The Community Design Assistance Center (CDAC) is an outreach center in the College of Architecture and Urban Studies at Virginia Tech that assists communities, neighborhood groups, and non-profit organizations in improving the natural and built environments. Assistance is provided in the areas of landscape architecture, architecture, planning, and interior design. Working with communities, the conceptual planning and design provides communities with a graphic vision of their project that can then be used for grant applications and fundraising for the next steps toward implementation.

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SECTION 1: INTRODUCTION
The Community Design Assistance Center (CDAC) recognizes the need to incorporate detailed stewardship plans with conceptual design work. A project cannot be truly successful without a strategy for maintaining it. The following template details maintenance strategies for various project types at CDAC. It is our goal that this template will be used to provide a stewardship plan to each community we assist and, when paired with the conceptual design work, will help them create a viable vision for their future.

1.1 General Maintenance

1.1.1 Levels of Maintenance
Considering the level of maintenance for different projects depends on the project type and use. Frequency of day-to-day maintenance tasks are based on the level of maintenance required for each project to be sustained as designed. Additional considerations, when determining the level of maintenance for projects, are funding and who will be performing the tasks. Each individual community must determine their resources and how those resources will be allocated within their budget.

Sources of funding may be donated by various community groups, and partnerships can help to bolster a community’s capacity. For example, if a town cannot afford to install irrigation systems for their athletic fields, a local interest group could donate that installation money. The town would then assume the management responsibilities of that irrigation system onward.

1.1.2 Long-term vs. Short-term Maintenance
Short-term maintenance refers to the day-to-day tasks involved in managing a project. Some of these tasks would include: watering, mulching, mowing, weeding, tree trimming, litter and trash removal, inspection, and other regularly scheduled activities. Short-term maintenance also includes minor repairs and replacements such as fixing a broken fence post or painting a bridge. These types of repairs should be included in a general maintenance budget.

Long-term maintenance means correcting landscape problems and replacing or restoring major components that have been destroyed, damaged, or have deteriorated. Examples of long-term maintenance could include stabilization of an eroded hillside or the control/eradication of an invasive species on a site. These costs can be unforeseen and typically warrant their own budgets. They can become projects themselves.

1.1.3 Maintenance Checklist and Schedule
A checklist and schedule should be included within a stewardship plan that addresses both short-term and long-term maintenance functions. A checklist allows for regular reporting of the day-to-day tasks and often includes itemized tasks and a section to report problems and their solutions.
Reviewing these reports can help identify any trends or problem areas that could point to a less obvious dysfunction or design flaw.

A maintenance schedule should include the following:
1. List of specific maintenance activities
2. Frequency of each activity
3. Cost per application of each activity
4. Annual cost of each activity
5. Who will perform the activity (park crews, different agencies, or volunteers)

A schedule can begin to determine budgets and labor needed for a project. For example, it may be determined that some tasks, such as power washing site amenities annually, may not be able to be covered under the project budget. Those tasks could be performed by volunteer groups.

A successful stewardship program should also promote a public monitoring system which allows for citizens to report maintenance problems and receive feedback. This is especially helpful when there is a limited crew trying to maintain a large area or a number of projects. Every set of eyes can help!

Sources:
SECTION 2: STEWARDSHIP
BY PROJECT TYPE
2.1 Tree Planting and Care

2.1.1 Planting

*Pre-Installation*

**Step 1: Check above ground**

Do not plant a tree where it will interfere with buildings, overhead utility lines, pavement, or intersection sightlines as it gets bigger. Make sure the planting spot is at least:

- 3 feet from pavement or fencing
- 15 feet minimum from building or other trees
- 25 feet from overhead electric wires if the tree will grow taller than 30 feet

![Diagram showing tree planting guidelines](image)

**Figure 1:** Image from “Tree Owner’s Manual,” United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. [www.treeownersmanual.info](http://www.treeownersmanual.info).

**Step 2: Check below ground**

At least 72 hours in advance of planting, call the underground utility locating service in your area to be sure that there are no buried utilities where the tree will be planted. Most services will mark utilities (electric, cable, or gas) for free. 1-888-258-0808

**Step 3: Check laws**

Check with your town or municipality to see if there are any laws
regarding planting and pruning.

**Installation**
* Planting should occur during the dormant season, in late fall after leaf drop or early spring before budbreak.

**Step 1:** Move the tree to a location near where it will be planted
Do not lift or carry the tree by its trunk.

**Step 2:** Remove trunk and branch packaging.
Remove trunk wrap, twine, and labels. Leave any root packaging in place during this step.

**Step 3:** Prune critical branches and no others!
Prune only branches that are broken or dead. Also remove competing leaders, if present. Most trees should have one central leader. If there are two or more leaders, choose which should remain and remove the other(s). Pruning should be minimized at the time of planting to combat transplant shock. Do not prune oaks in the spring or early summer if you live in an area with oak wilt!

![Tree Diagram]

Figure 2: Image from “Tree Owner’s Manual.” United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. www.treeownersmanual.info.

**Step 4:** Find the root flare and remove excess soil
Remove soil from the top of the root ball until the top of the root flare is exposed. There should be several roots at least as big around as a pencil extending in opposite directions from the trunk. Two to four inches of soil may have to be removed before finding the main roots.
Bare root trees: There is no soil or root packaging to remove.

Balled-and-burlapped trees: Remove the top of the root ball packaging. Cut any twine from around the trunk taking care not to nick the bark, then bend the wire basket back off the top of the ball. Remove soil from the top of the root ball until the main root system is found. Some of the wire may have to be cut. Leave the rest of the wire basket in place until the tree is put in the ground.

Container trees: Remove the entire container. Pull or cut the soil off the top of the root ball until the main root system is found.

* Container trees can be pot-bound. Inspect root system for circling roots. Always purchase container trees from a reputable nursery.

Step 5: Remove problem roots
Remove all small roots above the main root system with a hand pruner. Examine the main root system for roots that extend out but then turn to the side or back towards the trunk. Prune these roots at the point where they turn.
Step 6: Determine how deep and wide to dig
Measure the height of the remaining root ball. This is exactly how deep the hole should be dug. Measure the approximate width of the root ball or root system. Multiply this by 2, or if the soil is hard (clay or compacted), by at least 3. This is how wide the hole should be dug.

Step 7: Dig the hole
The dimensions of the hole are very important in determining the survival of the tree. Dig the hole ONLY as deep as the root system (NO deeper!).

Step 8: Put the tree in the hole
If the tree has a heavy root ball, slide it into the hole, and straighten the trunk.

Step 9: For balled-and-burlapped trees, remove root ball packaging
Without loosening the root ball, cut, peel back, and remove as much of the wire basket or burlap as possible (at least the top third).

* A root ball should remain a root ball. If it starts to fall apart while removing the wire and burlap, backfill the hole with enough soil to stabilize it then carefully remove the wire and burlap and backfill. Try to keep the root ball intact.

Step 10: Backfill with the same soil
Make sure the trunk is straight. Put the original soil back in the hole, breaking up large clods, and working it in with hands or a shovel.

Step 11: Water
Water the root ball and entire backfilled area.

Step 12: Mulch
Section 2: Stewardship by Project Type
Tree Planting and Care

Put a 2 to 4 inch layer of organic mulch over the backfilled area. Pull mulch away from the trunk so that none touches the bark.

* There should never be more than 4 inches of mulch over the roots. Too much can prevent the roots from getting the necessary water.

2.1.2 Care
Watering

The first 3 years of a tree’s life is critical. Smaller caliper trees need less water and can establish faster than larger caliper trees. Generally, the establishment period for trees is at least 1 year for every 1 inch caliper. Check 6 inches below the surface every other day in fast draining soils and weekly in slow draining soils to see if the soil is dry, if so, then water. If the soil is dry, 1 1/2 gallons of water per 1 inch diameter of trunk is recommended. If irrigation is not present then water trucks can be used. Watering bags or “gatorbags” are a great way to slowly release water over a long period of time and can be filled weekly.

After 3 years, check weekly and water when dry. Soil type and weather conditions can influence the demand for water, watering schedules and amounts can vary.

* Trees may have small root systems for the first year after planting.
and may dry out sooner than anticipated! Make sure to check regularly for dry soils even after recent rainfall.

**Mulching**
Mulching helps maintain soil moisture, controls weeds, and insulates the soil. It also reduces the likelihood of tree damage from weed whackers or lawn mowers.

There are 2 types of mulch to consider: inorganic and organic. Inorganic mulch consists of various types of stone, rock, pulverized rubber, geotextile fabrics, or other materials. Some negative aspects to inorganic mulch are that it does not decompose or improve soil structure by providing nutrients. However, since it does not decompose, it does not need to be replenished very often.

Organic mulch includes wood chips, pine needles, hardwood and softwood bark, leaves, compost mixes, and a variety of other products derived from plants. Each material decomposes at a different rate depending on the climate and soil. For example, wood chips can take longer to break down and therefore should not require frequent replenishing. Avoid using fine, non-composted wood chips because soil nitrogen may be taken up by the tree’s roots as the wood chips begin to decompose. Organic mulch can improve soil quality and fertility. It is the preferred material by arborists, horticulturalists, and other landscape professionals for its benefits. Applying newspaper as a layer before mulching in grassed or weedy areas where it is no longer desired kills grass. This can also help prevent weeds from growing through unwanted mulched areas.

When applying mulch, 2 to 4 inches is recommended for well-drained sites, closer to 2 inches is recommended for poorly drained areas. Mulch should be placed to the outer edge of the tree’s crown or beyond. Excessive mulch can cause problems. It can create excessive moisture and cause root rot. Thick layers of fine mulch can prevent penetration of water while piling mulch against a trunk can stress stem tissues which can lead to insect and disease problems.

**Trunk Protection**
Young deciduous trees have thin bark that can easily be damaged by animals and equipment such as weed whackers or lawn mowers. Mulch around trees can protect trees from these elements, but sometimes rodents such as rabbits and mice will chew on young bark. To prevent damage associated with trunk wounding, plastic tubing or hardware cloth can be installed around the trunk. The tubing should be big enough to allow 1 to 4 inches of space between it and the trunk.
It should be 1 to 3 feet tall to accommodate snow and deter small rodents.

Figure 8: Sketch of tree protection guard. Image from "Tree Owner’s Manual." United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. www.treeownersmanual.info.

Fertilizing
It is not recommended that fertilizers be used in the first year after planting a tree due to the tree’s small root system. Apply additional fertilizers after the tree’s establishment period only if an arborist or soil test indicates that it is necessary. Overdosing with fertilizer can harm the tree. Fertilizer not absorbed by the tree can alter the soil or leach out, potentially polluting groundwater, rivers, ponds, and lakes. Be careful when using “weed and feed” on lawn areas surrounding trees. Some combinations of fertilizers and herbicides will injure trees.

Checking Tree Health
To maintain a tree’s health, yearly inspection is important. Check for size, color, trunk damages, and distribution of leaves. Observe the growth rate of the tree compared to the past year’s growth. Fast growth does not necessarily mean good health, but a dramatic reduction in growth rate could indicate a problem. Trees should also be inspected after storms for broken, dead, or hanging branches. Cracks, fungi, branch unions, or a weak trunk on a leaning trunk should be treated quickly.

Pruning
Pruning can be dangerous in certain situations. Hire an arborist or contact the appropriate people to prune if the following applies:
- Pruning cannot be done with both feet on the ground
- Trees or branches are located within 10 feet of utility lines
- Pruning requires power equipment

Pruning is important for public safety and tree health. It can encourage trees to develop a strong structure which can reduce the amount of damage during severe weather.

Pruning for public safety involves removing branches that could fall and cause injury or property damage, trimming branches that interfere
with sight lines of streets or driveways, and removing branches that could grow into utility lines.

Pruning for tree health would involve removing diseased or insect-infested wood, thinning the crown to increase airflow and reduce pest problems, and removing crossing or rubbing branches.

**Pruning Young Trees**
Pruning correctly when trees are young will help the tree develop a strong, well-balanced crown. During the first to third years after planting, attention should be paid to pruning a tree. Young trees should have branches that are well attached to the trunk, one central leader, good spacing between branches, enough clearance between the ground and the first branch, and a good crown height. Pruning correctly early in a tree’s life can greatly help to produce a long-lived tree and will be more cost efficient in the long-run. Refer to [http://tinyurl.com/trainingyoungetrees](http://tinyurl.com/trainingyoungetrees) for a video on how to prune a young tree.

![Diagram of proper pruning technique](image)

**Pruning Mature Trees**
Beginning 3 years after planting, trees should be pruned lightly every year or every other year. After 10 years, frequency of pruning will vary depending on the species of tree and the conditions in which it is planted. A general rule is not to remove more than 25% of a tree’s living branches. Broken, dead, rubbing branches, or branches sprouting from the base of the trunk can be removed every year.

Winter is the best time of year to prune because branches are easy to see, diseases cannot be spread, and there is minimal stress to the tree. Most trees, however, can be pruned at any time except for trees that are prone to fire blight or oak wilt. Trees susceptible to fire blight
Trees susceptible to oak wilt include most oaks.

Topping
One pruning technique that should be avoided is topping. Topping is the indiscriminate removal of branch ends. Many myths revolve around topping. Some believe topping will make the tree easier to maintain or that it invigorates a tree. Others believe it will add value to their property; however, the opposite is true. Topped trees will require more attention because of the fast growing, loosely attached shoots that form. Topping also immediately injures the tree and exposes it to decay and invasion from insects and disease, which will cause the life span of a tree to be reduced. The property value of a home may also decrease because topped trees lack natural beauty. Topping is not pruning, not recommended for any tree, and not performed by certified arborists. If topping is suggested by someone maintaining your trees, it may reflect a lack of knowledge and another professional should be found.

Protecting Trees from Construction Damage
Another consideration to take when caring for trees is the impact construction may have on a tree’s health. When protecting trees from construction damage a defined protected root zone should be identified. To identify the protected root zone, the following should be considered:

- Measure the diameter (width) of the trunk at chest height to the nearest inch.
- Multiply that number by 1.5 feet for every inch for mature or stressed trees or by 1 foot for young, healthy trees.

Figure 10: Sketch of a topped tree. Image from “Tree Owner’s Manual.” United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. www.treeownersmanual.info.
example, 20 inches of trunk diameter would equal 30 feet of protected root zone.
- Measure that distance from the trunk of the tree. The area within that radius is the protected root zone.
- A minimum of 6 feet must be protected around trees regardless of the trunk diameter.

All construction activities, such as storing materials and moving equipment, changing the grade, excavating, and paving should be kept away from the protected root zone by placing a tree protection fence around the radius of the tree.

When to Hire an Arborist?
At some point during the life span of a tree an arborist may need to be consulted. Certain situations may require an arborist’s expertise such as: when pruning or removing large trees, when pruning around utilities or structures, when pruning involves heights taller than standing capability or the use of powered equipment, or if disease or insect problems occur.

Sources:


2.2 Controlling Nonnative Invasive Plants

The best defense against nonnative invasive plants is constant surveillance of all projects and the use of effective control measures upon discovery of invaders. Early detection can minimize cost and labor compared to eradicating an established infestation. It is possible to eradicate established invasive stands but only with the proper treatment and persistence. The following discusses ways to effectively treat nonnative invasive plants.

2.2.1 Effective Treatments

If a stand of invasive plants already exists, proper and aggressive eradication measures should be taken to avoid spread. Using effective herbicide applications offers the best means of controlling or eradicating because herbicides can kill the roots without leaving the soil bare and susceptible to reinvasion or erosion. However, herbicide use is never a recommended method along rivers because it can cause the destruction of aquatic and animal life. When using herbicides, use only EPA–approved products. To be successful with herbicide treatments, the following should be done:

- Use the most effective herbicide for the species.
- Follow the application methods as prescribed on the label.
- Choose the optimum time of year to apply treatments. For leaves, apply mid-summer to early fall and no later than a month before expected frost. Evergreens and semi-evergreens can be treated effectively in winter.
- Adhere to all label prohibitions, precautions, and best management practices during herbicide transport, storage, mixing, and application.
- After application, be patient; allow herbicides to work for several months before resorting to other treatment options.

2.2.2 Selective Herbicide Application Methods

Some aggressive infestations require a broadcast treatment of herbicide. Broadcast treatment, however, may kill desirable plants, as well as invasive species. In many cases, the best approach can be spot application to target invasive plants while avoiding exposure to desired plant material.

Directed Foliar Sprays

Directed foliar sprays are usually applied with a backpack sprayer and aim to target plant foliage by saturating all leaves to the point of run off. It is recommended to use low pressure, drift retardants, or spray shields when using this method to avoid unwanted overspray. This method of application is very cost efficient and should be applied from

Community Design Assistance Center Stewardship Plan Template

Section 2: Stewardship by Project Type

Controlling Nonnative Invasive Plants
mid-summer to late fall to be most effective.

**Stem Injection**
Stem Injection is an herbicidal concentrate mixed with water and applied to incision cuts spaced around woody stems created by an ax, hatchet, machete, brush, or tree injector. This application is best for large trees and shrubs with trunks more than 2 inches in diameter. When applying the injection treatment, avoid times when rainfall might occur within 48 hours. The incisions could be washed out into the soil and nearby plants can be damaged. The most effective time of year to use this application is late winter and throughout the summer. Sap production in the spring can wash herbicides from cuts.

**Cut-Treat**
The cut-treat application method involves an herbicidal concentrate mixed with water and applied to the outer circumference of freshly cut stumps or the entire top surface of cut stumps. A backpack sprayer, spray bottle, wick or paint brush can all be used to apply the herbicide with this method. The most effective time of year to use this application is in the late winter and summer.

**Basal Sprays**
Basal sprays are herbicidal oil based mixtures sprayed or daubed onto the lower portions of woody stems with a backpack sprayer or wick applicator. This method is effective in controlling invasives with woody stems that are less than 6 inches in diameter. Examples of basal sprays are Pathfinder II and Vine-X which are premixed and ready to use. The most effective time of year to apply this herbicide is late winter and early spring when the leaves do not hinder spraying the stem. Summer sprays can also be effective but are difficult due to the presence of leaves.

**Soil Spots**
Soil spots are Velpar L herbicide applied in measured amounts to the soil around targeted invasive woody stems or in a grid pattern for treating many stems in one area. This can be applied with a spot gun or a backpack sprayer with a stream nozzle. This application is only effective on specific nonnative invasive species when applied during the spring and early summer.

### 2.2.3 Selecting an Effective Herbicide
Nonnative invasive plants are usually difficult to control or eradicate. Herbicides that are both applied to the foliage and soil are usually the most effective with the least number of applications. However, when using herbicides on the soil, caution should be taken to limit...
the damage to surrounding plants when their roots are present in the treatment area or soon after a rainfall. Some herbicides have residues that can be transferred to other plants during temperatures exceeding 80 degrees fahrenheit, therefore it is recommended to only apply those herbicides on cooler days. Also when possible, use herbicides that target specific invasive species and choose the proper time of year to apply. For example, basal sprays should be applied to the bark of invasive plants in the late winter before most other plants emerge and foliar sprays on evergreen/semi evergreen invasives should be applied after surrounding plants have entered a dormant period.

2.2.4 Other Treatments

**Overgrazing**
Overgrazing can reduce the growth of invasives but it will not eradicate them. Examples of overgrazing can be the use of goat herds in large invasive areas. Charlottesville Virginia has successfully used goats in some of their parks to control invasive plant spread.

**Prescribed Burning**
Prescribed burning can also eradicate invasives, but it is limited in its effectiveness and requires specific knowledge to be successful.

**Cutting or Mowing**
Cutting or mowing invasives removes the above ground plant and slows down the growth but doesn’t eradicate them. This method, when used with herbicides, can be extremely effective in eradication.

**Hand-Pulling**
If discovered early, small infestations can be controlled with hand-pulling of the plants.

An eradication program for infestations of invasive plants usually requires several years of treatment and many more years of surveillance to check for new invasions. To be successful, a planned strategy should be followed with persistence.

2.2.5 Rehabilitation Phase

The rehabilitation phase can be the most important step in the process of eradicating and reclaiming sites. Rehabilitation requires establishment of native plants that can outcompete and outlive any surviving nonnative invasive plants while stabilizing and protecting the soil. In some areas, native plant communities may naturally reinivate successions after eradicating nonnative plants, but if not, native plants should be seeded or planted. Tree nurseries operated by state forestry agencies are a good source for many species of native
trees and shrubs. Native plant seed can also be used, but proper sowing and planting would be required to assure fast germination. To ensure the success of a project, constant surveillance, treatment of new invasives, and rehabilitation following eradication are critical to preventing and controlling invasions of nonnative species.

Sources:
2.3 Natural Pest and Disease Control

Natural pest control has many benefits. It can be more cost effective than buying and applying pesticides and it is safer for the garden, people, wildlife and the environment. Most pests can be controlled by planting a diverse garden that can attract a variety of beneficial insects. To target certain pests, in addition to beneficial insects, physical controls may also need to be put in place. If needed, an organic insecticide can be used. A products list, approved by the US National Organic Program, has been included in section 2.3.4 Organic Insecticides.

2.3.1 Prevention

A healthy garden is the best defense against garden pests. To maintain a healthy garden consider the following:

• Remove any dead or weak plants. Even if the plants aren’t dead they can attract predators. Dispose of plants away from the garden area.
• Naturally composting, mulching, and top-dressing your planting beds can be a great way to develop strong, vigorous plants.
• Use seaweed spray or fertilizer in mulch. Seaweed contains iron, zinc, barium, calcium, sulfur, and magnesium which promotes growth in plants and helps repel slugs.
• Clear garden area of debris and weeds which can be breeding grounds for insects.
• Interplant and rotate crops. When plantings are mixed, pests are less likely to spread. Rotating crops can prevent a reinfestation year after year.
• Keep foliage dry. Water planting beds early in the day so the foliage can dry throughout the day. Wet foliage encourages insects and fungal disease. Drip irrigation can be used to avoid wet foliage.
• Disinfect tools that have been in contact with infested plants. This can reduce the spread of disease.

2.3.2 Beneficial Insects

Beneficial insects are insects which you can attract to a garden or release that will prey on harmful insects and their larvae. There are many different species that target specific problems. For a more extensive list refer to Organic Pest Control Series: Beneficial Insects which can be found in section 3.1 Appendix: Online References.

• Braconids, Chalcids, and Ichneumon Wasps destroy leaf eating caterpillars. Plant carrots, celery, parsley, and caraway (members of the Umbelliferae family) to attract these insects to a garden.
• Ladybugs are common insects that consume aphids, mites,
whiteflies and scale. Attract ladybugs to a garden by planting members of the daisy family (Compositae) such as yarrow. Ladybugs can be purchased online and released into the garden.

- **Lacewings** are consumers of aphids and their larva. Lacewings are attracted to “composite” flowers such as yarrow, goldenrod, black-eyed susan’s and asters. Lacewings can also be purchased online and released into the garden.
- **Hover-flies** eat aphids, and the larva of hover-flies eat aphids and other pests. They are also attracted to flowers like yarrow, goldenrod, black eyed susan’s and asters.
- **Praying Mantis** are large insects that eat most garden pests. Their eggs are available online.
- **Soldier beetle** larvae feed on the eggs and larvae of beetles, grasshoppers, moths and other insects. Adult soldier beetles feed on aphids and other soft bodied insects. Plant marigolds and goldenrod to attract these beneficial insects.
- **Nematodes** are effective against cutworms, beetles, and root weevil larvae. Nematode eggs are mixed with water and applied to the soil where they hatch and go to work. Wash eggs off foliage onto the ground if needed.

2.3.3 Physical Pest Control Solutions

Often it is necessary to use physical pest control solutions in addition to beneficial insects. Below is a list of physical pest control ideas.

- **Yellow Flypaper** can be effective to trap aphids and whiteflies. Any board painted yellow and coated with a sticky substance, such as tanglefoot, can be effective.
- **Apple Maggot Traps** are sticky red sphere traps. Hang one trap for every 100 apples in a tree. Apple maggots can be extremely destructive pests for apples.
- **Pheromone traps** attract insects and catch them with a sticky substance. Position them around the garden perimeter to avoid attracting unwanted pests into the garden.
- **Floating Row Covers** consist of lightweight opaque material which can be draped over planting beds or trees. Sunlight and water can penetrate the cover but insects and birds cannot. The material is light enough to allow plants to continue to grow underneath it. Anchor the cover, with rocks or boards to prevent the wind from lifting it. Row covers are great for protecting seedlings and vegetables such as carrots, beets, broccoli, chard and spinach.
- **Cloche** is a miniature greenhouse for seedbeds and young plants. Unlike the row cover, the cloche needs to be opened to water and during hot days.
Barrier Paper is scraps of waxed cardboard such as milk cartons or roofing felt. It is a simple and effective method against cabbage moths.

2.3.4 Organic Insecticides

If needed, an organic insecticide can be used to combat diseases. Below is a brief list of approved products by the US National Organic Program. Refer to A Glossary of Natural Garden Pest Control Solutions for more information in the Appendix: Online References section.

- **Bt (Bacillus thuringiensis)** Apply late in the day to be effective on armyworms, cabbageworms, corn earworms, diamondback moths, grape leaf rollers, melon worms, tomato fruitworms, tomato hornworms, and various webworms and budworms. Do not apply on butterfly host plants.

- **Diatomaceous earth (DE)** is a powder that has sharp edges and cuts into insects' bodies killing them of dehydration. Lightly sprinkle dry DE on the soil's surface where Japanese beetles, slugs, or other pests will come into direct contact with the dry particles.

- **Horticultural oils** applied directly to pests interfere with respiration, causing insects to suffocate and die. These oils help control aphids, whiteflies and other pests, but can also kill beneficial mites and injure the leaves of some plants.

- **Insecticidal soaps** have fatty acids that break down the protective cuticles of soft-bodied pests, such as aphids, which will then quickly become dehydrated and die. Soap sprays have no residual effect and only kill insects that are sprayed directly.

