Morganton, NC: Trail and Natural Resource Enhancement Stewardship Plan

Prepared for the City of Morganton, NC

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community design assistance center
College of Architecture + Urban Studies
Virginia Polytechnic Institute and State University

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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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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

Section 1.1: General Maintenance

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:
Greenways, A Guide to Planning, Design, and Development, Section 15: "Greenway Management." Charles A. Fink & Robert M. Searns.

SECTION 2: STEWARDSHIP BY PROJECT TYPE

Section 2.1: Tree Planting and Care

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

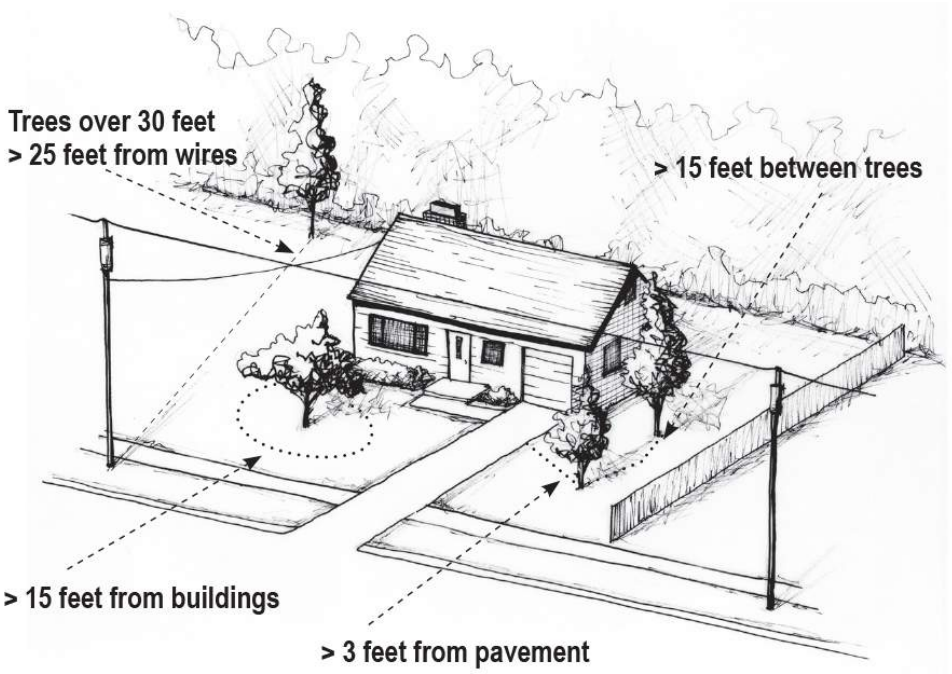


Figure 1: Image from "Tree Owner's Manual." United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. *www.treeownersmanual.info.*

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.

Section 2.1: Tree Planting and Care

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!

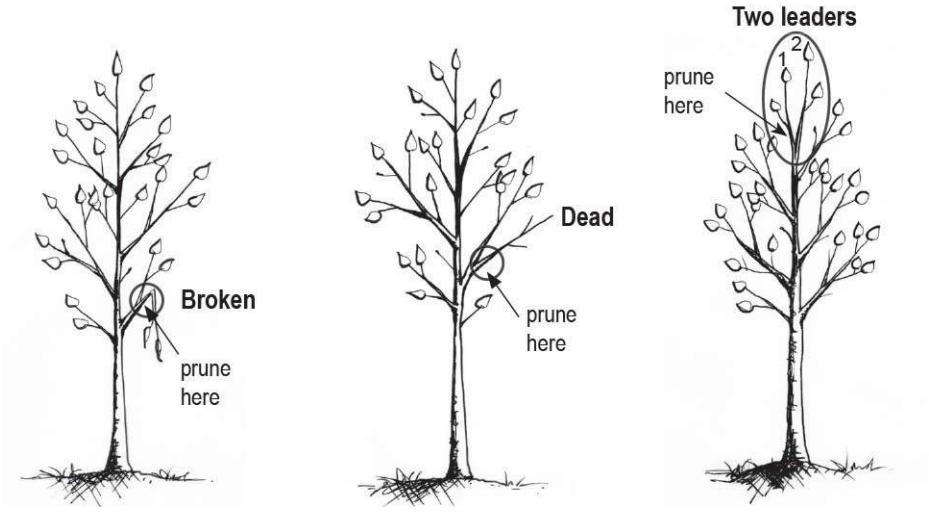


Figure 2: Image from "Tree Owner's Manual." United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. *www.treeownersmanual.info.*

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.

Section 2.1: Tree Planting and Care

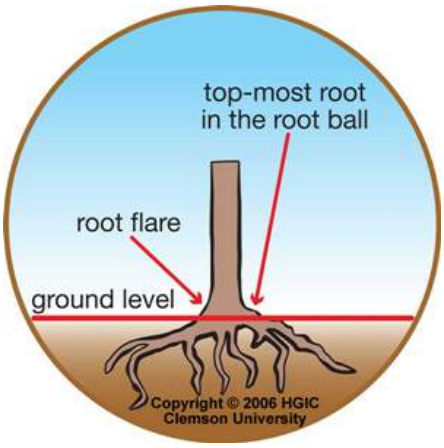


Figure 3: Diagram of root flare. Image from "How to Plant a Tree." Clemson Extension. *https://www.clemson.edu/extension/hgic/videos_posters/posters/tree_planting.pdf.*

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.

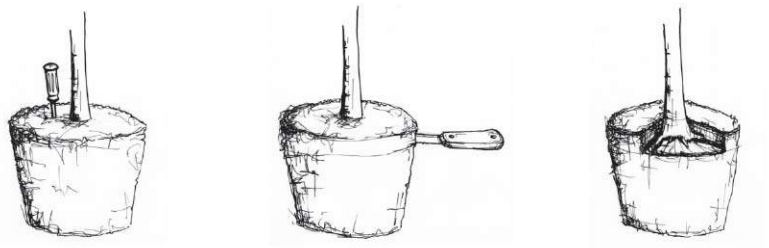


Figure 4: Diagram of removing the soil from the top of the root ball. Image from "Tree Owner's Manual." United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. *www.treeownersmanual.info.*

<u>Step 5: Remove problem roots</u>

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.

Section 2.1: Tree Planting and Care

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.

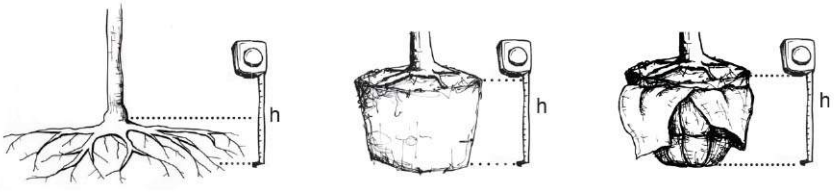
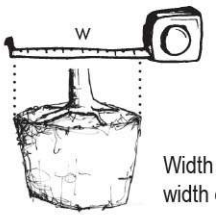


Figure 5: Image from "Tree Owner's Manual." United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. *www.treeownersmanual.info.*



Width of hole should be 2-3 times the width of the root ball

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.

Section 2.1: Tree Planting and Care

Step 12: Mulch

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.

Figure 6: Diagram of proper mulching technique. Image from "Tree Owner's Manual." United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. *www.treeownersmanual.info.*

2.1.2 Care

Watering

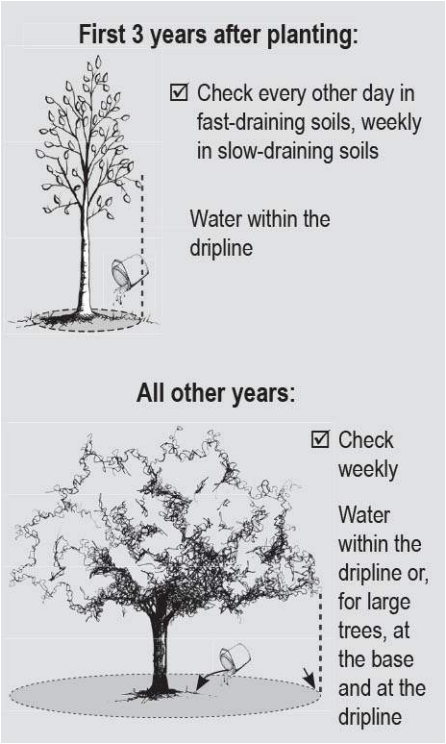


Figure 7: Diagram of tree watering. Image from "Tree Owner's Manual." United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. *www.treeownersmanual.info.*

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.

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* 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

Section 2.1: Tree Planting and Care

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.

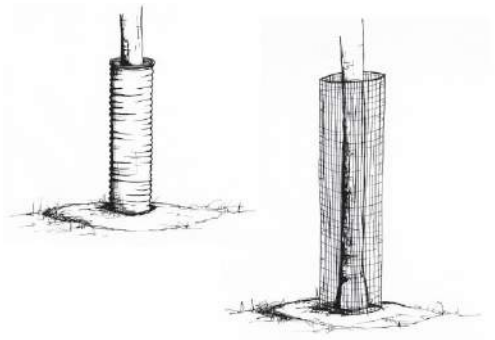

Figure 8: Sketch of tree protection guard. Image from "Tree Owner's Manual." United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. *www.treeownersmanual.info.*

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 in 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.

Section 2.1: Tree Planting and Care

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/trainingyoungtrees* for a video on how to prune a young tree.

