utilize non-potable water from a variety of indoor and outdoor sources to irrigate their garden. Non-potable water is not safe for drinking, but can be a great resource for watering vegetation (though use caution when watering vegetable gardens and edible plants). On-site alternative water resources, such as rainwater runoff, air-conditioner condensate, and greywater, are typically considered waste products in unsustainable gardens and quickly removed from the site. Sustainable gardens capture this water. Doing so protects nearby ecosystems from pollutants commonly carried in stormwater. In addition, the volume of water going to storm sewer systems is reduced, lessening the likelihood of flooding and combined sewer overflows.*

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- ✓ **Passive Rainwater Harvesting** *diverts water overland to vegetated areas for immediate use. Roads, driveways, and sidewalks are designed to direct water to vegetated areas instead of storm drains. Design features such as shallow bioswales (vegetated channels used to redirect, absorb and filter stormwater runoff) or terracing can be integrated into the garden and used to slowly convey and disperse the water throughout the garden. Rain gardens also help collect water and prevent runoff.*
- ✓ **Active Rainwater Harvesting** *captures water in a barrel or cistern where it is held for reuse. The containers are manufactured in a variety of shapes and sizes and can be connected to the downspouts of the roof gutter system. Rain barrels generally hold about 50 gallons of water and come with a screened cover and an overflow spout. Cisterns are used to store larger volumes of water and may be buried below ground or integrated into the garden as a freestanding structure.*



Rain Garden & Bioswale Courtesy of LFL

Rain Gardens and Bioswales: *One of the most effective ways to conserve water and prevent runoff of polluted stormwater from a home garden is to create biofiltration gardens. Also known as rain gardens or bioswales, the gardens use plants, soils, mulch, and microbes to slow and treat stormwater runoff. The management practice is modeled after natural ecosystems and has been shown to effectively reduce heavy metals, bacteria, other pollutants, and water temperatures. Like the rest of your garden, biofiltration areas can be easily integrated into the garden and composed of a variety of beautiful plants. The gardens hold standing water temporarily and typically drain within 24 to 48 hours. Because water is held only for short periods of time, these areas are typically not habitat for mosquitoes. Besides reducing the transfer of polluted stormwater, rain gardens and bioswales provide a variety of additional benefits. They reduce the likelihood of downstream flooding, increase the amount of water a garden receives, and replenish groundwater supplies.*

Protect and Restore Vegetated Buffers along Waterways, Wetlands and Roads: *In undisturbed natural areas, waterways and wetlands are protected by adjacent vegetation. Grassland, woodland, and wetland plant communities naturally absorb and cleanse stormwater. Buffers along waterways, wetlands and roads can also improve wildlife and fish habitat by providing food, shelter, and shade. When vegetation is replaced by impervious surfaces, stormwater runoff volumes increase. Stormwater often carries pollutants including nutrients from fertilizers, pet waste, and sediment into natural water bodies. Pollutants reduce the water quality and negatively affect wildlife habitat. In residential areas, turf grass often extends down to the water, polluting it with fertilizers and pesticides routinely used in lawn care. In developed areas, vegetated buffers can fulfill the same important ecological functions as undisturbed waterside vegetation. As the name suggests, these are thickly vegetated strips of land that protect waterways and wetlands from polluted runoff and erosion. They also provide year-round habitat for a variety of wildlife, including “stopover habitat” for migrating birds in spring and fall. Research shows that ecological benefits are positively correlated with the width of a vegetated buffer. Buffers less than 50 feet wide offer minimal benefits while those 200 to 300 feet in width offer a wide range, including soil stabilization, stream shading, water quality protection, flood prevention, and wildlife habitat. Vegetated buffers more than 300 feet wide can function as wildlife corridors and even harbor imperiled and sensitive species.*