- **Iron phosphate slug bait** can be sprinkled throughout your garden beds, and slugs will eat it instead of plants, then crawl off to die. The bait is nontoxic to pets and humans.

- **Neem** is an oil that can slow the growth of many insects. It is best used on young insects and can control aphids and leaf-eating caterpillars.

- **Pyrethrum** is one of the oldest known pesticides. It is fast-acting and the strongest insecticide allowed under U.S. National Organic Standards, so use it only after all other methods have been exhausted. Insects, including beneficial ones, typically become paralyzed as soon as they come into contact with pyrethrum, which is made from the dried flowers of the daisy Tanacetum cinerariifolium.

- **Spinosad** is a biological pesticide derived from the bacterium Saccharopolyspora spinosa. Spinosad controls all types of caterpillars, Colorado potato beetle larvae and blister beetles,
and works best on pests that consume a lot of leaf tissue.

Sources:


**Natural Garden Pest Control.** Eartheasy: Solutions for Sustainable Living. [http://eartheasy.com/grow_nat_pest_cntrl.htm](http://eartheasy.com/grow_nat_pest_cntrl.htm)

2.4 Habitats

2.4.1 Meadow

Converting or restoring open lands to native grasses addresses the needs of many bird and mammal species that require prairie-like conditions to survive. Native grass habitats are more productive for wildlife because of their varying grass heights and excellent cover. Grass cover is a necessity for ground dwelling animals that need to find food, escape predators, or raise their young. Native grass meadows are usually low maintenance as well. Minimal watering is required beyond normal rainfall once established. Because native plants are already adapted to the local environment, less water, little to no fertilizer or pesticides, less mowing, and less of your time is needed. Still, some think meadows are maintenance free. This is false. Meadows should be managed by either prescribed burning or mowing. Healthy meadows are at least 50 percent native grasses and 50 percent perennial wildflowers. Newly planted meadows require at least 2 growing seasons to become fully established. The following details tasks involved in starting and maintaining a successful meadow.

Starting a Meadow

Successful meadows are a result of proper soil preparation and choosing the correct seed mix suitable for your region and desired aesthetic. To prepare an area for planting, existing weeds like fescue must be completely killed. The site should be treated in the fall with an herbicide, and a second application may be needed the following spring for maximum effect. Once the existing weeds have been removed, till the soil to a depth of only 1 inch. If the soil is disturbed any deeper than 1 inch, dormant weed seeds can be unearthed and may begin to grow again. Seeds should be planted at a depth of 1/2 inch on a firm soil bed.

Another planting option is to plant over existing turf cover. Turf should not be any taller than 1 inch, so mowing may be necessary. Seed can then be broadcast and raked or dragged to ensure contact with the soil. Planted areas should be watered at the time of seeding and will need adequate moisture leading up to germination. If needed, supplement water during times of drought.

Managing a Meadow

After planting, managing a meadow properly is very important for its viability. To control weeds during the first year after seeding, mow when the weeds first reach 18 inches height. Be careful not to harm the newly planted grass seedlings by raising the mower blades adequately. Once established, if you plan to hay or graze your meadow, do not cut the grasses below 10 inches during the growing
season. Do not mow after September 1, as this is the time when plants are moving nutrients from their leaves to the roots. If you DO NOT plan to hay or graze your meadow, then you will need to manage the grasses by burning or mowing. Prescribed burning can be the preferred method over mowing because fire removes the build-up of plant litter that naturally occurs over time. After the third year, begin prescribed burning on only 1/3 of the area in late March or early April when grasses only have 1 to 2 inches of new regrowth. Burning only 1/3 of a meadow each year ensures maximum habitat.

2.4.2 Constructed Wetlands and Riparian Corridors

* Constructed Wetlands*

Constructed wetlands are large, shallow, planted ponds that filter stormwater runoff, slow water flow, and help control flooding to a downstream waterway or stormwater system. They should be managed properly to perform well. Typically, it can take up to 3 years for a wetland to become established. Once established, constructed wetlands should require little maintenance but still should be routinely monitored, inspected, and outlet systems should be cleaned to ensure a successful and functioning habitat. Below is a guide to maintaining a constructed wetland.

**Hydrology**

- Water should reach all parts of the wetland surface.
- Check monthly and after storms to ensure that water is moving and that debris, litter, or other blockages are not blocking flow paths.
- Remove floating debris from the pond area.
- Inspect for algal blooms or dead fish. This could indicate water has extremely low levels of oxygen, high nutrient loads, and/or pollutants. Test water quality if this is suspected.

**Structures**

- Dikes, spillways, and water control structures should be inspected monthly or following a storm. Debris or blockage should be removed immediately.
- Any damage, erosion, or blockage should be repaired as soon as possible to prevent the wetland from not functioning and causing more expensive repairs.
- Inspect banks for settlement, erosion, scouring, cracking, sloughing, seepage and rilling. Repair as needed.
- Sediment should be removed from the forebay before it occupies 50 percent of the forebay, typically every 3 to 7 years.

**Vegetation**
Section 2: Stewardship by Project Type

Habitats

- Water levels are key to the success of wetland vegetation.
- Wetland plants can tolerate some changes in water level; however, attention should be paid to the species and their tolerance levels for water changes over extended periods of time.
- During the first growing season, vegetation should be inspected every 2 to 3 weeks.
- Replace dead plants as needed to fill the voids.
- Vegetation should maintain at least 85 percent cover of the emergent vegetation zone (the area where plants grow in the water, but their leaves and stems extend out of the water.)
- Prevent excessive shading by controlling tree and tall shrub growth. Most wetland plants require at least 6 hours of sun every day.
- Invasives species should be removed immediately. (Refer to Section 2.2 Controlling Nonnative Invasive Plants: 2.2.4 Other Treatments)
- Herbicides should not be used since they can severely damage water quality and emergent vegetation.
- Water depth should be increased during the winter to increase retention time and to protect against freezing.

Burrowing animals and Mosquitoes

- Muskrats and other burrowing animals can damage water control structures. If wire screening is not installed, a thick layer of gravel or rock can deter these animals.
- Stagnant water creates a breeding ground for mosquitoes. The best defense is to keep water flowing and vegetation cover. Vegetation cover provides oxygen and prevents stagnant water. Unblocking flows also prevent stagnant backwaters.
- Disperse floating plants to provide cover.
- Purple martins, swallows, and bats can help manage mosquito population. Provide houses, perches, and boxes for wildlife.
- The use of insecticides is usually ineffective because they dilute in the water or the organic matter absorbs them.
- It is not recommended to chemically treat for mosquitoes because you run the risk of contaminating both the wetland, wildlife, and the downstream water body.

Monitoring

- Monitoring is needed to measure whether the wetland is meeting its goals.
- Photographs should be taken each time at the same location.
- Systems that have little inflow and have been doing well, only need to be checked monthly and after a major storm. Systems
Riparian Corridors
Riparian corridors are stream buffers that improve water quality by filtering pollutants from stormwater runoff such as oil, fertilizers, pesticides, and animal waste. They reduce flooding and erosion by stabilizing stream banks and moderate stream temperatures by providing shade and keeping fish and other aquatic life healthy. The corridor also provides nesting and foraging habitats for many species of wildlife. A riparian buffer should be monitored and maintained regularly, then periodically as the buffer becomes established. Routine maintenance may be necessary, depending on weather conditions. Below is a list of items to consider when maintaining a riparian buffer.

Water
- During the first growing season, newly planted trees and shrubs need water at least once a week or as needed until established, approximately 2 to 3 years. (Refer to Section 2.1 Tree Planting and Care)
- After heavy rains, vegetation should be inspected for damage.

Weed Control
- Weed control may be necessary for the first few years of establishment. Refer to Section 2.2 Controlling Nonnative Invasive Plants.
- Organic mulches such as leaf humus, wood chips, pine mulch, or shredded bark can help to retain moisture and limit weeds in a newly planted buffer. Once a vegetative cover is created, the shade should prevent weeds from forming; however, time is needed for native species to grow without competition from weeds.
- Mechanical methods of weed control, such as hand-pulling, are recommended. The use of herbicides are not recommended because they can damage water quality, vegetation, and wildlife habitat. If absolutely necessary, spot-treat only.
- Fallen trees form important habitats and should remain where they pose no hazard to safety.

Mowing
- Most riparian buffers need at least 100 feet total width from the stream’s edge. Native grasses and wildflowers planted in the upland zone, furthest from the stream’s edge, can be mowed once or twice a year to prevent it from becoming overgrown with shrubs (Refer to Figure 1). Avoid mowing from April to July.
2.4.3 Naturalized Open Space

Naturalizing an open space is an alternative landscape maintenance technique where plants are allowed to grow naturally without being mowed. These areas can help re-establish indigenous or native plants to a landscape. Reducing mowing of areas and establishing more naturalized areas will also help decrease labor and can be more cost efficient for a community. Creating a naturalized open space can be as easy as to stop or limit mowing and letting natural processes of growth take back an area. Sometimes this can still be difficult for a maintenance staff because of the preconceived image that parks or open spaces should be neatly groomed. Limiting the mowing to once a year will allow only a certain amount of succession to take place while over time, if an open space is not mowed it can transition into a shrubland and eventually a forest. The frequency of mowing should be based on your community’s desires and needs. Below is a list of tasks involved in maintaining a successful naturalized open space.

- Limit mowing to once a year or DO NOT mow! For example, a local farmer could cut and bale the grass in the spring or fall.
- Maintain its natural appearance. By limiting mowing, natural succession can begin again.
- Remove fallen trees or branches that pose a hazard especially if there are trails in the area.
- Inspect for disease and insect outbreaks regularly. Refer to Section 2.3 Natural Pest and Disease Control.
- Post and maintain appropriate signage to limit unwanted mowing or to explain that the area is a naturalized open space.
in progress. This will hopefully explain to communities why the area may not look as groomed as other areas.

- Control and reduce invasive plant species. (Refer to Section 2.2 Controlling Nonnative Invasive Plants)

### 2.4.3 Rain Gardens

A rain garden is a small, shallow, constructed garden depression that is planted with deep-rooted native plants and grasses. It is usually located in an area that receives runoff from hard surfaces such as a roof, sidewalk, or driveway. Rain gardens slow, capture, and hold water from these surfaces for a short period of time. This allows it to naturally infiltrate into the ground. Rain gardens can be easy to maintain but are not maintenance free. It is important to weed, clean, and re-mulch the garden. The first 2 years require the most care while plants are becoming established. Below is a guide to maintaining a rain garden.

#### Water

- Water plants weekly during the first 1 to 2 growing seasons.
- A newly planted rain garden needs approximately 1 inch of water per week or roughly 6 gallons per square yard per week. The length of time to water can vary based on the size of the garden and water pressure.
- If your rain garden or pond has a pump, inspect it regularly to maintain working condition. Refer to manufacturer’s guide on the maintenance of your pump. In general, if filters are present, clean weekly. Turn off pumps and filters during the winter months. Unless fish are present, pumps are not generally needed to maintain a healthy water garden with clear water.

#### Weeding

- During the establishment period, weeding should be done often. Weeding in the spring will help control weeds in the summer. It is best to remove weeds before the seeds mature and spread.
- Pulling weeds reduces competition for space, light, and water. As the garden matures, weeding will need to happen less frequently.

#### Mulching

- Mulch 2 to 3 inches during the spring to keep soil moist and allow easy infiltration of rain water.
- Use an organic mulch.

#### Monitoring
Section 2: Stewardship by Project Type

Habitats

- Rain gardens should be inspected monthly.
- Clear any dead vegetation and debris that may have collected.
- Replanting may be necessary over time. If a plant is not thriving in one location of the garden, try relocating it to a wetter or dryer area.

2.4.4 Woodland Gardens

A woodland garden is composed of shade tolerant perennials, shrubs, and understory trees. When planted with native plants, a woodland garden can be very low-maintenance once established. Plant litter should be left to decompose and form humus that can build a healthy soil rich in nutrients. There are only a few instances when fallen leaves should be removed from a woodland garden:

- Diseased plant leaves may spread to other plants and should be removed and disposed of in the trash. Do not compost it, as composting may not sterilize the leaves. Even after months or years in the compost bin diseased leaves can still spread to other plants.
- Some trees or shrubs might produce thick leaf litter that could smother the plants below them. Ideally, plants that can survive an annual layer of litter should be planted under these trees or the area under the trees should be left unplanted. However, if planting should happen under a heavily littering tree, remove some of the leaf litter from the plants every fall.

* For tree care refer to Section 2.1 Tree Care and Planting. For planting bed maintenance refer to Section 2.9 Schoolyard Gardens.

2.4.5 Orchards

A successful orchard begins with choosing the appropriate fruit tree. Select varieties that are disease-resistant and appropriate for your soil and climate. No fruit trees are invincible to all diseases. The following explains how to care and maintain an orchard.

**Planting and Pruning**

- Fruit trees should be planted where they will receive full sun for 6 or more hours per day during the growing season.
- Proper training of young fruit trees is essential to the development of a strong framework that will support fruit production.
- Regular pruning and training will also maximize light penetration to flower buds and fruit. Air circulation will also minimize pest problems.
- When pruning allow for a strong central leader. Adequate clearance should be left between the start of the branching and the ground to allow for work under the tree.
The first year after planting, 3 to 4 branches, called the “scaffold whorl” should be spaced uniformly around the trunk (not across from one another.) Above the first scaffold whorl should be an open area of 18 to 24 inches to allow light to reach all the lower leaves and fruit. Maintain alternating scaffold whorls and open areas up the leader to the desired tree height.

Figure 1: Diagram of a tree whorl and light slot. Image from "Growing Apple Trees In The Home Garden": North Carolina Cooperative Extension Service North Carolina State University. http://www.ces.ncsu.edu/hil/hil-8301.html

Scaffold training spreads larger branches by hanging weights on the branches or tying them down with string wrapped loosely around the limbs. All upright growth from scaffold branches should be either pulled down to a horizontal position or removed when it is 3 to 4 inches long to prevent breakage under a heavy fruit load.

Fruit Thinning

- Apple trees often have a heavier fruit production than the limbs can handle. To ensure good fruit size, prevent tree breakage, and encourage next year’s blooms thinning should occur.
- Every apple blossom results in a bloom cluster of 5 to 6 blossoms which when cross-pollinated will result in a fruit. Apples should be thinned when they are the size of a dime. Cut off enough fruit so that the remaining apples are spaced 4 to 6 inches apart and leave only 1 fruit per cluster.

Fertilize

- Test soil prior to planting and every year thereafter at the same time of year. Add nutrients based on the soil test as needed.
Section 2: Stewardship by Project Type

Habitats

Watering
• Refer to Section 2.1 Tree Planting and Care

Mulching
• Refer to Section 2.1 Tree Planting and Care

Natural Insect and Disease Control
Prevention
• Refer to Section 2.3 Natural Pest and Disease Control

Sources:


Section 2: Stewardship by Project Type
Habitats
2.5 Trail Systems

Like any public park amenity, trails need regular maintenance. Removing litter and controlling vandalism are needed for safety and aesthetic reasons. Other maintenance elements vary by trail type and use. For example, greenways require different maintenance than forest trails. Greenways are usually paved surfaces. These surfaces are durable but require repaving, patching, or resealing to remain safe and usable. Forest trails are generally bare soil or mulch. These surfaces are vulnerable to erosion and require moving soil and clearing woody material to remain usable.

Maintenance needs can be minimized by appropriately designing trails. The two most important factors for sustainable trail design are trail grade (steepness) and trail slope alignment (TSA). TSA describes what direction the trail is traveling relative to the prevailing landform. Trails that travel straight up a slope have a high TSA. Trails that travel parallel to the prevailing landform slope have a low TSA. In general, trails are more sustainable and require less maintenance if they have low grades and TSAs. (Figure 1)

![Figure 1](image_url)

Maintainance elements can be separated into short-term and long-term categories. Both categories are important to complete. However, long-term elements are needed less when trails are designed appropriately and short-term elements are completed regularly.

2.5.1 Short-term Maintenance (day-to-day maintenance)

Short-term maintenance needs vary by trail type and use level. Choose the elements that make most sense for your trail.

**Surfaces**

- Inspect surfaces at least once a month.
- Remove dirt, sand, and organic debris from hard surfaces.
- Repave, patch, or reseal hard surfaces as needed.
- Maintain the desired depth of protective materials on soft surfaces (for example, 1" of mulch).
- Inspect trail for tripping hazards such as holes, low spots, ruts,
and loose paving material. Repair trail to reduce these risks.

- Inspect trail for proper drainage. This is best done during and after high rainfall events. Install and maintain culverts, drains, ditches, and water bars to optimize water runoff and minimize soil erosion.

**Vegetation**

- Cut and clear vegetation along trail corridor to maintain desired width and height. Do this at least twice per year (spring and fall.) Try to maintain a closed canopy (overstory) during this process. Open overstories allow greater sunlight penetration and encourage the spread of nonnative, invasive plant species.
- Clear and remove downed trees and large limbs as they occur or at least monthly.
- Cut grasses and herbaceous plants growing into the trail corridor. Avoid doing this too frequently or extensively. Over trimming/cutting creates disturbed areas that allow the invasion and spread of non-native and invasive plants. Some trail sections may require more frequent cutting than others. Managers may want to cut sunny sections, or sections so they look more groomed. This might require twice a week cuttings during the growing season. There are more sustainable and lower maintenance methods than such frequent cuttings. For example, mowing can be completed in swaths that allow some areas to remain naturalized meadows.
- Survey invasive plants annually, preferably in early to mid-summer. Implement treatment strategies as soon as patches are discovered. Frequent removal of small patches is the most efficient strategy.
- Inspect trail for other potential vegetative hazards and obstacles. These may include overhanging dead branches ("widow makers"), downed trees, or exposed roots. Remove these obstacles immediately.

**Site Amenities**

- Inspect signs, benches, and other site amenities at least monthly. Replace or repair immediately.
- Remove litter and trash daily or weekly based on conditions.
- Repair parking lots at trailheads as needed.
- Inspect other structures and keep them in good repair.

**Vandalism and Crime Control (Safety)**

- Maintain sightlines. For example, remove thickets close to urban trails where a person could hide.
- Clear surfaces covered with graffiti. Do this as soon as graffiti
Section 2: Stewardship by Project Type

Trail Systems

is discovered to deter further vandalism.

• Consider installing and maintain lighting at trailheads and/or along trails to reduce dark areas where crime can occur.
• Consider installing and maintain mile markers every ½ or 1 mile for better orientation during emergency situations.
• Request police and competent citizen volunteers to patrol urban trails.

Signage

• Install and maintain trail blazes along trail. Blazes should occur regularly enough so users can always see a trail blaze in either direction regardless of where they are along the trail. Blazes can be applied to trees with high-visibility paint in lines approximately the size of a dollar bill.
• Trim vegetation around signs and blazes to maintain their visibility.
• Inspect sign lettering, surfaces, and posts at least monthly. Repair or replace signs to maintain design and safety standards as needed.

2.5.2 Long-term Maintenance

Similar to short-term maintenance needs, long-term needs vary by trail type and use level. Choose the elements that make most sense for your trail. In general, the most common long-term problems deal with erosion and drainage. Some level of impact and subsequent maintenance needs are inevitable with public recreation use. That said, proper planning, design, and constructing the trail can reduce these problems.

Surface Water Control

Diverting surface water off the trail is a top priority for the maintenance of any trail. Runoff can slowly erode the tread and eventually destroy the trail entirely if not handled promptly. Standing water can also cause muddy or boggy conditions. To avoid such problems, water should be directed off the trail as efficiently and quickly as possible. Below are a few techniques of doing this.

• Design trail tread to have an outslope. Tread is the part of a trail where the users’ shoes, boots, or bicycle tires, or a pack animals’ hooves, meet the trail. Outsloping treads describe a trail on which the downslope side is slightly lower than the uphill side. This is best visualized by looking at a cross-section of the trail (Figure 2). Outslopes should be between 3% and 5%.
Recreate outslopes as needed. Soil often moves to the outside of trail treads during use. It moves uphill to form berms and downhill to form sloughs. Move displaced soil toward the center of the trail to recreate outslopes. Afterward, compact the new tread to prevent soil displacement and erosion.

Design trails with regular grade reversals (also known as grade dips). These features require trails to fluctuate between downhill and uphill travel. They divert water off of trails without the regular maintenance required of water bars. These are best installed when the trail is first built. However, reversals can also be installed post-construction. Although this option is labor intensive, it is still preferred over the use of water bars.
When grade reversals are impossible, install water bars. Dig a drainage ditch oriented at a 45 degree angle from the direction of travel. Enforce the downhill side of this ditch with rocks or a rot-resistant log. Avoid drainage ditches with shallower angles. They slow water runoff prematurely. As a result, eroded soil is deposited into the ditch rather than off the trail. Soil in ditches decreases water bars' effectiveness.

Inspect and maintain the effectiveness of water bars at least twice per year. Remove soil, leaves, and other organic matter from the ditch. Reposition rocks and logs as needed. Re-dig ditches so they are wide enough to prevent clogging and they remain pointed at a 45 degree angle or more.

Repair any trail segments damaged by landslides and uprooted trees, washouts or boggy conditions.
Erosion Prevention

Some level of erosion will naturally occur on non-paved trails. However, there are several ways to minimize this issue. These ways are summarized below.

• Identify trail segments that are not sustainable and prone to erosion. Consider hiring a trail expert to survey the trail system and identify segments with steep slopes and/or TSAs. Alternatively, survey the trail system yourself and identify segments that intercept and carry larger volumes of water during rainstorms. Plan and implement strategies to replace these segments. Avoid wasting staff and budget resources by maintaining these segments: Closure and/or relocation will be less costly long-term.

• Build trails with grades of 10% or less. These will be less prone to erosion than steeper slopes. If necessary, build reinforce short sections of steeper slopes with gravel and/or rock.

• Locate trails along “side-hill” alignments as much as possible. Such trails follow contour lines. They do not travel steeply up or down them. As a result, they are less prone to erosion. (See Figure 1)

• Encourage sustainable amounts of soil compaction. Compaction is helpful in preventing soil erosion and muddiness if the tread surface doesn’t become too consolidated. Locate trails in areas with a variety of soil and rock sizes. This is the best type of soil for compaction. If trail systems are located in areas without naturally-available varied soil sizes, mix gravel and/or rocks to create optimal conditions.

• Prevent trails from becoming wide. Narrower trails lessen runoff. Limit trail width by placing large rocks or the butt ends of logs on either side of trails. If appropriate, encourage encroaching vegetation to grow closer to the trails’ boundaries. These techniques will encourage users to use narrower sections of trails.

• Increase the amount of rock in trails. Add rock steps, stepping stones, rock armoring, or gravel. Mix angular gravel and/or rock of varying sizes with local soil to create an erosion-resistant and aesthetically-pleasing surface.

Trail maintenance is described in more detail in the following sources.

Sources:
Community Design Assistance Center Stewardship Plan Template

Section 2: Stewardship by Project Type
Trail Systems


Natural Surface Trails by Design, Section 5 “Physical Forces”, Section 6 “Tread Materials”, Section 7 “Tread Watersheds”. Troy Scott Parker.


Trail Design & Maintenance. Jeff Marion, USGS Research Scientist.

2.6 Streetscapes

A streetscape refers to the natural and built fabric of a street. It is a public place where people are able to engage in various activities and helps define a community’s aesthetic quality, economic activity, health, and sustainability. Streetscapes include the road, adjoining buildings, street furniture, trees and open spaces, that combine to form the street’s character. Street trees provide green infrastructure and vegetation that softens noise, reduces glare, and provides shade, while increasing beauty, reducing stress, and improving livability within a community. A streetscape stewardship plan involves maintaining all the hardscape elements, such as benches, trash receptacles, lighting, and vegetation within the right of way.

Below is a list of maintenance tasks that are included when maintaining streetscapes. Based on the type of project, choose the elements that make sense for your project.

**Watering**
- Newly planted trees (Refer to Section 2.1 Tree Planting and Care)
- Watering planting beds from a truck should be done with care so that the force from the water does not damage the plants or mulch.
- A watering schedule is necessary.
- Establishment period for shrubs and ground covers is approximately 6 months to 1 year. Flowers establish much more quickly.
- Water planting beds 2 to 3 times per week for the first 8 weeks after planting then water once a week until they are established.

**Irrigation System (if present)**
- Inspect system monthly and repair system if needed.
- Back flow test annually.

**Mulching**
- Maintain mulch depth of 2 to 4 inches. (Refer to Section 2.1 Tree Planting and Care for more mulching information)

**Tree Pruning**
- Prune low branches posing hazard to pedestrian walkways or streets.
- Prune to a minimum height of 6 to 7 feet to allow comfortable passage beneath by pedestrians and vehicles.

**Shrub and Ornamental Grass Pruning**
- Selectively prune shrubs based on species. Maintain sightlines at intersections.
Section 2: Stewardship by Project Type

Streetscapes

- Ornamental grasses have attractive foliage throughout the winter and should not be pruned until the spring. This also helps insulate the crown of the plant. In the spring, before growth resumes, cut back ornamental grasses to approximately 4 to 6 inches.

Pest Management

- Problem areas should be inspected monthly and handled on a case by case basis. Spot-treat, DO NOT over treat.  
- Immediately remedy problem in accordance with the Departments of Integrated Pest Management Program (IPM).

Vandalism

- Graffiti should be repaired immediately within 24 hours if possible.

Hardscape

- Remove debris, sand, dirt, and organic material from walks weekly.  
- Remove tripping hazards from pedestrian areas as soon as possible.  
- Blow grass clippings after mowing away from hard surfaces.  
- Remove weeds growing in cracks as needed.

Litter and Trash Removal

- Pick up litter from tree grates and empty trash containers on a regular basis as determined to be needed by your community.

Holiday Banners

- Consider appropriate timing for putting up and removing holiday banners.  
- Replace banners as needed.

Seasonal/Annual Plantings in Pots or Hanging Baskets

- Replant seasonally.  
- Check daily for moisture content.  
- Water every other day during times of drought or when needed.  
- Use drip irrigation system if present.