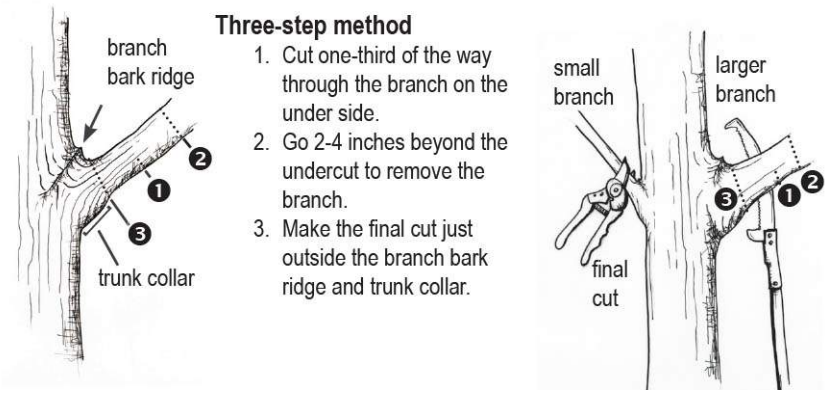

Figure 9: Diagram of proper pruning technique. Image from "Tree Owner's Manual." United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. *www.treeownersmanual.info*.

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 include mountain ash, apple, crabapple, hawthorn, pear, flowering quince, and pyracantha. 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.

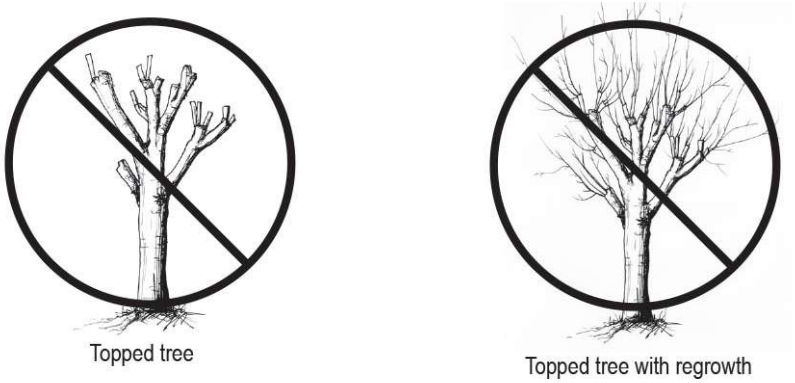

Figure 10: Sketch of a topped tree. Image from "Tree Owner's Manual." United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. *www.treeownersmanual.info.*

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.

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- Multiply that number by 1.5 feet for every inch for mature or stressed trees or by 1 foot for young, healthy trees. For 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:
Training Young Trees. Larry Costello, University of California. *http://tinyurl.com/trainingyoungtrees.*

Tree Owner Information. *International Society of Arboriculture. www.treesaregood.org & www.isa-arbor.com*

Tree Owner's Manual. United States Department of Agriculture, Forest Service, and Northeastern Area State and Private Forestry. *www.treeownersmanual.info.*

Section 2.2: Controlling Nonnative Invasive Plants

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

Section 2.2: 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 reinitiate 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

Section 2.2: Controlling Nonnative Invasive Plants

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:
Nonnative Invasive Plants of Southern Forests: A Field Guide for Identification and Control, Section "General Principles for Controlling Nonnative Invasive Plants." U.S. Department of Agriculture, Forest Service. *http://www.srs.fs.usda.gov/pubs/gtr/gtr_srs062/07_other_nn_plants.pdf*

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 addtion 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.

Section 2.3: Natural Pest and Disease Control

- *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.

Section 2.3: Natural Pest and Disease Control

Sources:
A Glossary of Natural Garden Pest Control Solutions. Mother Earth News. *http://www.motherearthnews.com/organic-gardening/natural-garden-pest-control-zm0z14jjzsto.aspx?PageId=4#axzz3D1YnWNED*

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

Organic Pest Control Series: Beneficial Insects. Mother Earth News. http://www.motherearthnews.com/organic-gardening/beneficial-insects-zl0z0413zkin.aspx#axzz3D1YnWNED

Section 2.4: Habitats

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 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 effecient 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

Section 2.4: Habitats

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

- 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.

Section 2.4: Habitats

2.4.4 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.

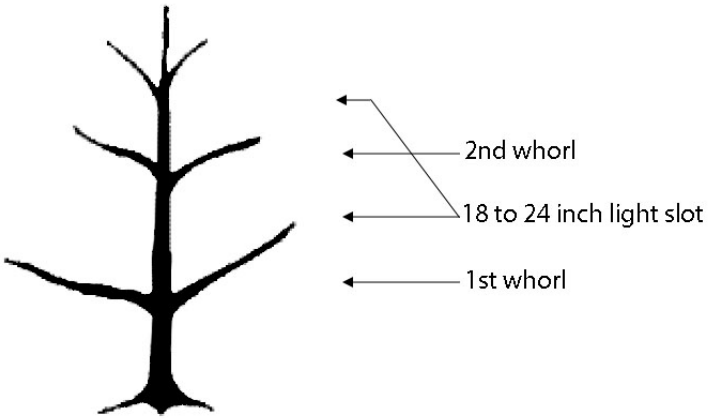

Figure 1: Diagram of a tree whorl and light slot. Image from "Growing Apple Trees In The Home Garden": North Carolina Cooperative Extension Service North Carolina State University. *http://www.ces.ncsu.edu/hil/hil-8301.html*

- 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.

Section 2.4: Habitats

(Refer to Section 2.1 Tree Planting and Care and **Growing Apple Trees In The Home Garden** in the Appendix: Attached Reference Materials section for more information)

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.

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:

Apple Tree Care. National Gardening Association Editors. *http://www.garden.org/foodguide/browse/fruit/apple/1600*

Grow a Native Grass Meadow. Carol A. Heiser. *http://www.dgif.virginia.gov/habitat/wild-in-the-woods/grow-a-native-grass-meadow.pdf*

Growing Apple Trees In The Home Garden. Michael L. Parker, Department of Horticultural Science North Carolina Cooperative Extension Service. *http://www.ces.ncsu.edu/hil/hil-8301.html*

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*

Section 2.4: Habitats

Maintaining a Rain Garden. Crystal Environmental Quality Commission. *http://www.ci.crystal.mn.us/cityofcrystal/uploads/Maintaining_a_Rain_Garden_Information_2011.pdf*

Maintaining your Rain Garden. Rutgers University, Water Resources Program. *http://www.water.rutgers.edu/Projects/RGRebate/RGMaintenance.pdf*

Maintaining Your Woodland Garden. Evelyn J. Hadden. *http://www.lesslawn.com/articles/article1073.html*

Section 2.5: Trail Systems

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)

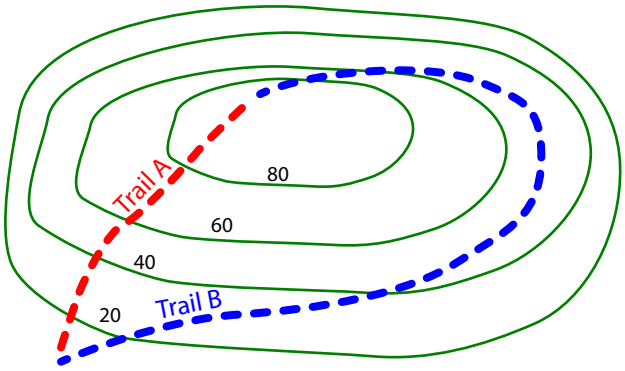

Figure 1: Trail A is traveling perpendicular with the contours and has a high TSA. Trail B travels parallel with the contours and has a low TSA. Image from "Trail Design & Maintenance." Jeff Marion, USGS Research Scientist.

Maintenance 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

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%.

Section 2.5: Trail Systems

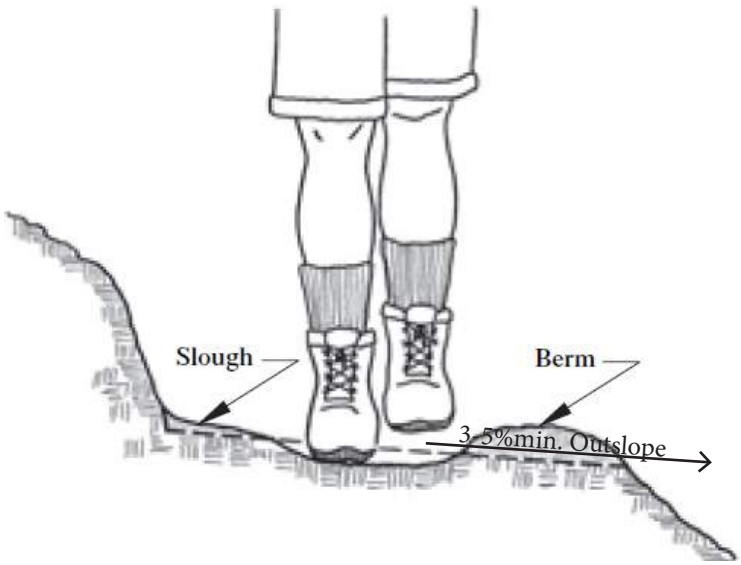

Figure 2: Diagram of a trail outslope reestablishment. Image from "Trail Construction and Maintenance Notebook." USDA Forest Service. *http://www.fs.fed.us/t-d/pubs/pdfpubs/pdf07232806/pdf07232806dpi72.pdf.*

- 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.

