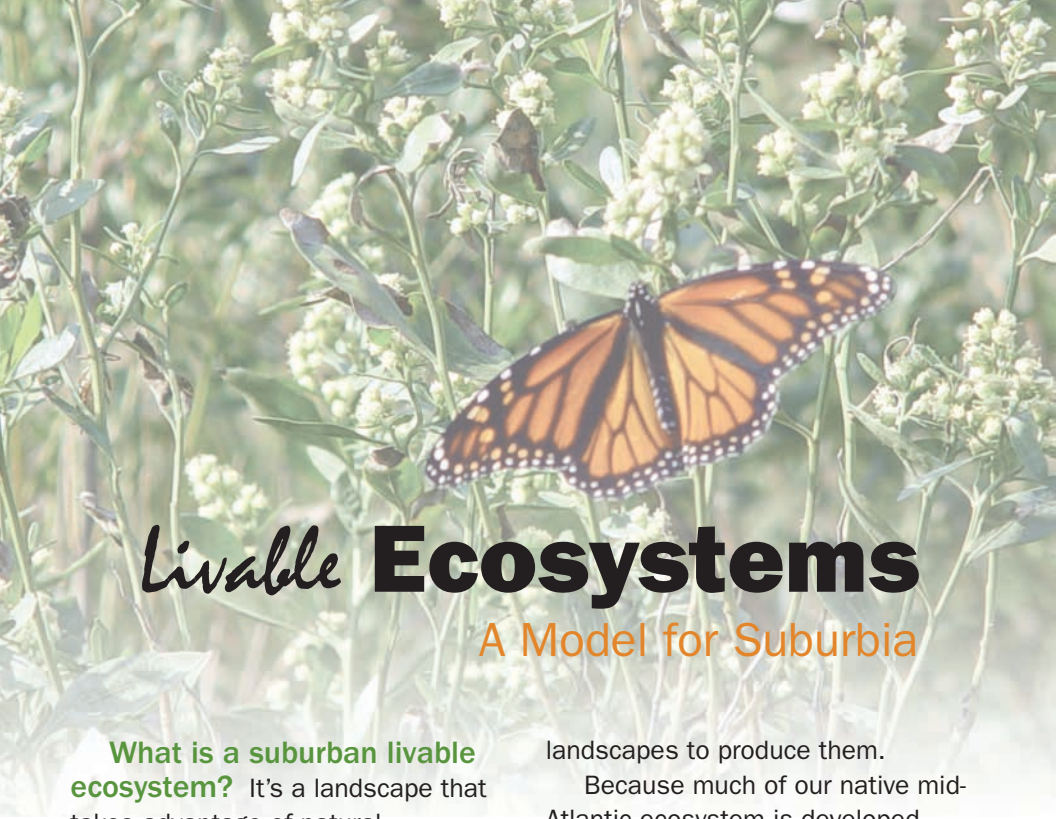
Livable Ecosystems

A Model for Suburbia



Livable Ecosystems

A Model for Suburbia

What is a suburban livable ecosystem? It's a landscape that takes advantage of natural processes while providing tangible benefits to its owner. When we think of home landscapes as ecosystems, we can start to see the opportunities to produce ecosystem services right in our yards; services such as cleaning water, increasing plant and animal diversity, cooling the environment, saving energy, sequestering carbon, and enjoying landscapes for the pleasure they can provide.

Ecosystem services are goods and services received from natural resources contributing directly and indirectly to human welfare (de Groot, Wilson and Boumans, 2002). This brochure focuses on these services, the benefits they provide and the strategies that can be used in home landscapes to produce them.

Because much of our native mid-Atlantic ecosystem is developed, suburban home owners can play an important role in redesigning landscapes to provide vital ecosystem services. The traditional home landscape contains a limited palette of plants, has large areas of regularly mowed lawn, and provides relatively few ecosystem services. Forests and meadows, on the other hand, provide many ecosystem services. By using more plants, planting more natives, planting to conserve energy, and incorporating managed meadows and forest fragments into yards, suburbia can become a valuable substitute for the long-gone, predevelopment forests and meadows.

While one homeowner can't expect to fix the world, each person can make small improvements over time

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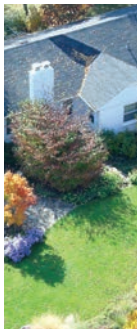


Ecosystem Service	Benefits	Home Landscape Strategies
Clean Water	• Erosion control • Water infiltration • Removal of pollutants • Recycling of water	• Bioswales • Rain gardens • Reduced lawn size
Fresh Air	• Lower temperatures • Removal of pollutants • Carbon sequestration • Reduced energy use • Reduced emissions from lower temperatures and reduced energy use	• Strategic tree planting • Wind breaks • Less lawn • Plants as groundcover • Leaves and yard waste as mulch • Diverse, mixed plantings • Fall fertilization
Wildlife	• Pollination • Seed distribution • Plant decomposition • Natural population controls to reduce pesticides • Observational fun	• Planting native species to provide a variety of food • Planting for cover • Incorporating water into the landscape • Reduced use of pesticides
Human Wellness	• Stress reduction • Quicker healing • Less crime • Increased property values • Healthy food • A stronger sense of community • Reconnection with nature • Better quality of life	• Functional landscapes with usable spaces • Surround activity spaces with appealing plants • Less lawn • Become engaged in the garden

This traditional home landscape has a limited palette of plants and large expanses of irrigated, routinely mowed lawn.

that add up to positive change. If you want to make a difference, this brochure will tell you how! Read on to find out about planting more shade trees, reducing lawn, recycling grass clippings, using leaves as mulch, planting dense groundcovers, and incorporating native plants into your landscape. If you've been planning a large scale project where you live, work or play, consider planting a rain garden, a windbreak or a wildlife habitat garden—this brochure will help you get started!

This neighborhood has cooperated to manage an area beyond their mowed lawns as a grassy meadow.