Limit impervious surfaces: *Impervious surfaces are typically constructed surfaces such as rooftops, sidewalks, roads, and driveways which are covered by impenetrable materials such as concrete, blacktop, and mortared brick or stone. Urban and suburban soils, which are often compacted by intense foot traffic or construction equipment, can also be highly impermeable.*

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As urbanization increases, so does the amount of impervious surface. Studies have shown that the quality of many urban watersheds is negatively correlated with the amount of impervious cover in the watershed. Impervious surfaces are a primary cause of elevated stormwater runoff because they prevent precipitation from being absorbed into the soil. During heavy rainfall events, large areas of impervious surfaces allow runoff to gather volume, speed, and pollutants leading to excessive flooding and the damage of nearby ecosystems.

Common sources of stormwater pollution are fertilizers, herbicides, and insecticides; fluids and particles from automobiles such as oil and gas, brake linings, and tire and engine wear; sediment from improperly managed landscapes; building materials such as treated lumber, galvanized materials, copper and zinc roofs or gutters; coal tar sealants used on paved roads; and road salt (in colder areas). Excess nutrients from overuse and runoff of fertilizer can cause algal blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms have difficulty surviving in water with low dissolved-oxygen levels. Insecticides and herbicides present in stormwater can poison aquatic life. Land animals and people can become sick from eating contaminated fish or drinking pesticide-contaminated water. Homeowners can reduce the risk of these pollutants by minimizing the use of fertilizers and pesticides and by properly disposing of them before they have an opportunity to pollute stormwater.

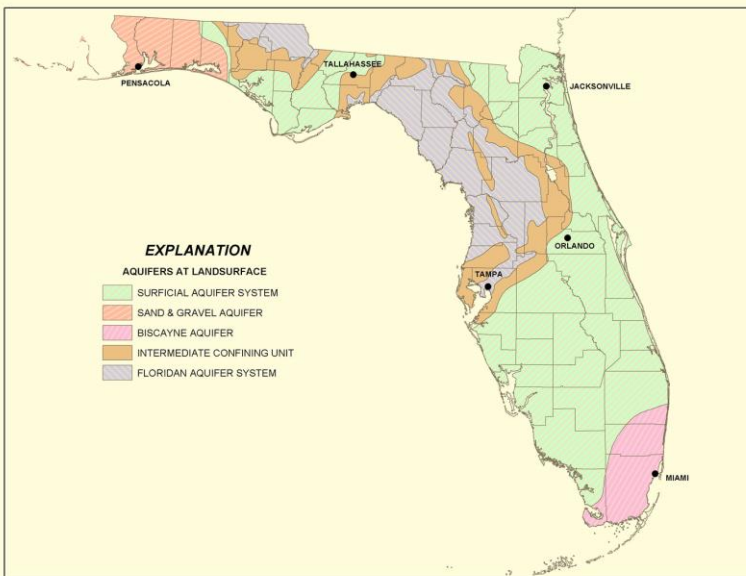


Algal Bloom

Photo by Dr. Sean McGlynn

To assess your landscape, locate any existing water features such as wetlands, ponds, streams, or other waterways on or adjacent to your property. Note the direction water flows across the garden and areas where water pools during storm events and where stormwater runoff is concentrated and eventually leaves the site (such as driveways, drainage pipes, storm gutters, etc.).

“Excess nutrients from overuse and runoff of fertilizer can cause algal blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms have difficulty surviving in water with low dissolved-oxygen levels. Insecticides and herbicides present in stormwater can poison aquatic life. Land animals and people can become sick from eating contaminated fish or drinking pesticide-contaminated water.” ~ LFL



Aquifers at Land Surface

Courtesy of Florida DEP

<https://fldep.dep.state.fl.us/swapp/Aquifer.asp#>

“The vast majority of the public water systems in Florida use ground water as their source. There are approximately 12,000 wells associated with ground water systems used for public water supply in Florida. These wells produce water from five major aquifers or aquifer systems.” ~ DEP



Additional Resources:

Rain Gardens

<http://gardeningsolutions.ifas.ufl.edu/design/types-of-gardens/rain-gardens.html>

Friends of Wakulla Springs

www.wakullasprings.org

Florida's Water Resources – IFAS Extension

<http://edis.ifas.ufl.edu/fe757>

FWC Wildlife 2060

<http://myfwc.com/conservation/special-initiatives/wildlife-2060/next-50/>

Do You Know?

