Morganton, NC: Trail and Natural Resource Enhancement Stewardship Plan

PROJECT TEAM

Elizabeth Gilboy
Director

Lara Browning
Landscape Architecture Project Coordinator

Amy Eliason
Undergraduate Student, Landscape Designer

Carter Gresham
Undergraduate Student, Landscape Designer

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.

CDAC Team Members: Lara Browning, Amy Eliason, Elizabeth Gilboy, and Carter Gresham

Community Design Assistance Center
101 South Main Street, Blacksburg, Virginia 24060
p: 540.231.5644    f: 540.231.6089
w: http://cdac.arch.vt.edu
The work upon which this publication is based was funded in whole or in part through a grant awarded by the Southern Region, State and Private Forestry, U.S. Forest Service.

In accordance with Federal Law and US Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, or disability.

To file a complaint of discrimination, write USDA Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Ave., SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity employer.
The team would like to acknowledge the following individuals for their contributions and tireless involvement throughout the project.

Mr. Michael Helmick, Ph.D
President, Western Piedmont Community College

Mrs. Sandy Hoilman
Vice President for Administrative Services/Chief Financial Officer, WPCC

Mr. Lee Kiser
Dean, Workforce and Professional Development, WPCC

Mr. Andrew Kota
Stewardship Director, Foothills Conservancy

Mr. Lee Anderson
Director, City of Morganton Development and Design Services

Ms. Nancy Stairs
Coordinator, Urban and Community Forestry Program, North Carolina Forest Service

Mr. Eric Muecke
Western Urban Forestry Specialist, North Carolina Forest Service

Mr. Brian Fuller
Virginia Outdoors Foundation, Design Review Panelist
**Morganton, NC: Trail and Natural Resource Enhancement Stewardship Plan**

**TABLE OF CONTENTS**

<table>
<thead>
<tr>
<th>Section 1: Introduction</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 General Maintenance</td>
<td>7</td>
</tr>
<tr>
<td>1.1.1 Levels of Maintenance</td>
<td>7</td>
</tr>
<tr>
<td>1.1.2 Long-term vs. Short-term Maintenance</td>
<td>7</td>
</tr>
<tr>
<td>1.1.3 Maintenance Checklist &amp; Schedule</td>
<td>7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section 2: Stewardship by Project Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Tree Planting and Care</td>
<td>10</td>
</tr>
<tr>
<td>2.1.1 Planting</td>
<td>10</td>
</tr>
<tr>
<td>2.1.2 Care</td>
<td>14</td>
</tr>
<tr>
<td>2.2 Controlling Nonnative Invasive Plants</td>
<td>20</td>
</tr>
<tr>
<td>2.2.1 Effective Treatments</td>
<td>20</td>
</tr>
<tr>
<td>2.2.2 Selective Herbicide Application Methods</td>
<td>20</td>
</tr>
<tr>
<td>2.2.3 Selecting an Effective Herbicide</td>
<td>21</td>
</tr>
<tr>
<td>2.2.4 Other Treatments</td>
<td>22</td>
</tr>
<tr>
<td>2.2.5 Rehabilitation Phase</td>
<td>22</td>
</tr>
<tr>
<td>2.3 Natural Pest and Disease Control</td>
<td>24</td>
</tr>
<tr>
<td>2.3.1 Prevention</td>
<td>24</td>
</tr>
<tr>
<td>2.3.2 Beneficial Insects</td>
<td>24</td>
</tr>
<tr>
<td>2.3.3 Physical Pest Control Solutions</td>
<td>25</td>
</tr>
<tr>
<td>2.3.4 Organic Insecticides</td>
<td>26</td>
</tr>
<tr>
<td>2.4 Habitats</td>
<td>28</td>
</tr>
<tr>
<td>2.4.1 Meadow</td>
<td>28</td>
</tr>
<tr>
<td>2.4.2 Naturalized Open Space</td>
<td>29</td>
</tr>
<tr>
<td>2.4.3 Rain Gardens</td>
<td>29</td>
</tr>
<tr>
<td>2.4.4 Orchard</td>
<td>31</td>
</tr>
<tr>
<td>2.5 Trail Systems</td>
<td>34</td>
</tr>
<tr>
<td>2.5.1 Short-term Maintenance</td>
<td>34</td>
</tr>
<tr>
<td>2.5.2 Long-term Maintenance</td>
<td>36</td>
</tr>
<tr>
<td>2.6 Playgrounds</td>
<td>41</td>
</tr>
<tr>
<td>2.6.1 Natural Play</td>
<td>41</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section 3: Appendix</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Appendix - Online Resources</td>
<td>45</td>
</tr>
<tr>
<td>3.2 Appendix - Book Reference Materials</td>
<td>48</td>
</tr>
<tr>
<td>3.3 Appendix - Attached Reference Materials</td>
<td>49</td>
</tr>
</tbody>
</table>
SECTION 1: INTRODUCTION
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:
SECTION 2: STEWARDSHIP
BY PROJECT TYPE
2.1 Tree Planting and Care

2.1.1 Planting

Pre-Installation

Step 1: Check above ground
Do not plant a tree where it will interfere with buildings, overhead utility lines, pavement, or intersection sightlines as it gets bigger. Make sure the planting spot is at least:

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

![Diagram showing planting distance](image)

Step 2: Check below ground
At least 72 hours in advance of planting, call the underground utility locating service in your area to be sure that there are no buried utilities where the tree will be planted. Most services will mark utilities (electric, cable, or gas) for free. 1-888-258-0808

Step 3: Check laws
Check with your town or municipality to see if there are any laws regarding planting and pruning.
**Installation**

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

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

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

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

![Image](https://via.placeholder.com/150)

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](http://www.treeownersmanual.info).