Ecosystem Service 1: **Clean Water**

Water coming from the roof runs down this rain chain and into the planting bed.

Clean, fresh water is critical for the survival of most life forms, but too much of a good thing can be a problem when it arrives with devastating force. Traditionally, stormwater has been managed by efficient collection and transport away from sensitive areas. But as stormwater collects, it gets more and more forceful, carrying pollutants and eroding the soil. Contemporary methods for managing stormwater slow water down allowing water to percolate into the ground. Plants absorb and transpire water back to the atmosphere. Lawns are poor at capturing water, particularly on slopes and during the summer when the soil is sun-baked. Forests don't need stormwater engineers—percolation and transpiration happen naturally, providing fresh, clean water for future use.

Direct water to landscape plantings. Direct the water from your roof, driveway and patio to landscape plantings in your garden. Take advantage of the existing topography to slow water and allow it to seep into the ground.

Build a rain garden. With a little more effort, you can dig out the soil and plant the sunken area with moisture-tolerant trees, shrubs and perennials. (See page 14 for instructions)

The early emerging perennials in this rain garden, slow water from the lawn above.

Ecosystem Service 2: **Fresh Air**

Plants improve air quality by reducing temperature, removing air pollutants, sequestering carbon, and reducing energy use in buildings.

- Transpiration and shade from trees reduces air temperatures.
- Lower air temperatures result in fewer temperature-dependent pollutants and ozone forming chemicals.
- Leaves intercept particles and take up air pollutants.
- Trees remove carbon through photosynthesis and store it for many decades.

One acre of healthy forest sequesters 2.6 tons of carbon per year, enough to balance the 2.3 tons of carbon dioxide released by one person each year.

Trees and the shade they cast reduce the heat that is absorbed and reflected from this pavement.

Each person in the US generates approximately 2.3 tons of carbon dioxide each year. One acre of healthy forest sequesters about 2.6 tons per year. So the carbon dioxide produced by one person would be off-set by one acre of trees. By lowering temperatures and shading buildings in the summer, trees and other plants can reduce building energy use. Less need for fossil fuel means fewer carbon emissions.

When your landscape is designed to consider minimizing energy usage and inputs, you save money and time while helping improve your environment.

Plant trees to reduce heating and cooling bills. Strategically placed trees can reduce winter heating bills and summer cooling bills. Use plants to provide shade and to reduce wind. Plants that shade paved areas save energy. Light energy striking dark pavement like asphalt is absorbed, heating the air. Light colored pavement absorbs less energy, but can reflect it toward a building. Tree leaves reduce heat and reflection by

absorbing light energy and using it to evaporate water. Consider planting a wind break to reduce heating costs in open landscapes (see page 17 for instructions).

Reduce lawn area. By reducing mowed lawn area, you can reduce fuel consumption and emissions and improve the permeability of your property. If your lawn is small enough, you may be able to use a push reel mower and eliminate the need for fuel altogether. What can the land be other than lawn? Planted landscape beds will look great but are expensive to install. Depending on the size of your lawn, consider allowing some lawn to become a managed meadow (See page 21 for instructions) and allow the rest to grow into a forest (See page 19 for instructions).

Use plants to control weeds. Design the landscape so plant competition is the primary method of weed control. When healthy plants grow together in a meadow, forest or landscape bed, there is no exposed soil to allow weeds to get a foothold.

This solid planting of ground cover controls weeds and forms the carpet for the shrubs in this landscape.

Leaves provide the perfect mulch for this grove of trees.

In any managed landscape there will be some need for weed control. Cut weeds before they flower and go to seed. Dig out perennial weeds removing the entire root system. Spot spray difficult weeds or invasive plants.

Use recycled mulch. When plants are young and have yet to cover the exposed soil, add mulch to reduce weeds. Use composted yard waste or chopped leaves collected in the fall to cover bare soil in the landscape. This improves the permeability of your bed and also provides a place for young fireflies to grow.

Plant a complex mix of native plants. Reduce the need for disease and insect control by planting a variety of primarily native trees and shrubs. Diverse plantings provide

Fall colors and flowers provide garden interest and support a diverse population of wildlife.

This small lawn was fertilized in the fall and has a bright green color the following spring.

opportunities for beneficial insects to thrive and keep pest populations low. Practice integrated pest management by scouting for pests in the landscape. If pests become a problem, treat the vulnerable life stage with the least toxic control option available.

Fertilize with nitrogen in the fall to promote growth. Nitrogen is present in decomposing plant tissue so lawn clippings, fallen leaves and composted yard waste are a great source. Lawns and actively growing young trees require additional nitrogen. Apply fertilizer in the fall when plants put most of their energy into root growth. Never apply more fertilizer than plants can take up at any given time. The excess is likely to leach into groundwater or run off in surface water. Apply no more than one pound of actual nitrogen per 1000 square feet if the nitrogen is in a quick release form. Slow release nitrogen, such as some organic manures and coated fertilizer particles, can be applied at a rate of 2 pounds of nitrogen per 1000 square feet.

Add other nutrients based on soil test results. Most soils in Delaware contain plenty of phosphorus, potassium, calcium, magnesium and sulfur for lawn and landscape plants, so you rarely need to add more. Conduct a soil test to learn the existing nutrient levels and pH. Soil test bags are available at your County Cooperative Extension Office. If soil pH is too high or too low, required nutrients may not be available to plants, so you will need to add sulfur or lime to get the pH in the proper range for plant growth.

Ecosystem Service 3: **Wildlife**

Wildlife—is it good or bad for the landscape? Gardeners often think of insects as pests, but in fact, only a small percentage of insects become pests on ornamental plants. Most insects provide food for birds (96 % of our birds rear their young on insects) and other animals. Diverse landscapes support a wide variety of beneficial insects and microorganisms that help control the plant pests we do have. Besides being fun to observe, wildlife provides important functions such as pollinating flowers, distributing seeds, breaking down (eating) plants, and controlling the population size of organisms lower on the food chain.