What is your area's annual precipitation rate?

What is the local freshwater source?

How many people rely upon the resource?

What are the population projections for the area?

How will this impact the water supply?

The Importance of Materials in Sustainable Gardening



The principles of “reduce, reuse, and recycle” can help in selecting the materials needed to create sustainable home gardens and surrounding landscapes. Using reused or recycled materials and reducing the quantity, transport, and packing of these products can conserve energy and decrease pollution throughout a material’s life cycle.

Homeowners can minimize waste, energy consumption, and pollution associated with the manufacturing process by limiting the use of new materials and other products. Of the reduce, reuse, and recycle hierarchy, reducing the amount of materials or products imported into a project provides the greatest benefits.

REDUCE: Some strategies are especially helpful to reduce the materials imported into a project:

- ✓ Design garden features using standard material sizes to avoid waste and additional cuts and labor.
- ✓ Select manufactures or suppliers that reuse or eliminate packaging materials.
- ✓ Use durable materials that will last the life of the project and can be reused in the future.
- ✓ Design garden elements to be exposed. Avoid covering garden elements with additional materials for aesthetic purposes, such as covering a concrete wall with brick or stone façade.



Courtesy of Landscape For Life
www.landscapeforlife.org

REUSE: Reuse is one of the most effective strategies for offsetting the initial environmental and human health impacts of material or products because a majority of the material’s life cycle can be bypassed. Reuse is the repurposing of materials in a way that requires little or no processing. For example, reusing reclaimed brick, rather than allowing the brick to go to the dump, bypasses the raw material extraction, manufacturing, and disposal portions of the brick’s life cycle. If the brick is reclaimed from the site, the pollutants released during transportation and distribution can also be eliminated. In addition to providing numerous environmental benefits, using reclaimed materials in the garden can also provide design details unique to the site and help reduce costs. Strategies for reusing materials include the following:

- ✓ **Consider The Options:** Reclaimed materials can be used in whole form or deconstructed and dismantled to create a completely new object.
- ✓ **Be Creative:** Homeowners should be open to new and creative ways in which materials may be incorporated into the garden. When reusing materials it is often helpful to let the material inspire design.
- ✓ **Locate Materials Early In The Design Process:** Determining what materials are available for reuse early in the design process will allow time for creativity and design exploration.
- ✓ **Select Materials That Can Be Reused:** When designing new site features, homeowners can encourage the reuse of materials in future projects by selecting durable and non-toxic materials that come in modular and/or standard sizes.
- ✓ **Design For Deconstruction:** Design site features to allow them to be disassembled with reasonable effort and without extensive damage to the material. For example, use screws instead of nails and avoid the use of glues or other liquid adhesives.

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RECYCLE: Recycled materials should be considered after options to reuse and reduce materials have been fully explored.

Homeowners can support the use of recycled materials in two ways. First, they may purchase materials with recycled content. Typically, the higher the recycled content, the better. Second, they may purchase materials that can be easily recycled in their local area. Using materials produced in the region has multiple advantages. It reduces the fossil fuels required for shipping and their associated pollutants, including greenhouse gas emissions. It supports local businesses and the larger regional economy. One of the additional benefits of landscaping with local materials is that they can showcase the region's unique sense of place.

What constitutes "local" varies to some extent, depending on the type of material. The heavier the material, the more energy it consumes and the more pollutants emitted during transport, and therefore the closer the source should be.