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

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

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

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

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

![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.](image)

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

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

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

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

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

**Step 11: Water**
Water the root ball and entire backfilled area.
**Step 12: Mulch**

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.

![Diagram of proper mulching technique](www.treeownersmanual.info)

**2.1.2 Care**

**Watering**

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

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

![Diagram of tree watering](www.treeownersmanual.info)
Section 2.1: Tree Planting and Care

* 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, horticulturists, 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
**Morganton, NC: Trail and Natural Resource Enhancement Stewardship Plan**

**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 inspected after storms for broken, dead, or hanging branches. Cracks, fungi, branch unions, or a weak trunk on a leaning trunk should be treated quickly.

**Pruning**

Pruning can be dangerous in certain situations. Hire an arborist or contact the appropriate people to prune if the following applies:

- Pruning cannot be done with both feet on the ground
- Trees or branches are located within 10 feet of utility lines
- Pruning requires power equipment

Pruning is important for public safety and tree health. It can encourage trees to develop a strong structure which can reduce the amount of damage during severe weather.
Pruning for public safety involves removing branches that could fall and cause injury or property damage, trimming branches that interfere with sight lines of streets or driveways, and removing branches that could grow into utility lines.

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

**Pruning Young Trees**

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

**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.
Section 2.1: Tree Planting and Care

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.

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.

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.
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:
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
Section 2.2: Controlling Nonnative Invasive Plants

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 reinstate successions after eradicating nonnative plants, but if not, native plants should be seeded or planted. Tree nurseries operated by state forestry agencies are a good source for many species of native trees and shrubs. Native plant seed can also be used, but proper
sowing and planting would be required to assure fast germination. To ensure the success of a project, constant surveillance, treatment of new invasives, and rehabilitation following eradication are critical to preventing and controlling invasions of nonnative species.

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

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

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

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

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

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

2.3.3 Physical Pest Control Solutions

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

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

Section 2.3: Natural Pest and Disease Control

Sources:


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 efficient for a community. Creating a naturalized open space can be as easy as to stop or limit mowing and letting natural processes of growth take back an area. Sometimes this can still be difficult for a maintenance staff because of the preconceived image that parks or open spaces should be neatly groomed. Limiting the mowing to once a year will allow only a certain amount of succession to take place while over time, if an open space is not mowed it can transition into a shrubland and eventually a forest. The frequency of mowing should be based on your community’s desires and needs. Below is a list of tasks involved in maintaining a successful naturalized open space.

- Limit mowing to once a year or DO NOT mow! For example, a local farmer could cut and bale the grass in the spring or fall.
- Maintain its natural appearance. By limiting mowing, natural succession can begin again.
- Remove fallen trees or branches that pose a hazard especially if there are trails in the area.
- Inspect for disease and insect outbreaks regularly. (Refer to Section 2.3 Natural Pest and Disease Control)
- Post and maintain appropriate signage to limit unwanted mowing or to explain that the area is a naturalized open space in progress. This will hopefully explain to communities why the area may not look as groomed as other areas.
- Control and reduce invasive plant species. (Refer to Section 2.2 Controlling Nonnative Invasive Plants)

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

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

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

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

**Monitoring**
- Rain gardens should be inspected monthly.
- Clear any dead vegetation and debris that may have collected.
- Replanting may be necessary over time. If a plant is not thriving in one location of the garden, try relocating it to a wetter or dryer area.
2.4.4 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.


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

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

Fertilize

- Test soil prior to planting and every year thereafter at the same time of year. Add nutrients based on the soil test as needed.

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:


Morganton, NC: Trail and Natural Resource Enhancement
Stewardship Plan

**Section 2.4: Habitats**

**Maintaining a Rain Garden.** Crystal Environmental Quality Commission. 

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

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)

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%. 
Recreate outslopes as needed. Soil often moves to the outside of trail treads during use. It moves uphill to form berms and downhill to form sloughs. Move displaced soil toward the center of the trail to recreate outslopes. Afterward, compact the new tread to prevent soil displacement and erosion.