The food chain begins with plants that create sugars from sunlight and air (pretty awesome!). Herbivores eat plants, carnivores eat animals, and omnivores eat both. Finally detritivores, scavengers and decomposers eat dead plants and animals, returning biomass to the soil system. This is a sound system and the more our landscapes allow these natural processes to occur, the better.

To support wildlife, the landscape must provide food, water, cover and territory. Each wildlife species has a unique set of requirements that may change as an individual species goes through its life cycle. For example, butterflies can survive on a variety of nectar plants, but their larvae (young) may develop on specific plants (see pages 24-25).

Plant a diverse mix of primarily native plants. Wildlife diversity is directly proportional to plant diversity. Grasses provide grains and greens, shrubs and groundcovers provide fruit, flowering plants provide nectar and seed, and trees provide fruit and nuts. All of these plants provide insects for birds. Scientists deem oaks and pines as the most valuable woody plants for wildlife, followed by

This blue jay can harvest acorns from the nearby oak when native trees are included in the garden.

blackberry, wild cherry and dogwood. Lawns, on the other hand, provide little wildlife value. There is evidence that native insects require native plant species for food. Without sufficient native plants to feed native insects, the rest of the food web may be limited (Tallamy, 2009). Plant for all life stages; for example, butterfly gardens must contain plants that feed larvae as well as plants that provide nectar for butterflies (See pages 23-25 for plant lists).

Provide cover in the landscape. Cover provides protection from weather extremes, the eyes of predators, and anything else that poses a threat. Cover supplies shelter, escape routes, refuge and places to rest. It offers a nesting or roosting location. It must be adequate for wildlife to successfully rear their young. It can be located in or under vegetation (living or dead), or in small spaces found in rocks, buildings or underground. Reforest an area that was formally lawn to provide many opportunities for cover (See page 19 for instructions).

Incorporate water into the garden. Water varies in importance from species to species. Browsers, such as deer and rabbits, receive all the water they need from the leaves of plants. Some animals need a source of drinking water, while others require a larger body of water. Bodies of water attract many types of wildlife, including songbirds, wading birds, small mammals, small reptiles, amphibians and insects. In general, flowing water is more attractive to wildlife than still water.

This fallen log becomes home to many organisms when it is allowed to decay in the landscape.

The final habitat requirement, territory, is the spatial area an individual animal needs to successfully live its life. Territorial behavior results in an even distribution of a population over the available space. Species with a high degree of territorialism appear to be at a disadvantage in human dominated environments.

A bird bath nestled among shrubs provides water in a spot that has some protective cover.

Design landscapes to promote wildlife–

- Increase the diversity of plant species.
- Use different plant combinations for different locations on site.
- Use native species.
- Select species that provide food for the wildlife you want to encourage.
- Grade to develop topographic variation.
- Reestablish drainage patterns.
- Leave water-collecting depressions.
- Vary plant community structure across the site (meadow, shrub thicket, woods).
- Maintain a variety of sizes of trees and shrubs.

Manipulate the garden to reduce habitat for unwanted wildlife. There are also unwelcome species of wildlife in the built landscape. Wildlife may be destructive to buildings (woodpeckers, raccoons), and vegetation (deer, rabbits, squirrels, moles). It may defecate in public areas (geese). It can simply be a nuisance (skunks). Habitat manipulation is more effective than direct population reduction, because wildlife populations will rebound if habitat requirements are present.

Design to control unwanted wildlife–

- Avoid planting food-producing vegetation in areas where the presence of animals can endanger public health and safety, such as airports, electric power stations and high-traffic areas.
- Install a buffer of vegetation that deer dislike (such as ferns, sedges, grasses, spice bush) at the woods' edge.
- Install a fence to restrict larger wildlife.
- Plant a buffer strip of tall, unmowed vegetation along the edge of a water body or in an open field to discourage geese.

Geese can be a real problem when a pond is surrounded by mowed lawn, but tall plants next to a pond, not only filter runoff but eliminate geese habitat.