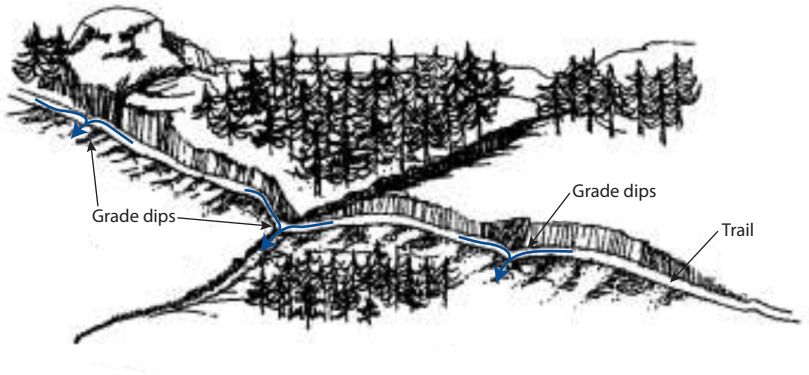

Figure 3: Sketch of a trail using grade dips to divert water off the tread. Image from "Trail Design & Maintenance." Jeff Marion, USGS Research Scientist.

- 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.

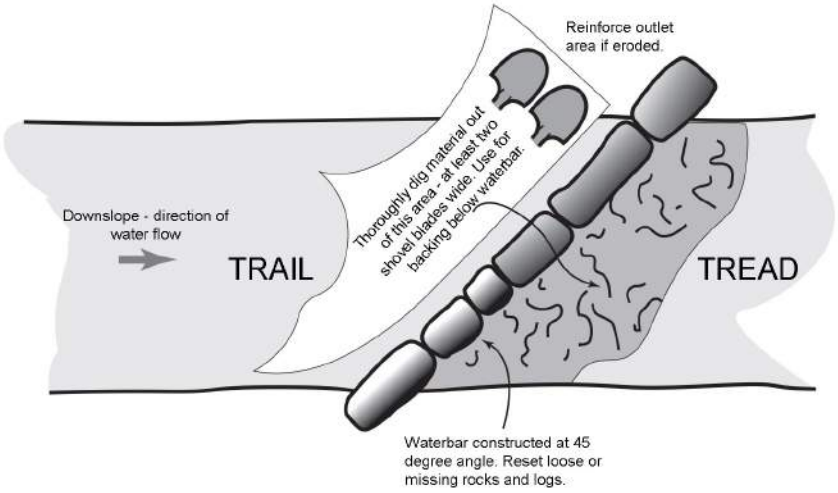

Figure 4: Plan view sketch of a rock water bar. Image from "Trail Construction and Maintenance Notebook." USDA Forest Service. *http://www.fs.fed.us/t-d/pubs/pdfpubs/pdf07232806/pdf07232806dpi72.pdf* .

Figure 5: Image of a rock water bar along a trail. Image from "White Mountain Sojourn." Alex Macphail. *http://whitemountainsojourn.blogspot.com/2013_09_01_archive.html.*

- Inspect and maintain the effectiveness of water bars at least twice per year. Remove soil, leafs, 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.

Section 2.5: Trail Systems

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:

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

Section 2.5: Trail Systems

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Section 2.6: Playgrounds

2.6 Playgrounds

2.6.1 Natural Play

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.
- 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 deteremined 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.

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MOTHER EARTH NEWS

A Glossary of Natural Garden Pest Control Solutions

Faced with a pest problem? Learn a three-tiered approach to natural garden pest control: attract beneficial insects, employ effective physical pest controls such as handpicking and row covers, and use organic pesticides if needed.
June/July 2014
http://www.motherearthnews.com/organic-gardening/natural-garden-pest-control-zm0z14jjzsto.aspx
By Barbara Pleasant and Shelley Stonebrook

Place birdhouses and simple water features around your garden to invite in natural predators. Keep chickens near your garden to feed them handpicked pests. They can also work over beds at season's end. Keep out slugs by laying out copper stripping and use row cover to protect cabbage-family crops.

Illustration by Linda Cook

An abundance of buzzing, hopping, fluttering and crawling insects is a trademark of any healthy organic garden. This diversity means insects that might feed on your crops are likely to be kept in check by their enemies. In small numbers, pests simply provide food for birds and beneficial insects, and if your soil and crops are healthy, plants fend off the pressure easily. Only when pest populations become excessive do gardeners need to step in to restore balance to keep their gardens thriving.

A good overarching mantra to guide you in your natural garden pest control efforts can be summed up in two words: Look closely. Examine your plants regularly, noting what kinds of insects you see. Observe whether you see just a few of a particular kind of insect or whether populations are growing, and look up pictures of what you see so you know which are beneficial and which are detrimental. (For pictures of and detailed information about beneficial and pest insects, see our Organic Pest Control Series.)

Refer to this glossary to preemptively ward off pests and, if problems do crop up, to target each complication with the best organic pest control solutions. We've separated this glossary into sections that present a three-pronged system of organic pest control: First, attract a diversity of beneficial insects by interplanting flowers and herbs — especially those that produce nectar from numerous small florets, such as mints and sweet alyssum. Second, put a variety of physical controls in place when pests get out of check or are known to be troublesome in your area (see the Top 15 Worst Garden Pests chart). Last, if needed, bring in organic insecticide reinforcements. The products listed in this glossary all have been approved by the U.S. National Organic Program.

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 cabbageworms 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, cabbageworms, Colorado potato beetles, corn earworms, cutworms and slugs.

Hover fly (aka syrphid fly). Black-and-yellow-striped hover fly adults 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 cabbageworms.

Lacewing (aka aphid lion). Lacewing larvae prey on aphids, cabbageworms, 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 so lacewings can check them for pests. 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. Goldenrods, 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

by night, or simply waiting by their burrow for unsuspecting prey. Perennial herbs that grow into lush bushes often make top-notch spider conservatories, and biodegradable mulches, such as straw and grass clippings, create an ideal habitat for advantageous wolf spiders. (Note that poisonous spiders don't generally favor gardens.)

Tachinid fly. Tachinid flies are gruesome parasites that glue their eggs onto an insect so that, when the egg hatches, the maggot can consume its host as food. Some species lay eggs on foliage that's food for insects, and then the eggs hatch in the insects' innards. Or, the flies inject eggs into another insect's body with a sharp ovipositor. Garden pests controlled by tachinid flies include armyworms, cabbageworms, cutworms, grasshoppers, Japanese beetles, leaf rollers and squash bugs. Attract tachinid flies by growing plants that bear umbels of tiny flowers. Buckwheat, carrots, cilantro, dill, Queen Anne's lace and sweet clover are among the crops that fit this bill.

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. Take caution if yellow jackets or hornets show up, and mark wasp nests so you can avoid disturbing them. Paper wasps are less aggressive than yellow jackets or hornets, and are happy to nest in bottomless birdhouses placed around the garden.

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-spotters, 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 cabbage patch in this way, along with other cabbage-family crops, to keep cabbageworm moths from laying eggs on your plants. Use hoops or blunt stakes to hold up the covers. Remove covers after crops, such as squash, 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 caught in the goo.

Organic Insecticides

Bt (***Bacillus thuringiensis***). 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.

Diatomaceous earth (DE). A powder made from fossilized remains of aquatic organisms called "diatoms," DE has sharp edges that cut into insects' bodies and cause them to die of dehydration. DE is less effective when wet, yet can still be used in the garden to make life difficult for flea beetles and newly emerged cutworms and Japanese beetles. In dry weather, DE spread beneath plants will repel slugs. 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. Renew after rain or dew.

Horticultural oils. When applied directly to pests, horticultural oils 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. 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.

Insecticidal soap. Fatty acids in insecticidal soaps 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. Thoroughly wet both sides of leaves and the insides of all crevices. Repeat applications may be needed every week as new aphids or whiteflies hatch and form colonies. To make soap sprays at home, mix 1 tablespoon of dishwashing liquid per quart of water. Purchased insecticidal soaps are purer, however, and less likely to injure foliage. Frequent soap sprays may reduce the yields of some crops. Use soft or rainwater when diluting soap concentrates.

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.

Section 3.3: Appendix - Attached Reference Materials

A Glossary of Natural Garden Pest Control Solutions

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.

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+.

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Composting

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Composting

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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.

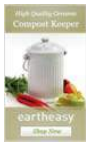
Good for the environment:

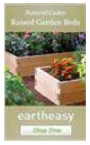
Composting offers a natural alternative to chemical fertilizers.

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

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





dryer lint	Carbon	best if from natural fibers
sawdust pellets	Carbon	high carbon levels; add in layers to avoid clumping
wood chips / pellets	Carbon	high carbon levels; use sparingly

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 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 a 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 composter and toss in the contents.

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 also excellent for compost, but should be sprinkled into the bin with other materials, or dug in to the center of the ple and mixed. Avoid putting them on in 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 a 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, conifer needles, 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 - 6 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.

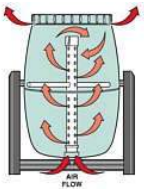
~ Leaf-mould tea
You can also use leaves to make a nutrituous "tea" for your plants. Simply wrap a small pile of leaves in burlap and immerse in a garbage can or large bucket of water. Leave for three days, then remove the "tea bag" and dump contents into the compost. Scoop out the enriched water with 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 flip the material. Without this, the contents tend to stay 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.