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

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

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

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

- Identify trail segments that are not sustainable and prone to erosion. Consider hiring a trail expert to survey the trail system and identify segments with steep slopes and/or TSAs. Alternatively, survey the trail system yourself and identify segments that intercept and carry larger volumes of water during rainstorms. Plan and implement strategies to replace these segments. Avoid wasting staff and budget resources by maintaining these segments: Closure and/or relocation will be less costly long-term.
- Build trails with grades of 10% or less. These will be less prone to erosion than steeper slopes. If necessary, build reinforce short sections of steeper slopes with gravel and/or rock.
- Locate trails along "side-hill" alignments as much as possible. Such trails follow contour lines. They do not travel steeply up or down them. As a result, they are less prone to erosion. (See Figure 1)
- Encourage sustainable amounts of soil compaction. Compaction is helpful in preventing soil erosion and muddiness if the tread surface doesn’t become too consolidated. Locate trails in areas with a variety of soil and rock sizes. This is the best type of soil for compaction. If trail systems are located in areas without naturally-available varied soil sizes, mix gravel and/or rocks to create optimal conditions.
- Prevent trails from becoming wide. Narrower trails lessen runoff. Limit trail width by placing large rocks or the butt ends of logs on either side of trails. If appropriate, encourage encroaching vegetation to grow closer to the trails' boundaries. These techniques will encourage users to use narrower sections of trails.
- Increase the amount of rock in trails. Add rock steps, stepping stones, rock armoring, or gravel. Mix angular gravel and/or rock of varying sizes with local soil to create an erosion-resistant and aesthetically-pleasing surface.

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

Sources:

**Environmentally Sustainable Trail Management.** Jeffrey L. Marion and Yu-Fai Leung.
Morganton, NC: Trail and Natural Resource Enhancement Stewardship Plan

Section 2.5: Trail Systems


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


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

Trail Solutions: IMBA’s Guide to Building Sweet Singletrack, Section 7 “Trail Maintenance”. IMBA International Mountain Bicycling Association
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 spiny 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 determined appropriate for your community (ie. once a week, twice a week, once a day etc.)
- During the cold season (November – March) this will not need to be as frequent, but a regular schedule should be developed based on your community’s needs.

**Vandalism**

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

**Storm Cleanup**

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

**Signage**

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

**Other Features**

- Inspect wooden elements monthly for rotting and hazardous areas. Use child-friendly, non-toxic wood preservative if wooden elements need resurfacing.
- Inspect benches, trash containers, picnic tables, drinking fountains, and other site amenities at least monthly. Repair or replace as needed.
Morganton, NC: Trail and Natural Resource Enhancement Stewardship Plan

Section 2.6: Playgrounds

Sources:


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

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

**Poisonous Plants in the Landscape.** Robert R. Westerfield and Gary L. Wade, The University of Georgia Cooperative Extension. [http://extension.uga.edu/publications/files/pdf/C%20957_2.PDF](http://extension.uga.edu/publications/files/pdf/C%20957_2.PDF)
SECTION 3: APPENDIX
3.1 Appendix - Online Resources

Section 2.1 Tree Planting and Care


Section 2.2 Controlling Nonnative Invasive Plants


Section 2.3 Natural Pest and Disease Control


Section 2.4 Habitats


Morganton, NC: Trail and Natural Resource Enhancement Stewardship Plan

Section 3.1: Appendix - Online Resources


Section 2.5 Trail Systems

Section 2.6 Playgrounds


What About Maintenance? Ron King, Natural Playgrounds Company LLC. www.naturalplaygrounds.com

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

Section 3.1: Appendix - Online Resources

Section 2.7 Schoolyard Gardens

**Composting.** Eartheasy: Solutions for Sustainable Living.  
http://eartheasy.com/grow_compost.html


**How to Install and Maintain a Rain Barrel.** City of Chicago.  


**Schoolyard Habitat Project Guide.** U.S. Fish & Wildlife Service.  


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

**Poisonous Plants in the Landscape.** Robert R. Westerfield and Gary L. Wade, The University of Georgia Cooperative Extension.  
http://extension.uga.edu/publications/files/pdf/C%20957_2.PDF
Section 3.2: Appendix - Book Reference Materials

3.2 Appendix - Book Reference Materials

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


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

Trail Solutions: IMBA’s Guide to Building Sweet Singletrack, Section 7 “Trail Maintenance”. IMBA International Mountain Bicycling Association
Chapter 3.3: Appendix - Attached Reference Materials


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

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 aphid 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 predaceous 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 beetles 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 margarids 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.
section. (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 cabbage worms 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. 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, cabbage worms, 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. 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.

Cutover worms. USB 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 squash 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-eating fowl will devour practically any insect that moves, including ticks, grasshoppers, Colorado potato beetles, slugs and more. Ducks are reportedly sharp slug-sackers, whether you let them work over the garden in spring and fall or enlist a pair as your assistants throughout the growing season. Chickens work best in winter, because their scratching can damage crops during the growing
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+.

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

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.

**Recycle kitchen and yard waste:** Composting can divert as much as 30% of household waste away from the garbage can.

**Introduces beneficial organisms to the soil:** Microscopic organisms in compost help aerate the soil, break down organic material for plant use and ward off plant disease.

**Good for the environment:** Composting offers a natural alternative to chemical fertilizers.

Reduces landfill waste: Most landfills in North America are quickly filling up; many have already closed down. One-third of landfill waste is made up of compostable materials.

---

**What to Compost**

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

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, lawn clippings,, grass clippings, and green leaves. 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 shreading, 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 compost, rather than build your own compost pile, you may consider buying a rotating compost tumbler which makes it easy to mix the compost regularly.

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

Carbon - carbon-rich matter (like branches, stems, dried leaves, peels, bits of wood, bark dust or sawdust pellets, shredded brown paper bags, corn stalks, coffee filters, onion skins, 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 WOBI 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 normally used as a fertilizer because it is low in nutrients.