Signage

- Inspect sign lettering, surfaces, and posts at least monthly.  
- Repair/replace signs to maintain design and safety standards as needed.

Site Amenities

- Inspect benches, trash containers, bicycle racks, and other site amenities at least monthly. Repair or replace as needed.
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Streetscapes

- Clean/power wash amenities annually if possible.

Lighting
- Inspect monthly.
- Repair/replace bulbs or posts immediately.

2.6.1 Site Preparation and Street Tree Selection

Many factors can place stress on a street tree, such as air pollution, temperature extremes, lack of sufficient soil for root growth, limited space, overhead obstructions, and improper use (i.e. using a tree as a bike rack.) With proper selection and site preparation, trees can survive and thrive in an urban environment. Available space for proper root growth is one of the most limiting factors and can determine a tree’s health and longevity. When designing tree pits consider the following to provide the best environment for a street tree to thrive:

- Tree pits should be as large as possible to allow tree roots ample growing space. Optimal tree pit size would be 4 feet by 10 feet or 5 feet by 10 feet if available.
- If tree pits already exist within a sidewalk, enlarge the tree well as much as possible while still allowing adequate space for pedestrian traffic.
- Combine tree pits to include several trees in a continuous planting strip.
- Use a porous pavement, such as dry-laid pavers in surrounding sidewalk to allow water to penetrate the soil below.
- Use a structural soil mix, also known as engineered soil, under paved areas. Structural soil consists of gap-graded gravels which are made up of crushed stone, clay loam, and a hydrogel stabilizing agent. (* Source: [http://www.hort.cornell.edu/uhi/outreach/csc/article.html](http://www.hort.cornell.edu/uhi/outreach/csc/article.html)) It uses angular stones in the planting mix under hardscaped areas, such as sidewalks and parking lots, which can be compacted to provide the structural support required for hardscape installation but also be open enough to provide adequate drainage and aeration for trees.
- If there is a public park or lawn nearby, let the roots grow into the adjacent area by planting the tree at the back of the sidewalk.

Selecting the right tree for the situation is also important to a healthy street tree. For example, a large tree that is thriving in an open park space may not do well in a tree well along a street. The tree that thrives in a park may need much more space to adequately grow roots and obtain the proper amount of water, nutrients, and support to become an healthy specimen. There are many tree species that can survive in challenging spatial situations. For example, if spacing is too
tight between street and building or overhead utility lines exist, select a tree that will fit. If a tall tree is desired for a tight space consider selecting a cultivar with a narrow upright growth habit. For further information on which cultivars work best for certain situations refer to *Urban Tree Selection Manual* in the sources at the end of this section.

Sources:


*Landscape Design Guidelines*, Section 5 “Installation and Maintenance.” Tennessee Department of Transportation. [http://www.tdot.state.tn.us/environment/beautification/landscape/Chapter_5_Installation_Maintenance.pdf](http://www.tdot.state.tn.us/environment/beautification/landscape/Chapter_5_Installation_Maintenance.pdf)

2.7 River Access Points

After an access point has been established, communities can be faced with the constant challenge of balancing the needs and values of recreation and conservation. Each access point should be regularly maintained and patrolled to prevent illegal activity and promote safety for the area. Volunteer organizations or town staff should make an ongoing effort to conduct the day-to-day and seasonal tasks. The follow are tasks involved in the managing of an access point.

- Mow only lawn areas once a week if needed to maintain 3-3 ¼ inches height.
- Empty trash containers every day, as needed, or on a regular basis, however a regular schedule should still be determined based on your specific situation. During the cold season (November – March) containers may not need to be emptied as often.
- Graffiti should be repaired immediately within 24 hours if possible.
- Inspect sign lettering, surfaces, and posts at least monthly.
- Repair/replace signs to maintain design and safety standards as needed.
- Clear limbs to maintain visibility of the access point entry from the river.
- Signage should be visible. Prune or trim all brush and limbs preventing visibility of access points and signs.
- Trail blazes (the size of a dollar bill) should be repainted if faded or missing.
- Clean and repair parking areas, launch ramps, campsites, fire rings, toilets, portage trails, signs, exhibits, and other facilities. Establish a regular maintenance schedule and keep records of repairs and replacements.
- Organize public campaigns to clean up trash along the waterway at least twice a year, before and after the busy season.
- Use volunteers to remove invasive nonnative plants and restore native vegetation along the waterway. Herbicides should not be used since they can severely damage water quality and emergent vegetation. Conduct or participate in fisheries surveys and other wildlife studies.
- Document the use of access points, campsites, picnic areas, and other facilities to help formulate conservation programs and restoration projects.
- It is recommended that the hours of operation should be determined on a locality-to-locality basis for public access points unless the site is located on private land where hours would be up to the owner’s discretion. In some locations, a locked gate in
the evening time may be desired.
• No loitering or overnight camping should be allowed unless there is a designated separate camping area adjacent to site.
• Enlist volunteers to establish and conduct an ongoing water-quality monitoring program. Alert officials about illegal dumping, floodplain encroachments, and damage to natural, archaeological, and historical resources.

Building support for a water trail and its access points is an on-going process and should be considered as an element of a stewardship plan. Educating the public will help community members become informed and active in stewardship activities. The following are some examples of ways to educate the community about the waterway.

• Conduct educational interpretive programs for children and adults.
• Hold special events such as water festivals, paddling trips, canoe races, and other water-related events to broaden community support.
• Promote conservation practices such as including conservation messages in your publications and signs and informing the public about the waterway’s connection with programs to restore the ecology.

Sources:
Clinch River Access Points Design Guidelines. Section 1.6 “Maintenance”. Community Design Assistance Center.


2.8 Parks
A park stewardship plan consists of day-to-day maintenance tasks as well as long-term maintenance such as controlling invasive species and taking on projects like upgrading park elements. Each park’s level of maintenance depends on the type, usage, and budget. For example, the frequency of mowing would vary if it were a recreational field versus a low-trafficked passive park. Another example would be a volunteer group taking responsibility for a certain maintenance task in a park. Towns sometimes do not have the budget or man power to maintain every park to a certain level of quality and may need to coordinate with volunteer groups for help.

Some parks could have different elements not found in others therefore requiring different tasks. Below is a list of maintenance tasks that are included when maintaining parks. Based on the type of park, choose the elements that make sense for your project.

**Athletic Fields**
- Mow twice a week if used heavily or once a week if needed to maintain 2 ½ inches height.
- Frequency of mowing depends on rain/watering.
- Fertilize twice a year.
- Apply pre-germinated seed to heavily worn areas.
- Aerate twice a year.
- Over seed annually.

**Park Lawns**
- Mow once a week if needed to maintain 3-3 ¼ inches height.
- Trim perimeters once per week with string trimmer.

**Trees (Refer to Section 2.1 Tree Planting and Care)**

**Shrub and Ornamental Grass Pruning**
- Selectively prune shrubs based on species and desired form.
- Ornamental grasses have attractive foliage throughout the winter and should not be pruned until the spring. This also helps insulate the crown of the plant.
- In the spring, before growth resumes, cut back ornamental grasses to approximately 4 to 6 inches.

**Weeding**
- The goal is to establish a solid cover of desired vegetation that will choke out weed growth.
- Proper plant selection, spacing, and soil conditions should reduce long-term weed growth by providing plants the optimum conditions to grow to their mature size and block the light needed for weeds.
to grow.
• Identify which plants are a part of the habitat and which should be removed.
• Certain techniques such as using newspaper or weed cloth beneath the mulch in planting beds can lessen the need for weeding.
• Weed in early spring thoroughly before weeds can take root and become a bigger labor intensive problem during the summer.
• Hand-pulling weeds can be effective if they are removed immediately upon discovery.

Storm Cleanup (Usually a town water department’s responsibility)
• Inspect drain covers twice a month. Remove debris and organic material immediately.
• Maintain water inlet height and an undisturbed flow of drainage.

Watering Plants
• Watering from a truck should be done with care so that the force from the water does not damage the plants or mulch.
• A watering schedule is necessary.
• Establishment period for shrubs and ground covers is approximately 6 months to 1 year. Flowers establish much more quickly.
• Water 2 to 3 times per week for the first 8 weeks after planting then water once a week until they are established.

Mulching Plants
• Maintain mulch depth of 2 to 4 inches.
  (Refer to Section 2.1 Tree Planting and Care for more mulching information)

Irrigation System (if present)
• Inspect system monthly and repair system if needed based on park usage
• Back flow test annually.

Litter and Trash Removal
• Pick up litter and empty trash containers every day, as needed, or develop a regular litter/trash pick up schedule as determined appropriate for your community (ie. once a week, twice a week, once a day etc.)
• During the cold season (November – March) this will not need to be as frequent, but a regular schedule should be developed based on your community’s needs.
Vandalism

- Graffiti should be repaired immediately within 24 hours if possible.

Hardscapes (around buildings, pathways, or gathering areas)
- Inspect surfaces at least once a month. Replace or repair any surface that poses a hazard to pedestrians.
- Remove dirt, sand, and organic debris from hard surfaces after storms. The frequency depends on available labor.

Outdoor Courts
- Inspect weekly (when mowing) for damages and repair.
- Replace nets when broken or removed.
- Maintain posts, backboards, rims, and hardware to original design specifications.

Site Amenities
- Inspect benches, trash containers, picnic tables, grills, bicycle racks, drinking fountains, and other site amenities at least monthly. Repair or replace as needed.
- Clean/power wash amenities yearly. This task is an example of what could be done by a volunteer group like the boy scouts. The town could provide supplies while the volunteer group provided the time and labor.

Fences and Gates
- Inspect fences, gates, and bollards when mowing. Repair any damages.

Signage
- Inspect sign lettering, surfaces, and posts when mowing or at least monthly.
- Repair/replace signs to maintain design and safety standards immediately.
- Clean signs yearly. Another task where volunteer groups could provide time and labor while the town could provide supplies.

Lighting
- Inspect monthly.
- Repair/bulb replace immediately.

Pest Management
- Problem areas should be inspected monthly and handled on a case by case basis. Spot–treat, DO NOT over treat.
- No pesticides on parks with kid or dog activity.
  (Refer to Section 2.3 Natural Pest and Disease Control)
Each park’s future success depends on how well it is maintained for its use. A park improvement team is one example of how that success can continue throughout a park’s lifespan. A park improvement team consists of community volunteers that inspect and review successes and failures of different parks. Each person has a different perspective and can comment on what maintenance or design aspects are working or not working for each park. For example, after inspecting park benches it could be noted that placing pavers under benches can eliminate water ponding and the need to edge.

Long-term maintenance considerations should be included in a stewardship plan. What will a park look like in 5 to 10 years or 15 years? Landscapes have a lifespan and when necessary adjustments should be made to accommodate plants nearing the end of their lifecycle. For example, as mature trees begin to reach their lifespan, younger trees can be planted so that they will be established by the time the older trees need to be removed.

Sources:

**Landscape Design Guidelines,** Section 5 “Installation and Maintenance.” Tennessee Department of Transportation. [http://www.tdot.state.tn.us/environment/beautification/landscape/Chapter_5_Installation_Maintenance.pdf](http://www.tdot.state.tn.us/environment/beautification/landscape/Chapter_5_Installation_Maintenance.pdf)


2.9 Playgrounds

2.9.1 Natural Playgrounds

Natural playgrounds use the natural environment and elements to promote play, discovery, and learning. Sand, water, wood, and plants are examples of elements that may be found in a natural play area. Most natural playgrounds use very little or no traditional play equipment therefore maintenance and upkeep can be less expensive than a conventional playground where manufactured equipment can be costly to replace. However, natural play areas still require some maintenance. Below is a list of tasks involved with maintaining a natural playground. Based on the elements of your playground, choose the tasks that make sense for your project.

**Lawn Areas**
- Identify which areas are to be mowed and which are to be left unmowed to naturalize.
- Mow designated naturalized areas once or twice a year.
- Mow lawn once a week if needed to maintain 3-3 ¼ inches height.
- Edge perimeters once per week.

**Trees** (Refer to Section 2.1 Tree Planting and Care)

**Plant Selection**
- Do not select plants with thorns or spiney tips.
- Do not select plants that are toxic. (Refer to Common Plants and Their Toxicity and Poisonous Plants in the Landscape in the Appendix: Attached Reference Materials section of this document for a list of toxic plants to avoid.)

**Shrub and Ornamental Grass Pruning**
- Selectively prune shrubs based on species and desired form.
- Ornamental grasses have attractive foliage throughout the winter and should not be pruned until the spring. This also helps insulate the crown of the plant.
- In the spring, before growth resumes, cut back ornamental grasses to approximately 4 to 6 inches.

**Watering Plants**
- Watering from a truck should be done with care so that the force from the water does not damage the plants or mulch.
- Develop a watering schedule.
- Establishment period for shrubs and ground covers is approximately 6 months to 1 year. Flowers establish much more quickly.
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Playgrounds

- Water 2 to 3 times per week for the first 8 weeks after planting then water once a week until they are established.

**Mulching Plants**
- Maintain organic mulch depth of 2 to 4 inches. (Refer to Section 2.1 Tree Planting and Care for more mulching information)

**Surfaces**
- Inspect for tripping hazards, such as exposed concrete, tree stumps, and rocks when mowing. Remove immediately.
- Remove litter and rake loose-fill safety surfaces weekly.
- Surfaces around playground equipment should maintain at least 12 inches of wood chips, mulch, or sand.
- Replace play surface at the end of its lifespan or when damaged.
- Pull weeds that are encroaching into play areas.

**Litter and Trash Removal**
- Pick up litter and empty trash containers every day, as needed, or develop a regular litter/trash pick up schedule as determined appropriate for your community (ie. once a week, twice a week, once a day etc.)
- During the cold season (November – March) this will not need to be as frequent, but a regular schedule should be developed based on your community’s needs.

**Vandalism**
- Graffiti should be repaired immediately within 24 hours if possible.

**Storm Cleanup**
- Inspect play areas for damage including equipment, surfaces, and site amenities. Repair and replace as needed.

**Signage**
- Inspect sign lettering, surfaces, and posts when mowing or at least monthly.
- Repair/replace signs to maintain design and safety standards immediately.

**Other Features**
- Inspect wooden elements monthly for rotting and hazardous areas. Use child-friendly, non-toxic wood preservative if wooden elements need resurfacing.
- Inspect benches, trash containers, picnic tables, drinking fountains, and other site amenities at least monthly. Repair or replace as needed.
2.9.2 Conventional Playground

Conventional playgrounds usually require more maintenance than natural play areas due to additional manufactured equipment that can exist. Safety standards must be upheld to avoid injuries and potential safety hazards. Below is a general list of tasks involved with maintaining a playground. Based on the elements of your playground, choose the tasks that make sense for your project.

**Lawn Areas**
- Identify which areas are to be mowed and which are to be left unmowed to naturalize.
- Mow designated naturalized areas once or twice a year.
- Mow lawn once a week if needed to maintain 3-3 ¼ inches height.
- Edge perimeters once per week.

**Trees** (Refer to Section 2.1 Tree Planting and Care)

**Plant Selection**
- Do not select plants with thorns or spiney tips.
- Do not select plants that are toxic. (Refer to *Common Plants and Their Toxicity* and *Poisonous Plants in the Landscape* in the Appendix: Attached Reference Materials section of this document for a list of toxic plants to avoid.)

**Shrub and Ornamental Grass Pruning**
- Selectively prune shrubs based on species and desired form.
- Ornamental grasses have attractive foliage throughout the winter and should not be pruned until the spring. This also helps insulate the crown of the plant.
- In the spring, before growth resumes, cut back ornamental grasses to approximately 4 to 6 inches.

**Watering Plants**
- Watering from a truck should be done with care so that the force from the water does not damage the plants or mulch.
- A watering schedule is necessary.
- Establishment period for shrubs and ground covers is approximately 6 months to 1 year. Flowers establish much more quickly.
- Water 2 to 3 times per week for the first 8 weeks after planting then water once a week until they are established.

**Mulching Plants**
- Maintain organic mulch depth of 2 to 4 inches.
  (Refer to Section 2.1 Tree Planting and Care for more mulching...
Surfaces
• Inspect for tripping hazards, like exposed concrete, tree stumps, and rocks when mowing. Remove immediately.
• Remove litter and rake loose-fill safety surfaces weekly.
• Surfaces around playground equipment should maintain at least 12 inches of wood chips, mulch, sand or mats made of safety-tested rubber or rubber-like materials.
• Replace play surface at the end of its lifespan or when damaged.
• Pull weeds that are encroaching into play areas.

Litter and Trash Removal
• Pick up litter and empty trash containers every day or as needed.
• During cold season (November – March) may only need to occur weekly.

Vandalism
• Graffiti should be repaired immediately within 24 hours if possible.

Storm Cleanup
• Inspect play areas for damage including equipment, surfaces, and site amenities. Repair and replace as needed.

Signage
• Inspect sign lettering, surfaces, and posts when mowing or at least monthly.
• Repair/replace signs to maintain design and safety standards immediately.

Other Features
• Inspect benches, trash containers, picnic tables, drinking fountains, and other site amenities at least monthly. Repair or replace as needed.
• Inspect play equipment for long-term wear and tear or misuse.
• Refer to your play equipment manufacturer for guidelines detailing safety standards and replace any equipment necessary.
• Play equipment typically needs to be replaced approximately every 10 years.

Safety
• Conduct annual overall safety inspection of the playground. A Certified Playground Safety Inspector (CPSI) are mandatory in some states. Check your local regulations. Refer to your local parks and recreation department, insurance carriers, or the
Section 2: Stewardship by Project Type

Playgrounds

National Recreation and Park Association for a list of CPSIs in your area.

Sources:


**What About Maintenance?** Ron King, Natural Playgrounds Company LLC. [www.naturalplaygrounds.com](http://www.naturalplaygrounds.com)

**Common Plants and Their Toxicity** University of California, Davis, Medical Center, Regional Poison Control Center. [http://fcs.sites.mjc.edu/127PlantToxicity.pdf](http://fcs.sites.mjc.edu/127PlantToxicity.pdf)

**Poisonous Plants in the Landscape.** Robert R. Westerfield and Gary L. Wade, The University of Georgia Cooperative Extension. [http://extension.uga.edu/publications/files/pdf/C%20957_2.PDF](http://extension.uga.edu/publications/files/pdf/C%20957_2.PDF)
2.10 Schoolyard Gardens

A schoolyard garden offers students a place to test and explore classroom concepts in the real world. It stimulates curiosity and encourages students to explore their continually changing environment. Any space requires maintenance and the ever-changing outdoor classroom is no different. Some daily tasks can be folded into the educational process becoming a hands-on way to learn about stewardship. Other maintenance tasks should be done by the custodial or school grounds crew, volunteers, or trained summer youth work groups. The first couple of years is a critical period for schoolyard habitat establishment. Since a schoolyard garden primarily functions during the academic year, the following are tasks involved with maintaining a schoolyard garden categorized by season.

**Summer (June-August)**

- Pull weeds if needed.
- Mulch planting beds 2 to 4 inches thick with compost or bark mulch to replenish soil, retain moisture, and control weeds.
- Mulch walking areas and tree beds with larger size wood chips to reduce weeds and provide food for worms and bugs. Newspaper or cardboard placed as a layer before mulch in walkways can help prevent weeds from occurring.
- If a summer school program is using the garden, plant vegetables and establish a watering schedule with parents, neighbors, or volunteers.
- New plantings will need summer watering until they become established. (Refer below to “Watering”)

**Fall (September-November)**

- Pull new weeds in beds when ground is moist before they develop deep roots.
- Clear unwanted growth and compost it for the spring.
- Keep compost pile as moist as a wrung-out sponge. Check compost pile temperature and turn. (Refer to Composting in “Sources” at the end of this section.)
- Mulch planting beds with leaves or compost to minimize winter weeds and replenish the soil. Prepare new annual planting beds by mixing compost and top dress with bark mulch.
- Prepare for spring bulbs. Order or obtain in September and plant in October and early November. Examples of early spring bulbs are crocus and narcissus.

**Winter (December-February)**

- Rake winter leaf mulch onto annual planting beds.
- Remove any remaining weeds to prevent them from going to seed.
- Remove trash and rake surfaces as needed.
Section 2: Stewardship by Project Type
Schoolyard Gardens

- Selectively prune shrubs based on species when dormant.

Spring (March-May)
- Trim back any meadow plants to 4 to 6 inches before new growth emerges. This also helps insulate the crown of the plant. Compost the cuttings, if possible.
- Watch for and record emerging new plants such as tulips and crocus.
- Identify which plants are a part of the habitat and which are weeds that should be removed. Pull weeds at first discovery while the soil is moist and before weeds can take root and make seeds. If prolonged, weeding can become a labor intensive problem during the summer.
- Plan and prepare student experimental planting beds. Mix in 1 to 3 inches of compost from on site bin.

Watering
Watering is the most important day-to-day task. New plantings will require watering until established (usually the first 2 years). Monitor the rainfall and supplement with watering or irrigation when needed for at least the first 2 years of a garden. Special attention should be paid during hot, dry summer months. Watering could involve installing a drip irrigation, sprinkler system, laying a soaker hose, or rain barrels. Establish a watering schedule based on the plants installed and make sure to provide access to the water source especially during the summer. In general, plantings should be watered 2 to 3 times per week for the first 8 weeks after planting then once per week until they are established. However, you may need to fine-tune the watering based on your specific conditions. For watering newly planted trees refer to Section 2.1 Tree Planting and Care. For more information on installing and maintaining rain barrels refer to How to Install and Maintain a Rain Barrel in the Appendix: Attached Reference Materials section of this document.

Borders
It is important that the maintenance team and volunteers understand where the boundaries are of a schoolyard habitat. This can help avoid mishaps such as an area being accidentally mowed. It can be helpful to designate areas of your habitat to let others know the boundaries. Fencing, edging, or natural materials can be used to indicate boundaries.

Replanting
It is not uncommon to have plants die in the first few months. Replanting due to unexpected events such as extreme weather is
normal; however, if plant loss is more than 50 percent, an evaluation of the site should be conducted before replanting to ensure future habitat success. When choosing plants do not select plants that are toxic, have thorns, or spiney tips. Safety should be considered when selecting plants for child-friendly areas. Refer to Common Plants and Their Toxicity and Poisonous Plants in the Landscape in the Appendix: Attached Reference Materials section of this document for a list of toxic plants to avoid.

**Weeding**
Weeds are inevitable and removing weeds is an ongoing process. Before weeding takes place, it is important to identify which plants are a part of the habitat and which are weeds that should be removed. In some instances like a meadow, some plants may look like weeds. In this situation, a knowledgeable group should weed this area. Removing certain weeds can reduce competition and allow desired plants to flourish. It is best to remove weeds before the seeds mature and spread. If weeding is neglected for months at a time, weeds will become permanent invaders of the garden as they disperse their seed and spread their roots. Weeding in early spring thoroughly before weeds can take root and become a bigger labor intensive problem during the summer can be important. Certain techniques such as using newspaper or weed cloth beneath the mulch in planting beds can lessen the need for weeding as well.

**Controlling Nonnative Invasive Plants**
The most efficient method for controlling nonnative invasive plants is early detection and immediate removal. Common control methods include hand-pulling, mowing, and herbicidal spraying. The method of removal should depend on the specific plant, size of infestation, and the amount of surrounding desired vegetation. For most invasives, hand pulling should be adequate if discovered early enough. Be sure to remove the entire plant including roots before the plant begins to seed. Herbicidal treatment is not recommended in areas where children gather.

**Other Features**
Check, refill, and clean bird feeders, bird baths, bird houses, and water pumps regularly. During hot months, items such as bird baths may need to be cleaned more often. Site amenities such as benches, fences, arbors, pavilions, and signs should be checked often for vandalism and to ensure they are functioning properly. Any vandalized elements should be repaired immediately within 24 hours if possible. This deters vandalism from happening again. The best way to decrease vandalism is to have activity and support from the staff,
students, and the surrounding community.

Pathways should be kept free of debris or obstruction. If it is a soft surface material, level, fill, and compact any holes or ruts. Inspect surfaces at least once a month. ADA accessible pathways should be inspected regularly for obstruction or surface repairs/replacement that pose a hazard. Repairs should be done immediately. Trash containers and litter should be removed daily, if needed. Outdoor classroom elements such as tables and seating should be inspected and repaired/replaced if damaged upon discovery.

**Student Field and Care Guide**

Creating a field and care guide for a schoolyard garden can be a great opportunity for students to apply all they have learned. It can also be an educational tool for others. The guide can serve as a resource for other classes, school visitors, parents, community members or volunteers learning to maintain the garden. During the school year students can participate in the care and maintenance of the garden. The field and care guide can include a map of the garden, what plant species or other features are found in the garden, and instructions on how to care for the site. For more information on Field and Care Guides refer to **How to Guide for Schoolyard Habitats** Section 6 “Ensuring Continued Success”.

Sources:
Community Design Assistance Center Stewardship Plan Template

Section 2: Stewardship by Project Type
Schoolyard Gardens

Common Plants and Their Toxicity University of California, Davis, Medical Center, Regional Poison Control Center. http://fcs.sites.mjc.edu/127PlantToxicity.pdf

2.11 Dog Parks

When maintaining dog parks, some special considerations may need to happen. For instance, unlike regular parks, many heavily used dog areas cannot accommodate grass. Mulch or wood chips can be used and often are donated. For example, utility departments usually chip tree branches from pruning around power lines and are sometimes willing to donate those chips to public dog parks. Tree companies typically have wood chips available as well. Below is a list of maintenance tasks that are included when maintaining dog parks.

- Mow lawn areas (outside of gated dog areas) once a week if needed to maintain 3 ½ inches height.
- Provide/refill dog pick up bags. Ask users to clean up after their dogs.
- Remove hazardous debris weekly.
- Collect and dispose of broken toys daily or as needed.
- Remove trash daily or every other day based on usage.
- Fence and gates should be inspected when mowing and repair immediately.
- Inspect signage weekly to ensure park guidelines are clear and legible to users.
- Inspect benches, trash containers, picnic tables, and drinking fountains at least monthly. Repair or replace as needed.
- Clean/power wash amenities annually. This task is an example of what could be done by a volunteer group like the boy scouts. The town could provide supplies while the volunteer group provides the time and labor.