Every material or product in a garden has environmental, economic, and human health impacts. The manufacturing of materials is a consumptive and an often wasteful process. Each phase, including the raw material extraction, processing, manufacturing, packaging, distribution, installation, and disposal, requires energy and can produce harmful air, water, and soil pollutants and wastes. Sustainable gardens minimize these negative impacts by creating a circular material life cycle that is built upon the use of local, recycled or reused materials.



Ideas from Native Nurseries, www.nativenurseries.com

- ✓ *The life cycle of materials is a circular process, in which materials and products are reused or recycled to avoid the extraction of raw materials and minimize energy and resource consumption.*
- ✓ *Materials represent the regional identity of the area and support the local economy.*
- ✓ *When selecting materials, consideration is given to not only the cost but also the human health and environmental impacts.*

SUSTAINABLE LANDSCAPES:

- ✓ **Use Minimally Processed Materials:** The ecological and human health impacts of materials typically increase with each additional manufacturing phase. Therefore, materials that have reduced manufacturing and processing requirements often pose fewer environmental and human health risks.
- ✓ **Use Certified Wood:** Experts are hesitant to compile definitive lists of sustainable wood species because variability in harvesting techniques can lead to a tree being endangered in one area and responsibly harvested in another. In the case of domestic trees like Douglas fir, it is not the species itself but rather the old-growth forests from which specimens can be cut that are becoming rare. The best way to guarantee that the lumber and other wood products you purchase have been harvested sustainably is to choose products certified by the Forest Stewardship Council (FSC), www.fscus.org, or other independent nonprofit organizations that have determined that the materials meet a set of rigorous standards.

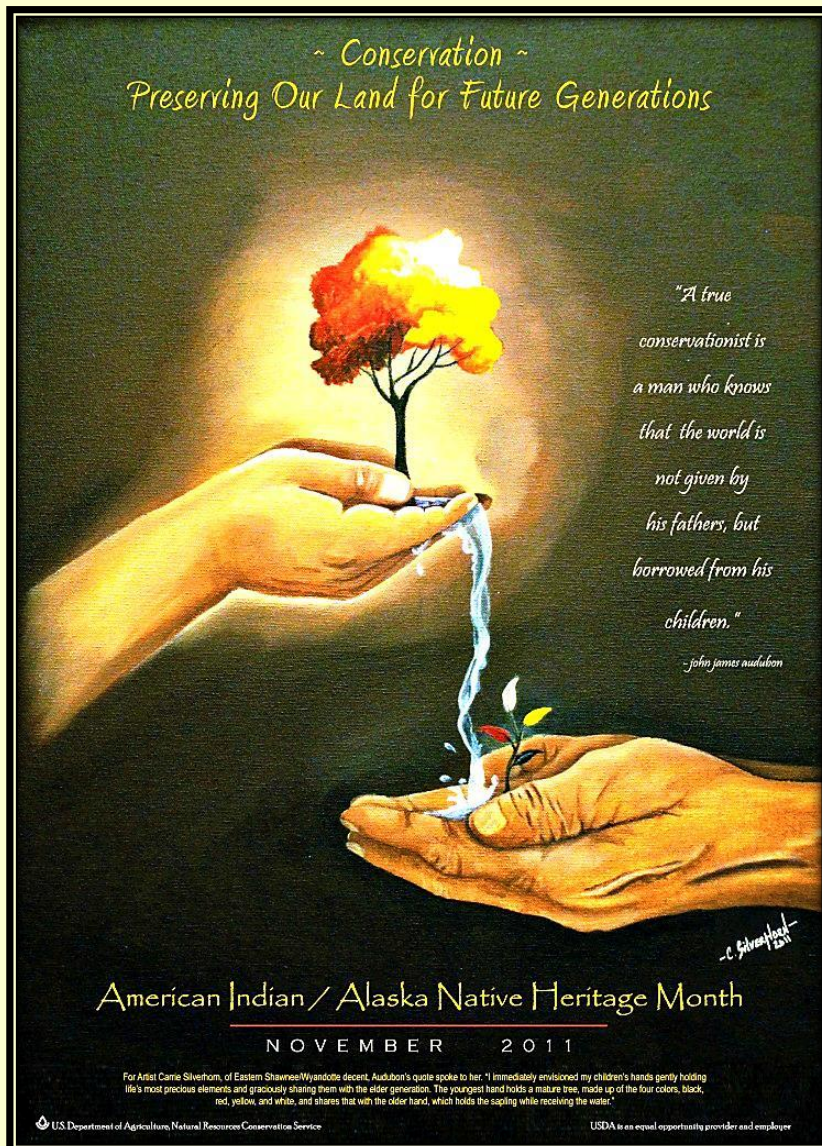
Avoid PVC: Polyvinyl chloride (PVC) releases dioxin, a known carcinogen, during its manufacturing and disposal phases. PVC is commonly used in products such as plastic fencing, irrigation pipe, decking, and garden hoses. It cannot be recycled and has a relatively short life span. Homeowners should consider alternatives to PVC such as high-density polyethylene (HDPE) piping or wooden decking or fencing.