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

Enclosed Compost Bins

For small-scale outdoor composting, enclosed bins are the most practical. The least expensive method is to build one yourself from a heavy-duty garbage can. Simply drill 1.5-cm aeration holes in rows at roughly 15-cm intervals around the can. Fill the can with a mixture of high-carbon and high-nitrogen materials. Stir the contents occasionally to avoid anaerobic pockets and to speed up the composting process. If the lid is secure, the bin can be laid on its side and rolled; a length of 2" cedar (use a 2 x 2 or a 2 x 4) 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 is possible to maintain relatively high temperatures in drum/tumbler systems, both because the container acts as insulation and because the tumbling keeps the microbes aerated and active. An interior "paddle" aids aeration and prevents clumping of the composting materials. This greatly speeds up the composting process.

An enclosed 'tumbler' system offers 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 nearly 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 to restore your compost pile, read our article "How to fix a soggy compost pile".

Matted leaves, grass clippings clumping together?
This is a common problem with materials thrown into the compost. 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 JK70.

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 exclusively as the growing medium. Compost is a source of rich organic matter which provides nutrients for growing plants, but should be thought of as one component of a healthy garden bed. To learn more about developing healthy soil, read our article: 6 Tips for Building Soil in your Raised Garden Beds and Planters.

Take advantage of autumn’s bounty.
The biggest challenge for small-scale backyard composting is finding enough carbon-rich materials to balance the regular input of nitrogen-rich materials which come from kitchen scraps, fruit and vegetable 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 should be 130 - 150 degrees F. It takes about 30 days at 140 degrees to kill all weed seeds.

2. Mix your pile.
While your compost may be hot in the center of the mass, the outside of the pile is cooler, giving seeds a chance to survive. Mixing brings cooler material to the warmer area and also increases aeration which helps sustain 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
Morganton, NC: Trail and Natural Resource Enhancement Stewardship Plan

Section 3.3: Appendix - Attached Reference Materials

Composting

Jora Insulated Compost Tumbler

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

Click to learn more about the Jora JK70 Composter

Urban Compost Tumbler - 9 cu ft

- Large capacity: heated chamber produces up to 120 lbs compost per batch. Back 100% recycled plastic heats up quickly for faster composting.
- Convenient design: easy to position on a wheelbarrow underneath. Large hopper opening.

Click to learn more about the Urban Compost Tumbler 9

Stainless Steel Compost Keeper - Prevent odors:

- 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 Earthasy’s online store for compost tumblers, bins, and more!

Share this Article:

Sign up to our newsletters for updates and exclusive Earthasy content:
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 predators. Ground-dwelling birds rely on a range of cover types, such as nest cover to incubate eggs, loafing cover to rest between forays, and winter cover to store the remnants. Dry grass stalks bend over and form pockets of protection even during winter, when other plants are completely dormant. Another advantage of native warm season grasses is that they grow in clumps or bunches. Although many birds are 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.

Native warm season grass habitats are more productive for wildlife because they support a diverse range of species. For example, the bobwhite quail has become one of the best known and most widespread species throughout Virginia in the last century. Although the state’s bobwhite population has rebounded from a low of 20,000 in 1975, the population is still threatened. In addition to the bobwhite quail, 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.

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 nonetheless protects the area’s native warm-season grasses as much of its habitat works. These grasses are suitable for both large-scale farm plantings as well as smaller meadows that provide valuable wildlife habitats. 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 thrive.

Grassland Habitats Many of the existing “grassland” one commonly sees in Virginia’s rural landscape is not very accessible to birds woody shrubs or bushes. The spaces between the clumps are exposed patches of bare ground, and bird feeders should be placed above the ground to provide seed and habitat for the plants. In this environment, seeds and insects 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 predators. Ground-dwelling birds rely on a range of cover types, such as nest cover to incubate eggs, loafing cover to rest between forays, and winter cover to store the remnants. Dry grass stalks bend over and form pockets of protection even during winter, when other plants are completely dormant. Another advantage of native warm season grasses is that they grow in clumps or bunches. Although many birds are 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.
The landowner who stocks herock, native warm season grasses till the very end of summer when other grasses are drying. These grasses are very palatable to cattle, require little or no fertilizer, are disease resistant, and do not exhibit the endophyte (fungal) problem often associated with fescue. They can also be planted in summer, after the peak nesting time of ground-nesting birds, and should be mowed high (4 to 10 inches) for proper management, which also allows substantial wildlife cover.

For the ‘fancier’ landowner tired of mowing or raking all summer, native grasses can form an interesting landscape element that provides habitat beauty and a pleasing background to wildflowers. In addition, native grasses can be used of forever in field borders, fence strips, waterways, and roadsides.