For more info, or to purchase a compost tumbler, click here

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, raccoons, 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 tumbler 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 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 materials 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 compost. (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 get 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 exclusivley 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 peelings, 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 shoud 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 resistent 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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Section 3.3: Appendix - Attached Reference Materials

Grow a Native Grass Meadow

frequently used include orchardgrass or fescue. Landowners especially appreciate the non-native fescue for its tough, aggressive qualities that ensure fast growth, reduced soil erosion, and the ability to withstand heavy grazing. Unfortunately, there is a downside to fescue's tenacity; it is invasive and forms a dense mat that effectively out-competes native grasses, thereby excluding the plant diversity and habitat structure essential to many open-land 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 predation. Native warm season grass habitats are more productive for wildlife because their higher degree of species diversity bestows varying plant heights and excellent cover.

The value of cover can not be over-emphasized. Ground-dwelling birds rely on a range of cover types, such as nest cover to incubate eggs, brood cover to raise young, loafing cover to rest between forays, and winter cover against the elements. Warm season grasses stand upright and are quite tall, from six to eight feet. Height provides valuable overhead cover from predators, like hawks, as wildlife moves about underneath. Dry grass stalks bend over and form pockets of protection even during winter, when other plants are completely covered by snow.

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 the first six inches above the ground is loosely structured and fairly open. In this environment, seeds and insects are more accessible to birds like quail and turkey broods. Wildlife can also move quickly and easily between the plants should danger strike.

Wildlife which keys in on these open, early stages of plant growth or succession are called "early successional species." Of nationwide 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, meadowlark, sedge wren, and the state threatened upland sandpiper and loggerhead shrike.

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 (upper left).

Big bluestem

Grow a Native Grass Meadow

by Carol A. Heiser
illustrations by Spike Knuth

When Katharine Lee Bates first wrote her 1895 poem "America the Beautiful," which has since become one of our best-loved patriotic songs, her "amber waves of grain" and "fruited plain" 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 60 million bison, not to mention a whole guild of grassland 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 attractive 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

Indiangrass

Switchgrass

Section 3.3: Appendix - Attached Reference Materials

Grow a Native Grass Meadow

A blue grosbeak perched on sumac overlooks a native grass meadow.

Reaping Benefits

In addition to improving wildlife habitat, there are several other benefits of using native grasses in the landscape. Because their historical origin is the prairie, where conditions are typically hot and dry during the growing season, native grasses are extremely drought tolerant and have a distinct survival advantage over non-natives during the summer months. In hot weather, fescue and other cool season plants wilt miserably or turn to brown crunch, while native grasses are growing vigorously and showing off their green—hence their name, "warm season" grasses. Natives like switchgrass, indiangrass, little bluestem, and big bluestem all have very deep roots—some up to 12 to 14 feet—that are adapted to find moisture in the soil and withstand the effects of extended dry spells. The plants are also adapted to fire and will respond with renewed vigor after a prescribed burn.

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 (fungal) problems often associated with fescue. They can also be hayed in summer, after the peak nesting time of ground-nesting birds, and should be mowed high (at 10 inches) for proper management, which also leaves substantial wildlife cover.

For the "farmette" homeowner tired of mowing five acres of lawn every summer, native grasses can form an interesting landscape element that provides textural beauty and a pleasing backdrop to favorite wildflowers.

In addition, native grasses can be used effectively in field borders, filter strips, waterways, and right-of-ways.

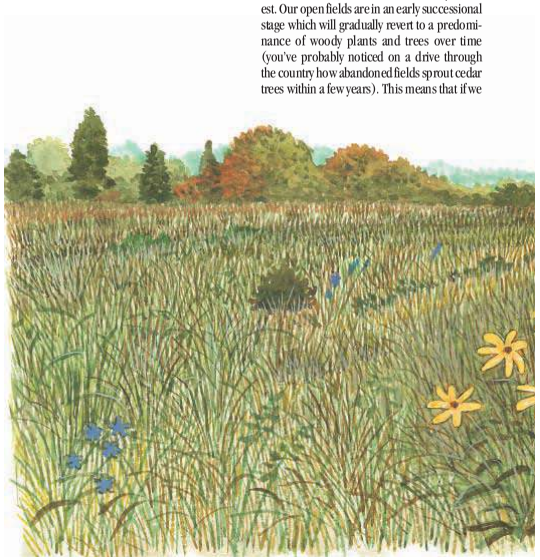
Meadow Myths

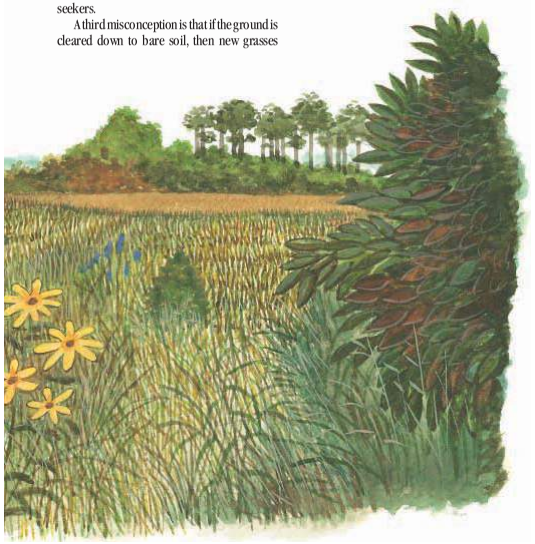
Midwestern prairies are considered a climax plant community, which means that the community of grassland plants which occur there is the last stage of succession. Succession is a term ecologists use to describe the gradual change of vegetative types over time. Here in the East, in contrast, the climax community is forest. Our open fields are in an early successional stage which will gradually revert to a predominance of woody plants and trees over time (you've probably noticed on a drive through the country how abandoned fields sprout cedar trees within a few years). This means that if we want to maintain an area as an open grassland or meadow, we must manage that area with burning and mowing to keep it in an early successional stage. Meadows are, therefore, never "maintenance free," as the purveyors of meadow-in-a-can type products might have us believe.

Another misconception is that a meadow is mostly flowers. It would certainly seem so, if we were to base our view solely on all those visually stunning pictures found in catalogs and magazine advertisements. In reality, a healthy meadow is at least 50 percent grasses, and usually more. The "wildflower" meadow is a myth, because here in Virginia it would be extremely difficult to establish and perpetuate a large field solely of flowers without a high degree of maintenance. Wildflower mixes that promise a burst of color the very first year are usually loaded with annuals. These plants will die after the first year of growth. They are intended to reward you with initial gratification while you wait for the perennials—the real powerhouses of a "wildflower" meadow—to become established in the second year. If you want to see continual splashes of color in a warm season grass meadow, plan for a 50:50 mix of native grasses and perennial wildflowers as a general rule (60:40 would be better). Flowers enhance a meadow habitat for butterflies and other nectar seekers.

A third misconception is that if the ground is cleared down to bare soil, then new grasses and flowers planted there will automatically have a head start over any weeds, and there shouldn't be a weed problem. However, keep in mind that disturbing the soil during preparation for planting will bring dormant weed seeds to the surface, and the majority of them are well-adapted to thrive in the conditions you just created (that's because they're early successional species, too). 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 a new meadow to grow successfully, you can't just walk away after the seeds or plugs are in the ground and forget about them. Growing a meadow is like any other type of gardening or farming: it requires some maintenance.

One must exercise patience after planting native warm season grasses, because they require at least two growing seasons (sometimes three) to become fully established. The most invaluable point to take home when planning a meadow of native warm season grasses is that fescue and any other pre-existing plants **must be completely** killed first, or you will be wasting your time, and probably money, too.





Planning a Meadow: What to Buy

When planning a meadow of native warm-season grasses, whether or not you choose to add flowers, select a site that receives full sun more than eight hours a day. Also consider placement with regards to how or whether you will be able to burn the field for future management. Remember, these plants are large and adapted to be out in the open. They will need a lot of space and are not well-suited to a small urban or suburban yard. At a very minimum, a full-blown grassland meadow should be at least one acre (43,560 sq. ft.) to have some benefit for wildlife.

Order your seeds directly from a supplier who will prepare a customized mix. This way you'll get exactly the species you want and the quantities you need, with no extra frills or surprises. Be sure to request Pure Live Seed (PLS) when ordering. PLS is the percentage of viable (live) seed that is contained in a bag of bulk seed, since most bulk native grass seed consists of other plant parts and chaff. A bag of bulk seed should be at least 75 percent PLS for good establishment.

On large acreages, the following is a good mix for wildlife:

2 lbs. PLS Switchgrass *(Panicum virgatum)*
2 lbs. PLS Indiangrass *(Sorghastrm nutans)*
or Big Bluestem *(Andropogon gerardii)*
2 lbs. PLS Little Bluestem *(Schizachyriu scoparium)*
TOTAL = 6 pounds of seed PER ACRE

If the objective is grazing land for livestock:

2 lbs. PLS Cave-in-Rock Switchgrass *(Panicum virgatum)*
3 lbs. PLS Big Bluestem *(Andropogon gerardii)*
2 lbs. PLS Indiangrass *(Sorghastrum nutans)*
TOTAL = 7 pounds of seed PER ACRE

If you want a grassland meadow with a fine display of flowers, use this recipe instead:

2 lbs. PLS Little Bluestem *(Schizachyrium scoparium)*
1 lb. PLS Shelter or Blackwell Switchgrass *(Panicum virgatum)*
1 lb. PLS Rumsey Indian Grass *(Sorghastrum nutans)*
1 lb. PLS Round Tree Big Bluestem *(Andropogon gerardii)*

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Section 3.3: Appendix - Attached Reference Materials

Grow a Native Grass Meadow

2 lbs. of a MIX of native perennial flowers that are true species types, not cultivars. Choose from the following list, based on your preferences and pocketbook, to make up 2 pounds of seed: black-eyed Susan (make sure it's the perennial kind); partridge pea (actually a bi-annual, but it reseeds itself like a perennial); lance-leaf coreopsis; "sunflower" heliopsis; purple coneflower; *Gaillardia* (blanketflower); Maximillian sunflower (gets 3 to 6 feet tall with numerous yellow flowers on the top third of the plant); butterfly milkweed; New England aster *Liatris* (gayfeather).
TOTAL = 7 pounds of seed PER ACRE

[**Note:** the terms "Cave-in-Rock," "Shelter," "Blackwell," "Rumsey," and "Round Tree" listed above refer to particular grass varieties you should select.]