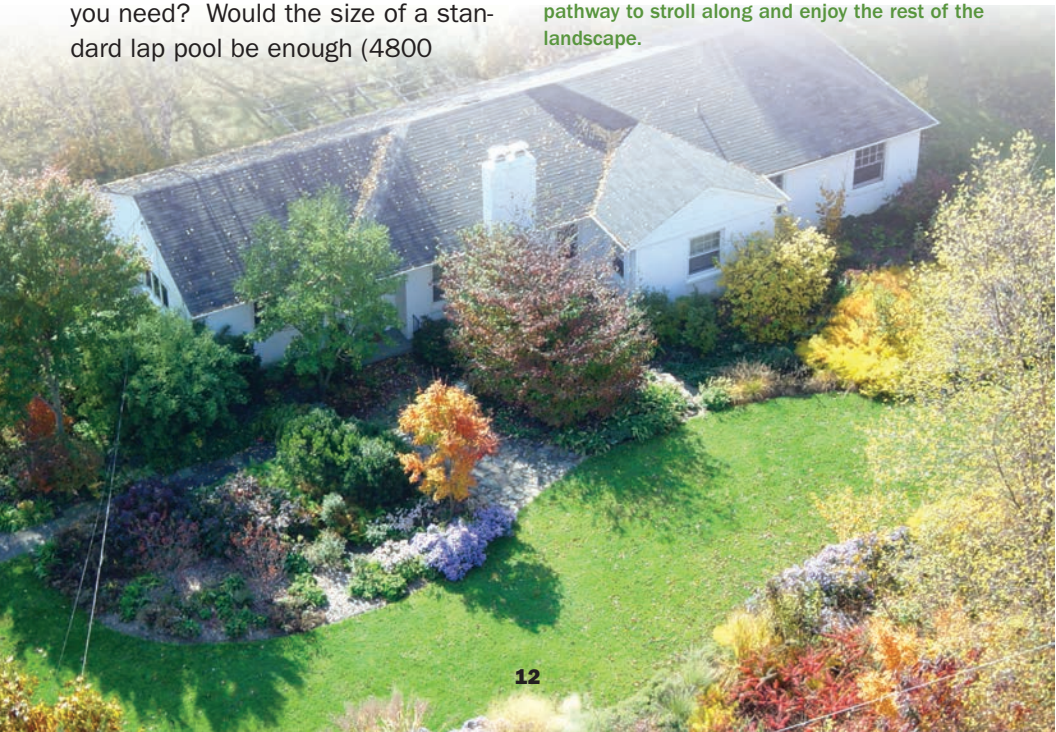
Ecosystem Service 4: **Human wellness**

Traditional home landscapes feature vast areas of under-utilized space, such as large mowed lawns. Lawn is an important component of most landscapes. It is the only viable play surface; it is used for walking, since it withstands traffic; and it is the green carpet that compliments other more complex plantings. Since lawn is so important, we should choose precisely where it belongs in the landscape. In other words, plan the lawn first. Include lawn spaces that have pleasing shapes and perform appropriate functions in the landscape. If you want to toss a ball with your kids, how much space do you need? Would the size of a standard lap pool be enough (4800 square feet) or how about the infield of a baseball field (11,000 square feet)? How much space do you need for entertaining—the size the dining area in a typical McDonald's restaurant (1600 square feet)? Once you design the lawn spaces, the rest of the landscape can be something else – landscape beds, meadow or forest.

Create spaces for human enjoyment by designing outdoor rooms to suit specific needs. Use trees as ceilings and shrubs or tall perennials as walls to define different rooms within the larger landscape. One room may be used for entertaining, another for play, and a third for a vegetable garden and storage shed.

Interaction with gardens and natural spaces offers a variety of mental, physical and social benefits for hu-

The lawn in this garden provides a generous pathway to stroll along and enjoy the rest of the landscape.



A simple mowed path encourages entry into what might otherwise appear to be an inaccessible meadow.

Get friends and family engaged in the garden by providing spaces for entertaining.

mans, ranging from stress reduction, quicker healing, and mitigation of Attention Deficit Disorder in children to decreased crime in cities. Research has shown that people who interact with green spaces have a stronger sense of community, cope better with everyday stress and hardship, are less aggressive and violent, perform better on tests of concentration, and manage problems more effectively. A minor investment in green spaces can have a huge payoff in reducing costs for social, medical and safety services. As Henry David Thoreau claims, a remedy we can never have enough of is a healthy dose of nature.

Become more engaged in the landscape –

- Plan functional spaces in the landscape for play, entertaining and producing food.
- Grow, harvest and cook your own produce.
- Garden for pleasure—move plants on a whim and peacefully pull a few weeds in a nice shady corner of your garden.
- Provide activities for kids to do garden projects.
- Attend garden tours and visit public gardens to get ideas for your own gardens.
- Use paths to encourage strolling through the garden.
- Photograph your garden to capture highlights.

It can be highly therapeutic and "just plain fun" to get your hands dirty in the garden as these students found out in an Environmental Club project.

When you have time, money and energy to tackle some big projects, here are a few ways you can make a big difference in your home landscape:

Install a rain garden:

Rain gardens filter water to prevent pollutants from entering streams and lakes; protect communities from flooding; recharge local and regional aquifers; and provide valuable habitat for birds, butterflies and many beneficial insects.

Locating the rain garden –

- Construct a rain garden at least 10 feet from the house so infiltrating water doesn't seep into the foundation.
- Do not place a rain garden directly over a septic system.
- Avoid areas where water already ponds. The goal of a rain garden is to encourage infiltration. Wet areas are where infiltration is slow.
- Locate the rain garden in full or partial sun.
- Look for a relatively flat site because the rain garden should be level.
- Choose a spot that will capture the current flow of rain water from impervious surfaces (roof, driveway, paving) or regrade to direct water into the rain garden.
- Incorporate the rain garden into the rest of the landscape – it does not need to be a stand-alone bed, but can be connected to any other landscape bed or border.

Sizing the rain garden –

- A rain garden should be about 10-30% of the square footage of the source area.
- Most home rain gardens range from 100 to 300 square feet.
- The surface of the rain garden should be 6 to 8 inches below the surrounding grade.
- Soil matters. If your soil is well-drained sand, you need about half as large an area as you will with poorly drained clay soil.
- If you calculate a rain garden size larger than 300 square feet, you might want to create several smaller rain gardens.
- A rain garden should be about twice as long as it is wide. Orient the long dimension of the rain garden perpendicular to the slope and water source (i.e. downspout).

Constructing the rain garden –

- Kill the existing vegetation.
- Dig out the rain garden to the planned depth, piling soil on the downhill side. This soil will be used to create a berm to keep water from flowing rapidly out of the rain garden in a rainstorm.
- If the area is almost flat, dig the rain garden to the same depth throughout. If the area is sloped, dig the high end of the rain garden deeper than the low end so the result is a level base.
- If you plan to mix compost into the soil, dig the rain garden 2 inches deeper.
- Build a berm or "wall" across the back and sides of the rain garden. Taper the berm to be equal to the surrounding grade on the uphill side.
- Tamp the berm well so it is compacted and stabilize by planting grass (use straw or an erosion control mat until the grass is established) or spreading mulch on the berm.

Planting the rain garden-

- Select plants that fit into your landscape.
- Plants in rain gardens must tolerate standing water for several days as well as drought conditions.
- Hardy, herbaceous, native plants generally perform best in rain gardens.
- Loosen the soil and plant into wide holes breaking up root systems to get the plant integrated into the garden quickly.
- Provide one inch of water per week until plants are fully established.

Native plants capture rainwater from this roof. Eventually, these plants will all grow together and there will be no need for mulch.

Maintaining the rain garden-

- Weed the rain garden aggressively in the first few years until plants fill in and cover the ground surface.
- Monitor the rain garden for weed problems as you would any other garden bed.
- Cut back perennials in the spring prior to new growth.