Meadow Myths

Midwestern prairies are considered a climax plant community which means that the community of grassland plants which occur form in the last stage of succession in an area once used as farmland or even as a forest. These plants are dominant, the climax community stage. Any open field is in an early successional stage which will gradually evolve to a permanent meadow (you probably noticed this) or a drive through the country how abandoned fields sprout cedar trees within a few years). This means that if you want a native meadow to grow successfully, you can’t just walk away after the seeds or plugs are in the ground and forget maintenance. Remember, these plants are large and require at least two growing seasons (sometimes three) to become established. The most valuable point is to take home when planning a meadow of native warm season grasses is that these plants will respond with renewed vigor after a prescribed burn. 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 naturally drought tolerant and have a distinct survival advantage over non-native grasses during the summer months. In hot weather, fewer and other cool season plants will wilt, or you will be wasteful if the ground is cleared down to bare soil, then new grasses will not establish. If the objective is grazing land for livestock: 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 naturally drought tolerant and have a distinct survival advantage over non-native grasses during the summer months. In hot weather, fewer and other cool season plants will wilt, or you will be wasteful if the ground is cleared down to bare soil, then new grasses will not establish. If the objective is grazing land for livestock:

<table>
<thead>
<tr>
<th>Grasses</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little Bluestem</td>
<td>2 lbs.</td>
</tr>
<tr>
<td>Big Bluestem</td>
<td>3 lbs.</td>
</tr>
<tr>
<td>Switchgrass</td>
<td>2 lbs.</td>
</tr>
<tr>
<td>Shelter or Blackwell</td>
<td>1 lb.</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3 lbs.</td>
</tr>
</tbody>
</table>

The objective is to grow a native grass meadow. When planning a meadow of native warm season grasses to become established, the most valuable point is to take home when planning a meadow of native warm season grasses is that these plants will respond with renewed vigor after a prescribed burn. The following is a good mix for wildlife:

<table>
<thead>
<tr>
<th>Grasses</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big Bluestem</td>
<td>2 lbs.</td>
</tr>
<tr>
<td>Switchgrass</td>
<td>2 lbs.</td>
</tr>
<tr>
<td>Big Bluestem</td>
<td>3 lbs.</td>
</tr>
<tr>
<td>Indian Grass</td>
<td>2 lbs.</td>
</tr>
<tr>
<td>TOTAL</td>
<td>7 lbs.</td>
</tr>
</tbody>
</table>

Order your seeds directly from a supplier who will prepare a customized mix. This way you will get exactly the species you want and the quantities you need, with no extra frills or expenses. Be sure to request Pure Live Seed (PLS) (live) seed that is contained in a bag of bulk seed, since most native grass seed consists of other plant parts and chaff. A bag of bulk seed should contain at least 90% (90,000,000) viable seed.

Order your seeds directly from a supplier who will prepare a customized mix. This way you will get exactly the species you want and the quantities you need, with no extra frills or expenses. Be sure to request Pure Live Seed (PLS) (live) seed that is contained in a bag of bulk seed, since most native grass seed consists of other plant parts and chaff. A bag of bulk seed should contain at least 90% (90,000,000) viable seed.

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 mix that receives full sun more than eight hours a day. Also consider placement with regards to how whether you will be able to use the field for fire 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 "wildflower" meadow should be cut once a year (6-10 inches) to remove some benefit to wildlife.

Order your seeds directly from a supplier who will prepare a customized mix. This way you will get exactly the species you want and the quantities you need, with no extra frills or expenses. Be sure to request Pure Live Seed (PLS) (live) seed that is contained in a bag of bulk seed, since most native grass seed consists of other plant parts and chaff. A bag of bulk seed should contain at least 90% (90,000,000) viable seed.

Order your seeds directly from a supplier who will prepare a customized mix. This way you will get exactly the species you want and the quantities you need, with no extra frills or expenses. Be sure to request Pure Live Seed (PLS) (live) seed that is contained in a bag of bulk seed, since most native grass seed consists of other plant parts and chaff. A bag of bulk seed should contain at least 90% (90,000,000) viable seed.

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 mix that receives full sun more than eight hours a day. Also consider placement with regards to how whether you will be able to use the field for fire 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 "wildflower" meadow should be cut once a year (6-10 inches) to remove some benefit to wildlife.

Order your seeds directly from a supplier who will prepare a customized mix. This way you will get exactly the species you want and the quantities you need, with no extra frills or expenses. Be sure to request Pure Live Seed (PLS) (live) seed that is contained in a bag of bulk seed, since most native grass seed consists of other plant parts and chaff. A bag of bulk seed should contain at least 90% (90,000,000) viable seed.
Section 3.3:  Appendix - Attached Reference Materials

2 lbs. of a mix of native perennial flowers that are true species types, including seeds. There is also a much higher availability of seeds for preparing and planting a meadow.

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 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 more, the Virginia Department of Game and Inland Fisheries offers two invaluable pieces of equipment, both available at no charge. The first is a grass drill to do the planting. This is a dolly seeder type of equipment, specially outfitted to plant native warm season grass seed, which does not ordinarily flow through conventional no-till drills. The second is a "bum trailer," if you are prepared to conduct a pre-broadcast burn as you plant. This equipment 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) 598-3777, or visit the website for instructions 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 bird that is benefited from these efforts. Habitat and crop common species may also benefit from this type of management, as the plan outlines an innovative approach that targets habitat for a wide variety of grassland species that have parallel objectives. For more information about the NBCI, see the Virginia Department of Conservation and Natural Resources website.