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 for maximum effect. A conventional till method without chemicals can be used instead to turn under the existing sod. However, there will likely be future headaches with persistent plants unless the area is tilled more than once and the second tilling is done at the right time after the first flush of new weeds.

The seedbed must be firm when you plant, and seeds should be planted at a depth of ½ inch. Control weeds during the establishment year by mowing them when they first reach 18 inches, taking care that the mower blade is set above the warm-season grass seedlings.

In subsequent years when haying or grazing—or at anytime during the growing season—do not cut warm-season grasses below 10 inches. The first growth node of these grasses occurs at 10 inches above the ground, and cutting below this point during the growing season will force the plants to use valuable energy stored in the roots. Repeated cuttings below 10 inches at this time of year will eventually kill the plants. Also, do not mow or graze after September 1, as this is the time when the plants are moving nutrients from the leaves to the roots in preparation for winter dormancy.

If you do not plan to take hay or graze your meadow but instead leave it for wildlife, then you will need to manage the grass stand by burning or mowing.

Prescribed burning is preferred over mowing because fire removes the build-up of thatch and plant litter on the ground that will gradually occur. Untended, thatch reduces plant vigor and eventually causes the stand to thin out, which also leaves it more susceptible to fresh weed invasion. Therefore, in the third year of your meadow, begin a prescribed fire rotation by burning only one-third of the field in late March or early April, when the warm season grasses have only one to two inches of new regrowth (at this early stage of the growing season, the "10 inch rule" does not apply).

Burning only one-third of the field at a time each year ensures maximum habitat effect. The most recently burned area will be open, 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 Brillion seeder, a machine driller that is typically used to plant lawns. However, if the species you've selected have very "fluffy" seeds, they might clog this type of seeder. In this case you might simply broadcast with a chest bag, starting with the big seeds first and then going back over with other, smaller seeds. Check your local lawn and garden supplier for these types of equipment.

For large scale planting projects on several acres or a farm, the Virginia Department of Game and Inland Fisheries offers two invaluable pieces of large equipment, both available at no charge. The first is a grass drill to do the planting. This is specially outfitted to plant native warm season grass seed, which does not ordinarily flow through conventional no-till drills. The second is a "burn trailer," if you are prepared to conduct a prescribed burn on your own. The trailer—which can be pulled behind a pickup truck—is equipped with drip torches, hand tools, a fire weather kit, and a 150 gallon spray rig tank. Call the Powhatan field office of VDGIF at (804) 598-5706 to reserve or ask questions about the equipment.

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. Rather all early successional species reap the rewards of landscape-scale habitat restoration that the plan outlines. Also, 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/seqsg/nbci/nbci.cfm**.

Learning More...

Native Warm Season Grasses 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) 367-0994 for a free copy.

Virginia Native Plant Society, **www.vnps.org**.

Landscaping with Native Plants, an EPA page written for the Great Lakes region but with good links and information useful to Virginians, at **www.epa.gov/greenacres/**.

Wild Ones Natural Landscapers Ltd., a nonprofit that promotes environmentally sound landscaping practices, at **www.for-wild.org/**. See their online *Handbook* for landscaping with grasses and other natives.

Prairies Forever **www.prairies.org**, a nonprofit dedicated to promoting the ecological and cultural significance of the American prairie

Seed Suppliers—several seed companies offer fact sheets or helpful tips and techniques for planting a grass and wildflower meadow. Here is a sampling (not an endorsement):
www.prairienursery.com
www.sharpseed.com
www.stokseed.com
www.ernstseed.com
www.prairiesource.com

A grasshopper sparrow sways back and forth on a thin stem of switchgrass.

A dickcissel loudly chirps his presence from atop the flower of a common mullein plant.

Virginia Naturally

Growing Apple Trees In The Home Garden

ces.ncsu.edu /hil/hil-8301.html

Growing Apple Trees In The Home Garden

2/95 -- Author Reviewed 5/97 HIL-8301

Michael L. Parker Extension Horticultural Specialist Department of HorticulturalScience North Carolina Cooperative Extension Service North Carolina State University

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 root-stock. 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 root-stocks 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.

Rootstock	Tree Size as Percent of Seedling	Tree Spacing in Row (ft)	Anchorage	Years to Fruit Production
Seedling*	100	15-18	Excellent	6-10
MM.111	85	14-18	Excellent	4-6
MM.106	80	12-16	Excellent	3-4
M.7a	70	10-14	Fair	3-4
M.26**	50	8-12	Poor	2-4
Mark**	35-40	6-8	Good	2-3
M.9**	35	4-8	Poor	2-3

* 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.

Variety	Fruit Color	Fruit Use	Relative Bloom Time	Potential Cross-Pollinizers
Gala	Yellow-orange to red	Fresh	Early to Midseason	Golden Delicious
Empire	Dark red over green background	Fresh, cooking	Early	Golden or Red Delicious, Gala
Jonagold*	Yellow with light red stripes	Fresh, cooking	Midseason	Gala, Empire
Golden Delicious	Yellow green to light yellow	Fresh, cooking	Midseason to Late	Red Delicious, Gala, Empire
Red Delicious	Red	Fresh	Early	Golden Delicious, Gala
Stayman*	Blush to red	Fresh, cooking	Midseason	Gala, Golden or Red Delicious
Rome	Blush to red	Fresh, cooking	Late	Fuji, Braeburn
Braeburn	Green with light red blush	Fresh	Midseason	Rome, Fuji
Fuji	Green with red stripes	Fresh	Midseason	Rome, Braeburn

* 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 (above) 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 pollinizer 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 tree spacing guidelines that pertain to the rootstock you have chosen from Table 1. Do not plant trees near wooded 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. Grass competes 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 vole 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 ripening foods can kill young trees.
- 2) "Heel-in" the tree. To heel-in a tree, dig a trench and place the tree roots evenly 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 allow work under the tree. The first year, 3 to 4 branches, collectively called a "scaffold whorl", 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 whorl should be an area of 18 to 24 inches, called a "light slot", without any branches to allow light to reach all lower leaves and fruit. This light slot is followed by another whorl of scaffolds. Maintain alternating scaffold whorls and light slots 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.

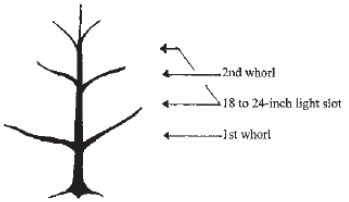

Figure 1. Side view of a central leader tree.

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 spread to a wider crotch angle that will provide a stronger framework for fruit production. Toothpicks or clothespins 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

excessive vigor and serious limb breakage under a heavy fruit load. Larger branches can be spread out using short wooden boards with a notch cut in each end for the branch to fit into. Hanging weights on the branch or tying it down with string wrapped loosely around the limb are other methods for spreading the branches. 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.

Dormant Pruning vs. Summer Pruning - Pruning the tree during the winter, while it is dormant, will invigorate the tree and cause it to grow and branch more the following season. To promote scaffold branch development, cut the central leader 20 to 28 inches above the highest usable scaffold whorl during the dormant season. It is best to do dormant pruning in late winter or early spring, after the risk of severe freeze is over. Be sure to remove any dead or diseased wood and dried apples at this time as well. After the tree resumes growth in the spring, continue to train the scaffold branches of the tree as you did the previous growing season. Select a new upright shoot to continue the central leader, and remove all new shoots 4 inches below it. Also select the branches to form another whorl of 4 to 5 scaffold branches. Prop all lateral branches out to a 50 to 60 degree angle.

Summer pruning will devigorate the tree and cause it to grow less in that growing season. Remove all undesirable branches directly across from one another on the central leader when they are 3 to 4 inches long. Also, select lateral branches that are spaced uniformly around the leader to prevent crowding as the limbs grow in diameter. Once the tree has filled its allotted space, lateral branches will need to be cut back to their desired length during the summer to devigorate the tree and prevent further growth, not during the dormant season. Ask your County Extension Center for information on the best way to prune your apple tree.

Fruit Thinning - Apple trees often set a heavier crop of fruit than the limbs can withstand. To ensure good fruit size, return bloom for the following year, and to prevent tree breakage, it is necessary to thin the fruit. Every apple blossom results in a bloom cluster of 5 to 6 blossoms. Apples should be thinned when they are about the size of a dime. Cut off enough fruit so that the remaining apples are spaced 4 to 6 inches apart, and leave only one fruit per cluster. It may seem like very few fruit remain, but you will harvest higher-quality fruit, potentially reduce insect and disease problems, and increase the chances for a full crop the next season.