Sources:
SECTION 3: APPENDIX
Section 3: Appendix

Online Resources

3.1 Online Resources

Section 2.1 Tree Planting and Care


Section 2.2 Controlling Nonnative Invasive Plants


Section 2.3 Natural Pest and Disease Control


Section 2.4 Habitats


Grow a Native Grass Meadow. Carol A. Heiser.
Community Design Assistance Center Stewardship Plan Template

Section 3: Appendix

Online Resources


Section 2.5 Trail Systems


Section 2.6 Streetscapes


Section 2.7 River Access Points


Section 2.8 Parks


Section 2.9 Playgrounds


What About Maintenance? Ron King, Natural Playgrounds Company LLC. www.naturalplaygrounds.com
### Section 3: Appendix

**Online Resources**

- **Common Plants and Their Toxicity** University of California, Davis, Medical Center, Regional Poison Control Center. [http://fcs.sites.mjc.edu/127PlantToxicity.pdf](http://fcs.sites.mjc.edu/127PlantToxicity.pdf)


**Section 2.10 Schoolyard Gardens**

- **Composting** Eartheasy: Solutions for Sustainable Living. [http://eartheasy.com/grow_compost.html](http://eartheasy.com/grow_compost.html)


- **The Learning Grounds Guide for Schools** Section 6 “Maintenance Strategy”. Evergreen. [www.evergreen.ca](http://www.evergreen.ca)

- **Common Plants and Their Toxicity** University of California, Davis, Medical Center, Regional Poison Control Center. [http://fcs.sites.mjc.edu/127PlantToxicity.pdf](http://fcs.sites.mjc.edu/127PlantToxicity.pdf)

3.2 Book Reference Materials

Section 2.5 Trail Systems

**Environmentally Sustainable Trail Management.** Jeffrey L. Marion and Yu-Fai Leung.


**Guidance for Managing Informal Trails.** Jeff Marion, USGS Research Scientist.

**Natural Surface Trails by Design,** Section 5 “Physical Forces”, Section 6 “Tread Materials”, Section 7 “Tread Watersheds”. Troy Scott Parker

**Trail Design & Maintenance.** Jeff Marion, USGS Research Scientist.

**Trail Solutions: IMBA’s Guide to Building Sweet Singletrack,** Section 7 “Trail Maintenance”. IMBA International Mountain Bicycling Association

Section 2.6 Streetscapes


Section 2.7 River Access Points

**Clinch River Access Points Design Guidelines.** Section 1.6 “Maintenance.” Community Design Assistance Center.
### 3.3 Attached Reference Materials

<table>
<thead>
<tr>
<th>Reference Material</th>
<th>Author/Source</th>
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<tr>
<td><strong>Composting. Eartheasy: Solutions for Sustainable Living.</strong></td>
<td><a href="http://eartheasy.com/grow_compost.html">http://eartheasy.com/grow_compost.html</a></td>
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<tr>
<td><strong>Common Plants and Their Toxicity</strong> University of California, Davis, Medical Center, Regional Poison Control Center.</td>
<td><a href="http://fcs.sites.mjc.edu/127PlantToxicity.pdf">http://fcs.sites.mjc.edu/127PlantToxicity.pdf</a></td>
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Pest-Eating Beneficial Insects

The following insects feed on other insects, helping prevent pest species from doing more than minor damage to your crops.

Assassin bug. These 1-inch-long predatory bugs have shield-shaped backs and are active pest hunters. Larvae and adults feed on aphids, caterpillars, Colorado potato beetles, insect eggs and more. Assassin bugs are among the few natural predators that help control Mexican bean beetles.

Braconid wasp. North America is home to nearly 2,000 species of these non-stinging wasps. Adults are less than a half-inch long, and they lay eggs inside or on host insects; the maggot-like larvae feed on their prey from inside. Braconids lay eggs on numerous pests, such as aphids, caterpillars (including cabbage and tomato hornworms), and leaf miners.

Ground beetle. These beneficial insects live in the soil beneath mulches, around compost piles, and in the sheltered areas below perennial plants. Some create vertical tunnels that they use to ambush and trap prey, but most ground beetles wander about aboveground, foraging for food at night. They dine on asparagus beetles, cabbage worms, Colorado potato beetles, corn earworms, cutworms and slugs.

Hover fly (aka syrphid fly). Black-and-yellow-striped hover flies resemble yellow jackets but are harmless to humans. Larvae are petite, tapered maggots that crawl over foliage to feed on small insects. They are aphid-eating machines and also devour mealybugs, mites, thrips, scale insects, and small caterpillars, such as cabbage worms.

Lacewing (aka aphid lion). Lacewing larvae prey on aphids, cabbage worms, caterpillar eggs, whiteflies, and more. They feed for about a month, in which time each larva consumes about 600 aphids. Remove row covers from plants during evening hours or use row covers to protect cabbage-family crops. Do not use pesticides when lacewings are active, which happens early in the gardening season compared with most natural insect predators.

Lady beetle (aka ladybug). Lady beetle larvae and adults eat aphids, small caterpillars and insect eggs. A few species specialize in eating mealybugs, mites, scale insects and even powdery mildew. If you see adult lady beetles on a plant, look in the foliage for clusters of yellow-orange eggs, which will often be near an aphid colony. Dark-colored larvae, which resemble miniature alligators, will hatch in about a week and consume several aphids per day.

Minute pirate bug. Less than a quarter-inch long, this compact predator controls corn earworms early in the worms’ life cycle. Minute pirate bugs also feed on aphids, thrips and whiteflies.

Praying mantis. The largest insect you’re likely to see in your garden, this predatory species is always on the prowl, eating any other insect that moves, including crop-munching grasshoppers.

Soldier beetle (aka leatherwing beetle). You’ll spy elongated, half-inch-long soldier beetles among flowers or in thick vegetation. In some areas, the larvae are key predators of grasshopper eggs, so attracting soldier beetles can provide grasshopper control. Soldier beetle larvae eat moths, several insects, and the eggs and larvae of other beetles. Adults feed on aphids, caterpillars and other soft-bodied insects. Goldenrod, single-flowered marigolds and members of the daisy family are soldier-beetle magnets.

Spider. These eight-legged critters are probably the most abundant pest predators on your property. Any garden will likely already host several dozen types of spiders, and the most common garden spiders don’t spin webs. For example, wolf spiders live in shallow underground burrows, wandering the soil’s surface.
the garden; however, scientists have found that flower nectar from buckwheat and sweet alyssum enhanced wasp reproduction in lab experiments.

**Trichogramma wasp.** These gnat-sized wasps lay their eggs inside the eggs of other insects, where the young trichogramma then develop as internal parasites, breaking the host’s life cycle. Common hosts include eggs of cabbageworms, codling moths and European corn borers. Trichogramma wasps are too tiny to observe in the garden; however, scientists have found that flower nectar from buckwheat and sweet alyssum enhanced wasp reproduction in lab experiments.

**Organic Insecticides**

- **Bacillus thuringiensis (Bt).** This naturally occurring bacterium kills caterpillars when they eat leaves that have been sprayed with it. Armyworms, cabbageworms, corn earworms, diamondback moths, grape leaf rollers, melon worms, tomato fruitworms, tomato hornworms, and various webworms and budworms are candidates for Bt treatment. Butterfly larvae may also be killed by Bt, so don’t use it on butterfly host plants, such as parsley. Additional strains of Bt include one that kills mosquito larvae and one that is toxic to Colorado potato beetle larvae. Sunlight degrades Bt after a few hours, so apply it late in the day. Reapply after heavy rain.

- **Horticultural oils.** When applied directly to pests, these oils interfere with respiration, causing insects to suffocate and die. These oils help control aphids, whiteflies and other pests, but they can also kill beneficial insects and injure the leaves of some plants. Frequent use can reduce yields even when the pest is under control. Best applied in cool weather, horticultural oils are valuable allies in organic orchards, where they can control pests that overwinter in bark crevices.

- **Iron phosphate slug bait.** Sprinkle slug-bait granules evenly throughout your garden beds, and slugs will eat it instead of your plants, then crawl off to die. The bait is nontoxic to pets and humans. Sluggo is a popular brand of this type of bait.

- **Poultry.** Insect-munching fowl will devour practically any insect that moves, including ticks, grasshoppers, Colorado potato beetles, slugs and more. Ducks are reportedly sharp slug-spotter, whether you let them work over the garden in spring and fall or enlist a pair as your assistants throughout the season. (See Chickens in the Garden: Organic Pest Control for reader reports about how to most effectively control pests with poultry.)

**Row covers.** A lightweight row cover or tulle netting will keep some crops pest-free. Cover your plants with these nettings when you see an influx of insects. Cover up the covers. Remove covers after crops, such as squashes, begin to flower, so that pollinators can reach the flowers.

**Vacuum.** Some gardeners report successfully controlling squash bugs and other pests by sucking them up with a shop vacuum. Got poultry? Empty the vacuum bag into their pen and everybody wins —except the pests, of course.

- **Trichogramma wasp.** These gnat-sized wasps lay their eggs inside the eggs of other insects, where the young trichogramma then develop as internal parasites, breaking the host’s life cycle. Common hosts include eggs of cabbageworms, codling moths and European corn borers. Trichogramma wasps are too tiny to observe in the garden; however, scientists have found that flower nectar from buckwheat and sweet alyssum enhanced wasp reproduction in lab experiments.

- **Wasp (stinging types).** Wasps can be great garden allies because they consume huge numbers of leaf-eating caterpillars and irritating flies, which they feed to their growing larvae. Use hoops or blintz stakes to hold up the covers. Remove covers after crops, such as squashes, begin to flower, so that pollinators can reach the flowers.

**Physical Pest Control Solutions**

**Cleanup.** Practice good garden sanitation for certain crops at season’s end to disrupt the life cycle of pests that feed on those crops. After your cucumber and squash plants are spent, remove plant debris from the garden and chop it into small pieces before composting it. Do the same with asparagus, which can host asparagus beetles, and with broccoli and cabbage stumps, which can harbor cabbage aphids. If you have problems with pests that overwinter as adults, mow down any weedy areas in fall.

- **Copper strips.** Slugs receive an unpleasant electrical jolt if they crawl over copper. Garden centers sell copper stripping that you can place around particular crops or even use to encircle entire garden beds to keep slugs out. The strips should be at least a few inches wide so slugs can’t traverse them unscathed.

- **Cutworm collars.** Push cylindrical “collars” — which can be made from small cans, yogurt cups or toilet paper rolls — into the soil around tomato, pepper and other transplants to protect the young plants from cutworm damage.

- **Handpicking.** Ultra-low-tech but effective for organic gardeners, handpicking is just what it sounds like: spot pests and squish them or brush them into a pail of soapy water (or collect them for your chickens). Keeping a close eye on your crops and knowing how to identify pests are the keys to this method. Pests that haven’t become overwhelming in number and are big enough to spot easily, such as slugs, tomato hornworms and other worm-type pests, are prime candidates for handpicking.

- **Poultry.** Insect-munching fowl will devour practically any insect that moves, including ticks, grasshoppers, Colorado potato beetles, slugs and more. Ducks are reportedly sharp slug-spotter, whether you let them work over the garden in spring and fall or enlist a pair as your assistants throughout the season. Chickens work best in winter, because their scratching can damage crops during the growing season. (See Chickens in the Garden: Organic Pest Control for reader reports about how to most effectively control pests with poultry.)

**Row covers.** A lightweight row cover or tulle netting will keep some crops pest-free. Cover your plants with these nettings when you see an influx of insects. Cover up the covers. Remove covers after crops, such as squashes, begin to flower, so that pollinators can reach the flowers.

**Vacuum.** Some gardeners report successfully controlling squash bugs and other pests by sucking them up with a shop vacuum. Got poultry? Empty the vacuum bag into their pen and everybody wins —except the pests, of course.

- **Yellow sticky traps.** Hang flat, sticky traps near cucumber plants to catch cucumber beetles. To snare flea beetles, place traps near eggplants and other crops suffering from flea beetle pressure. These pests are attracted to the color of the traps and will get stuck in the goo.
**Neem.** When applied to insects and the plants they eat, neem oil, which is derived from an Asian tree, causes many insects to feed less, grow more slowly, molt less and stop laying eggs. Neem works best on young insects, particularly those that grow rapidly, such as Colorado potato beetles, Mexican bean beetles and squash bugs. Neem can also control aphids and leaf-eating caterpillars.

**Pyrethrum.** One of the oldest known pesticides, fast-acting pyrethrum is also the strongest insecticide allowed under U.S. National Organic Standards, so use it only after you’ve exhausted other methods. Insects, including beneficials, typically become paralyzed as soon as they come into contact with pyrethrum, which is made from the dried flowers of the daisy *Tanacetum cinerariifolium*. Aphids, armyworms, Colorado potato beetles, cucumber beetles, cutworms, leafhoppers, squash bugs and whiteflies can often be brought under control with pyrethrum.

**Spinosad.** A biological pesticide, spinosad is derived from the bacterium *Saccharopolyspora spinosa*, which produces a substance that works as a neurotoxin in many (but not all) insects. Susceptible insect species become excited to the point of exhaustion, stop eating, and die within two days. Spinosad controls all types of caterpillars, Colorado potato beetle larvae and blister beetles, and works best on pests that consume a lot of leaf tissue.

**Need to deal with garden pests?** Check out the Top 15 Worst Garden Pests chart.

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Contributing editor **Barbara Pleasant** gardens in southwest Virginia, where she grows vegetables, herbs, fruits, flowers and a few lucky chickens. Contact Barbara by visiting her website or finding her on Google+.

**Shelley Stonebrook** is MOTHER EARTH NEWS magazine’s main gardening editor. She’s passionate about growing healthy, sustainable food and taking care of our environment. Follow her on Twitter, Pinterest and Google+.
Composting

Eartheasy

eartheasy.com/grow_compost.html

Composting

< grow >

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Compost is the single most important supplement you can give your garden soil.
Composting is a simple way to add nutrient-rich humus which fuels plant growth and restores vitality to depleted soil. It’s also free, easy to make and good for the environment.

Composting Benefits

Soil conditioner: With compost, you are creating rich humus for lawn and garden. This adds nutrients to your plants and helps retain moisture in the soil.
Recycles kitchen and yard waste: Composting can divert as much as 30% of household waste away from the garbage can.
Introduces beneficial organisms to the soil: Microscopic organisms in compost help aerate the soil, break down organic material for plant use and ward off plant disease.

Good for the environment:
Composting offers a natural alternative to chemical fertilizers.
Reduces landfill waste: Most landfills in North America are quickly filling up; many have already closed down. One-third of landfill waste is made up of compostable materials.

What to Compost

<table>
<thead>
<tr>
<th>Material</th>
<th>Carbon/Nitrogen</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>table scraps</td>
<td>Nitrogen</td>
<td>add with dry carbon items</td>
</tr>
<tr>
<td>fruit &amp; vegetable</td>
<td>Nitrogen</td>
<td>add with dry carbon items</td>
</tr>
<tr>
<td>scraps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>eggshells</td>
<td>neutral</td>
<td>best when crushed</td>
</tr>
<tr>
<td>leaves</td>
<td>Carbon</td>
<td>leaves break down faster when shredded</td>
</tr>
<tr>
<td>grass clippings</td>
<td>Nitrogen</td>
<td>add in thin layers so they don’t mat into clumps</td>
</tr>
<tr>
<td>garden plants</td>
<td></td>
<td>use disease-free plants only</td>
</tr>
<tr>
<td>lawn &amp; garden</td>
<td>Nitrogen</td>
<td>only use weeds which have not gone to seed</td>
</tr>
<tr>
<td>weeds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>shrub prunings</td>
<td>Carbon</td>
<td>woody prunings are slow to break down</td>
</tr>
<tr>
<td>straw or hay</td>
<td>Carbon</td>
<td>straw is best; hay (with seeds) is less ideal</td>
</tr>
<tr>
<td>green comfrey</td>
<td>Nitrogen</td>
<td>excellent compost ‘activator’</td>
</tr>
<tr>
<td>leaves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pine needles</td>
<td>Carbon</td>
<td>acidic; use in moderate amounts</td>
</tr>
<tr>
<td>flowers, cuttings</td>
<td>Nitrogen</td>
<td>chop up any long woody stems</td>
</tr>
<tr>
<td>seaweed and kelp</td>
<td>Nitrogen</td>
<td>apply in thin layers; good source for trace minerals</td>
</tr>
<tr>
<td>wood ash</td>
<td>Carbon</td>
<td>only use ash from clean materials; sprinkle lightly</td>
</tr>
<tr>
<td>chicken manure</td>
<td>Nitrogen</td>
<td>excellent compost ‘activator’</td>
</tr>
<tr>
<td>coffee grounds</td>
<td>Nitrogen</td>
<td>filters may also be included</td>
</tr>
<tr>
<td>tea leaves</td>
<td>Nitrogen</td>
<td>loose or in bags</td>
</tr>
<tr>
<td>newspaper</td>
<td>Carbon</td>
<td>avoid using glossy paper and colored inks</td>
</tr>
<tr>
<td>shredded paper</td>
<td>Carbon</td>
<td>avoid using glossy paper and colored inks</td>
</tr>
<tr>
<td>cardboard</td>
<td>Carbon</td>
<td>shred material to avoid matting</td>
</tr>
<tr>
<td>corn cobs, stalks</td>
<td>Carbon</td>
<td>slow to decompose, best if chopped up</td>
</tr>
<tr>
<td>Material</td>
<td>Carbon</td>
<td>Notes</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>dryer lint</td>
<td>Carbon</td>
<td>best if from natural fibers</td>
</tr>
<tr>
<td>sawdust pellets</td>
<td>Carbon</td>
<td>high carbon levels; add in layers to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>avoid clumping</td>
</tr>
<tr>
<td>wood chips /</td>
<td>Carbon</td>
<td>high carbon levels; use sparingly</td>
</tr>
<tr>
<td>pellets</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

You can also add garden soil to your compost. A layer of soil will help to mask any odors, and micro-organisms in the soil will accelerate the composting process.

Do not compost meat, bones or fish scraps (they will attract pests), perennial weeds (they can be spread with the compost) or diseased plants. Do not include pet manures in compost that will be used on food crops. Banana peels, peach peels and orange rinds may contain pesticide residue, and should be kept out of the compost.

Black walnut leaves should not be composted. Sawdust may be added to the compost, but should be mixed or scattered thinly to avoid clumping. Be sure sawdust is clean, with no machine oil or chain oil residues from cutting equipment.

For kitchen wastes, keep a container with a lid and handle under the sink. Consider using a stainless steel compost pail with air filter, or the ceramic model. If you don’t mind occasional smells, use an old ice-cream pail. Chop up any large chunks before you toss them in. When the container is full, take it out to your composting area and let the contents break down.

With yard and garden wastes, different composting materials will decompose at different rates, but they will all break down eventually. If you want to speed up the composting process, chop the larger material into smaller pieces. Leaves and grass clippings are excellent for compost, but should be sprinkled into the bin with other materials, or dug in to the center of the pile and mixed. Avoid putting them in on thin layers - they will mat together and reduce aeration, which slows the composting process.

### How to Compost

1. Start your compost pile on bare earth. This allows worms and other beneficial organisms to aerate the compost and be transported to your garden beds.
2. Lay twigs or straw first, a few inches deep. This aids drainage and helps aerate the pile.
3. Add compost materials in layers, alternating moist and dry. Moist ingredients are food scraps, tea bags, seaweed, etc. Dry materials are straw, leaves, sawdust pellets and wood ashes. If you have wood ashes, sprinkle in thin layers, or they will clump together and be slow to break down.
4. Add manure.

   green manure (clover, buckwheat, wheatgrass, grass clippings) or any nitrogen source. This activates the compost pile and speeds the process along.
5. Keep compost moist.

   Water occasionally, or let rain do the job.
6. Cover

   with anything you have - wood, plastic sheeting, carpet scraps. Covering helps retain moisture and heat, two essentials for compost. Covering also prevents the compost from being over-watered by rain. The compost should be moist, but not soaked and sodden.
7. Turn.

   Every few weeks give the pile a quick turn with a pitchfork or shovel. This aerates the pile. Oxygen is required for the process to work, and turning "adds" oxygen. You can skip this step if you have a ready supply of coarse material, like straw.

   Once your compost pile is established, add new materials by mixing them in, rather than by adding them in layers. Mixing, or turning, the compost pile is key to aerating the composting materials and speeding the process to completion.

   **Note:**

   If you want to buy a composter, rather than build your own compost pile, you may consider buying a rotating compost tumbler, which makes it easy to mix the compost regularly.

### Carbon/Nitrogen Ratio

All compostable materials are either carbon or nitrogen-based, to varying degrees. The secret to a healthy compost pile is to maintain a working balance between these two elements.

- **Carbon** - carbon-rich matter (like branches, stems, dried leaves, peels, bits of wood, bark dust or sawdust pellets, shredded brown paper bags, corn stalks, coffee filters, coriander seeds, egg shells, straw, peat moss, wood ash) gives compost its light, fluffy body.

- **Nitrogen** - nitrogen or protein-rich matter (manures, food scraps, green lawn clippings and green leaves) provides raw materials for making enzymes.
A healthy compost pile should have much more carbon than nitrogen. A simple rule of thumb is to use one-third green and two-thirds brown materials. The bulkiness of the brown materials allows oxygen to penetrate and nourish the organisms that reside there. Too much nitrogen makes for a dense, smelly, slowly decomposing anaerobic mass. Good composting hygiene means covering fresh nitrogen-rich material, which can release odors if exposed to open air, with carbon-rich material, which often exudes a fresh, wonderful smell. If in doubt, add more carbon!

Simplest Composting Methods

~ "No-turn" composting
The biggest chore with composting is turning the pile from time to time. However, with "no-turn composting", your compost can be aerated without turning.

The secret is to thoroughly mix in enough coarse material, like straw, when building the pile. The compost will develop as fast as if it were turned regularly, and studies show that the nitrogen level may be even higher than with turned compost. With 'no-turn composting', add new materials to the top of the pile, and harvest fresh compost from the bottom of the bin. This can be easily done in an Aerobin Composter, or a WIBO compost bin.

~ Composting leaves
If you have too many leaves to incorporate into the compost bin, you can simply compost the pile of leaves by itself. Locate the pile where drainage is adequate; a shaded area will help keep the pile from drying out.

The leaf pile should be at least 4" in diameter and 3" in height. Include a layer of dirt between each foot of leaves. The pile should be damp enough that when a sample taken from the interior is squeezed by hand, a few drops of moisture will appear. The pile should not be packed too tightly.

The pile will compost in 4 - 5 months, with the material being dark and crumbly. Leaf compost is best used as an organic soil amendment and conditioner; it is not normally used as a fertilizer because it is low in nutrients.

~ Leaf-mold tea
You can also use leaves to make a nutritious "tea" for your plants. Simply wrap a small pile of leaves in burlap and immerse in a garbage can or large bucket of water. Leave for three days, then remove the "tea bag" and dump contents into the compost. Scoop out the enriched water with a smaller bucket and use to water your plants and shrubs.

Enclosed Compost Bins

For small-scale outdoor composting, enclosed bins are the most practical. The least expensive method is to build one yourself from a heavy-duty garbage can. Simply drill 1.5 cm aeration holes in rows at roughly 15-cm intervals around the can. Fill the can with a mixture of high-carbon and high-nitrogen materials. Stir the contents occasionally to avoid anaerobic pockets and to speed up the composting process. If the lid is secure, the bin can be laid on its side and rolled; a length of 2" cedar (use a 2x2 or a 2x4) can be bolted to the inside, running top to bottom, to help keep the materials in place while the bin is rolled.

Another option is a compost bin, sometimes called a 'compost digester'. Compost bins are enclosed on the sides and top, and open on the bottom so they sit directly on the ground. These are common composting units for homes in residential areas where bins tend to be smaller, yet enclosed enough to discourage pests. These bins are inexpensive, but it is difficult to turn the compost, so it can take several months to produce compost. These bins are thin-walled plastic, and may chip along the edges, especially during a freeze.

The most efficient enclosed bin method is the compost tumbler. It's possible to maintain relatively high temperatures in drum/tumbler systems; both because the container acts as insulation and because the turning keeps the microbes aerated and active. An interior "paddle" aids aeration and prevents clumping of the composting materials. This greatly speeds up the composting process.

An enclosed 'tumbler' system offer the following benefits:
- speeds up the composting process
- can compost year-round, due to higher internal temperature
- cannot be accessed by rodents, racoons, dogs or other critters
- keeps compost neatly enclosed and odor-free, well-suited for residential areas

To learn more, see Compost Tumblers: Comparing different compost tumblers models

Tips for successful composting

~ Activate your compost.
'Activators' can be added to your compost to help kick-start the process and speed up composting. Common compost activator materials are: comfrey leaves, grass clippings, young weeds, well-rotted chicken manure.

~ Flying insects attracted to your compost?
Small fruit flies, especially, are naturally attracted to the compost pile. They can be discouraged by simply covering any exposed fruit or vegetable matter. Keep a small pile of grass clippings next to your
compost bin, and when you add new kitchen waste to the pile, cover it with one or two inches of clippings. Adding lime or calcium will also discourage flies.

Unpleasant odors from your compost pile?
This can be a concern in urban and suburban areas with small lots and neighbors living close by. Odors can be reduced, or eliminated, by following two practices: first, remember to not put bones or meat scraps into the compost; second, cover new additions to the compost pile with dry grass clippings or similar mulch. Adding lime or calcium will also neutralize odors. If the compost smells like ammonia, add carbon-rich elements such as straw, peat moss or dried leaves.

Is your compost pile steaming?
No problem. A hot, steamy pile means that you have a large community of microscopic critters working away at making compost.