Virginia Native Plant Society, www.vnps.org
Wild Ones —several seed companies offer fact sheets or helpful tips and techniques for planting grasses and wildflowers. Visit www.sharpseed.com or www.stockseed.com. The seedbed must be firm when you plant, and weeds should be a depth of 1½ inches. 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 grazing or burning is used to maintain the grass stand, control weeds before the grass seedlings are large enough to be controlled with a weed barrier. Repeat cutting during the growing season —about every six weeks — reduces the occurrence of weeds. The first growth node of these grasses occurs at 1½ inches above the ground, and cutting below the ground level will kill the plants. Also, do not mow or graze your meadow after September 1, as this will flush new weeds. The seedbed must be firm when you plant, and weeds should be a depth of 1½ inches. 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.

To prepare a large area for planting, use a conventional till method without chemicals that can be used to maintain a uniform seedbed. However, there will likely be future batches with persistent plants unless the area is well tilled. Further weed control is done at the right time after the first flush of new weeds.

In a new meadow, broadcast and cover 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 more, the Virginia Department of Game and Inland Fisheries offers two invaluable pieces of equipment, both available at no charge. The first is a grass drill to do the planting. This is a dolly seeder type of equipment, specially outfitted to plant native warm season grass seed, which does not ordinarily flow through conventional no-till drills. The second is a "bum trailer," if you are prepared to conduct a pre-broadcast burn as you plant. This equipment 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) 598-3777, or the website for instructions about the equipment.

Taking Initiative
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 bird that is benefited from these efforts. Habitat and crop common species may also benefit from this type of management, as the plan outlines an innovative approach that targets habitat for a wide variety of grassland species that have parallel objectives. For more information about the NBCI, see the Virginia Department of Conservation and Natural Resources website.
Growing Apple Trees In The Home Garden

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

Rootstocks and Tree Spacing - All apple trees sold commercially consist of two parts that are grafted together to form the tree. The "scion" is the top portion that branches and bears fruit and is grafted onto a "rootstock". The type of fruit is determined by the scion variety. The rootstock can be a "seeding", 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 seeding rootstock. Rootstock, soil fertility, and pruning can influence tree size, and therefore influence tree spacing. Table 1 suggests a range of planting distances with the wider distances for trees planted in good, fertile soils and optimum growing conditions. Trees on the more dwarfing rootstocks must be staked for the life of the tree to obtain optimum growth and to prevent leaning and potential tree breakage. Commonly used stakes consist of a 3-inch diameter wood pole or a 1-inch diameter metal conduit. The stake should be 10 feet high with 2 feet driven into the ground approximately 6 inches from the base of the tree.

Table 1: Rootstock Characteristics

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

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.

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

* Pollen produced by these varieties is sterile.

Varieties - The variety of apple selected should be based on fruit characteristics, bloom time and pollen compatibility. Table 2 (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 pollinator variety. You will need to plant at least two varieties of apple trees together in order to maximize fruit production and quality. Make sure that the varieties you choose have overlapping bloom dates, so that both varieties bloom at the same time. Some varieties, such as Winesap, Mutsu, Jonagold, and Stayman, produce sterile pollen and should never be used as pollinizers. However, pollen from other varieties can be used to pollinate these pollen-sterile varieties. Remember, two
trees of the same apple variety cannot be used for cross-pollination. Since the pollen from apple blossoms is transferred primarily by bees, be careful not to spray insecticides during bloom when honey bees are present.

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

Air Drainage - It is important to select a site where the tree will not be in a "frost pocket", where cold air settles in low-lying areas. In a frost pocket, low spring temperatures commonly kill 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 clippings 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 voles damage, freezing, and overheating. If the roots have dried somewhat, soak them in water for about 24 hours before planting. If you are unable to plant the tree immediately, there are two options:

1) Wrap the roots in plastic along with moist sawdust or newspaper, and place the tree in a refrigerator or cooler at 40 F. Never store the tree with fruit or vegetables, as ethylene gas from the produce will 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 a 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 scaffold branches.

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.](image)

Newly Planted Trees - After early winter planting, wait until just before the buds start to grow in the spring to "head", or cut, the unbranched central leader to 36 inches above the soil surface to encourage new lateral branching. When new growth is 3 to 4 inches long, identify the most upright shoot that will continue to be the central leader. Leave it and remove all new shoots growing 3 to 4 inches immediately below this new terminal to prevent competition. This will also encourage lateral growth in the area 6 to 14 inches below the cut tip of the young tree. Branches that form 6 to 14 inches below the cut tip of the tree are less vigorous, less upright, and easier to train as productive scaffold limbs. When the lateral branches, or scaffold branches, are 3 to 6 inches long, they should be spaced to a wider cradle angle that will provide a stronger framework for fruit production. Toothpicks or clothespins can be used to train 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 upward growth from scaffold branches should be either pruned 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 stimulate the tree and cause it to grow branch more the following season. To promote scaffold branch development, cut the central leader 20 to 28 inches above the highest usable scaffold wood 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. Prune all lateral branches out to a 50 to 60 degree angle.

Summer pruning will de-stimulate 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 de-stimulate 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 trees.

Fruit Thinning - Apple trees often set a heavy 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 tree. 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 grasses around young apple trees minimize 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 cultivation, 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 household disinfectant (Lysol) or bleach, before and after use and between trees. Household disinfectants, such as Lysol, will not contaminate tools or run 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 throughout 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 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°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..."