Fertility - Adequate tree nutrition is essential for quality apple production. Determine the nutrient status of your soil by taking a soil sample prior to planting and each year thereafter at the same time of year. Follow the fertilization guidelines provided by the soil test. This will prevent over-fertilization, will be cost-efficient, and will maintain healthy and productive trees. A leaf sample taken in July or August will determine the nutrient status of the tree and can be helpful in conjunction with the soil test. In addition to soil analysis and foliar analysis, regular observation of vegetative growth is a useful indicator of tree fertility. Optimum fertility exists if lateral, outward growth is between 12 and 18 inches per year.

If you are unable to take a soil test, a useful rule is to apply 1 pound of 10-10-10 fertilizer to each tree the first year, 2 pounds the second year, and 3 pounds the third year up to a maximum of 5 to 6 pounds for a mature tree. Always adjust rates of fertilizer application according to annual shoot growth. Apply fertilizer in late winter or early spring before growth begins. Fertilizer should be broadcast on the soil surface around the drip line of the tree. The "drip line" is the circular line at the outer ends of the branches. Avoid getting fertilizer within 6 inches of the trunk as it could burn the tree.

Weed Control - Controlling weeds and gras-ses around young apple trees minimizes competition for soil nutrients and moisture, encourages vigorous tree growth, and increases fruit size. It will also help to minimize damage from pine and meadow voles, and other rodents. Keep all vegetation controlled out to the drip line of the tree where the outer branches end. Do not use weed whips; these will girdle the tree without any visible signs of injury. Avoid mechanical weed culti-vation, such as tilling, as it damages shallow tree roots. Herbicides are effective, but follow the label directions carefully and keep them off the tree. Mulch will also control weeds and conserve soil moisture, however rodents may burrow under the mulch and gnaw tree trunks and roots. When using mulch, place rodent guards around the base of the tree, and pull mulch back in the fall, leaving a 1-foot circle of bare soil surrounding the trunk.

Disease and Insect Control - Diseases and insects can cause serious damage to apple trees and fruit. Good sanitation practices are necessary to control pest problems. Cut out all dead or diseased wood, remove dried apples, and clear leaves and fallen debris away from trees. Disinfect pruning tools with a 10% solution of a household disinfectant (Lysol) or bleach, before and after use and between trees. Household disinfectants, such as Lysol, will not corrode tools or ruin clothing. A regular spray program is essential for high fruit quality and healthy trees. Use a multipurpose fungicide and insecticide labeled for apples. These can be obtained from a garden center and will include application instructions. A spray to control fungus problems should be applied when the first sign of green tissue appears. A horticultural oil should also be sprayed on apple trees at the first sign of green growth in the spring to suffocate scale insects and reduce overwintering mite and aphid eggs. For homeowners with only a few trees, premixed orchard sprays are available from many garden centers. Begin applications after full bloom is over and spray every 10 to 14 days through-out the summer.

If you think you have an insect or disease problem, contact your County Extension Center immediately. It is important to identify the pest accurately so an effective treatment can be selected.

Harvesting and Fruit Storage

Apples reach maturity at different times, depending on variety and climate. There is not a specific date at which you can expect to harvest your apples. Instead, you can observe your apples as they grow and inspect the fruit for certain changes which indicate maturity. The "ground" or base skin color of the apples changes from green to yellow as the fruit matures. Flesh color also loses its greenish tint and turns yellow or white. When you are convinced that the apples look mature, take a bite! A mature fruit will be crisp and juicy. A pleasing taste is the final indicator of fruit maturity.

Proper storage conditions help prolong the shelf-life of your apples. Store apples at 32 ^{o}F and maintain high humidity. The crisper drawers of many refrigerators work well, but keep the fruit away from vegetables since ripening fruit gives off gas that may spoil vegetables. Apples can also be stored in plastic bags in the refrigerator to prevent fruit dehydration.

Always remember, "An apple a day...!"

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Section 3.3: Appendix - Attached Reference Materials

How to Install and Maintain a Rain Barrel

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

Tools: Rain barrel. Hacksaw. Aluminum downspouts: 6 screws and a screwdriver. PVC downspouts: PVC cement.

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

Section 3.3: Appendix - Attached Reference Materials

How to Install and Maintain a Rain Barrel

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

kaboom.org/build_playground/toolkit/safety/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.

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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

- Recruit responsible children to be part of a maintenance committee. They'll lead other children in carrying out and documenting daily or weekly inspections. Give the designated student a title that he or she will be proud of, and rotate the position to give several students the opportunity to participate.
- Teach kids what to look for: splinters, loose hardware, broken equipment, graffiti, vandalism, litter, water puddles, and any debris mixed in with the surfacing. They can also check to see that all accessible routes are clear, and that the surfacing is evenly raked (be sure to check in high-use areas such as swings and slides).
- Sponsor an individual, class or neighborhood competition: Who can pick up the most trash? Rake the biggest area of safety surfacing? Recruit the most volunteers for clean-up day?
- Make maintenance a habit: Have teachers set aside a specific day and time that children will be responsible for checking equipment and cleaning the playspace.

- Consider having at least one fundraiser per year that children can participate in, with the proceeds going to playspace maintenance.

Playspace management: Questions to address

Many old, run-down playspaces have fallen through administrative cracks for one simple reason — nobody knows who's in charge. Therefore, any comprehensive maintenance plan should assign responsibility for the different aspects of playspace upkeep and management. When creating your management plan, bring in all playspace stakeholders, and be sure to reach agreement on these important questions:

- Who will be held accountable for timely cleaning and repairs?
- Who will be responsible for documentation and record-keeping?
- How should playspace damage be reported, and to whom?
- How should vandalism or illegal behavior on the playspace be reported, and to whom?
- What does the warranty cover?
- What role will the play equipment company and/or installers play in ongoing maintenance?
- If repairs are required, how will contractors be chosen?
- Will volunteers be engaged in repair work? If so, how? Who will be responsible for organizing volunteer efforts?
- How can we involve children and youth in the regular inspections, cleaning and maintenance of the playspace?
- What do the relevant insurance policies cover?
- What is the procedure for ordering equipment replacements through the original company?
- In whose name will the maintenance fund be kept? How many people will have access to it?
- Who will be responsible for playspace bookkeeping?
- Who will be responsible for spending decisions related to the playspace?

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Avoiding damage and vandalism

It's everyone's worst nightmare...waking up one morning to find that your new playspace 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 playspace from vandals is to prevent it from happening in the first place. Install overhead 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 weekend nights, 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 positive 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 Hatton of the Citizens' Congress of Nicetown (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,

because she believed in something. And she was right.

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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 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.
2. Did your team achieve its planned goals and objectives? If not, why?
3. In what circumstances was your team especially effective?
4. In what circumstances was your team not so effective?
5. How much time would you guess an average team member spent on playspace planning per week?
6. Regarding your team, what would you do differently next time, and why?
7. What would you do exactly the same?
8. Additional comments:

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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 as 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.

Prune woody trees and shrubs when dormant between December and February.

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 moisture 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.

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.

Any deciduous leaves can be used, a variety is even better.

Rake leaves to fill the leaf cage.

A measuring stick records the changing height of the leaf pile during the process.

Leaf mold keeps decomposing through the winter and into spring.

Turn and stir the leaf mixture to help the breakdown.

One or two years later, leaf mold is ready to spread on garden beds. In dry conditions it may take several years to create leaf mold that is as dark and rich as shown.

cdac community design assistance center
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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.

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, with irregular water and sun conditions.

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 clear 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.

If weeding is neglected for months at a time, weeds will become more permanent inhabitants of the outdoor classroom as they disperse their seeds and spread their roots underground.

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.

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.

Weeds ready to be removed in cracks between pavers in a gathering area.

Weeds encroaching on a designate pathways - these weeds look small in May or June, yet can take over a site, and completely hide a pathway, if left alone until September.

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 flower, the bulb's leaves and flower buds push out of the earth. A few weeks later blossoms are ready to discover and observe.

Once planted, bulbs multiply and will bloom year after year. Plant 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 blossom, 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.learner.org/jnorth/tulip/index.html

Bulb planting tips:
www.learner.org/jnorth/tm/tulips/Planting.html

Outdoor writing - observing tulips and daffodils.

Crocus

Narcissus

Alliums

Section 3.3: Appendix - Attached Reference Materials

Create a Maintenance Plan

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, mowing, 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:


Frank Marsden

- Create a "Most Unwanted" species lists 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.

Borders

One of the most common frustrations for a Schoolyard Habitat project occurs when it is accidently 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.


AE

Summer weeding and watering are common challenges of Schoolyard Habitat projects. Be sure you have a plan in place to address this challenge.

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 springs 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 resource 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**

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.

FIRST TWO YEARS				
Category	Tasks	Responsible	Assist	Consult
Water	Monitor weekly rainfall	Mrs. Jones's 6th grade class and Mrs. Hogan's Summer Habitat Scouts	PTA members	Maintenance supervisor and Assistant Principal
	Monthly check on irrigation equipment including timers and hoses	Maintenance supervisor	Assistant Principal	Schoolyard Habitat Team
Plants	Monthly monitoring and removal of invasive non-natives	Mrs. Jones's 6th grade class and Mrs. Hogan's Summer Habitat Scouts	Schoolyard Habitat Team	Maintenance supervisor and Assistant Principal
	Every spring new trees are planted to replace any mortality from previous year	Mr. Casey's 8th grade class	Schoolyard Habitat Team	Maintenance supervisor and Assistant Principal
Structure	Monthly monitoring and reporting of any vandalism issues	Schoolyard Habitat Team	PTA members	Assistant Principal
ONGOING				
Category	Tasks	Responsible	Assist	Consult
Plants	Monthly monitoring and removal of invasive non-natives	Mrs. Jones's 6th grade class and Mrs. Hogan's Summer Habitat Scouts	Schoolyard Habitat Team	Maintenance supervisor and Assistant Principal
Structure	Benches, sign and fence are repaired as needed	Maintenance supervisor	Assistant Principal	Schoolyard Habitat Team
	Trail head is mulched and trail maps are in stock	Mrs. Hogan's Summer Habitat Scouts	Schoolyard Habitat Team	Assistant Principal

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.