Is your compost pile soggy?
This is a common problem especially in winter when carbon-based materials are in short supply. You can restore your compost to a healthy nitrogen-carbon balance. To learn how to restore your compost pile, read our article "How to fix a soggy compost pile".

Matted leaves, grass clippings clumping together?
This is a common problem with materials thrown into the composter. The wet materials stick together and slow the aeration process. There are two simple solutions: either set these materials to the side of the composter and add them gradually with other ingredients, or break them apart with a pitchfork. Grass clippings and leaves should be mixed with rest of the composting material for best results.

Problems with raccoons?
If there's a population of raccoons in your area, they will be naturally attracted to your compost pile. The best solution to this problem is to bar their entry to the composter. (Traps and poisons are more trouble than they're worth.) A wood or metal lid can be easily hinged to the bin described above on this page, or you can buy a commercially-made compost bin with secure fitted lids which are pest-proof, such as the Aerobin, UCT-9 or Jora JK270.

A moveable feast.
The soil beneath a compost bin becomes enriched as nutrients filter down with successive waterings. You can place your bin on a plot of earth which you plan to use for a future vegetable or flower bed, or fruit tree. Each year, you can move the bin to a different area; you'll gain a double benefit - the compost from the bin, and a bed of nutrient-rich soil ready for new plantings.

Additive only. Compost should be used as a soil additive, and not exclusively as the growing medium. Compost is a source of rich organic matter which provides nutrients for growing plants, but should be thought of as one component of a healthy garden bed. To learn more about developing healthy soil, read our article.

6 Tips for Building Soil in your Raised Garden Beds and Planters.

Take advantage of autumn's bounty. The biggest challenge for small-scale backyard composting is finding enough carbon-rich materials to balance the regular input of nitrogen-rich materials which come from kitchen scraps, fruit and vegetable peels, coffee grounds, grass clippings and other fresh materials. To learn how to make the most of autumn's bounty, read Autumn Composting Tips.

Composting and weed seeds
A liability in composting is the unexpected introduction of new weed seeds to your garden. This is caused by slow or incomplete composting which did not generate enough heat to kill any and all weed seeds. Weed seeds in compost are a nuisance because once the compost is transferred to your garden beds, the compost acts to fertilize the weeds and make them even more persistent!

With home compost bins or piles, the way to eliminate weed seeds is twofold:

1. Make sure your compost is hot enough. Reach your hand into the center of the pile - it should be almost too hot for comfort. Specifically, the temperature should be 130 - 150 degrees F. It takes about 30 days at 140 degrees to kill all weed seeds.

2. Mix your pile. While your compost may be hot in the center of the mass, the outside of the pile is cooler, giving seeds a chance to survive. Mixing brings cooler material to the warmer area and also increases aeration which helps attain the higher heat levels. Compost tumblers are very useful for this.

If you are buying bedding for animals, mulch or carbon-rich material to bulk up your compost pile, be aware of introducing seeds to your garden, via the compost. For example, make sure to get straw, and not hay, since straw is mostly weed-free. Ask the sales staff if there have been any complaints about seeds in these products.

Below are a few samples. To see all the composters in our store, click here
Section 3.3: Appendix - Attached Reference Materials

Composting

Jora Insulated Compost Tumbler

- Pest resistant dual chamber system: start a new batch while the first batch ages.
- Insulated: great for colder climates and all-weather composting.
- Ease of use: tumbles easily for maximum aeration.

Click to learn more about the Jora JK270 Composter

Urban Compost Tumbler - 9 cu ft

- Large capacity: heated chamber produces up to 120lbs of compost per month.
- Efficient material: Black 100% recycled plastic heats up quickly for faster composting.
- Convenient design: Easy to position a wheelbarrow underneath. Large top opening.

Click to learn more about the Urban Compost Tumbler 9

Stainless Steel Compost Keeper - Prevent odors:
- Carbon air filter in lid.
- Attractive & Convenient: keep on your counter for easy access. Click to learn more about the Stainless Steel Compost Keeper

Compost Tumblers: Comparing different compost tumbler models

Visit Eartheasy's online store for compost tumblers, bins, and more!

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When Katharine Lee Bates first wrote her 1895 poem “America the Beautiful,” which has since become our national anthem and a song that has inspired generations with its imagery and call for a united America, she described an icon of the American Midwest that was fast becoming our country’s breadbasket: the prairie. Hundreds of thousands of square miles of grasslands covered more than a quarter of the continental U.S. and supported an estimated 30 million bison, not to mention a whole guild of prairie birds and other species that made up the prairie ecosystem. Over the last century, however, the prairies succumbed to the marvel of agriculture, their rich soils rewarding us with tons of wheat and corn. Today, in stark contrast to their original size, only 1 percent of the original prairies are left, and conservationists are faced with the daunting challenge of how to preserve or restore the remnants.

Fortunately there is a resurgence of interest in these dwindling grassland ecosystems, and Virginia is no holdout. Although we cannot hope to reestablish all of the historical ecosystems missing from our now highly developed and populated landscape, the Department of Game and Inland Fisheries nevertheless promotes the use of native warm season grasses in much of its habitat work. These grasses are suitable for both large-scale farm plantings as well as smaller meadows brimming with attract-ive wildflowers. By converting or restoring open lands to native grasses, we mimic prairie habitats and address the needs of numerous bird and mammal species that require prairie-like conditions to survive.

**Grassland Habitats**

Much of the existing “grassland” one commonly sees in Virginia’s rural landscape is either cut for hay or grazed by livestock. These open fields are planted with a final product in mind—grass or forage—and the plants most frequently used include orchardgrass or fescue. Landowners especially appreciate the non-natives for their tough, aggressive qualities that ensure fast growth, reduced soil erosion, and little phosphorous and nitrogen runoff. Unfortunately, there is a downside to these traits: it is invasive and forms a dense mat that effectively out-competes native grasses, thereby excluding the plant diversity and habitat structures essential to many open-billed wildlife species.

Missing from these artificial grassland monocultures are layers of different vegetation and the freedom of movement between plants that ground-foraging birds and mammals need to find food and to escape predators. Native warm season grass habitats are more productive for wildlife because their higher degree of species diversity before springing plant heights and root systems. The value of cover cannot be over-emphasized. Ground-dwelling birds rely on a range of cover types, such as nesting cover, areas where they can nest, brood, loaf, and forage cover, which allows them to move about and hide from predators. In addition, native grasses provide areas of shelter and escape for other species that require prairie-like conditions to survive.

Another advantage of native warm season grasses is that they grow in clumps or bunches. The spaces between the clumps are exposed patches of bare ground and allow for a range of species that benefit from open spaces to thrive. When the plants are tall enough, they can provide cover for birds and mammals alike.

Wildlife which keys in on these open, early stages of plant growth or succession are called “early successional species.” Of national concern is the grassland bird community that has been especially vulnerable to increasing development pressure and whose numbers are declining. In addition to quail mentioned above, other early successional species that benefit from native grassland management are grasshopper sparrow, dickcissel, bobolink, dunnock, and the state threatened upland sandpiper.

**Wild in the Woods**

by Carol A. Heiser

illustrations by Spike Knuth

Switchgrass, indiangrass, and big bluestem are native grasses that benefit a variety of bird species, including the sedge wren (perched on foxtail grass, right) and bobwhite quail (top right).
and flowers planted there will automatically have a head start over any weeds, and there shouldn't be a weed problem. Those ideal growing conditions will help any plant get well established in the first year. Also, since grasses grow from the base of the plant or from underground stems called rhizomes, any bits of living grass roots or stems remaining in the soil at planting time will already have a foothold for stiff competition. This means that if you want to grow meadow flowers, you don't need to worry about them. Growing a meadow is like any other type of gardening or farming: it requires some maintenance.

**Meadow Myths**

Meadow gardeners are considered a dyed-in-the-wool plant community, which means that the community of grassland plants which occur there is the last stage of succession. Succession is a term of option to describe the gradual change of vegetative types over time. In the forest, in contrast, the climax community is forest. Once the field is in an early successional stage which will gradually revert to a dominance of woody plants and trees over time (you're probably on a drive through the county, how abandoned fields sport odd trees within a few years). This means we want to maintain an area as open grassland or meadow, we must manage that area with burning and mowing to keep it in an early successional stage. Meadows are for-dense, ever-flowering flower gardeners and they must prepare a customized mix. This way you'll get exactly the species you want and the quantities you need, with no waste. If the objective is to kill the grass seed, you should plant mixtures of fescue and other cool season plants which will act as a weed suppressant or herbicides. If this is not the case, your grass seed should be at least 75 percent PLS for good establishment.

**Planning a Meadow: What to Buy**

When planting a meadow of native warm-season grasses, whether or not you choose to add flowers, select a seed that contains no more than eight hours of a day. Also consider the plan that you choose before you will have to prepare the soil for future management. Remember to choose larger and adapted to our open grasslands. They will need a lot of space and are not well-suited to a small urban or suburban yard. At a minimum, a full-blow grassland meadow should be at least one acre (43,560 sq. ft.) to have some benefit to wildlife.

**Reaping Benefits**

In addition to improving wildlife habitat, there are several other benefits of using native grasses in the landscape. Because free formula- dials are more productive, where conditions are complexity and dry during the growing season, native grasses are stressed less, in contrast to the native grasses, which are more vigorous and show less of their true habit. "warm season" grasses. Native-like switch grass, indiangrass, Little Bluestem, and big bluestem are native to moist or wet meadows, where native grasses are often small andCollection include the presence and benefits of extended dry spells. The plants are also adapted to fine and dry conditions, with renewed vigor after a wet spell.

**For the landowner who raises livestock, native warm season grasses fill the void in summer when other forages are drying up. These grasses are very palatable to cattle, require little or no fertilizer, are disease resistant, and do not exhibit the endophyte (fungus) problems often associated with fescue. They can be hard to find in store, after the peak mowing time of ground-nesting birds, and should be mowed high (at 10 inches) for proper maintenance, which also allows substantial wildlife over.

**Note:** For the "extreme" homeowner, there is a third scenario to consider: the extreme homeowner, where the property owner is not interested in maintaining a typical lawn or meadow, but rather in creating a natural habitat for wildlife. In this case, native warm season grasses are a great option because they require minimal maintenance and offer a wide range of wildlife benefits. For example, they support the growth of butterflies, bees, and birds, which are essential to the ecological balance of the property. By planting native warm season grasses, you can create a habitat that supports the health of the ecosystem, while also reducing the need for chemical pesticides and herbicides.

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**Native Warm Season Grasses**

Native warm season grasses are a great option for creating a natural habitat for wildlife. They are hardy and require minimal maintenance, making them ideal for busy homeowners. In addition, they support the growth of butterflies, bees, and birds, which are essential to the ecological balance of the property. By planting native warm season grasses, you can create a habitat that supports the health of the ecosystem, while also reducing the need for chemical pesticides and herbicides.

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which is better habitat for rearing young and finding seeds. There is also a much higher availability of insects in the first year after a burn. In the unburned parts of the field that have older plant material, songbirds, rabbits, quail, and other wildlife use the dead litter for nest construction and cover.

**Need Equipment?**

It’s always best to use the right equipment for the right job. If you are planting a small area by hand, you might use a shovel or a rake; a machine that is typically used to plant lawns. However, if the species you’ve selected are very “thick” seeds, they might require a type of seeder. In this case you might simply broadcast with a chest bag, starting with the largest seeds first and either back dragging the field or pulling the small seeds in. Check with your local farm and garden supply for these types of equipment.

For large scale planting projects on several acres, a drill or a drum seeder is a great option. It is typically used for planting grasses, and other large seeds. It is a good option for large scale projects. It is also a great option for planting a meadow. Here is a sampling (not complete) of seed suppliers:

- **www.stockseed.com**
- **www.ernstseed.com**
- **www.prairiesource.com**
- **www.sharpseed.com**
- **www.prairienursery.com**

To prepare a large area for planting, treat the site in the fall (October) with an herbicide that will kill existing vegetation; a second application may be needed the following spring to ensure complete control. A conventional till method without chemicals can be used instead, but it may not produce the best results. If you are planting a small area by hand, you might use a shovel or a rake; a machine that is typically used to plant lawns. However, if the species you’ve selected are very “thick” seeds, they might require a type of seeder. In this case you might simply broadcast with a chest bag, starting with the largest seeds first and either back dragging the field or pulling the small seeds in. Check with your local farm and garden supply for these types of equipment.

**Planting and Future Maintenance**

To prepare a large area for planting, treat the site in the fall (October) with an herbicide that will kill existing vegetation; a second application may be needed the following spring to ensure complete control. A conventional till method without chemicals can be used instead, but it may not produce the best results. If you are planting a small area by hand, you might use a shovel or a rake; a machine that is typically used to plant lawns. However, if the species you’ve selected are very “thick” seeds, they might require a type of seeder. In this case you might simply broadcast with a chest bag, starting with the largest seeds first and either back dragging the field or pulling the small seeds in. Check with your local farm and garden supply for these types of equipment.

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**Taking Initiative**

In an effort to address the continuing decline of early successional bird species, a management plan called the Northern Bobwhite Conservation Initiative (NBCI) was written in March 2002 by biologists, land managers, and other researchers. The word “bobwhite” in the name is somewhat misleading, because quail are not the only birds that benefit from these efforts. Bobwhite, which is a common bobwhite quail, is one of several species that have shared habitat restoration efforts. The initiative is integrated with other species management plans that have parallel objectives, such as Partners in Flight and the North American Waterfowl Management Plan. More information about the NBCI is available at [www.qu.org](http://www.qu.org).

**Learning More…**

Native Treasures for Virginia and North Carolina is a booklet that lists the detailed specifications for preparing and planting a meadow. Contact the Virginia Department of Game and Inland Fisheries at (804) 367-0904 for a free copy.

**Note:** A list includes “Cave-in-Rock,” “Blackwell,” “Rumsey,” and “Round Tree” listed above. A list of grasses and wildflowers that are native to Virginia includes New England aster; Maximillian sunflower; red admiral; partridge pea; “sunflower” heliopsis; purple coneflower; Maximillian sunflower; purple coneflower; “sunflower” heliopsis; purple coneflower; Maximillian sunflower; purple coneflower; and other wildflowers. Choose from the following list, based on your preferences and pocketbook, to make up 2 pounds of seed: Starflower; black-eyed Susan; purple coneflower; black-eyed Susan; purple coneflower; Maximillian sunflower; purple coneflower; Maximillian sunflower; purple coneflower; and other wildflowers. Choose from the following list, based on your preferences and pocketbook, to make up 2 pounds of seed: Starflower; black-eyed Susan; purple coneflower; black-eyed Susan; purple coneflower; Maximillian sunflower; purple coneflower; Maximillian sunflower; purple coneflower; and other wildflowers.
Growing Apple Trees In The Home Garden

Growing apple trees in the home garden can be fun and rewarding. Several factors are important to consider before planting for successful apple production. Apple variety and rootstock, site selection, proper planting, training and pruning, adequate fertility, and pest control all contribute to healthy and productive trees.

A brief discussion of these considerations follows.

Rootstocks and Tree Spacing - All apple trees sold commercially consist of two parts that are grafted together to form the tree. The "scion" is the top portion that branches and bears fruit and is grafted onto a "rootstock." The type of fruit is determined by the scion variety. The rootstock can be a "seedling," which produces a full-size or standard tree, or the rootstock can be "size-controlled" or "dwarfing," which produces a tree that is smaller than full size. The rootstock determines the relative size of the tree but does not affect the type or quality of fruit that the tree bears. Different rootstocks are desirable because they can control the size of the apple tree, reduce the time until the tree reaches fruit-bearing age, and may offer some pest resistance.

Table 1 lists some important characteristics of the rootstocks that are commercially available. Tree size is relative and is shown as a percent of the size that the tree would be on a full-size seedling rootstock. Rootstock, soil fertility, and pruning can influence tree size, and therefore influence tree spacing. Table 1 suggests a range of planting distances with the wider distances for trees planted in good, fertile soils and optimum growing conditions. Trees on the more dwarfing rootstocks must be staked for the life of the tree to obtain optimum growth and to prevent leaning and potential tree breakage. Commonly used stakes consist of a 3-inch diameter wood pole or a 1-inch diameter metal conduit. The stake should be 10 feet high with 2 feet driven into the ground approximately 6 inches from the base of the tree.

Table 1: Rootstock Characteristics.

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Tree Size as Percent of Seedling</th>
<th>Tree Spacing in Row (ft)</th>
<th>Anchorage</th>
<th>Years to Fruit Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seedling*</td>
<td>100</td>
<td>15-18</td>
<td>Excellent</td>
<td>6-10</td>
</tr>
<tr>
<td>MM 111</td>
<td>85</td>
<td>14-18</td>
<td>Excellent</td>
<td>4-6</td>
</tr>
<tr>
<td>MM 106</td>
<td>80</td>
<td>12-16</td>
<td>Excellent</td>
<td>3-4</td>
</tr>
<tr>
<td>M.7A</td>
<td>70</td>
<td>10-14</td>
<td>Fair</td>
<td>3-4</td>
</tr>
</tbody>
</table>

* Mature tree is 12-20 feet tall, depending on variety.
** Trees should be staked and tied to the stake at planting.

Table 2: Variety characteristics in order of maturity.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Fruit Color</th>
<th>Fruit Use</th>
<th>Relative Bloom Time</th>
<th>Potential Cross-Pollinators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gala</td>
<td>Yellow-orange to red</td>
<td>Fresh, cooking</td>
<td>Early</td>
<td>Golden Delicious</td>
</tr>
<tr>
<td>Empire</td>
<td>Dark red over green background</td>
<td>Fresh, cooking</td>
<td>Early</td>
<td>Golden or Red Delicious, Gala</td>
</tr>
<tr>
<td>Jonagold*</td>
<td>Yellow with light red stripes</td>
<td>Fresh, cooking</td>
<td>Midseason</td>
<td>Gala, Empire</td>
</tr>
<tr>
<td>Golden Delicious</td>
<td>Yellow green to light yellow</td>
<td>Fresh, cooking</td>
<td>Midseason to Late</td>
<td>Red Delicious, Gala, Empire</td>
</tr>
<tr>
<td>Red Delicious</td>
<td>Red</td>
<td>Fresh</td>
<td>Early</td>
<td>Golden Delicious, Gala</td>
</tr>
<tr>
<td>Stayman*</td>
<td>Blush to red</td>
<td>Fresh, cooking</td>
<td>Midseason</td>
<td>Gala, Golden or Red Delicious</td>
</tr>
<tr>
<td>Rome</td>
<td>Blush to red</td>
<td>Fresh, cooking</td>
<td>Late</td>
<td>Fuji, Braeburn</td>
</tr>
<tr>
<td>Braeburn</td>
<td>Green with light red blush</td>
<td>Fresh</td>
<td>Midseason</td>
<td>Rome, Fuji</td>
</tr>
<tr>
<td>Fuji</td>
<td>Green with red stripe</td>
<td>Fresh</td>
<td>Midseason</td>
<td>Rome, Braeburn</td>
</tr>
</tbody>
</table>

* Pollen produced by these varieties is sterile.

Varieties - The variety of apple selected should be based on fruit characteristics, bloom time and pollen compatibility. Table 2 shows several popular varieties in North Carolina, listed in order of fruit maturity. Nurseries can also provide varietal information and pollen compatibility suggestions. Crabapple trees can also be used as pollinizers if they bloom at the same time as the desired variety.

Pollination - All apple varieties should be considered self-incompatible, meaning that they cannot pollinate themselves or any flowers of the same apple variety. The highest quality fruit is harvested when cross-pollination occurs with a suitable pollinator variety. You will need to plant at least two varieties of apple trees together in order to maximize fruit production and quality. Make sure that the varieties you choose have overlapping bloom dates, so that both varieties bloom at the same time. Some varieties, such as Winesap, Mutsu, Jonagold, and Stayman, produce sterile pollen and should never be used as pollinizers. However, pollen from other varieties can be used to pollinate these pollen-sterile varieties. Remember, two
trees of the same apple variety cannot be used for cross-pollination. Since the pollen from apple blossoms is transferred primarily by bees, be careful not to spray insecticides during bloom when honey bees are present.

Site Selection

Soils - Take a soil test prior to planting your apple trees. Your local County Extension Center can instruct you in collecting the soil sample, help you interpret the results, and provide valuable information about the soil in your county. Results from the soil test will determine the soil amendments necessary to correct nutrient deficiencies and adjust soil pH. The amendments should be worked into the soil to a depth of 12 to 18 inches where the tree will root, not just the planting hole. Apple trees will tolerate a wide range of soils as long as water and nutrients are not limiting and soil pH is adequate. Avoid heavy, poorly-drained soils and low spots, since apple trees cannot survive if water remains standing in the root zone.

Air Drainage - It is important to select a site where the tree will not be in a “frost pocket”, where cold air settles in low-lying areas. In a frost pocket, low spring temperatures commonly kill the blossoms or developing fruit because cold air settles around the tree. Good air drainage, especially during early spring frosts, is critical. Choose a higher site with a slope if possible so cold air will flow down away from the trees and will not accumulate around the trees. Do not plant the trees close to a fence row, wooded area, or at the bottom of a hill, as cold air drainage will be impeded.

Other Considerations - Apple trees require full sun and should be planted where the trees will not be shaded from large trees or buildings. Follow the tree spacing guidelines that pertain to the rootstock you have chosen from Table 1. Do not plant trees near woody areas or streams to avoid animal damage. Prior to planting, remove weeds either manually or with an approved herbicide that will not harm the young tree. If you are planting the tree in a lawn, remove the grass from the planting area in a 4-foot diameter circle. Gravel composes with young trees for available water and nutrients and can significantly reduce tree growth and productivity.

Planting the Tree

Tree Purchase and Preparation - Purchase a healthy 1-year-old nursery tree, 4 to 6 feet tall, with a good root system. A small tree with a good root system will transplant better than a large tree. When you get the tree, protect it from injury, drying out, mouse or mole damage, freezing, and overheating. If the roots have dried somewhat, soak them in water for about 24 hours before planting. If you are unable to plant the tree immediately, there are two options:

- 1) Wrap the roots in plastic along with moist sawdust or newspaper, and place the tree in a refrigerator or cooler at 40 F. Never store the tree with fruit or vegetables, as ethylene gas from the ripening fruits can kill young trees.
- 2) "Heel-in" the tree. To heel-in a tree, dig a trench and place the tree roots vertically in it, cover the roots with soil, sawdust or peat, and water the tree thoroughly. The tree can be kept for several weeks using this method before permanently planting.

Planting the Tree - In North Carolina, trees can be set from late fall to early spring. To plant the apple tree, first dig a hole approximately twice the diameter of the root system and 2 feet deep. Place some of the loose soil back into the hole and loosen the soil on the walls of the planting hole so the roots can easily penetrate the soil. Spread the tree roots on the loose soil, making sure they are not twisted or crowded in the hole. Continue to replace soil around the roots. As you begin to cover the roots, firm the soil to be sure it surrounds the roots and to remove air pockets. Do not add fertilizer at planting time as the roots can be "burned". Fill the remainder of the hole with the loose soil, and press the soil down well. Important: The graft union must be at least 2 inches above the soil line so that roots do not emerge from the scion. When you have finished planting the tree, water well to eliminate air pockets and provide good contact between the roots and the soil.

Training and Pruning Central Leader Trees

Proper training and pruning of fruit trees is essential to the development of a strong tree framework that will support fruit production. Properly shaped trees will yield high-quality fruit much sooner and will live significantly longer. Regular pruning and training will also maximize light penetration to the developing flower buds and fruit. Additionally, a well-shaped tree canopy permits adequate air movement through the tree, which promotes rapid drying to minimize pest problems.

Central Leader Trees - A central leader tree has one main, upright trunk, called the "leader". Branching should begin on the leader 24 to 36 inches above the soil surface to a low branch under the tree. The first year, 3 to 4 branches, collectively called a "scaffold" or "scaffolding", are selected. The selected branches should be spaced uniformly around the trunk, not directly across from or above one another. The major lateral branches are commonly referred to as scaffold branches on which the central leader tree is "built". Above the first scaffold branch should be an area of 18 to 24 inches, called a "light shock", without any branches to allow light to reach all lower leaves and fruit. This light shock is followed by another shock of scaffold branches. Maintain alternating scaffold whorls and light shocks up the leader to the desired maximum tree height. The shape of a properly trained central leader tree is like that of a Christmas tree (except with slots for light). See Figure 1.

![Figure 1. Side view of a central leader tree.](image)

Newly Planted Trees - After early winter planting, wait until just before the buds start to grow in the spring to "head" or cut, the unbranched central leader to 36 inches above the soil surface to encourage new lateral branching. When new growth is 3 to 4 inches long, identify the most upright shoot that will continue to be the central leader. Leave it and remove all new shoots growing 3 to 4 inches immediately below this new terminal to prevent competition. This will also encourage lateral growth in the area 6 to 14 inches below the cut tip of the young tree. Branches that form 6 to 14 inches below the cut tip of the tree are less vigorous, less upright, and easier to train as productive scaffold limbs. When the lateral branches, or scaffold branches, are 3 to 6 inches long, they should be spaced to a wider crotch angle which will provide a stronger framework for fruit production. Toothpicks or cloth strips can be used to prop the young branches out to a 50 to 60 degree angle. This angle will slow vegetative growth, promote lateral branches, and allow the tree to initiate flowers and produce fruit sooner.

Scaffold Training - Improperly trained fruit trees have very upright branch angles, which result in
Section 3.3: Appendix - Attached Reference Materials

Growing Apple Trees in the Home Garden

Apples reach maturity at different times depending on variety and climate. There is no specific growth period at which the flowers are most receptive to pollination. However, for long-term fruit production, plant apples in spring after danger of frost has passed. To determine the exact time for planting in your area, consult your local Cooperative Extension Service.

Apples can be grown in a variety of soils, from sandy loams to heavy clay. It is important to select a site that is well-drained and has adequate sunlight. Apple trees require at least 6-8 hours of direct sunlight per day.