Alternative Construction-

- When soil does not percolate well, you can dig out an area much deeper than 6-8 inches (up to 4 feet) and backfill with well-drained sandy soil, leaving the surface 6-8 inches below the surrounding grade.
- Another solution is to dig out columns of soil using an auger to

improve percolation. You can rent many different sized augers depending on the scope of your project and need for improved percolation. Back fill the columns with well-drained sandy soil.

Columns dug three feet deep and filled with gravel help this rain garden percolate.

Plants for a rain garden-

Perennials:

Aquilegia canadensis, Canadian columbine
Arisaema triphyllum, Jack-in-the-pulpit
Asclepias incarnata, Swamp milkweed
Aster novae-angliae, New England Aster
Aster novi-belgii, New York Aster
Athyrium filix-femina, Lady fern
Baptisia australis, False indigo
Boltonia asteroides, Boltonia
Carex stipata, Tussock sedge
Chelone lyonii, Pink turtlehead
Cimicifuga racemosa, Black snakeroot
Eupatorium maculatum, Joe-pye weed
Gillenia trifoliata, Bowman's root
Helianthus angustifolius, Swamp sunflower
Hibiscus moscheutos, Marsh mallow
Iris cristata, Dwarf crested iris
Lobelia cardinalis, Cardinal flower
Lobelia siphilitica, Blue lobelia
Meehania cordata, Meehan's mint
Phlox paniculata, Garden phlox
Physostegia virginiana, Obedient plant, False dragonhead
Spiranthes cernua, Nodding lady's tresses
Stylophorum diphyllum, Celandine poppy
Tradescantia x *andersoniana*, Virginia spiderwort
Vernonia noveboracensis, Common ironweed
Veronicastrum virginicum, Culver's root

Shrubs:

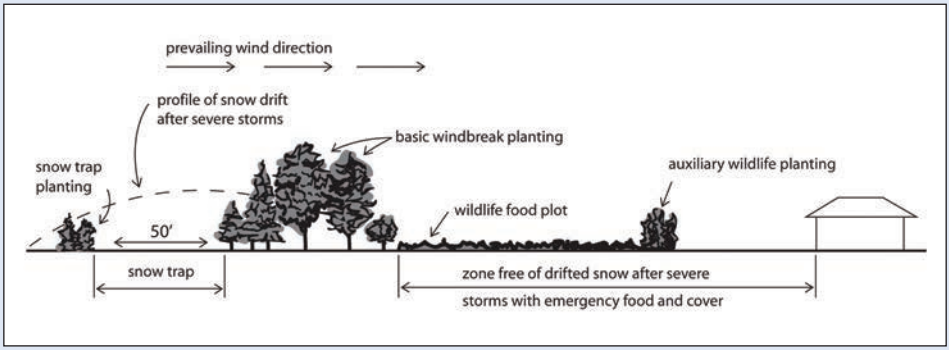
Cephalanthus occidentalis, Buttonbush
Clethra alnifolia, Summersweet
Cornus amomum, Silky dogwood
Cornus sanguinea, Bloodtwig dogwood
Ilex glabra, Inkberry holly
Ilex verticillata, Winterberry holly
Sambucus canadensis, American elderberry
Viburnum dentatum, Arrowwood

Plant a windbreak:

A windbreak is a barrier of one or more rows of trees or shrubs used to reduce and redirect wind. By reducing wind speed behind a windbreak, a more desirable microclimate is created in the sheltered zone. If designed properly, windbreaks around a home can reduce the cost of heating and cooling and save energy. Windbreaks also provide wildlife habitat for nesting, loafing, escape and protection from the elements.

Locate trees for maximum energy benefits –

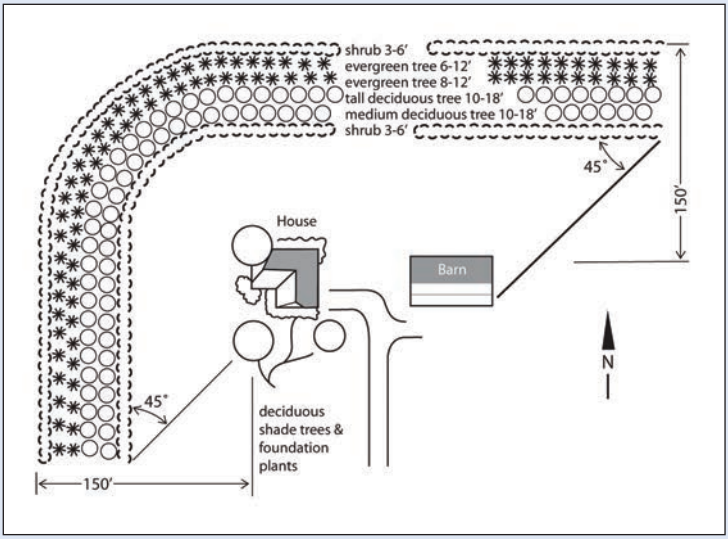
- Plant deciduous trees to shade east-facing walls and windows from 7 to 11 AM and west-facing surfaces from 3 to 7 PM during June, July, and August.
- Plant trees with mature heights of at least 25 feet approximately 10 to 20 feet east and west of the house.
- Trees planted to the southeast, south, or southwest will only shade a building in the summer if they extend out over the roof. In the winter, when maximum sun is desired, such trees will provide too much shade. Even deciduous trees that have dropped their leaves cast quite a bit of shade in the winter.
- To avoid winter shading, locate trees no closer than 2-1/2 times their mature height to the south of a building.
- Locate trees on the southeast or southwest about four times their mature height from the building.
- Plant trees to shade paved areas.
- Shade air conditioners from mid-morning through evening. Prune branches to allow at least several feet clearance around the air conditioning equipment to encourage air flow. Avoid planting shrubs near the air conditioner since they reduce air flow and cooling efficiency.