SHORT-TERM	MONTH	LONG-TERM
Water as necessary.	January	Clean out nest boxes.
Water as necessary.	February	
Weed, remove invasive species. Water as necessary.	March	Monitor and remove invasive species.
Monitor species survival rates. Water as necessary.	April	
Weed and add mulch if needed. Water as necessary.	May	
Water as necessary.	June	
Water as necessary.	July	Monitor for drought.
Water as necessary.	August	
Weed and remove invasive species. Water as necessary.	September	Monitor and remove invasive species.
Monitor species survival rates and prepare for additional planting if necessary. Water as necessary.	October	
Water as necessary.	November	Mow half of meadow.
Water as necessary.	December	

6 Maintenance Strategy

A well-planned and organized maintenance strategy will protect your investment of energy, resources, money and time.

- Over time, the need for maintenance will decrease—but the more you plan for it in the beginning, the less work there will be later.
- Have one person oversee the maintenance plan to ensure the work is done.
- Realize that assessment of maintenance needs is on-going as conditions change.

WHEN MAKING YOUR MAINTENANCE PLAN CONSIDER THE FOLLOWING:


Laura Berman

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 (see Watering Issues). 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.

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 year to develop a good root system.

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 re: 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.**

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. Replace or remove any 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 - not make new ones! If new paths develop indicating a usage pattern, consider making the path a permanent one.

TIPS

- Weed before they form seed heads!
- Pull the whole plant—roots too!
- Remember: it's easier to weed after it rains!
- Weeds on pathways can be killed by pulling, cutting back or mowing and then applying boiling water or vinegar.


Don Morton

8. **Mulching, trimming and pruning—**Scheduling these activities will keep your plants healthy and protected. Mulch in the spring, prune in February and trim 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

summer. Reward their time with a share of fruits, vegetables or flowers at harvest time. Be sure to have this organized by mid May.

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.

Volunteers rarely like to work alone. Consider the buddy system so they can help each other out. A calendar with names and phone #'s facilitates collaboration.

Start work parties early in the AM while it is cool. Plan a breakfast break with fresh fruit, bagels, muffins and juice to make it a festive work party.

- 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, chocking 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.

Section 3.3: Appendix - Attached Reference Materials

Common Plants and Their Toxicity

Common Plants and Their Toxicity - UC Davis Medical Center Regional Poison Control Center

African Violet Saintpaulia	1	Jade Plant Crassula argentea	1
Agapanthus	3, 5	Jequerity Bean Arbus precatorius	4
Agapanthus, Pink Nerine bowdenii	3, 7	Jerusalem Cherry Solanum pseudocapsicum	4
Albizzia	1	Jimson Weed Datura stramonium	4
Aloe Vera	3	Juniper Juniperus species	3, 5, 7
Aluminum Plant Pilea cadierei	1	Katanchoe	1
Alyssum	1	Lady Slipper Orchid Cypripedium	5
Amaryllis belladonna	3	Lantana camara	4, 7
Apple Tree Malus species	4, 7	Larkspur Delphinium species	4
Apricot Tree Prunus armeniaca	4, 7	Licorice Plant	
Aralia Japanese Fatsia japonica	1	Glycyrrhizian lepidata	4, 7
Arrowhead Vine Syngonium podophyllum	2	Lilac Syringa	1
Asparagus Fern Asparagus setaceus or sprengeri	1	Lily of the Nile Agapanthus africanus	5
Avocado Persea americana	6, 7	Lily of the Valley Convallaria species	4
Azalea Rhododendron occidentale	4	Lipstick Plant Aeschynonthus lobbianus	1
Baby Tears Hekine soleirolii	1	Liquidambar	1
Baby's Breath Gypsophyla	1	Lobelia Species	4, 5
Bachelor Buttons Centaurea cyanus	1	Lupine Lupinus	4, 7
Begonia Begonia species	2	Magnolia stellata	1
Birch Tree Betula species	3, 5	Manzanita Arctostaphylos	1
Bird of Paradise Stelitzia reginae	6	Maple Tree Acer species	1, 7
Bird's Nest Fern Asplenium nidus	1	Marble Queen Pothos Scundapsus aureus	2
Black Acacia Robinia pseudoacacia	4, 7	Marigolds Calendula or Tagets	1
Black Locust Robinia pseudoacacia	4, 7	Mimosa Pudica	1
Boston Fern Nephrolepsis exalta	1	Mistletoe Phoradendron flavescens	6
Bottle Brush Callistemon species	1	Mock Orange Philadelphus species 1, Pittosporum tobira 1, Prunus caroliniana	4
Bougainvillea	1	Morning glory Lpomoca species	4
Boxwood Buxus sempervirens	3, 5	Mother-in-Law Tongue Sansevieria trifasciata	3
Cactus	1, 5	Mountain Laurel Kalmia latifolia	4
Caladium Caladium species	2, 5	Mulberry Tree Morus species	1
Calendula officinalis	1	Naked Lady Lycoris or Amaryllis	3
California Poppy Eschscholzia californica	6	Nandina domestics	6, 7
Calla Lilly Calla palustris	2	Nephthytis Syngonium podophyllum	2
Camelia Thea japonica	1	Nightshade, Black Solanium nigrum	4
Camphor Tree Cinnamomum camphora	4	Norfolk Island Pine Araucarica excelsia	1
Canna Lily Canna generalis	1	Oak Tree Quercus species	4, 7

1=Non-toxic 2=Oxalates 3=Minor Toxicity 4=Major Toxicity 5=Dematitis 6=Possibly Toxic 7=Animal Toxicity

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Carnation Dianthus caryophyllus	4	Oleander Nerium oleander	4, 5
Carolina Jasmine Gelsemium	4, 5	Orchid Cattleyas or Oncialum	1
Castor Beans Ricinus communis	4	Oregon Grape Mahonia acquifolium	1
Catalpa Speciosa	1, 5	Ornamental Pepper Solanum pseudocapsicum	4
Catnip Nepeta cataria	1	Ornamental Plum Tree Prunus Species	4
Cedar Thuja species	3, 5	Palm Species	1, 5
Century Plant Agave	3, 5	Pansy Viola tricolor	3
Cherry Tree Prunus	4, 7	Peach Tree Prunus persica	4, 7
China Berry Melia azedarach	4	Peperomia Species	1
China Doll Leea coccinea	1,	Petunia Species	1
Radermachera pentandra	1	Philodendron Species	2
Chinese Evergreen Aglaonema modestum	2	Photinia arbutifolia	4
Christmas Cactus Zygocatus truncates or Schlumbergera bridgesii	1	Piggyback Plant Tolmiea memziesii	1
Chrysanthemum Species	3, 5	Pilea	1
Coffee Tree Plant Polyscias guilfoyei	4, 5	Pine Tree Species	6, 7
Coleus Species	1	Pittosporum tobira	1
Coreopsis	1	Poinsettia Euphorbia pulcherrima	6
Corn Plant Draceana fragrans massangeana Cosmos	1	Pokeweed Phytolacca americana	4
Cotoneaster	6	Potato Plant Solanum tuberosum	4, 7
Crape Myrtle Lagerstroemia indica	1	Pothos Epipreumnum aureum	2
Creeping Charlie Glechoma hederacea	3	Prayer Plant Maranta Leuconeura	1
Creeping Charlie Lysimachia nummularia	1	Pregnant Onion Ornithogalum caudatum	4, 5
Creeping Charlie Pil nummularifolia	1	Pregnant Plant Kalanchoe pinnata	1
Creeping Fig Ficus pumilia	5	Privet Ligustrum Species	4
Crocus Species (Spring blooming only)	1	Purple Passion Plant Gynura sacramentosa	1
Crown of Thorns Euphorbia milli	3, 5	Purple Velvet Plant Gynura Species	1
Cyclamen	4	Pyracantha	3, 5
Daffodil Narcissus	3	Ranunculus	3, 5, 7
Dahlia Species	1	Redwood Tree Sequoia sempervirens	3, 5
Daisy Chrysanthemum	3, 5	Rhodondendron Species	4
Dandelion Taraxacum officinale=	1	Rhubarb Leaf Rheum species	2, 5
Daphne	4, 5	Rosary Beads Ibrus precatorius	4
Delphinium Species	4	Rosary Vine Crassula rupestris	1
Devil's Ivy Epipremnum aureum	2	Rose Rosa species	1, 5
Dieffenbachia Species	2	Rubber Tree Ficus elastica decora	1, 5
Donkey Tail Sedum morganianum	1	Sago Plant Cycas revoluta	4, 7