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- ✓ **Use No or Low VOC Products:** The term volatile organic compounds (VOCs) refers to a large number of mostly petrochemical-derived substances that readily volatilize, or become a gas, at room temperature. VOCs can be bad for the environment and harmful to human health. Among the hundreds of VOCs found in consumer products are formaldehyde; benzenes; toluene; styrene; xylenes; and chlorinated solvents such as trichloroethylene, carbon tetrachloride, and methylene chloride. Garden products that contain VOCs include primers, paints, stains, sealers, other finishes, paint strippers, adhesives, caulks, and pesticides. While VOCs were once necessary for good performance in many products, most companies now produce effective and cost-competitive alternatives. For example, paints that meet the Green Seal standard are certified lower than 50 g/l for flat finish or 100 g/l for non-flat finish.

IN CONCLUSION: There are now over 7 billion people inhabiting the earth. The growing population places increasing pressure on the planet's soils, waters, forests, and other natural resources. Sustainable gardens can help alleviate the pressure on the Earth's ecosystems by working with nature to provide clean air and water, fertile soils, wildlife habitat, and other essential ecosystem services. Significant portions of our urban environments are made up of residential land, which can impact the health and well-being of an entire region. Creating and maintaining sustainable gardens imparts a wide range of ecological, health, and economic benefits to homeowners and the surrounding community. Sustainable gardens also help protect and restore vital habitat that endangered birds, pollinators, and other wildlife need to survive. By embracing the ethic of stewardship, we can become stewards of the land by making sustainable changes in the way we manage of our immediate landscape. If each of us does a little, it will help a lot!



We are indebted to the Lady Bird Johnson Wildflower Center, www.wildflower.org and the United States Botanic Garden, www.usbg.gov, for the creation of the Landscape For Life program. Many thanks to Jonathan Garner and Tanya Zastrow with the Wildflower Center and Ray Mims with the United States Botanic Garden; without their help this series would not have been possible. This concludes the fifth in a five part series. More information is available at Landscape For Life, www.landscapeforlife.org.

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Additional Resources:

Audubon—A Bird-Friendly Yard

<https://www.audubon.org/magazine/july-august-2013/how-create-bird-friendly-yard>

Bringing Nature Home

Book by Dr. Doug Tallamy

<http://www.bringingnaturehome.net/gardening-for-life.html>

Florida Wildflower Foundation

www.flwildflowers.org

Landscape For Life

http://landscapeforlife.org/new/downloads/LFL%20Manual%20ructor_FINAL012914.pdf

Native Nurseries

1661 Centerville Road, Tallahassee

www.nativenurseries.com

The New American Landscape

Book by Thomas Christopher (Editor)

<https://www.amazon.com/New-American-Landscape-Sustainable-Gardening/dp/1604691867>

The Seed Underground

Book by Janisse Ray - <http://janisseray.weebly.com/>