Apples are propagated from seed. Propagation through seed allows for genetic diversity, which can be beneficial for disease resistance. However, it is not recommended for fruit production, as only one out of 10,000 seeds will likely produce a viable plant.

Apples are self-fertile, meaning they can pollinate themselves if planted individually. However, for the best fruit production, it is recommended to plant a minimum of three trees with different varieties to ensure cross-pollination.

Apples require regular fertilization with a balanced fertilizer. It is recommended to apply around 100 pounds of 5-10-5 fertilizer per tree in early spring. In addition, it is important to water regularly, especially during the fruit set and harvest periods.

Apples are susceptible to a variety of pests and diseases. Regular monitoring and control measures are necessary to maintain healthy trees. Some common pests include aphids, mites, and caterpillars. Common diseases include apple scab and fire blight.

Apples are harvested when they are fully colored and firm. Harvest can begin in late summer to early autumn, depending on the variety. It is recommended to harvest apples by hand, using a sharp knife to cut from the base of the stem, leaving a small stump.

Apples can be stored for several months after harvest. It is recommended to store apples in a cool, dry, and well-ventilated area to maintain their quality.
Ensuring Continued Success

This section provides strategies for ensuring the long-term sustainability of your Schoolyard Habitats project.

- Creating a Maintenance Plan
- Creating a Field and Care Guide
- Monitoring Projects
- Parent Involvement
- Schoolyard Habitats Certification

Creating a Maintenance Plan

Having a Schoolyard Habitats maintenance plan in place before summer break will help to ensure that this new habitat will be thriving when the school community returns to classes in the fall. The most critical time for a Schoolyard Habitats site is during its first year when newly planted trees, shrubs and plants are becoming established. This means that extra care needs to be taken to ensure that plants receive the proper amount of water, that they are not mowed or accidentally pulled out, and that they are protected from pesticide spraying.

If a school is lucky enough to have a staff member in charge of grounds keeping, they may be able to assist with this task. However, do not assume that they will be willing or able to do this without asking and planning ahead. Arrangements for weekend care may still be needed.

Many schools devise a schedule for student/parent/community volunteers to help with habitat care at different weeks throughout the summer. Some schools promote an “Adopt Our Habitat” campaign within the community to request assistance. This requires someone to coordinate and remind volunteers, but may be an effective way to keep students, parents, and volunteers involved in the project.

Alternatively, if the school has summer classes, maintenance of the site may be a good outdoor project for one or more classes.

However summer maintenance is provided, those involved may need training to understand what to do and what to observe when monitoring the health of the habitat.

Make sure those responsible for habitat maintenance during the summer:

- Know where to find and access supplies, equipment and water they will need
- Know the boundaries of the planting area so that it will not be mowed
- Can identify which plants are part of the habitat and which are weeds that should be removed
- Can identify insect pests (such as aphids) and know non-toxic methods to remove and deter them
- Can identify beneficial insects such as ladybird beetles (a.k.a. ladybugs), butterflies, and earthworms
- Have the number of a contact person to call if there are problems with the habitat

Ask those maintaining the site to keep a log of when the habitat was cared for, to note wildlife sightings, and to document any observational notes about problems with unhealthy plants or vandalism.

Engaging students in the Creating a Field and Care Guide (p. 10) activity is a great educational opportunity, and will leave your maintenance volunteers or staff with an excellent resource to guide their efforts.
CREATING A MAINTENANCE PLAN

Considerations for creating your Schoolyard Habitats Maintenance Plan:

What are the watering needs of the trees, shrubs and plants in your habitat area?
Remember that regular watering is extremely important in the first few summers of your project as young plants struggle to set their roots in their new homes.

How often will the habitat site need to be weeded?
Keep in mind that your “weeding” schedule will help to ensure that invasive exoticspecies do not take over your project and that beneficial native plants have the opportunity to thrive and provide habitat for local and migratory wildlife.

How often will mulch need to be applied to the area?
Maintaining a two-to-three-inch layer of mulch around the plants in your site will help to lessen the number of weeds in the area and will increase moisture retention.

Do feeders need to be filled? Cleaned?
If you decide to leave out feeders for birds, remember to assign the task of keeping them filled and clean. Also keep in mind that any bird baths will need to be cleaned regularly, every couple of days is advisable in hot summer months. These are ideal tasks for neighbors that have expressed an interest in your Schoolyard Habitats project.

Remember to answer the following additional questions in your maintenance plan:
Who? When? How often?

SCHOOLYARD HABITATS® – A HOW-TO GUIDE

K-8 ACTIVITY

Creating a Field and Care Guide

Summary

Students create a guide to the habitat site that includes a map and instructions on maintaining the site.

Grade Level: K-8

Time:
2 to 5 class periods (time depends on the number of elements included in the guide and the number of participants contributing)

Subjects:
Language Arts, Art, Science, Geography

Skills:
Classification, description, generalization, research, synthesis

Learning Objectives:
Students will be able to:
- Write a guide to the plants and other features found in their Schoolyard Habitats sites
- Create guidelines for site maintenance
- Describe site features to future students and community members

Materials:
- Pens, pencils, colored pencils, markers
- Regional field guides and other resources
- Care instructions that accompanied plants when purchased
- Pictures of plants, if available
- Field guides to local wildlife

3 ring binder

Note: If the class has access to typewriters or computers, consider having them type the text and insert graphics into the document.

Laminating the pages will make the guide last longer. In any case, bind the final product in a 3-ring binder so that additions and changes will be easy to make over time.

Background

Creating a field and care guide for their Schoolyard Habitats site is a great way for students to apply all that they have learned, while creating a useful, educational tool for others. The guide can be used as a learning resource for other classes, school visitors, parents, and community members who want to take group or self-guided walks through the site.

During the school year, many students can participate in the maintenance and care of the site. The maintenance section will help streamline procedures and help during holidays and summer when people unfamiliar with the site may be helping out. In this activity, all students involved in the project will pool their knowledge to ensure the stewardship of the site.

In addition to providing detailed instructions about caring for the wildlife habitat site, participants may want to add creative pieces to the guide, such as artwork, poetry, photos of plants, wildlife and the site (before and after), a special note to caretakers, and a dedication page.

This guide can also serve as a culminating assessment for student understanding of their habitat project.

Procedure

1. Divide the class into groups, or divide the work between various classes in school. Each group or class will produce one section.

Sections should include:
- Habitat Map
  All students to draw a map of the Schoolyard Habitats site that someone else could use to locate specific features. For slide
students, this is an opportunity to teach students to map to scale for younger students emphasize the importance of details in the maps. Students may want to color code or create a key for their maps, clearly indicating pathways, types of gardens, locations of birdfeeders, maintenance supplies, and entrance.

- **Plant List and Care**

  Instructions

  Much of this work will have been done during the plant selection activity, but have students organize and expand the plant information. For each tree, plant or flower in the habitat, groups should create one or two pages. Include plant names (common and scientific), pictures (can include phonies, drawings, dried leaf, rubbing, etc.), description (can include height, spread, type of leaves, flower color, plant uses, how it benefits wildlife, etc.), and plant care and growth requirements (soil, light, moisture, and pruning needs).

- **Special Features**

  This section can include descriptions of features other than plantings that have been included in the Schoolyard Habitats site. This is where students can describe the purpose and success of garden bed, compost bins, and compost bins, and any other unique features.

- **Wildlife Sightings**

  This section may require setting aside time for first-hand observations. Alternatively, create a journal that all habits or visitors can use to record what kinds of wildlife they saw at the site. Students may also want to poll other students in the school for a list of all wildlife seen at the site. A small amount of information, such as hints on where to look for the animal will help visitors trying to locate wildlife.

- **General Habitat Maintenance**

  Students should compile description of the general Schoolyard Habitats maintenance needs, including how often these tasks must be done and any special equipment needed. For example, students may need to weed down how often they refill a bird bath and how often they must clean it.

- **Seasonal Habitat Maintenance**

  In this section include maintenance tips for different seasons. In winter, feeders may need to be filled more often. In summer, water supplies might need to be replenished daily instead of twice a week.

- **Cover Design, Artwork and Acknowledgments**

  The cover and artwork pages (which may be interspersed throughout the guide) are ideal for student creativity. Consider leaf prints, painting with berries from the garden or using dried flowers in a collage. To highlight how the site has impacted students personally, they may want to add short creative writing pieces or poetry written about the site. The acknowledgment page should include the names of all those who helped create the Schoolyard Habitats site, as well as all of those who donated time or materials to the project. You may want to include a photograph of the students and other members of the Habitat Team.

1. Once sections are complete, put them in a 3-ring binder. To ensure that remote copies have not been destroyed, make color copies and/or laminate the pages. You may want to store a copy in a "visitor's box" near the site, and keep another in the school lobby, office or library.

2. Tell other teachers and community members where the notebook is kept (preferably in an area that others can access). Add new pages as they are needed, and the site develops over time.

**Monitoring Projects**

Monitoring the health, behavior, population size etc. of wildlife in the schoolyard is a meaningful way for students to act as scientists, collecting, recording, and analyzing data, while becoming keenly aware of the behavior of certain schoolyard species on a long-term basis. Over the years, this accumulated data will provide an excellent resource for future classes to assess the impact that schoolyard enhancements have had on local wildlife populations.

Many schools with streams and/or ponds on site also choose to engage students in on-going studies and monitoring of water quality over the year. Again, this provides both an excellent educational opportunity and a clear way to assess the effectiveness of efforts to remove local aquatic habitat.

Below are a number of resources to assist you with on-going schoolyard monitoring.

**Butterflies**

- **Journey North**
  - www.journeynorth.org/north

  Free on-line program throughout North America. Classrooms can track the spring migrations of various species. Students share information with other students and scientists online; website provides supporting curriculum and resources for educators.

- **Monarch Watch**
  - www.monarchwatch.org

  Based in the University of Minnesota, this project supports monarch monitoring and classroom instruction.

**Birds**

- **Project FeederWatch**
  - www.projectfeederwatch.org

  Program run by the Cornell Laboratory of Ornithology provides curriculum, resources, and support for bird monitoring and online data exchange.

- **North American Bluebird Society**
  - www.nabluebirdsociety.org

  This non-profit conservation, education and research organization, promotes the recovery of bluebirds and other native cavity-nesting bird species. Through the Transcontinental Bluebird Trail (TBT) program, students and school communities create nest box trails, monitor their boxes, and share information and data collected from their trail.
In a recent survey by the National Parent and Teacher’s Association, parents of public school students answered many questions about their level of involvement in their children’s schools. Their answers provide useful insights into successfully engaging parents in Schoolyard Habitats projects.

Ninety-one percent of parents surveyed agreed that it is “extremely important” for them to be involved in their children’s schools. However, not all parents are able to be as involved as they would like. The survey identified several key barriers to parental involvement, the most frequently named of which is parents lack of availability during school hours. Several other barriers noted include: inadequate communication between the school and parents; lack of transportation or childcare; parents uncertainty as to the ways in which they can contribute; language and cultural differences; and parents feeling unwelcome and/or intimidated by their child’s school. The #1 response in answer to the question of how schools could improve their efforts to get parents involved was “more and better communication between schools and parents.”

What does this tell us in light of planning and carrying out Schoolyard Habitats projects? First, remember that not all parents do want to be involved in their child’s education. Remove the barriers that frequently thwart interested parents from volunteering and contributing to the life of the school. Regularly update the parent community about the status of the Schoolyard Habitats project. Many important tasks necessary for the success of Schoolyard Habitats projects can be accomplished in the late afternoons and on the weekends, which are more convenient times for parents working during school hours. Identify the skills needed at each stage of the project, and publicize these short and long-term opportunities for volunteering and contributing. Think creatively when assessing the possibilities for parent contributions: for instance, is there a bilingual parent who would be willing to translate your Schoolyard Habitats updates for non-English speaking parents? Which parent has the woodworking skills you are seeking to help build nest boxes? A survey of relevant parent skills and interests will help connect parents with appropriate projects.

Be proactive in identifying and removing barriers for parents. Consider: will providing an hour of childcare help more parents participate in your upcoming weekend planting day? Parents understand that volunteering matters: let them know they are welcome, that they have valuable skills and knowledge to contribute, and that the school is willing to take extra steps to help them get involved. Keep communication with parents—and the entire school community—clear, accessible and consistent, and everyone will benefit.

### Parent Involvement Resources

  - Provides resources, training and information for communities interested in both restoring and monitoring the health of their local watershed.
- **The GLOBE Program Manual** (see above) includes a useful section on Hydrology, the study of water.
- **GREEN Global Rivers Environmental Education Network**: www.greennet.org/education
  - This is a project that involves students in monitoring water quality and evaluating issues in their community.
- **Mississippi Headwaters River Watch**: www.mississippiheadwaters.org/
  - This organization assists students and community members in monitoring waterways and shorelines along the Mississippi River and its tributaries.
- **Save Our Streams**: www.saveourstreams.org/
  - SOS educates citizen volunteers and community organizations to clean, monitor, and protect Maryland’s waterways. SOS addresses the root causes of stream pollution by educating and supporting citizens to perform conservation projects to solve them. They also help to build bridges between community organizations, government and businesses.
- **Amphibian and Reptile Resources**
  - A Thousand Friends of Frog
  - Rezendes, Paul, and Signs, Water Monitoring
  - An excellent resource on animal tracks, scat, and other signs. It contains illustrations and photographs of tracks, scat, rubbings, and vomit of many species.
- **Vegetation Monitoring Resources**
  - Field and Laboratory Methods for General Ecology
  - Laboratory reference for collecting and analyzing ecological data, including a variety of sampling methods for plants and animals.
  - **Global Learning and Observation to Benefit the Environment (GLOBE)**
  - www.globe.gov
  - A worldwide science and education program coordinating the work of students, teachers, and scientists to study and understand the global environment. The GLOBE Program Manual, which can be downloaded from their website, includes a 14-page section on monitoring large-scale land cover types and biomass. Includes protocols, learning activities, and reference materials.
SCHOOLYARD HABITAT CERTIFICATION

NATIONAL WILDLIFE FEDERATION

Attracting Wildlife

Attracting Birds, Butterflies and Other Wildlife is a fun way to enjoy nature right in your own yard or garden. Imagine your garden teeming with singing birds, colorful butterflies and beautiful plants and water features that attract wildlife. It’s easier than you might think. National Wildlife Federation can help!

Components of Habitat

There are five basic elements of a Certified Wildlife Habitat™:

1. Food
   Native plants provide wildlife with nectar, seeds and berries used by an exciting variety of wildlife. Feeders can supplement natural food sources.

2. Water
   All animals need water to survive and some need it for bathing or breeding as well.

3. Places to Raise Young
   Wildlife need special habitat for bearing and raising young.

4. Cover
   Wildlife need places to find shelter from bad weather and predators.

5. Sustainable Gardening
   How you manage your garden can have an effect on the health of the soil, air, water and habitat for native wildlife as well as the human community.

National Wildflower Survey - www.nwf.org/gardenforwildlife

Simple Tips to Get Started

1. Plant a shrub that flowers for pollinators and produces berries for birds and other animals.
2. Put out a birdbath. Even small water features will be used by wildlife.
3. Provide cover with dense shrubs, wildflower gardens, rock walls and evergreens.
4. Hang a birdhouse, plant host plants for butterfly caterpillars or install a frog pond to provide places to raise young.
5. Put away the chemicals. Natural gardens are better for you and your family as well as wildlife.

Rick Lewis
Photodisc

www.nwf.org
Habitat Certification Application

Use this form to certify a wildlife friendly space in your yard, school, or anywhere in your community. Do your best to answer the questions and we'll make suggestions if something is missing. If your habitat meets the requirements, you'll receive a personalized certificate suitable for framing and become a member of the National Wildlife Federation (a $15 value), receiving our award-winning National Wildlife magazine. For questions call 1-800-822-9919 or certify online at www.nwf.org/certify.

Have you ever certified before? __ Yes __ No

If yes, have you moved ____ or is this for a second property ____?

If you are filling out this application for someone else, please write their name in the space provided below:
Name _____________________________________ Organization (if applicable) ______________________________

Name(s) to Appear on Certificate (if different from above) _______________________________________________

Address of Habitat __________________________________________________________________________________
City __________________________________________ State/Province _______________ Zip Code
Telephone ______________________________ Email Address ______________________________________________
Mailing Address (if different from above) ______________________________________________________________

In what type of area is your property?
___ Urban ___ Suburban ___ Rural

What is the size of your property?
___ < 1/8 acre ___ 1/8 - 1/4 acre ___ 1/4 - 1 acre ___ 1 - 5 acres ___ 5 - 10 acres ___ > 10 acres

Check the option that best describes your habitat:
___ Home ___ Apartment/Balcony ___ Workplace ___ Park/Community
___ Garden ___ Farm ___ Place of Worship ___ School/Educational Setting

FOOD SOURCES:
Plants provide the basic foods for wildlife. Feeders can be used as a supplemental source of food. Remember that some creatures will become food for others in a balanced habitat. How do you provide food for wildlife? (Minimum requirement: 3)

___ Seeds ___ Nuts ___ Pollen
___ Plants ___ Twigs ___ Nectar ___ Sap
___ Flowers ___ Foliage ___ Nectar ___ Sap

WATER SOURCES:
Wildlife need a clean water source for drinking and bathing. How do you provide water for wildlife? (Minimum requirement: 1)

___ Fountains ___ Birdbaths ___ Water Garden/Pond ___ Lake ___ Stream ___ Seasonal Pool
___ Stream ___ Butterfly Puddling Area ___ Rain Garden ___ Ocean ___ Stream

Supplemental Feeders:
___ Squirrel ___ Butterflies ___ Hummingbirds

Attracting Birds, Butterflies and Other Backyard Wildlife by David Mizejewski, NWF Naturalist and Media Spokesman
$12.95

Plants and other natural food sources are the key to a healthy ecosystem. How do you provide food for wildlife? (Minimum requirement: 3)

National Wildlife Federation® wants to recognize all efforts to create wildlife habitat. Just following the basic guidelines has made my yard come alive.

- Janet Allen, Syracuse, NY
PLACES FOR COVER: Wildlife need places to find shelter from the weather and from predators. How do you provide cover for wildlife? (Minimum requirement: 2)

- Wooded Area
- Dense Shrub/Thicket
- Bramble Patch
- Evergreens
- Ground Cover
- Brush/Log Pile
- Rock Pile/Wall
- Burrow
- Cave
- Meadow/Prairie
- Roosting Box
- Water Garden/Pond

PLACES TO RAISE YOUNG: In order to provide complete habitat, you must provide places for wildlife to engage in courtship behavior and to mate, and then to bear and raise their young. How do you provide places to raise young for wildlife? (Minimum requirement: 2)

- Mature Trees
- Dead Trees/Snags
- Meadow/Prairie
- Dense Shrub/Thicket
- Nesting Box
- Water Garden/Pond
- Wetland
- Burrow
- Nest Plants for Caterpillars
- Host Plants for Caterpillars

SUSTAINABLE GARDENING PRACTICES: How you manage your garden or landscape can have an effect on the health of the soil, air, water and habitat for native wildlife as well as the human community. What sustainable gardening techniques do you employ to help conserve resources? (Minimum requirement: 2)

- Soil and Water Conservation:
  - Riparian Buffer
  - Capture Rainwater from Roof
  - Xeriscape (water-wise landscaping)
  - Drip or Soaker Hose for Irrigation
  - Limit Water Use
  - Reduce Erosion (i.e. ground cover, terraces)
  - Use Mulch
  - Rain Garden

Controlling Exotic Species:
- Practice Integrated Pest Management
- Remove Nonnative Plants & Animals
- Use Native Plants
- Reduce Lawn Areas

Organic Practices:
- Eliminate Chemical Pesticides
- Eliminate Chemical Fertilizers
- Compost

To apply, please send:
- Completed application - REQUIRED
- $15 non-refundable application fee - REQUIRED

TO: NATIONAL WILDLIFE FEDERATION • P.O. Box 1583 • Merrifield, VA 22116-1583
Allow 4-6 weeks for processing. Please keep a copy of this application for your records.

Be Out There
Schoolyard Habitats® Program
I understand that photographs are sometimes taken of Schoolyard Habitats® Program participants by participants, participants’ family members, and NWF staff. I hereby grant permission to National Wildlife Federation, to use, copy, publish, and republish, in any form:

1. Any photograph(s) taken of myself or any minor of whom I am the parent or guardian, participating in the Schoolyard Habitats Program held on __________________________ (day, month and year of the program), or

2. Any photograph(s) taken by myself that I voluntarily submit to the National Wildlife Federation. The submission of any photograph in support of a Schoolyard Habitats Program is not required for processing an application and I have voluntarily chosen to submit this (these) photograph(s).

I understand that such photographs may be used or published by NWF for purposes of advertising and promoting NWF’s Schoolyard Habitats program or for any other purpose that NWF deems appropriate, in any and all media including, but not limited to, printed and electronic media. Neither my name, nor the name of the minor(s), if applicable, shall be published in connection with NWF’s use of any photograph(s). I further understand that no payment will be made to NWF for use of such photographs and that it is not possible for NWF to return any original photographs that I may send to NWF on my own initiative.

I/we will be participating in the National Wildlife Federation’s Schoolyard Habitats Program at:
________________________________________________________

I/we have read the above terms carefully and acknowledge my/our informed consent to its terms.

Participant ______________________ (and Parent or Guardian, if participant is under 18)

Please complete the following information (please print clearly):

Adult Participant’s Full Name __________________________ Date ______________

Minor(s) Participating in the NWF Schoolyard Habitats Program under my supervision (if applicable):

Minor’s Full Name __________________________

[Repeat for each minor]
How to Install and Maintain a Rain Barrel

Placing your rain barrel

- Choose a downspout on your house or garage that is close to the plants and garden you water most. Your other downspouts can be disconnected and directed into your yard.
- Choose a downspout where your rain barrel's overflow will soak into your own yard, and not your neighbors' property.
- Place your rain barrel on a pervious (e.g. landscaped) surface that allows overflow from your rain barrel to soak into the ground. If placed on an impervious (e.g. paved) surface, rain barrel water overflow during heavy rains could pool or seep into your house or garage foundation. Make sure overflow does not go onto your neighbors' property.
- You may want to place the rain barrel on concrete blocks if you are going to use a hose to direct water to your garden (gravity will help move the water), or if you want to fill up a watering can from the spigot (so the can fits underneath the spigot).

Connecting your downspout to your rain barrel


1. Place your barrel near the downspout you have selected, and plan out how you will direct the downspout.
2. Disconnect your downspout from the line leading to the storm drain or curb drain by sawing the downspout above where the top of the rain barrel will be, leaving room for the elbow to be attached.
3. Attach a downspout elbow to the end of your downspout so that water from your downspout is directed into the rain barrel through the plastic screen vent on top.
4. If you have an aluminum downspout, secure it to the elbow with screws.
5. If you have a PVC downspout, secure it to the elbow with PVC cement.
6. Place your rain barrel under the downspout elbow.
7. Optional: Attach a hose to the spigot, and/or to the overflow hole on the top-side of the barrel. Make sure that the overflow is directed into your own yard.

Using Rain Barrel Water

- Use the water collected in your rain barrel!
- Water your flowers, trees, shrubs, and lawn.
- Wash your car or pets. Rinse hands and feet, tools, or muddy boots.
- Keep your rain barrel lid on tight at all times to prevent children and animals from entering or falling in.
- **DO NOT DRINK WATER** from your rain barrel.

Source: City of Chicago
Maintaining your rain barrel

- Keep your rain barrel spigot closed when you are not using the water so that the rain barrel can collect water. Overflow water will spill from the black vent on the top and the overflow hole on the side near the top.
- Regularly check your gutters, downspouts, rain barrel water intake screen, rain barrel mosquito screen and rain barrel spigot for leaks, obstructions or debris.
- Keep your rain barrel lid sealed.
- Drain your rain barrel before temperatures drop below freezing.
- In the winter, keep your rain barrel spigot open so that water does not accumulate in the rain barrel and freeze. You can also turn it upside-down or bring it inside to ensure no water accumulates in the barrel.

Preventing Mosquitoes

Your rain barrel should be equipped with a mosquito-proof screen under the lid and inside the overflow hole to keep mosquitoes and other insects out.

- Place your barrel on a pervious (landscaped) surface, so that overflow water soaks into the ground instead of pooling on paved surfaces.
- Keep your rain barrel lid sealed.
- Keep your barrel free of organic material.
- During the rainy season, every 3-4 days use your hand to splash off any water that may collect on the top of the barrel. Mosquitoes need at least 4 days of standing water to develop as larva.
- If you believe mosquitoes are breeding in your rain barrel, empty your barrel completely. This will kill all mosquito larvae that may be in your barrel. If your mosquito netting is intact and there are no leaks where mosquitoes can enter the barrel, your rain barrel should be mosquito-free.

Controlling barrel overflow:

- Adjust your downspout so it is slightly above the barrel’s mesh screen. We recommend using an elbow and rest the downspout on the mesh. The downspout does not fit into the barrel or have a specific place on the barrel. Adjust it as you wish.
- For increased water pressure, elevate your barrel on a stand or bricks.
- Make sure that all hoses extending from the barrel are directed away from your foundation.

Source: City of Chicago
Maintenance and Rules

Playground safety extends far beyond planning and Build Day. Your team is responsible for setting guidelines for the ongoing TLC of your playspace, as well as setting some playground rules.

**Playspace rules**

Creating a set of rules—preferably affirmative ones—is a crucial part of playspace safety. Start with these rules and then encourage children to come up with their own! Consider making a sign of these rules.

- Wear proper footwear.
- Respect others.
- Take turns.
- Help children who are younger.
- Sit on the center of the swing and hold on with both hands.
- Go down slides feet first, sitting up, one person at a time.
- Check the bottom of the slide before you go down.
- Always watch out for others while climbing up and down.
- Dry off equipment after a rainstorm.
- When jumping or dropping, keep your knees bent and land on both feet.
- Stay seated on seesaws, and keep a firm hold with both hands.
- If you fall, try to roll.