Published by North Carolina Cooperative Extension Service

Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Employment and program opportunities are offered to all people regardless of race, color, national origin, sex, age, or disability. North Carolina State University at Raleigh, North Carolina.A&T State University, U.S. Department of Agriculture, and local governments cooperating.
How to Install and Maintain a Rain Barrel

**Placing your rain barrel**

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

**Connecting your downspout to your rain barrel**


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

**Using Rain Barrel Water**

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

Source: City of Chicago
Morganton, NC: Trail and Natural Resource Enhancement
Stewardship Plan

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
Morganton, NC: Trail and Natural Resource Enhancement Stewardship Plan

Section 3.3: Appendix - Attached Reference Materials

Maintenance and Rules

Playground rules

Creating safety and accessibility guidelines is crucial for playground safety. Follow these guidelines for the ongoing maintenance of your playground, as well as setting some playground rules.

1. Wear proper footwear.
2. Respect others.
3. Help maintain the playground.
4. Stay alert and be aware of your surroundings.
5. Do not use equipment for purposes other than those intended.
6. Do not bring pets to the playground.
7. Do not litter or leave trash on the playground.
8. Do not use equipment that is damaged or has missing parts.
9. Do not use equipment during inclement weather.
10. Do not use equipment if you are under the influence of alcohol or drugs.

Tips for supervisors

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

1. Become familiar with the age-appropriateness and proper usage of equipment.
2. Assess the playground environment and equipment for any hazards.
3. Provide a safe playing area by removing any dangerous objects.
4. Formulate a consistent discipline strategy and clearly communicate expectations.
5. Keep children within sight at all times.
6. Encourage children to play in pairs or small groups.
7. Promote a healthy physical activity environment.
8. Encourage children to use their creative and imaginative play.
9. Teach children safety rules and the importance of following them.
10. Provide feedback and praise for safe and responsible play.

Ways to involve children in maintenance

As part of the maintenance process, children can also participate in cleaning and caring for the playground. Encourage them to help with spreading mulch, picking up trash, and regularly checking the equipment for any signs of wear or damage.
 Recruiting 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 wide open, and that the surfacing is evenly laid (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? Make 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?

 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 a night-time 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 rebuilding. It’s still your park, so never give up on it! Including the entire community, including vandals and 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 Halton of the Citizens’ Congress of Noroton (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.

[back to top]

**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 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.
**Schoolyard Stewardship**

**Seasonal Activities**

**SPRING / MARCH-MAY**
- Trim back urban meadow plants in late March/April before new growth emerges. Compost.
- 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.

**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. Compost pile pte temperature.
- Mulch planting beds with leaves or compost to reduce winter weeds and feed the soil. Prepare new planting beds by mixing in compost, top dress with bark mulch.
- Prepare for spring bulbs. Order in September. Plant in October and early November. Select tulips for Journey North Project or early spring bulbs such as crocus and narcissus.

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

**What to do With all of Those Leaves?**

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

- **Uses of the leaf cage:** To make leaf compost (called leaf mold), to observe decomposition; to find invertebrates, 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 cleanups, 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 a year for leaves to break down under 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.

**Leaf mold keeps decomposing through the winter and into spring.**

**To use composted leaves:** As a soil conditioner, to improve soil structure, to hold moisture in planting beds. 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.

**Section 3.3: Appendix - Attached Reference Materials**

Morganton, NC: Trail and Natural Resource Enhancement Stewardship Plan
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 or even entire plants can be carried 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.

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
Consider Short-term Maintenance

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

**Watering**

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

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

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

**Mulching**

Once plants are established the need for mulch becomes obsolete. In many naturalized areas the annual deadfall will act as natural mulch. If you choose to add mulch for aesthetic reasons, refer to the calculations in Step 4 to find out how much you will need. Keep in mind that too thick a layer of mulch will prevent moisture from reaching the ground.
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:

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

Structures and other features

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

Exact timing and specific tasks will be determined by your project type and location. Below you will find some sample maintenance plans to help you 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

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

### ONGOING

<table>
<thead>
<tr>
<th>Category</th>
<th>Tasks</th>
<th>Responsible</th>
<th>Assist</th>
<th>Consult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plants</td>
<td>Monthly monitoring and removal of invasive non-natives</td>
<td>Mrs. Jones's 6th grade class and Mrs. Hogan's Summer Habitat Scouts</td>
<td>Schoolyard Habitat Team</td>
<td>Maintenance supervisor and Assistant Principal</td>
</tr>
<tr>
<td></td>
<td>Benches, sign, and fence are repaired as needed</td>
<td>Maintenance supervisor</td>
<td>Assistant Principal</td>
<td>Schoolyard Habitat Team</td>
</tr>
<tr>
<td>Trail</td>
<td>Trail is mulched and trail maps are in stock</td>
<td>Mrs. Hogan's Summer Habitat Scout</td>
<td>Schoolyard Habitat Team</td>
<td>Assistant Principal</td>
</tr>
</tbody>
</table>