A well-designed windbreak provides basic wind speed reduction, snow trap and wildlife habitat.

Plant an effective windbreak -

- Windbreak structure—height, density, number of rows, species composition, length, orientation and continuity—determines the effectiveness of a windbreak.
- Windbreak height is the most important factor determining the area protected by a windbreak. Since plants grow, windbreaks continue to become more effective as they age. Wind speed is reduced in an area 2 to 5 times the height of the windbreak on the windward side and up to 30 times the height of the windbreak on the leeward side.
- Windbreak density is the ratio of the solid portion of the barrier to the total area of the barrier. A windbreak density of 40 to 60 percent provides the greatest downwind area of protection. The number of rows, distance between rows and species composition control windbreak density. If the windbreak density is below 20 percent, a windbreak does not provide useful wind reductions. Above 80 percent, excessive turbulence may reduce the protected zone.
- Windbreaks are most effective when oriented at right angles to prevailing winds. The use of multiple-leg windbreaks provides a larger protected area than a single windbreak.
- For maximum efficiency, the uninterrupted length of a windbreak should exceed the height by at least 10:1.
- To attract a broad spectrum of wildlife, plant a multi-row windbreak consisting of evergreens, shrubs and tall deciduous trees.



Home with windbreak designed for wildlife habitat enhancement.

Plant a forest:

Climax vegetation is the combination of plants that eventually develop on an undisturbed plot of land. An oak/hickory forest is the climax vegetation for most of the mid-Atlantic region. That doesn't mean the forest contains only oaks and hickories. An oak/hickory forest might include other shade trees like sycamore and tulip poplar; understory trees, like dogwood, ironwood, beech and blackgum; shrubs like viburnum, spice bush and clethra; and lots of herbaceous plants starting with spring ephemerals and ending with fall blooming asters. A healthy forest provides more ecosystem services than any other type of vegetation. Nutrients are recycled effectively; water is cleaned and recharged into groundwater; carbon is sequestered in long-lived trees; and lots of wildlife is supported.

When a plot of land is unmanaged or abandoned it starts to go through a process of succession with the climax vegetation of the region as the endpoint. For example, if you stop mowing your lawn, early successional plants like goldenrod and little bluestem dominate for a few years. Then woody plants like eastern red cedar and spice bush arrive. Eventually, trees like red maple fill in and provide shade for the oaks and hickories to get started. At one time, this process happened gradually on any abandoned land. Unfortunately, the pressure of invasive exotic species has disrupted the successional process. So reforestation must be managed. You can start by releasing land from mowing. But, you will need to provide spot control of invasive species like autumn olive, multiflora rose and oriental bittersweet, either through hand digging or selective herbicides. You can also plant young trees to jump start the process and get a forest established more quickly.

These young trees will eventually grow into a forest if managed properly for 10-20 years.

Reforest an area –

- Stop routine mowing of the site.
- If you mow yearly, you will prevent woody plants from developing.
- If you want a forest to grow, you must stop mowing entirely.
- Watch the plants that grow and remove invasive species that will not contribute to a healthy ecosystem.
  - Remove by handdigging.
  - Remove by using a selective herbicide.

- Plant young grove-forming trees like persimmon and paw paw, to get a tree cover established.
- Plant larger shade trees like red maple, tulip poplar, sweet gum, oak and hickory to get a canopy established.
- Use spot treatment, hand removal or selective trimming to keep plants (aka weeds) that grow up between the trees from crowding out the trees or making the site look ugly.
- Create distinct edges between reforested areas and lawns by mowing lawns routinely on a pleasing line. This will go a long way toward making the reforestation site acceptable during its awkward early years.

While not an entire forest, this grove of trees in a residential front lawn grew up in less than 40 years to become a lovely wooded space.

Manage a meadow:

A tall grass meadow is a common sight in the midwest—called a prairie, but meadows also grow in the mid-Atlantic in areas that receive periodic disturbance. The New Jersey Pine Barrens has areas of meadow that are maintained by fire (once a natural occurrence and now planned burns).

If you stop mowing your lawn routinely and mow it only once or twice a year, the result will be a meadow. Meadows can be highly variable and will require management to promote and support desirable species. The composition will depend on soil moisture, sunlight and surrounding seed sources. Meadows require full sun to thrive. Native grasses like little bluestem, Indiangrass and switchgrass form the backbone of a healthy meadow. These grasses will come into a meadow eventually, but can also be seeded in to speed up the process. Moist areas tend to support native flowering perennials and discourage the common invasive plants that can dominate infrequently mowed spaces. Prevent woody plants from taking over by mowing the meadow at least once per year, preferably in March.

To seed a meadow, consider mixing seed with an organic carrier. Start by killing the existing plants with an herbicide or by covering the space with black plastic. Buy a mix of warm season grass seed with a few species of flowering perennials mixed in. Mix the seed with an organic carrier like composted sawdust or yard waste. Spread the organic carrier about ½ to 1 inch thick over the designated meadow. The carrier provides a moist medium for germination and prevents light from reaching the soil, reducing competition from annual crabgrass and foxtail.

A mowed path provides the "cue of care" in this back lawn turned meadow.