**Tips for supervisors**

Use these simple tips to educate parents and guardians about their role in playspace safety.

- Become familiar with the age-appropriateness and proper usage of all playspace components. Don’t let children wear helmets on play equipment! This can cause dangerous head entrapment situations.
- Before playing, always check to see that the equipment and surfacing are free of dangerous debris. Postpone play if the area is wet or frozen.
- Formulate and maintain a consistent discipline strategy; e.g., what to do when a child misbehaves, or when two children fight.
- Keep children in your sight at all times; it’s best if you remain active, roaming around the equipment.
- In case of emergency, memorize the name and address of the playspace. Find out where the nearest phone is located.
- Learn the procedure for reporting injuries, accidents, and maintenance concerns to the playspace owner.

Tip: When you picture your new playspace, do you see cigarette butts and plastic bags littering the site? Do you envision muddy streaks or moldy patches on the slides and tunnels? Of course not! Although it may seem minor, keeping the playspace clean is the first and most important line of defense against misuse, vandalism, and deterioration.

[back to top]

**General maintenance guidelines**

- **Daily/weekly inspections:**
  These informal checks can identify immediate damage due to weather, misuse or vandalism. It's also an opportunity to remove litter and rake loose-fill safety surfacing. Teachers, parents, staff and children are all ideal candidates for these inspections.
- **Periodic bi-monthly inspections:**
  These comprehensive checks evaluate long-term wear and tear on the equipment; your play equipment company should provide specific guidelines. These should be performed and documented by someone specifically responsible for facilities maintenance: a facilities director, staff at the school or park, or members of a volunteer maintenance group.
- **Annual inspections:**
  These formal audits, which evaluate the overall safety condition of the playspace, are best done by trained professionals. Your local parks and recreation department, insurance carriers, and the National Recreation and Park Association can generally provide a list of Certified Playground Safety Inspectors (CPSIs) in your area. Annual inspections by a CPSI are mandatory in some states, so be sure to check your local regulations!

**Ways to involve children in maintenance**
Community Design Assistance Center Stewardship Plan Template

Section 3.3: Appendix - Attached Reference Materials

Maintenance and Rules

Avoiding damage and vandalism

It's everyone's worst nightmare... waking up one morning to find that your new play space has been destroyed by vandalism or arson. There are planning considerations that can minimize the potential for damage - such as installing non-flammable engineered wood fiber - but ultimately, all playspaces are vulnerable. The single best way to protect your play space from vandals is to prevent it from happening in the first place. Install adequate lights to discourage after hours loitering, and report any undesirable behavior to authorities immediately, before it becomes habitual. Keep the area clean and free of litter. Get the neighbors involved - set up volunteer patrols on weekends, particularly during warm months. Ask the local police department to include the area in their regular rounds, and consider reaching out to potential vandals through youth programming. A park in Encinitas, Calif., installed R.V. hookups so that a senior citizen couple could live there free of charge, monitoring the park and making families welcome.

Even with the best prevention program, bad things can still happen to good parks. Respond immediately by cleaning up, re-painting, or re-building. It's still your park, so never give up on it! Including the entire community, including vandals and other past offenders, in the community-build process helps to give them a sense of ownership over the space and prevents future problems. Consider engaging local graffiti artists to design a mural to give them an opportunity to showcase their talents in a responsible way.

Show vandals that your will to rebuild is stronger than their will to destroy. Juanita Hutton of the Citizens' Congress of Nocield (in Philadelphia) saw her playground destroyed three times, and each time she rebuilt. When people asked her why she kept going, she told them that she would outlast the vandals.
Final tasks and evaluation

Thanks to your efforts, your community is now a better place for children and their families. Great work! You’ve shown people what can happen when citizens fight for positive change, and you’ve created a working model for future projects. To make sure that these seeds of change grow and blossom in the years ahead, we suggest taking a few simple steps toward maintaining your playspace and its network of supporters:

1. Introduce children to their new playspace.
   As the concrete sets on your new playspace, kids will be eagerly waiting to pounce on the new equipment. Make sure that the kids stay off the equipment until the concrete has had time to set—up to 72 hours in some cases. Safety fencing and caution tape provide a barrier during this time, but supervision is also essential. Swings, slides and climbers need no introduction! However, children may not understand the limits of their new playspace. We’ve encouraged you to give safety and maintenance lessons throughout the project, and this is your last chance to reinforce rules and procedures before unsafe habits get underway. Work with your co-chair(s) and Children’s Team captain to schedule a special playspace-orientation session that covers affirmative rules for the space, emergency procedures and simple daily maintenance. Then celebrate your success in the right way, by playing!

2. Send thank-you letters.
   Can you think of people who deserve a special thank-you for their hard work and support? Let them know! By taking the time to recognize them and make them feel appreciated, you ensure that they’ll stay involved in your community in the future. For many people, the thrill of participating in a playspace build is the start of a lifelong commitment to service.

3. Evaluate your planning process.
   If you had to do it all over again, what would you do differently? What worked, and what flopped? Your experience will prove invaluable to community organizers down the road, so take the time to record your team’s thoughts. (You’ll find an evaluation form below.)

4. Contribute to a “Friends of the Playspace” group.
   Your co-chair(s) or fellow team captains may be interested in forming an ongoing group to support your new playspace. Safety Team members can contribute by implementing maintenance procedures, maintaining relationships with sponsors and volunteers, and teaching each new generation of playspace users about proper safety.

   The group will also need your safety expertise if and when they make plans to expand the playspace or enhance the site. Whatever future your playspace holds, safety will be an important part of it!

   Congratulations on completing your build! You’ve made a big difference in the lives of your community members.

Team evaluation

Name of Team Captain:

1. List the three most important objectives of your team.
Schoolyard Stewardship

Seasonal Activities

SPRING / MARCH-MAY
Trim back urban meadow plants in late March/April before new growth emerges. Compost. Watch for new growth. Record emergence of shoots in OC log book. Watch for tulips. Identify and pull weeds when they first start growing — most easily done at this time of year, while soil is moist and roots are short, and before they make seeds.

Plan and prepare student planting beds, mixing in one to three inches of compost from bin. Return uncomposted stalks back to compost for another cycle.

SUMMER / JUNE-AUGUST
Record observations at the end of the school year through sketches and writing. Add to OC log book. Mulch planting beds with compost or bark mulch to nurture soil, conserve water, and control weeds. Mulch walking areas and tree beds with large size wood chips, to reduce weeds and provide food for worms and bugs.

Vegetable planting and tending in designated area by summer school program. Establish an as-needed watering schedule with parents and neighbors.

FALL / SEPTEMBER-NOVEMBER
Record observations at beginning of the school year through sketches and writing. Begin fall OC log book. Pull new weeds in beds when ground is moist and before they develop deep roots. Clear unwanted growth and compost it for spring. Keep compost pile moist as a wrung-out sponge. Check compost pile temperature. Mulch planting beds with leaves or compost to reduce winter weeds and feed the soil. Prepare new planting beds by mixing in compost; top dress with bark mulch.

Prepare for spring bulbs: Order in September. Plant in October and early November. Select tulips for Journey North Project or early spring bulbs such as crocus and narcissus.

WINTER / DECEMBER-FEBRUARY
Tuck in garden beds for winter. Rake winter leaf mulch back onto beds if winds blow it off. Remove any remaining weeds to prevent them from going to seed. Remove blown trash and rake gravel as needed. Observe and document winter conditions and changes with sketches and writing. Add to log book and display.

What to Do With all of Those Leaves?

A leaf cage is a wire container for leaves collected from fall and spring clean-ups.

Uses of the leaf cage: To make leaf compost (called leaf mold); to observe decomposition; to find isopods, worms and insects; to measure, collect data, and observe changes over time; to use for improving soil and holding moisture in planting beds; to use as mulch in the woodland area to hold down weeds.

Introduction to composting: Rake leaves and place inside wire cage. Measure height, note moist and dry levels, record color and condition of leaves. Add weeds from planting beds and pathways (no stems, woody sticks, paper, or trash). Do not add weeds that have formed seeds - they may promote more weeds in the future.

Maintaining the leaf cage: Remove all trash. Add leaves from fall and spring clean ups, and throughout the growing season. If there are extra schoolyard leaves to manage in the fall use paper leaf bags and work with the school department to arrange pick-up.

Uses of the leaf mold: To make leaf compost (called leaf mold); to observe decomposition; to find isopods, worms and insects; to measure, collect data, and observe changes over time; to use for improving soil and holding moisture in planting beds; to use as mulch in the woodland area to hold down weeds.

Introduction to composting: Rake leaves and place inside wire cage. Measure height, note moist and dry levels, record color and condition of leaves. Add weeds from planting beds and pathways (no stems, woody sticks, paper, or trash). Do not add weeds that have formed seeds - they may promote more weeds in the future.

Using the leaf mold: Every spring after a year of active composting remove the decomposed leaves (a brown crumbling soil-like mass). There may be remaining leaf material after one year, as it takes 2 years for leaves to break down beyond recognition. They will continue to break down as mulch. Composted leaves are acidic and as they continue to break down they use up nitrogen — if added to planting beds, additional fertilizer may be needed to grow vegetables.

Prune woody trees and shrubs when dormant between December and February.
Weeds in the Outdoor Classroom

Weeds happen. Once an outdoor classroom landscape is created, it starts to provide a fertile living habitat. It is easy for weeds to be introduced by the wind and by birds. Seeds can even be tracked in on people's feet, with irregular water and sun conditions.

Our definition of a weed is culturally determined: it's any plant that we feel is out of place. Weeds often are robust plants, able to establish themselves in poor soil. Please note: some plants that look like “weeds” in the urban meadow area are intentionally planted or left to grow as habitat; for this reason the urban meadow is normally not weeded except by the BSI horticulture staff. It is ok, however, to weed the pathways going through the meadow.

In the outdoor classroom we remove certain weeds to reduce competition and allow a diversity of plants that have specific educational uses to flourish. Weeding also keeps the foot pathways and work areas clean and inviting.

If weeds are removed on an ongoing basis, the process is easy. It is best to remove weeds before the seeds mature. Remove weeds from all pathways and gathering and work areas.

HOW TO REMOVE WEEDS

• Pull weeds out by hand (be careful to remove all of the roots) and place them in the leaf cage to decompose and make new soil.

• When weeds are removed on an ongoing basis, the process becomes easier year after year.

• It is important to remove weeds before their seeds mature, disperse, and make more weeds!

Involving students in outdoor classroom stewardship can be very rewarding, although teaching them to differentiate between weeds and plants that should be left alone can be challenging. Some teachers have each grade learn to identify a single weed which they are responsible for pulling out wherever they see it. Also consider giving each grade their own outdoor classroom task: for example, one grade weeds the pathway, another weeds along the fence, another picks up trash, etc.

Bulb Planting

Late fall is the time to prepare for spring by planting bulbs. Planting can take place as long as the ground is not frozen.

In March and April, a month before most other plants, flowers the bulbs' leaves and flower buds push out of the earth. A few weeks later blossoms are ready to discover and observe.

If planted, bulbs multiply and will bloom year after year. Place bulbs in protected schoolyard and outdoor classroom areas. Bulbs are well suited for under trees, along edges of buildings, or in the outdoor classroom woodland or meadow. Planting beds are not the ideal place for bulbs, because they are specially built for annual experimental plantings and vegetables. Bulbs planted in the raised planting beds may conflict with these other student uses.

Bulbs are available from local garden centers, hardware stores, and many mail order catalogues.

TYPES OF BULBS

Crocus — small blossoms in very early spring
Narcissus (daffodil) — early bloom, will be 10”-12” tall
Hyacinths — wonderful fragrance in spring
Alliums — late spring bloom, dramatic 40” high flower heads
Tulips — large blossoms, spring bloom

EDUCATIONAL OPPORTUNITIES

Journey North Project — engaging class program to participate with other schools and observe bulbs as a tool to chart seasonal change across the country.

Student project ideas: www.leaumer.org/jnorth/tulip/index.html
Bulb planting tips: www.leaumer.org/jnorth/tm/tulips/Planting.html

Outdoor writing - observing tulips and daffodils.

Crocus Narcissus Alliums
STEP SEVEN: Create a Maintenance Plan

Schoolyard Habitat projects are generally lower maintenance landscapes if ecologically sound. Most maintenance involves controlling unwanted plants, maintaining structures, removing trash and preserving aesthetics. Choose how much you want to maintain based on the availability of your team members' time and the maintenance requirements of the different features. For example, if you have a two-acre woodland restoration with a trail, you might have a more intensive maintenance plan for the entrance to the trail than you do for the majority of the forest.

There are essentially two levels of care that every project needs. Short-term maintenance includes watering, mulching, borders, weeding and replanting. Long-term maintenance includes invasive non-native species removal, care of structures and other project features. All maintenance provides an opportunity to engage students in learning more about their natural environment.

Consider Short-term Maintenance

The first two years after installation are the most critical and labor-intensive time for maintenance. A maintenance plan for the first two years should include specific tasks and indicate who will be responsible for them. This is a good time to recruit new members to your team. Below are aspects to consider when creating your plan.

Watering

Watering is the most important short-term maintenance task. Plan to monitor the rainfall and augment with watering or irrigation when needed for at least the first two years of your project. This is especially important during hot, dry summer months when staff and students are not at school. Water sufficiently and deeply but not too often. Thorough watering promotes stronger root systems, enabling plants to find water on their own once established.

Your watering plan could involve as much as installing drip irrigation or a sprinkler system, or as little as laying a soaker hose or using a hose with a sprinkler attachment. Establish a watering schedule with advice from the nursery from which you acquired the plants. On average, a newly planted habitat needs one inch of water per week for the first one to two years.

Your school’s maintenance staff should be part of the team to ensure there is access to water especially for the summer. Many schools require a special water key to operate outdoor spigots; these can be found in the plumbing section of your local hardware store. You may want to install a simple rain gauge at your project site to help monitor watering needs. Trees and shrubs need to be watered through the first two years. Many home and garden stores sell irrigation bags, often called tree gators, specifically for trees and shrubs. They can be filled with a hose once a week and provide a slow drip irrigation to the plant.

Mulching

Once plants are established the need for mulch becomes obsolete. In many naturalized areas the annual deadfall will act as natural mulch. If you choose to add mulch for aesthetic reasons, refer to the calculations in Step 4 to find out how much you will need. Keep in mind that too thick a layer of mulch will prevent moisture from reaching the ground.
Borders
One of the most common frustrations for a Schoolyard Habitat project occurs when it is accidentally mowed. It is helpful to mark off the area of your project to let the maintenance team and visitors know the boundaries. To indicate the boundaries of your project, you can use fencing, edging or natural materials. Find out if the maintenance personnel changes in the summer so that all staff are aware of the project.

Weeding
To improve the wildlife habitat of your school grounds, it is imperative that you eliminate invasive non-native plants. Weeding your project can sometimes seem daunting, especially when native species are young and hard to recognize. Keep in mind that not every species that sprouts up into your project is unwanted. Some plants that are native to the area could colonize the project site. As long as the colonizing plants are not invasive, it is fine to leave them alone.

The problem occurs when invasive non-native species are found in your habitat. These species will take over and must be removed as quickly as possible. This website http://www.aphis.usda.gov provides a list of federally prohibited plants. You can cross-reference any new plants you find with this list and other local native plant guides. It can also be helpful to have your planting map accessible during weeding.

Replanting
The survival rate of your plants will need to be evaluated in the first few months. Some plant loss can be expected. Replanting makes sense if the plant loss was caused by something unlikely to occur again such as an extreme weather event. If plant loss is more than 50%, evaluate the reason for the loss before replanting to maximize future success. The natural resources professional on your team can evaluate your site and offer suggestions for successful future plantings.

For more information about invasive species refer to the Invasive Plant Atlas of the United States http://www.invasiveplantatlas.org or the National Park Service www.nps.gov/plants/alien/factmain.htm

Consider Long-term Maintenance
For as long as the property remains a Schoolyard Habitat, some level of maintenance must be done.

Invasive Non-Native Species Removal
The best method for keeping invasive plants out of your project area is early detection and immediate removal. Common control methods include hand pulling, moving, chemical spraying or solarizing. Your invasive non-native species maintenance plan will depend on the specific invasive plant, the size of the patch and the amount of surrounding native vegetation. Contact your local master gardeners’ group or county extension office to find a weed control specialist to help with assessment and treatment options.

Maintenance tips for invasive non-natives:
• Create a “Most Unwanted” species list with identification features of the plants to help know which plants to remove.
• For most weeds, hand pulling is enough. Be sure to remove the entire plant both above and below the ground prior to the plant going to seed.
• Chemical methods for removing invasive non-native plants include a broadcast spray which will kill all plants in a large area or spot treatment which is applied to a specific problem plant only. Most school systems have protocols and licensed personnel for herbicide applications.
• If your project site has become overgrown with unwanted plants, you may want to tag species worth saving and have volunteers weed around the base of these plants to allow room for growth.

Structures and other features
Check feeders, birdbaths, water pumps, artificial structures, benches and signs to make sure mechanisms are functioning properly and vandalism has not compromised the integrity of the feature. With vandalism, trash and other issues, constant vigilance keeps an area looking good. The best way to decrease the likelihood that the site will be vandalized is to increase the support and participation of the students and community. Creating a sense of shared ownership and responsibility will provide multiple benefits for the project.
Sample Maintenance Plans

Exact timing and specific tasks will be determined by your project type and location. Below you will find some sample maintenance plans to help figure out your annual maintenance needs and help delineate the roles of each member of the Schoolyard Habitat team once the project is in the ground.

In this sample, the responsible party is ensuring that the task will be completed, the assisting party will help complete the task and the consulting party would be part of any decision making regarding that task.

<table>
<thead>
<tr>
<th>Category</th>
<th>Tasks</th>
<th>Responsible</th>
<th>Assist</th>
<th>Consult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Monitor weekly rainfall</td>
<td>Mrs. Jones’s 6th grade class and Mrs. Hogan’s Summer Habitat Scouts</td>
<td>PTA members</td>
<td>Maintenance supervisor and Assistant Principal</td>
</tr>
<tr>
<td></td>
<td>Monthly check: erosion equipment including timers and hoses</td>
<td>Maintenance supervisor</td>
<td>Assistant Principal</td>
<td>Schoolyard Habitat Team</td>
</tr>
<tr>
<td>Plants</td>
<td>Monthly monitoring and removal of invasive non-natives</td>
<td>Mrs. Jones’s 6th grade class and Mrs. Hogan’s Summer Habitat Scouts</td>
<td>Schoolyard Habitat Team</td>
<td>Maintenance supervisor and Assistant Principal</td>
</tr>
<tr>
<td></td>
<td>Every spring new trees are planted to replace any mortality from previous year</td>
<td>Mr. Casey’s 8th grade class</td>
<td>Schoolyard Habitat Team</td>
<td>Maintenance supervisor and Assistant Principal</td>
</tr>
<tr>
<td>Structure</td>
<td>Monthly monitoring and reporting of any vandalism or trash</td>
<td>Schoolyard Habitat Team</td>
<td>PTA members</td>
<td>Assistant Principal</td>
</tr>
</tbody>
</table>

**SHORT-TERM MONTH LONG-TERM**

<table>
<thead>
<tr>
<th>Category</th>
<th>Tasks</th>
<th>Responsible</th>
<th>Assist</th>
<th>Consult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plants</td>
<td>Monthly monitoring and removal of invasive non-natives</td>
<td>Mrs. Jones’s 6th grade class and Mrs. Hogan’s Summer Habitat Scouts</td>
<td>Schoolyard Habitat Team</td>
<td>Maintenance supervisor and Assistant Principal</td>
</tr>
<tr>
<td>Structure</td>
<td>Repair signs and fence as needed</td>
<td>Maintenance supervisor</td>
<td>Assistant Principal</td>
<td>Schoolyard Habitat Team</td>
</tr>
<tr>
<td>Trail</td>
<td>Trail signs are posted and trail maps are in stock</td>
<td>Mrs. Hogan’s Summer Habitat Scouts</td>
<td>Schoolyard Habitat Team</td>
<td>Assistant Principal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SHORT-TERM</th>
<th>MONTH</th>
<th>LONG-TERM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>January</td>
<td>Over next base.</td>
</tr>
<tr>
<td>Water</td>
<td>February</td>
<td></td>
</tr>
<tr>
<td>Weed, remove invasive species</td>
<td>March</td>
<td>Monitor and remove invasive species.</td>
</tr>
<tr>
<td>Monitor species survival rates</td>
<td>April</td>
<td></td>
</tr>
<tr>
<td>Weed and add mulch if needed</td>
<td>May</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>June</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>July</td>
<td>Monitor for drought.</td>
</tr>
<tr>
<td>Water</td>
<td>August</td>
<td></td>
</tr>
<tr>
<td>Weed and remove invasive species</td>
<td>September</td>
<td>Monitor and remove invasive species.</td>
</tr>
<tr>
<td>Monitor species survival rates</td>
<td>October</td>
<td>Prepare for additional planting if necessary.</td>
</tr>
<tr>
<td>Water</td>
<td>November</td>
<td>Mow half of meadow</td>
</tr>
<tr>
<td>Water</td>
<td>December</td>
<td></td>
</tr>
</tbody>
</table>

In this sample, maintenance needs are laid out by time of year. Short-term needs should be completed for the first two years, and long-term needs extend through the life of the project.
Watering Issues for Native Plants

Newly planted trees and shrubs will need summer watering until they become established (approx. three years).

Wildflowers usually need watering for the first summer to develop a good root system. However, the watering schedule may need to change over time.

On-going watering after these time periods will depend on the suitability of the vegetation for your site. Consult with your local arborist or tree nursery for recommendations on how much watering your trees need (i.e. slow trickle for three hours two times per week).

Even established plants may need assistance during periods of extreme drought.

When making your maintenance plan consider the following:

1. Include good quality maintenance tools in your grant applications (i.e. shovels, wheelbarrows, gardening gloves, hoses, hose reels, buckets, clippers, tree guards, weeding tools and edging tools).

2. Compaction strategy (see Choosing Wildflowers, Trees and Shrubs, Ch. 4)

3. Protection from pests such as rodents—protect young trees with tree guards.

4. Moisture strategy (watering and mulching)—Make sure you have a watering schedule to ensure trees, shrubs and plants get enough. Maintain a 15cm thick layer of mulch around the base of your plants. Mulching will retain moisture and improve the organic content of the soil.

5. Weed control strategy (mulching and hand weeding)—Mulching will also keep weeds to a minimum. However, make sure you have a work schedule to hand pull any weeds before they spread. If you keep on top of it, weeding is quick and easy.

6. Replacing damaged plants—If you can keep your project in good shape, people will tend to show it more respect than if it looks beaten-up and damaged. Remember to remove damaged plant material right away.

7. Maintaining trails—Another way of avoiding possible damage. Keep paths clear and well marked so people will use them. If new paths develop indicate the usage pattern, consider making the path a permanent one.

8. Mulching, trimming and pruning—Scheduling these activities will keep your plants healthy and protected. Mulch in the spring, prune in February and prune when the tree or shrub is not in a transitional period (i.e. transition periods are early spring and late fall).

9. On-going general clean-up—if you want others to show your project respect, lead by example. Provide garbage bins and empty regularly. Keep litter picked up. Maintain signage, seating and fencing.

10. Plan an annual spring cleanup and garden closing in the fall. This makes good use of available student power. In the fall, don’t forget to drain your hoses.

11. Seed collection—Collected native plants and heritage vegetable seeds can be scattered in different areas or packaged and sold as a fundraiser. They can also be shared with the community through the North American Native Plant Society seed exchange program (www.nanps.org) or Seeds of Diversity (www.seeds.ca).

12. Ease of maintenance—Trees and shrubs are easier to maintain than wildflowers. Wildflowers will always need more maintenance.

WHAT TO DO DURING THE SUMMER MONTHS

It may seem a little early to be worrying about summer maintenance plans, but figuring out who is available for watering and regular upkeep now, will save you from last minute scrambling later.

- Make sure maintenance teams have access to an outdoor tap, which may require a special key. Arrange for the key to be kept in a central location.
- Organize student volunteers to water and maintain the area for one-week periods during the...
During the summer, there are few people to do the work but the demands are greatest in terms of watering and weeding. Here are some creative solutions:

- Have a get-together BBQ in September for those who helped.
- Ask neighbours and community groups i.e. Guides and Scouts for a helping hand.
- Invite a local gardening or conservation organization to donate some time and energy.
- Coordinate with summer school/recreation programs to incorporate use and maintenance into their programs.
- Organize work parties. This is a fun way to share the load.
- Hire a student. Fundraising and matching government grants can assist with hiring a part-time student to weed and water.
- Some schools recognize planting volunteers with a native wildflower to grow at home. This recognizes their contribution and creates a seed bank in the community for natural regeneration and backup should you have a crop failure.
- Enlist the help of school teams or clubs to come out and volunteer their time each year.
- A maintenance log will help keep track of what was done and provide suggestions for the next round of maintenance.
- Caretakers and office staff may be willing to help with summer watering.
- Small areas can be assigned to individuals or small teams who can come at a time that suits them.

All Hands in the Dirt p. 34

has a year round calendar called A Year in the Outdoor Classroom. Use this as a guide for each season to get the most out of your project.
Common Plants and Their Toxicity

The following list covers common plants often encountered and questioned for toxicity. Plants are listed alphabetically by common name, followed by botanical names. Match the number following each plant with the toxicity rating descriptions below. If you have any questions or a plant is not included on this list, please call the Poison Center at 1-800-876-4766 or 1-800-8-POISON.

Note: In general, plants considered poisonous to humans are considered poisonous to animals. However, in some cases animals have been poisoned by plants considered safe for humans. Even if a plant is listed as having major toxicity, a very small amount ingested may not result in symptoms. Call the poison center before initiating any treatment. A plant listed as being non-toxic may still cause problems: if a child bites off a piece of the plant and it sticks to the throat, choking or gagging may result.