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Dracaena Species	1, 7	Schefflera Brassaia actinophylla	2, 5, 7
Dumbcane Dieffenbachia amoena	2	Sedum	1
Elderberry Sambucus	4, 7	Sensitive Plant Mimosa pudica	1
Elm Tree Ulmus species	5	Silk Tree Albizzia	1
Emerald Ripple Peperomia caperata	1	Snake Plant Sansevieria trifasciata	3
English Ivy Hedera helix	4, 5	Snap Dragon Antirrhinum species	1
Escallonia	1	Snowberry Symphoricarpos racemosus	3
Eucalyptus globulus Species	3	Spathiphyllum	2
Euonymus	4	Spider Plant Chlorophytum comosum	1
False Aralia		Split Leaf Philodendron Monstera deliciosa	2, 5
Dizygotheca elegantissima	1	Spruce Tree Picea species	6, 7
Ficus Benjamina	5	Star Jasmine Trachelospermum jasminoides	1
Fiddleleaf Fig Ficus lyrata	5	Stephanotis	1
Fir Abies or psuedotsuga	1	String of Hearts Creopegia woodii	1
Forget-me-nots Myosotis	1	String of Pearls Senecio rowleyanus or herreianus	4
Four-o'-clocks Mirabilis jallapa	4, 5	Swedish Ivy Plectranthus australis	1
Foxglove Digitalis purpurea	4	Sweet Pea Lathyrus odoratus	3, 7
Fuchsia Species	1	Sweet William Dianthus barbatus	3
Gardenia jasminoides	1	Ti Plant Cordyline terminalis	1
Geranium Pelargonium	5	Toyon Photinia arbutifolia	4
Geranium, California Senecio petasitis	4	Tulip Tulipa	5
Gladiola	3, 5	Umbrella Plant Cyperus altemifolius	3
Gloxinia Sinningia Speciosa	1	Umbrella Tree Scheffiera actinophylla	2, 5
Grape Ivy Cissus rhombifolia	1	Verbena Species	5
Grevillea Species	1, 5	Viburnum Species	1
Heavenly Bamboo Nandina domestics	6, 7	Vinca Species	4
Hen and Chicks Sempervivum tectorum	1	Violas Species	3
Hibiscus	1	Virgina Creeper Parthenocissus quinquefolia	2
Holly Ilex	3	Walnut Tree Black Juglans nigra	5
Honeysuckle Lonicera	6	Wandering Jew Tradescantia albifora	5
Hoya Wax plant	1	Wandering Jew, Red or White Zebrina pendula	1
Hyacinth Hyacinthus orientalis	3, 5, 7	Wax Plant Hoya comosa	1
Hydrangea Species	3	Weeping Fig Ficus benjamina	5
Ice Plant Aptenia cordifolia or Lampranthus	1	Wisteria	4
Impatiens	1	Xylosma	1
Indian Hawthorn Raphiolepis Indica	1	Yellow jessamine Gelsemium	4, 5

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Indian Laurel Ficus nitida	5	Yew Taxus species	4
Iris	3, 5	Yucca	1
Ivy Hedera Helix	4, 5	Zebra Plant Aphelandra squarrosa	1
Jack in the Pulpit Arisaema triphyllum	2, 5	Zinnia	1

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THE UNIVERSITY OF GEORGIA
COOPERATIVE EXTENSION
Colleges of Agricultural and Environmental Sciences & Family and Consumer Sciences

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.

Section 3.3: Appendix - Attached Reference Materials

Poisonous Plants in the Landscape

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

Plant Name	Botanical Name	Toxic Plant Part	Symptoms
Air potato	*Dioscorea bulbifera*	raw fruit	abdominal pain, nausea
Algerian Ivy**	*Hedera canariensis*	all parts	diarrhea, nervousness, labored respiration, convulsions
Allamanda	*Allamanda* spp.	all parts	nausea, high temperature, dryness of the mouth
Amaryllis	*Amaryllis* spp.	bulbs and seeds	gastrointestinal problems, vomiting, diarrhea
American Arborvitae**	*Thuja occidentalis*	leaves	low blood pressure, convulsions
Angel's Trumpet**	*Datura* spp.	all parts	blurring of vision, delirium
Anise-tree**	*Illicium floridanum, Illicium anisatum*	leaves	abdominal pain, vomiting, convulsions, death
Azalea	*Rhododendron* spp.	all parts	nausea, vomiting, weakness, dizziness, breathing difficulty, coma
Barberry	*Berberis* spp.	all parts	depressant action on the heart muscle
Black Locust	*Robinia pseudoacacia*	bark, seeds	nausea, weakness, depression
Boxwood	*Buxus sempervirens*	leaves	gastric, vomiting
Buckeye	*Aesculus* spp.	all parts	digestive irritant, nausea, vomiting
Caladium	*Caladium bicolor*	all parts	burning in mouth and throat, vomiting
Calla-lily	*Zantedeschia* spp.	all parts	burning and inflammation of the mouth and throat
Castor bean	*Ricinus communis*	seeds	burning in mouth and throat, gastric and intestinal problems
Century Plant	*Agave americana*	leaves	vomiting, diarrhea
Cherry (all species)	*Prunus* spp.	leaves, bark, seeds	gasping, nervous disorder
Clematis	*Clematis* spp.	all parts	gastrointestinal irritation
Crinum Lily	*Crinum* spp.	bulb	vomiting, diarrhea
Delphinium**	*Delphinium* spp.	all parts	digestive upset, nervous excitement or depression
Elderberry	*Sambucus canadensis*	root, bark, stem, leaves	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.
Elephant Ear**	*Colocasia esculenta*	all parts	intense burning and irritation of the tongue
English Ivy**	*Hedera helix*	leaves, stems, fruits	headache, fever, anxiety, breathing difficulty, coma
Eucalyptus**	*Eucalyptus* spp.	leaves	nausea, vomiting, diarrhea, weakness, respiratory difficulty

False Indigo**	*Baptisia* spp.	all parts	paralysis
Firethorn	*Pyracantha* spp.	berries	stomach ache, blistering of tongue, vomiting
Four-o-clock	*Mirabilis jalpa*	root, seeds	vomiting, diarrhea, abdominal pain
Ginkgo (female)	*Ginkgo biloba*	fruit	violent stomach pain, kidney disorders
Gloriosa Lily	*Gloriosa superba*	all parts	numbness of lips, tongue and throat, nervous system paralysis
Holly	*Ilex* spp.	Berries	vomiting, diarrhea
Honeysuckle, Japanese and Trumpet**	*Lonicera japonica, Lonicera sempervirens*	all parts	diarrhea, pupil dilation, irregular heartbeat, respiratory failure, coma
Hydrangea, Oakleaf Hydrangea, Bigleaf Hydrangea, Smooth	*Hydrangea quercifolia, Hydrangea macrophylla Hydrangea arborescens*	leaves, bark	gastric, intestinal, convulsions
Impatiens, balsam	*Impatiens* spp.	stem, leaves, root	vomiting, diarrhea
Iris	*Iris* spp.	underground stems	severe digestive tract discomfort
Jack-in-the-Pulpit	*Arisaema* spp.	all parts	mouth and throat irritation, vomiting
Juniper	*Juniperus* spp.	berry-like seeds	kidney damage
Lantana**	*Lantana* spp.	fruit	gastric, vomiting, diarrhea, circulatory collapse
Lily-of-the-Valley	*Convallaria majalis*	all parts	nausea, vomiting, diarrhea, irregular heartbeat and pulse, mental confusion
Lilies** (Rain Lily, Atamasco Lily, Easter Lily)	*Zephyranthus* spp.	all parts	dizziness, stomach pain, collapse, fatal to livestock
Mahonia	*Mahonia* spp.	all parts	depressant action on the heart muscle
Mimosa	*Albizzia* spp.	all parts	intestinal irritation
Morning Glory	*Ipomoea* spp.	seeds, root	hallucinations, vomiting, diarrhea, muscle tightness
Mountain Laurel**	*Kalmia latifolia*	leaves, twigs, flowers	gastric, paralysis, convulsions
Oleander**	*Nerium oleander L.*	all parts	dizziness, irregular heart beat, nausea, convulsions, death. This is one of the most toxic ornamental plants in the southeast
Ornamental Tobacco**	*Nicotiana* spp.	all parts	weakness, diarrhea, abdominal pain, paralysis
Periwinkle (vine)	*Vinca minor*	all parts	intestinal irritation
Periwinkle (annual)	*Catharanthus roseus*	all parts	hallucinations, damage to liver, kidney, nervous system
Plumbago	*Plumbago* spp.	leaves, stems	stomach pain
Privet	*Ligustrum* spp.	fruit	nausea, headache, abdominal pain, vomiting, diarrhea, low blood pressure
Sago Palm	*Cycas revoluta*	seeds, roots, trunk pith	headache, vomiting, stomach disorders
Sweet shrub	*Calycanthus floridus*	seeds	affects central nervous system, spasms, increased heart rate
Trumpet Creeper (Chalice Vine)	*Campsis radicans*	all parts except fruit	gastric irritation, dilated pupils, numbness in hands
Virginia Creeper (Woodbine)	*Parthenocissus quinquefolia*	berries, leaves	nausea, bloody vomiting, abdominal pain, kidney damage, headache
Wisteria	*Wisteria* spp.	pods, seeds	stomach pain, diarrhea, nausea, vomiting
Yew**	*Taxus* spp.	berries, foliage	foliage more toxic than berries, death can be sudden without symptoms

References:

Perkins, Kent D. and Payne, Willard. Guide to Poisonous and Irritant Plants of Florida, Circular 441, Florida Cooperative Extension Service.
Westbrooks, Randy G., & James W. Preacher. 1986. *Poisonous Plants of Eastern North America.*
Texas A&M University Web Site, "Poisonous Plants."
Mississippi State Extension Web Site, "Poisonous Plants."
Georgia Poison Control Center fact sheet.