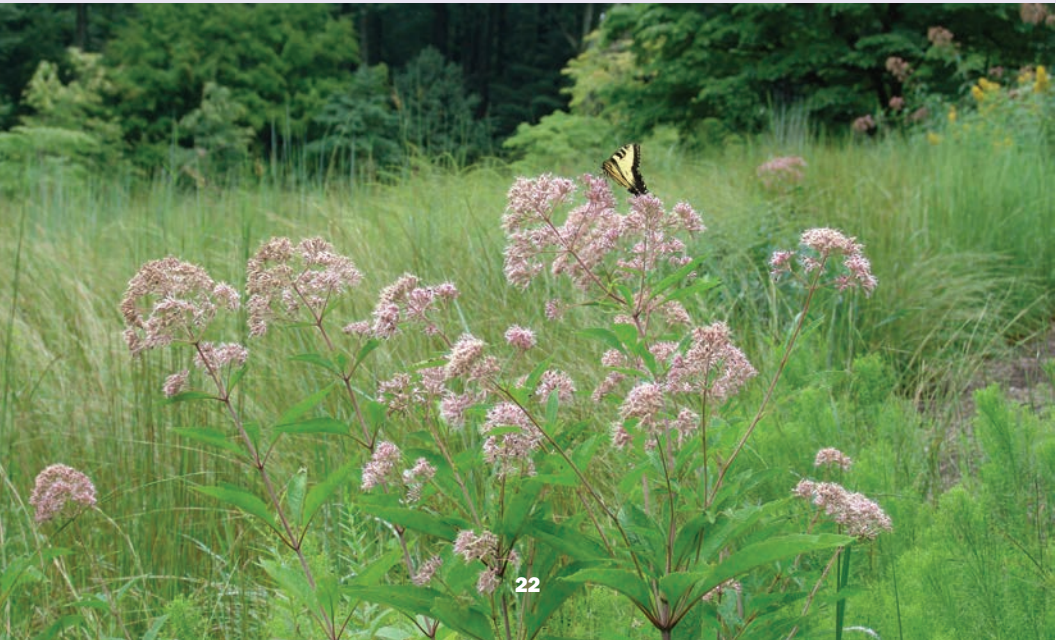
The bright green of this mowed path contrasts nicely with the tan grass in the meadow.

Meadows in managed landscapes look better when they have significant "cues of care." Mow the edge between the meadow and the lawn regularly to give the meadow a clean, well-defined edge. Mow a winding path through the meadow regularly to provide access and show that the meadow is planned. Consider planting special warm season grasses or flowering perennials at meadow edges to provide color and interest. Mow meadows in early spring to chop up the old leaves and allow new stems and leaves to emerge. Some meadows look better when they are kept shorter by mowing twice a year. A second mowing in late June will reduce the height of the meadow, keep tall grasses from flopping and reduce the tall flowering weeds that might look unattractive.

Grow a meadow –

- Stop routine mowing of the site.
- Mow at least once a year to prevent woody plants from developing.
- Watch the plants that grow and remove invasive species that will not contribute to a healthy ecosystem.
  - Remove by hand digging.
  - Remove by using a selective herbicide.
- To seed a meadow, kill the existing plants with a non-selective herbicide or a covering of black plastic.
- Mix seed with composted organic matter (i.e. sawdust or yard waste) and spread over desired meadow in 1/2- 1 inch layer.
- Provide "cues of care".
  - Mow neat edges.
  - Mow paths through the meadow.
  - Plant flowering perennials at key edges.
  - Mow in late-June to keep plants shorter.

A swallowtail butterfly is attracted to Joe Pye weed in this blowsy meadow.



Plant a butterfly garden:

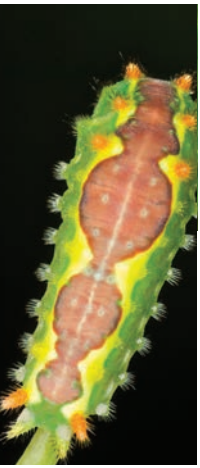
Here is one example of plants that will attract a highly desired form of wildlife—butterflies. In general, butterflies are less specific with nectar preferences. The plants listed below all supply nectar for a wide range of butterflies. Since individual species have more exacting requirements for larval food, the chart on pages 24-25 lists preferred larval food for a variety of mid-Atlantic butterflies.

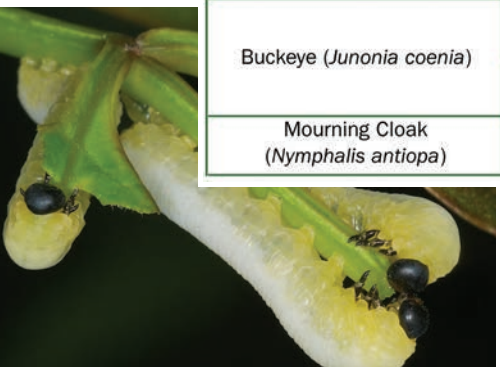
The following plants are good nectar sources and attract a wide variety of butterflies.

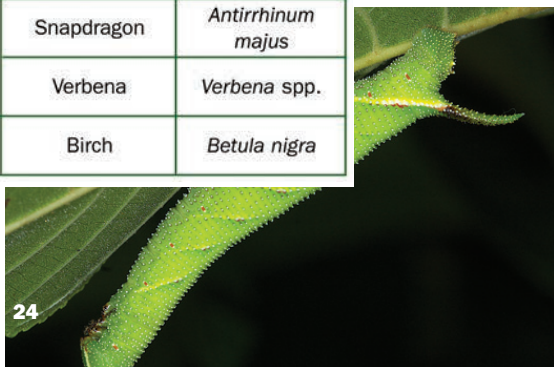
Asters, *Aster* spp,
Azaleas, *Rhododendron* spp.
Bee balm, *Monarda didyma*
Black-eyed Susan, *Rudbeckia* spp.
Blue giant hyssop, *Agastache foeniculum*
Bottlebrush buckeye, *Aesculus parviflora*
Butterfly weed, *Asclepias tuberosa*
Bush cinquefolia, *Potentilla fruticosa*
Clethra, *Clethra* spp.
Coreopsis, *Coreopsis* spp.
Gaillardia, *Gaillardia* spp.
Goldenrod, *Solidago* spp.
Heliotrope, *Heliotropum* spp.
Hibiscus, *Hibiscus* spp.
Ironweed, *Vernonia novaboracensis*
Joe-Pye weed, *Eupatorium* spp.
Lavendar, *Lavendula* spp.
Lilac, *Syringa vulgaris*
Lantana, *Lantana camara*
Marigold, *Tagetes* spp.
Milkweed, *Asclepias* spp.
Mint, *Mentha* spp.
Pentas, *Pentas lanceolata*
Phlox, *Phlox* spp.
Purple coneflower, *Echinacea* spp.
Rosemary, *Rosmarinus officinalis*
Shasta daisy, *Leucanthemum cv.*
Sunflowers, *Helianthus* spp.
Sweet pea, *Lathyrus odoratus*
Trumpet honeysuckle, *Lonicera sempervirens*
Verbena, *Verbena* spp.
Zinnias, *Zinnia* spp.