1. **Non-toxic**: Either these plants have proven non–poisonous or there is no record of a toxic exposure. Exposure to these plants is not expected to cause any symptoms.
2. **Oxalates**: The juice or sap of these plants contains oxalate crystals. Chewing these plants may cause pain and irritation of the mouth, lips, and tongue. Swelling of the throat may cause breathing difficulties.
3. **Minor toxicity**: Ingestion may cause some minor symptoms such as vomiting or diarrhea. Ingestions of small amounts may not cause any symptoms at all.
4. **Major toxicity**: Ingestion of these plants, especially in large amounts, is expected to cause serious effects to major organs such as the heart, liver or kidneys. If these plants are ingested call the Poison Control Center immediately.
5. **Dermatitis**: Exposure to juice or sap from the plant or a puncture would from the thorns may produce skin irritation or rash. Skin wounds from some plants can be extremely painful.
6. **Possibly toxic**: Although information about these plants is incomplete, ingestion of small amounts would not be expected to cause serious problems.
7. **Animal toxicity**: These plants are known to have caused problems in animals.

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| Common Plants and Their Toxicity - UC Davis Medical Center Regional Poison Control Center |
|---------------------------------|---------------------------------|----------------|
| African Violet, Saintpaulia      | 1                               | Jade Plant, Crassula argentea |
| Agapanthus                      | 3, 5                            | Jerusalem Cherry, Solanum pseudocapsicum |
| Agapanthus, Pink Nerine bowdenii| 3, 7                            | Jerusalem Cherry, Solanum pseudocapsicum |
| Albizia                         | 1                               | Jimson Weed, Datura stramonium |
| Aloe Vera                       | 3                               | Juniper, Juniperus species |
| Aluminum Plant, Pilea cadierei  | 1                               | Katanchoe |
| Alysum                          | 1                               | Lady Slipper, Orchid, Cypripedium |
| Amaryllis belladonna            | 3                               | Lantana, camara |
| Apple Tree Malus species        | 4                               | Larkspur, Delphinium species |
| Aiptoc Tree Prunus armeniaca    | 4                               | Licorice Plant |
| Aralia Japanese, Fatsia japonca | 1                               | Glycyrrhiza, lepidata |
| Arrowhead Vine, Syngonium podophyllum | 2                              | Lilac, Syringa |
| Asparagus Fern, Asparagus setaceus or sprengeri | 1                              | Lily of the Nile, Agapanthus, africanus |
| Avocado Persea americana        | 6, 7                            | Lily of the Valley, Cornallaria species |
| Azalea Rhododendron occidentale  | 4                               | Lipstick Plant, Aeschynonthus, lobbianus |
| Baby Tears, Helxine, soleriidl  | 1                               | Liquidambar |
| Baby's Breath, Gypsophyla       | 1                               | Lobelia, Species |
| Bachelor Buttons, Centaurea cyanus | 1                        | Lupine, Lupinus |
| Begonia Begonia species         | 2                               | Magnolia, stellata |
| Birch Tree, Betula species      | 3, 5                            | Manzanita, Arctostaphylos |
| Bird of Paradise, Stelitzia reginae | 6                              | Maple, Acer, species |
| Bird's Nest Fern, Asplenium nidus | 1                        | Marble Queen, Pothos, Scundapsus, aeurus |
| Black, Acacia, Robinia pseudocaca | 4                                 | Marigolds, Calendula, or Tagets |
| Black Locust, Robinia pseudocaca | 4, 7                            | Mimosa, pudica |
| Boston Fern, Nephrolepis exalta | 1                               | Mistletoe, Phoradendron, flavescens |
| Bottle Brush, Callistemon species | 1                              | Mock Orange, Philadelphia, species, 1, Pittosporum, tobia, 1, Prunus, caroliniana |
| Bougainvillea                   | 1                               | Morning glory, Lpomoca, species |
| Boxwood, Buxus sempervirens     | 3, 5                            | Mother-in-Law, Tongue, Sansevieria, trifasciata |
| Cacti                           | 1, 5                            | Mountain, Laurel, Kalmia, latifolia |
| Caladium Caladium species       | 2, 5                            | Mulberry, Tree, Morus, species |
| Calendula officinalis           | 1                               | Naked, Lady, Lycoris, or Amaryllis |
| California Poppy, Eschscholtzia californica | 6                        | Nandina, domestica |
| Calla Lilly, Calla palustris    | 2                               | Nephthys, Syngonium, podophyllum |
| Camellia Thea japonica          | 1                               | Nightshade, Black, Solanum, nigrum |
| Camphor Tree, Cinnamomum camphora | 4                               | Norfolk Island, Pine, Araucaria, excelsia |
| Cannna Lily, Cannna generalis   | 1                               | Oak Tree, Quercus, species |

1=Non-toxic 2=Oxalates 3=Minor Toxicity 4=Major Toxicity 5=Dematitis 6=Possibly Toxic 7=Animal Toxicity
<table>
<thead>
<tr>
<th>Common Plants and Their Toxicity - UC Davis Medical Center Regional Poison Control Center</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common Plant</strong></td>
</tr>
<tr>
<td>Carnation Dianthus caryophyllus</td>
</tr>
<tr>
<td>Carolina Jasmine Gelsemium</td>
</tr>
<tr>
<td>Caspian Beans Ricinus communis</td>
</tr>
<tr>
<td>Catalpa Speciosa</td>
</tr>
<tr>
<td>Cattleya nepeta cataia</td>
</tr>
<tr>
<td>Cedar Thuja species</td>
</tr>
<tr>
<td>Century Plant Agave</td>
</tr>
<tr>
<td>Cherry Tree Prunus</td>
</tr>
<tr>
<td>China Berry Melia azedarchal</td>
</tr>
<tr>
<td>China Doll Lea cocinea</td>
</tr>
<tr>
<td>Cotiniforma pentandra</td>
</tr>
<tr>
<td>Chinese Evergreen Aglaonema modestum</td>
</tr>
<tr>
<td>Christmas Cactus Zygocactus truncates or Schlumbergera bridgesii</td>
</tr>
<tr>
<td>Chrysanthemum Species</td>
</tr>
<tr>
<td>Coffee Plant Polyscia guifoiyai</td>
</tr>
<tr>
<td>Coleus Species</td>
</tr>
<tr>
<td>Coreopsis</td>
</tr>
<tr>
<td>Corn Plant Dracaena fragrans massangeana Cosmos</td>
</tr>
<tr>
<td>Coleoreaster</td>
</tr>
<tr>
<td>Grape Myrtle Lagerstroemia indica</td>
</tr>
<tr>
<td>Creeping Charlie Gladiola hederacea</td>
</tr>
<tr>
<td>Creeping Charlie Lysimachia mussnurailia</td>
</tr>
<tr>
<td>Creeping Charlie Pit mussnulafolia</td>
</tr>
<tr>
<td>Creeping Fig Ficus pumilia</td>
</tr>
<tr>
<td>Crocus Species (Spring blooming only)</td>
</tr>
<tr>
<td>Crown of Thorns Euphorbia milli</td>
</tr>
<tr>
<td>Cyclamen</td>
</tr>
<tr>
<td>Daffodil Narcissus</td>
</tr>
<tr>
<td>Dahlia Species</td>
</tr>
<tr>
<td>Daisy Chrysanthemum</td>
</tr>
<tr>
<td>Dandelion Taraxacum officinale</td>
</tr>
<tr>
<td>Daphne</td>
</tr>
<tr>
<td>Delphinium Species</td>
</tr>
<tr>
<td>Devil's Ivy Epipremnum aureum</td>
</tr>
<tr>
<td>Dieffenbachia Species</td>
</tr>
<tr>
<td>Donkey Tail Sedum morganianum</td>
</tr>
</tbody>
</table>

1=Non-toxic 2=Oxalates 3=Minor Toxicity 4=Major Toxicity 5=Dematitis 6=Possibly Toxic 7=Animal Toxicity
| Common Plants and Their Toxicity - UC Davis Medical Center Regional Poison Control Center |
|---------------------------------|---------------------------------|---------------------------------|
| Dracaena Species                | 1, 7                            | Schefflera brassaia actinophylla |
| Dumbcane Dieffenbachia amoena   | 2                               | Sedum                           |
| Elderberry Sambucus             | 4, 7                            | Sensitive Plant Mimosa pudica   |
| Elm Tree Ulmus species          | 5                               | Silk Tree Albizia                |
| Emerald Ripple Peperomia caperata | 1                        | Snake Plant Sansevieria trifasciata |
| English Ivy Hedera helix        | 4, 5                            | Snap Dragon Antirrhinum species |
| Escallonia                      | 1                               | Snowberry Symphoricarpus racemosus |
| Eucalyptus globulus Species     | 3                               | Spathiphyllum                    |
| Euonymus                        | 4                               | Spider Plant Chlorophytum comosum |
| False Aralia                    |                                  | Split Leaf Philodendron Monstera deliciosa |
| Dizygotheca elegansisima       | 1                               | Spruce Tree Picea species        |
| Ficus Benjamina                 | 5                               | Star Jasmine Trachelospermum jasminoides |
| Fiddleleaf Fig Ficus lyrata     | 5                               | Stephanotis                      |
| Fir Abies or pseudotsuga        | 1                               | String of Hearts Crepegia woodii |
| Forget-me-nots Myosotis         | 1                               | String of Pearls Senecio rowleyanus or herreianus |
| Four-o'clocks Misabilis jallapa | 4, 5                          | Swedish Ivy Plectranthus australis |
| Foxglove Digitalis purpurea     | 4                               | Sweet Pea Lathyrus odoratus      |
| Fuchsia Species                 | 1                               | Sweet William Dianthus barbatus  |
| Gardenia jasminoides            | 1                               | Ti Plant Cordyline terminalis    |
| Geranium Pelargonium            | 5                               | Toyon Photinia arbutifolia       |
| Geranium, California Senecio petasidis | 4                     | Tulp Tulipa                      |
| Gladiola                        | 3, 5                            | Umbrella Plant Cyperus atemflibus |
| Gloxinia Sinningia Speciosa     | 1                               | Umbrella Tree Schefflera actinophylla |
| Grape Ivy Cissus rhombifolia    | 1                               | Verbena Species                  |
| Grevillea Species               | 1, 5                            | Viburnum Species                 |
| Heavenly Bamboo Nandina domestics | 6, 7                        | Vinca Species                    |
| Hen and Chicks Sempervivum tectorum | 1                    | Violas Species                   |
| Hibiscus                        | 1                               | Virginia Creeper Parthenocissus quinquefolia |
| Holly lix                       | 3                               | Walnut Tree Black Juglans nigra |
| Honeysuckle Lonicera            | 6                               | Wandering Jew Travescantia albiata |
| Hoya Wax plant                  | 1                               | Wandering Jew, Red or White Zebrina pendula |
| Hyacinth Hyacinth orientalis    | 3, 5, 7                         | Wax Plant Hoya comosa            |
| Hydrangea Species               | 3                               | Weeping Fig Ficus benjamina      |
| Ice Plant Aptonia cordifolia or Lampranthus | 1                        | Wisteria                        |
| Impatients                      | 1                               | Xylosma                         |
| Indian Hawthorn Raphiolepis Indica | 1                      | Yellow jessamine Gelsemium       |

1=Non-toxic  2=Oxalates  3=Minor Toxicity  4=Major Toxicity  5=Dematitis  6=Possibly Toxic  7=Animal Toxicity
<table>
<thead>
<tr>
<th>Plant</th>
<th>Toxicity Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Laurel Ficus nitida</td>
<td>5</td>
</tr>
<tr>
<td>Yew Taxus species</td>
<td>4</td>
</tr>
<tr>
<td>Iris</td>
<td>3, 5</td>
</tr>
<tr>
<td>Yuca</td>
<td>1</td>
</tr>
<tr>
<td>Ivy Hederia Helix</td>
<td>4, 5</td>
</tr>
<tr>
<td>Zebra Plant Aphelandra squarrosa</td>
<td>1</td>
</tr>
<tr>
<td>Jack in the Pulpit Arisaema triphyllum</td>
<td>2, 5</td>
</tr>
<tr>
<td>Zinnia</td>
<td>1</td>
</tr>
</tbody>
</table>

1=Non-toxic, 2=Oxalates, 3=Minor Toxicity, 4=Major Toxicity, 5=Dematitis, 6=Possibly Toxic, 7=Animal Toxicity
Poisonous Plants in the Landscape
Robert R. Westerfield and Gary L. Wade, Extension Horticulturists

While most of us are familiar with common poisonous plants that cause dermatitis (skin irritations) such as Poison Ivy or Poison Oak, we fail to recognize common ornamental plants in the landscape that may cause internal poisoning when ingested. Although most adults would not intentionally eat the leaves or fruit of ornamental plants in the landscape, young children or pets sometimes do.

The purpose of this publication is to familiarize you with some of the common landscape plants known to have poisonous properties when ingested. You may be surprised to learn just how many of our common plants, such as azaleas, hydrangeas, boxwood and English ivy, are known to have poisonous properties.

Please note, however, that the term “POISONOUS” used in this publication does not imply that the plant is fatal. Some plants may be only mildly toxic and may cause stomach ache or mild irritation of the mouth and throat when ingested. There are also a number of variables that determine how severe the poisoning symptoms may be, such as the age, weight and health status of a person in relationship to the quantity of the plant ingested as well as the form that the plant was in at the time of ingestion (i.e. cooked versus raw, ripe fruit versus unripe fruit, etc.).

It is not the intent of this publication to discourage you from planting any of the plants on the list, but to make you aware of their potential hazard when used in landscapes frequented by young children, domestic animals or mentally challenged adults. As the saying goes “an ounce of prevention is worth a pound of cure.” Prevention is the best medicine to prevent toxic plant poisoning.

Internal poisons are a group of chemically different substances that, when ingested:

- Act on the brain causing narcotic reactions and other mental disturbances.
- Affect the spinal cord resulting in paralysis and convulsions.
- Act as heart depressants and stimulants.
- Irritate the digestive tract and nervous system.

To help prevent plant poisonings, follow these safety tips:

- Know the names of all the plants in your landscape. If you need help identifying a plant, take a piece of it to a nursery, florist or your county extension agent.
- Label all of your plants with their names so you can identify a plant that has been eaten.
- Keep plants, seeds, and bulbs out of the reach and sight of children and pets.
- Do not eat wild plants or mushrooms. Cooking poisonous plants does not make them safe to eat.
- Do not consume mushrooms growing in your landscape.
- Keep weed and insect killers in a locked cabinet, out of the reach of children and pets. Never put them in bottles used for drinking.
- Keep children and pets away from lawns newly sprayed with garden chemicals.
- Teach your children to never put any part of a plant into their mouths.
What to Do in a Poison Emergency

In the event of a poison emergency call the Georgia Poison Center. Keep the number near your telephone.

Call 24-Hours a Day, 7 Days a Week:
In Metro Atlanta Call: 404-616-9000
Outside Metro Atlanta Call: 1-800-282-5846
Teletype for the deaf and hearing impaired only: TDD 404-616-2987

If a poisoning occurs and the person is having trouble breathing, experiencing seizures, or will not wake up, CALL 911 (or your local emergency number) immediately.

Be prepared to give:

1. the attending physician the name of plant, if known, or description (save uneaten parts).
2. how long ago it was eaten.
3. how much and which parts were eaten.
4. age of individual.
5. symptoms.

If hospitalization is required, take a portion of the suspect plant with you for positive identification.

The attached table lists common ornamental plants known to be toxic when ingested. While this is not a complete list, it contains many plants commonly found in home landscapes in Georgia.

Ornamental plants reported to be toxic when ingested by humans

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Botanical Name</th>
<th>Toxic Plant Part</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air potato</td>
<td>Dioscorea bulbifera</td>
<td>raw fruit</td>
<td>abdominal pain, nausea</td>
</tr>
<tr>
<td>Algerian Ivy**</td>
<td>Hedera canariensis</td>
<td>all parts</td>
<td>diarrhea, nervousness, labored respiration, convulsions</td>
</tr>
<tr>
<td>Allamanda</td>
<td>Allamanda spp.</td>
<td>all parts</td>
<td>nausea, high temperature, dryness of the mouth</td>
</tr>
<tr>
<td>Amaryllis</td>
<td>Amaryllis spp.</td>
<td>bulbs and seeds</td>
<td>gastrointestinal problems, vomiting, diarrhea</td>
</tr>
<tr>
<td>American Arborvitae**</td>
<td>Thuja occidentalis</td>
<td>leaves</td>
<td>low blood pressure, convulsions</td>
</tr>
<tr>
<td>Angel’s Trumpet**</td>
<td>Datura spp.</td>
<td>all parts</td>
<td>blurring of vision, delirium</td>
</tr>
<tr>
<td>Anise-tree**</td>
<td>Illicium floridanum, Illicium anisatum</td>
<td>leaves</td>
<td>abdominal pain, vomiting, convulsions, death</td>
</tr>
<tr>
<td>Azalea</td>
<td>Rhododendron spp.</td>
<td>all parts</td>
<td>nausea, vomiting, weakness, dizziness, breathing difficulty, coma</td>
</tr>
<tr>
<td>Barberry</td>
<td>Berberis spp.</td>
<td>all parts</td>
<td>depressant action on the heart muscle</td>
</tr>
<tr>
<td>Black Locust</td>
<td>Rubus pseudococcia</td>
<td>bark, seeds</td>
<td>nausea, weakness, depression</td>
</tr>
<tr>
<td>Boxwood</td>
<td>Buxus sempervirens</td>
<td>leaves</td>
<td>gastric, vomiting</td>
</tr>
<tr>
<td>Buckeye</td>
<td>Aesculus spp.</td>
<td>all parts</td>
<td>digestive irritant, nausea, vomiting</td>
</tr>
<tr>
<td>Caladium</td>
<td>Caladium bicolor</td>
<td>all parts</td>
<td>burning in mouth and throat, vomiting</td>
</tr>
<tr>
<td>Calla-lily</td>
<td>Zantedeschia spp.</td>
<td>all parts</td>
<td>burning and inflammation of the mouth and throat</td>
</tr>
<tr>
<td>Castor bean</td>
<td>Ricinus communis</td>
<td>seeds</td>
<td>burning in mouth and throat, gastric and intestinal problems</td>
</tr>
<tr>
<td>Century Plant</td>
<td>Agave americana</td>
<td>leaves</td>
<td>vomiting, diarrhea</td>
</tr>
<tr>
<td>Cherry (all species)</td>
<td>Prunus spp.</td>
<td>leaves, bark, seeds</td>
<td>gasping, nervous disorder</td>
</tr>
<tr>
<td>Clematis</td>
<td>Clematis spp.</td>
<td>all parts</td>
<td>gastrointestinal irritation</td>
</tr>
<tr>
<td>Crinum Lily</td>
<td>Crinum spp.</td>
<td>bulb</td>
<td>vomiting, diarrhea</td>
</tr>
<tr>
<td>Delphinium**</td>
<td>Delphinium spp.</td>
<td>all parts</td>
<td>digestive upset, nervous excitement or depression</td>
</tr>
<tr>
<td>Elderberry</td>
<td>Sambucus canadensis</td>
<td>root, bark, stem, leaves</td>
<td>Has caused nausea and vomiting in children who have used stems as toys. Raw berries may cause nausea. Fruit commonly made into pies, jelly and wine - not harmful when cooked.</td>
</tr>
<tr>
<td>Elephant Ear**</td>
<td>Colocasia esculenta</td>
<td>all parts</td>
<td>intense burning and irritation of the tongue</td>
</tr>
<tr>
<td>English Ivy**</td>
<td>Hedera helix</td>
<td>leaves, stems, fruits</td>
<td>headache, fever, anxiety, breathing difficulty, coma</td>
</tr>
<tr>
<td>Eucalyptus**</td>
<td>Eucalyptus spp.</td>
<td>leaves</td>
<td>nausea, vomiting, diarrhea, weakness, respiratory difficulty</td>
</tr>
<tr>
<td>False Indigo**</td>
<td>Baptisia spp.</td>
<td>all parts</td>
<td>paralysis</td>
</tr>
<tr>
<td>Firethorn</td>
<td>Pyracantha spp.</td>
<td>berries</td>
<td>stomach ache, blistering of tongue, vomiting</td>
</tr>
<tr>
<td>Four-o'clock</td>
<td>Mirabilis jalapa</td>
<td>root, seeds</td>
<td>vomiting, diarrhea, abdominal pain</td>
</tr>
<tr>
<td>Ginkgo (female)</td>
<td>Ginkgo biloba</td>
<td>fruit</td>
<td>violent stomach pain, kidney disorders</td>
</tr>
<tr>
<td>Gloriosa Lily</td>
<td>Gloriosa superba</td>
<td>all parts</td>
<td>numbness of lips, tongue and throat, nervous system paralysis</td>
</tr>
<tr>
<td>Holly</td>
<td>Ilex spp.</td>
<td>Berries</td>
<td>vomiting, diarrhea</td>
</tr>
<tr>
<td>Honeysuckle, Japanese and Trumpet**</td>
<td>Lonicera japonica, Lonicera sempervirens</td>
<td>all parts</td>
<td>diarrhea, pupil dilation, irregular heartbeat, respiratory failure, coma</td>
</tr>
<tr>
<td>Hydrangea, Oakleaf Hydrangea, Bigleaf Hydrangea, Smooth</td>
<td>Hydrangea arborescens</td>
<td>leaves, bark</td>
<td>gastric, intestinal, convulsions</td>
</tr>
<tr>
<td>Impatiens, balsam</td>
<td>Impatiens spp.</td>
<td>stem, leaves, root</td>
<td>vomiting, diarrhea</td>
</tr>
<tr>
<td>Iris</td>
<td>Iris spp.</td>
<td>underground stems</td>
<td>severe digestive tract irritation, vomiting</td>
</tr>
<tr>
<td>Jack-in-the-Pulpit</td>
<td>Arisaema spp.</td>
<td>all parts</td>
<td>mouth and throat irritation, vomiting</td>
</tr>
<tr>
<td>Jonquil</td>
<td>Jonquils spp.</td>
<td>berry-like seeds</td>
<td>kidney damage</td>
</tr>
<tr>
<td>Lantana**</td>
<td>Lantana spp.</td>
<td>fruit</td>
<td>gastric, vomiting, diarrhea, circulatory collapse</td>
</tr>
<tr>
<td>Lily-of-the-Valley</td>
<td>Convallaria majalis</td>
<td>all parts</td>
<td>nausea, vomiting, diarrhea, irregular heartbeat and pulse, mental confusion</td>
</tr>
<tr>
<td>Lilies** (Rain Lily, Atamasco Lily, Easter Lily)</td>
<td>Zephyranthes spp.</td>
<td>all parts</td>
<td>dizziness, stomach pain, collapse, fatal to livestock</td>
</tr>
<tr>
<td>Mahonia</td>
<td>Mahonia spp.</td>
<td>all parts</td>
<td>depressant action on the heart muscle</td>
</tr>
<tr>
<td>Mimosa</td>
<td>Albizia spp.</td>
<td>all parts</td>
<td>intestinal irritation</td>
</tr>
<tr>
<td>Morning Glory</td>
<td>Ipomoea spp.</td>
<td>seeds, root</td>
<td>hallucinations, vomiting, diarrhea, muscle tightness</td>
</tr>
<tr>
<td>Mountain Laurel**</td>
<td>Kalmia latifolia</td>
<td>leaves, twigs, flowers</td>
<td>gastric, paralysis, convulsions</td>
</tr>
<tr>
<td>Oleander**</td>
<td>Nerium oleander L.</td>
<td>all parts</td>
<td>dizziness, irregular heart beat, nausea, convulsions, death. This is one of the most toxic ornamental plants in the southeast</td>
</tr>
<tr>
<td>Ornamental Tobacco**</td>
<td>Nicotiana spp.</td>
<td>all parts</td>
<td>weakness, diarrhea, abdominal pain, paralysis</td>
</tr>
<tr>
<td>Periwinkle (vine)</td>
<td>Vinca minor</td>
<td>all parts</td>
<td>intestinal irritation</td>
</tr>
<tr>
<td>Periwinkle (annual)</td>
<td>Catharanthus roseus</td>
<td>all parts</td>
<td>hallucinations, damage to liver, kidney, nervous system</td>
</tr>
<tr>
<td>Plumbago</td>
<td>Plumbago spp.</td>
<td>leaves, stems</td>
<td>stomach pain</td>
</tr>
<tr>
<td>Privet</td>
<td>Ligustrum spp.</td>
<td>fruit</td>
<td>nausea, headache, abdominal pain, vomiting, diarrhea, low blood pressure</td>
</tr>
<tr>
<td>Sago Palm</td>
<td>Cycas revoluta</td>
<td>seeds, roots, trunk pith</td>
<td>headache, vomiting, stomach disorders</td>
</tr>
<tr>
<td>Sweet shrub</td>
<td>Calycanthus floridus</td>
<td>seeds</td>
<td>affects central nervous system, spasms, increased heart rate</td>
</tr>
<tr>
<td>Trumpet Creeper (Chalice Vine)</td>
<td>Campsis radicans</td>
<td>all parts except fruit</td>
<td>gastric irritation, dilated pupils, numbness in hands</td>
</tr>
<tr>
<td>Virginia Creeper (Woodbine)</td>
<td>Parthenocissus quinquefolia</td>
<td>berries, leaves</td>
<td>nausea, bloody vomiting, abdominal pain, kidney damage, headache</td>
</tr>
<tr>
<td>Wisteria</td>
<td>Wisteria spp.</td>
<td>pods, seeds</td>
<td>stomach pain, diarrhea, nausea, vomiting</td>
</tr>
<tr>
<td>Yew**</td>
<td>Taxus spp.</td>
<td>berries, foliage</td>
<td>foliage more toxic than berries, death can be sudden without symptoms</td>
</tr>
</tbody>
</table>

References:

Texas A&M University Web Site, “Poisonous Plants.”
Mississippi State Extension Web Site, “Poisonous Plants.”
Georgia Poison Control Center fact sheet.