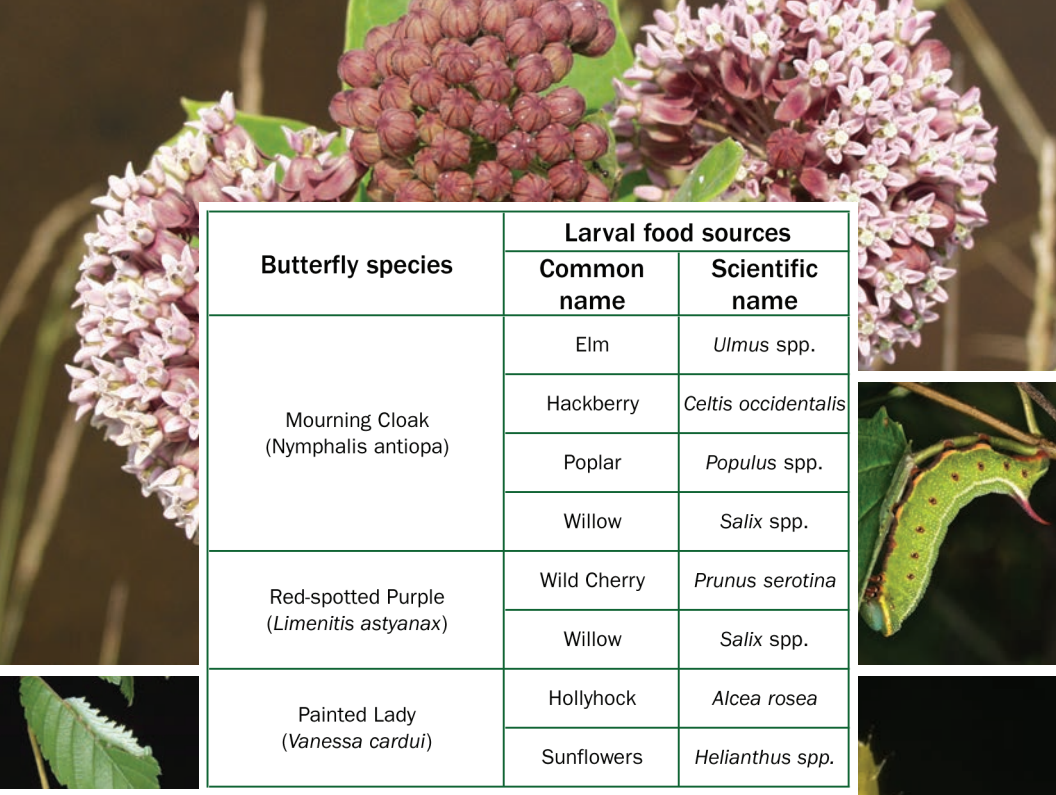
Plants that will provide food for butterfly larvae:

Butterfly species	Larval food sources	
	Common name	Scientific name
Black Swallowtail (*Papilio polyxenes*)	Carrot	*Daucus carota*
	Dill	*Anethum graveolens*
	Fennel	*Foeniculum vulgare*
	Parsley	*Petroselinum crispum*
Spicebush Swallowtail (*Papilio troilus*)	Sassafrass	*Sassafras albidum*
	Spicebush	*Lindera benzoin*
Tiger Swallowtail (*Papilio glaucus*)	Ash	*Fraxinus* spp.
	Birch	*Betula nigra*
	Lilac	*Syringa vulgaris*
	Poplar	*Populus* spp.
	Tulip tree	*Liriodendron tulipifera*
	Wild cherry	*Prunus serotina*
Cabbage White (Pieris rapae)	Garden nasturtium	*Tropaeolum majus*
Great Spangled Fritillary (Speyeria cybele)	Violet	*Viola* spp.
Pearl Crescent (*Phyciodes tharos*)	Asters	*Aster* spp.
Monarch (*Danaus plexippus*)	Milkweed	*Asclepias* spp.
Buckeye (*Junonia coenia*)	Snapdragon	*Antirrhinum majus*
	Verbena	*Verbena* spp.
Mourning Cloak (*Nymphalis antiopa*)	Birch	*Betula nigra*









Butterfly species	Larval food sources	
	Common name	Scientific name
Mourning Cloak (Nymphalis antiopa)	Elm	*Ulmus* spp.
	Hackberry	*Celtis occidentalis*
	Poplar	*Populus* spp.
	Willow	*Salix* spp.
Red-spotted Purple (*Limenitis astyanax*)	Wild Cherry	*Prunus serotina*
	Willow	*Salix* spp.
Painted Lady (*Vanessa cardui*)	Hollyhock	*Alcea rosea*
	Sunflowers	*Helianthus spp.*

The local native shrub, groundsel bush has attracted a monarch butterfly.

Why not Butterfly Bush?

Why not use butterfly bush in a butterfly garden? They certainly attract butterflies. Butterfly bush (*Buddleia davidii*) is originally from China and has been grown as an ornamental since 1900. Its popularity has skyrocketed in the past two decades, especially as a plant to attract butterflies and it has escaped from gardens into disturbed areas such as roadsides, open fields and waterways. In the garden, many seedlings can be found at the base of an existing butterfly bush. The jury is still out on the severity of butterfly bush's invasiveness. However, many people believe gardeners should avoid planting a potentially invasive species when there are so many other great butterfly-attracting plants available. While butterfly bush flowers are a nectar source for butterflies, the plant does not provide food for butterfly larvae.

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