### SHORT-TERM

<table>
<thead>
<tr>
<th>SHORT-TERM TASK</th>
<th>MONTH</th>
<th>LONG-TERM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water as necessary</td>
<td>January</td>
<td>Open nest boxes.</td>
</tr>
<tr>
<td>Water as necessary</td>
<td>February</td>
<td></td>
</tr>
<tr>
<td>Weed, remove invasive species, Water as necessary</td>
<td>March</td>
<td>Monitor and remove invasive species.</td>
</tr>
<tr>
<td>Monitor species survival rates, Water as necessary</td>
<td>April</td>
<td></td>
</tr>
<tr>
<td>Weed out mulch if needed, Water as necessary</td>
<td>May</td>
<td></td>
</tr>
<tr>
<td>Water as necessary</td>
<td>June</td>
<td></td>
</tr>
<tr>
<td>Water as necessary</td>
<td>July</td>
<td>Monitor for drought.</td>
</tr>
<tr>
<td>Water as necessary</td>
<td>August</td>
<td></td>
</tr>
<tr>
<td>Weed and remove invasive species, Water as necessary</td>
<td>September</td>
<td>Monitor and remove invasive species.</td>
</tr>
<tr>
<td>Monitor species survival rates and prepare for additional planting if necessary, Water as necessary</td>
<td>October</td>
<td></td>
</tr>
<tr>
<td>Water as necessary</td>
<td>November</td>
<td>Mow half of meadow.</td>
</tr>
<tr>
<td>Water as necessary</td>
<td>December</td>
<td></td>
</tr>
</tbody>
</table>
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:

1. Include good quality maintenance tools in your grant applications (i.e. shovels, wheelbarrows, gardening gloves, hoes, rakes, 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.
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 beat-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.
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.seedsofdiversity.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 months.
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.

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.

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.

All Hands in the Dirt p. 34

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

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

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

1. **Non-toxic**: Either these plants have proven non-poisonous or there is no record of a toxic exposure. Exposure to these plants is not expected to cause any symptoms.
2. **Oxalates**: The juice or sap of these plants contains oxalate crystals. Chewing these plants may cause pain and irritation of the mouth, lips, and tongue. Swelling of the throat may cause breathing difficulties.
3. **Minor toxicity**: Ingestion may cause some minor symptoms such as vomiting or diarrhea. Ingestions of small amounts may not cause any symptoms at all.
4. **Major toxicity**: Ingestion of these plants, especially in large amounts, is expected to cause serious effects to major organs such as the heart, liver or kidneys. If these plants are ingested call the Poison Control Center immediately.
5. **Dermatitis**: Exposure to juice or sap from the plant or a puncture would from 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.
### Common Plants and Their Toxicity

<table>
<thead>
<tr>
<th>Common Plant</th>
<th>Toxicity Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>African Violet</td>
<td>1</td>
<td>Saintpaulia</td>
</tr>
<tr>
<td>Agapanthus</td>
<td>3, 5</td>
<td>Jade Plant</td>
</tr>
<tr>
<td>Agapanthus, Pink Nerine bowdeni</td>
<td>3, 7</td>
<td>Jerusalem Cherry</td>
</tr>
<tr>
<td>Aloe Vera</td>
<td>1</td>
<td>Jimson Weed</td>
</tr>
<tr>
<td>Aluminum Plant</td>
<td>3</td>
<td>Pilea cadierei</td>
</tr>
<tr>
<td>Alyssum</td>
<td>1</td>
<td>Lady Slipper Orchid</td>
</tr>
<tr>
<td>Amaranthus</td>
<td>3</td>
<td>Lantana camara</td>
</tr>
<tr>
<td>Apple Tree Malus species</td>
<td>4, 7</td>
<td>Larkspur</td>
</tr>
<tr>
<td>Acanthus</td>
<td>4, 7</td>
<td>Licorice Plant</td>
</tr>
<tr>
<td>Aralia Japanese</td>
<td>1</td>
<td>Fatsia japonica</td>
</tr>
<tr>
<td>Arrowhead Vine</td>
<td>2</td>
<td>Syngonium podophyllum</td>
</tr>
<tr>
<td>Asparagus Fern</td>
<td>1</td>
<td>Asparagus setaceus or sprengeri</td>
</tr>
<tr>
<td>Azalea</td>
<td>6, 7</td>
<td>Rhododendron occidentale</td>
</tr>
<tr>
<td>Baby Tears</td>
<td>1</td>
<td>Helxine soleirolii</td>
</tr>
<tr>
<td>Bachelor Buttons</td>
<td>1</td>
<td>Centaurea cyanus</td>
</tr>
<tr>
<td>Begonia</td>
<td>2</td>
<td>Begonia species</td>
</tr>
<tr>
<td>Birch Tree</td>
<td>3, 5</td>
<td>Betula species</td>
</tr>
<tr>
<td>Bird of Paradise</td>
<td>6</td>
<td>Strelitzia reginae</td>
</tr>
<tr>
<td>Bird's Nest Fern</td>
<td>1</td>
<td>Asplenium nidus</td>
</tr>
<tr>
<td>Black Acacia Robinia pseudoacacia</td>
<td>4, 7</td>
<td>Robinia pseudoacacia</td>
</tr>
<tr>
<td>Boston Fern</td>
<td>1</td>
<td>Asplenium nidus</td>
</tr>
<tr>
<td>Bottle Brush Callistemon species</td>
<td>1</td>
<td>Callistemon exalata</td>
</tr>
<tr>
<td>Bougainvillea</td>
<td>1</td>
<td>Morning glory</td>
</tr>
<tr>
<td>Bogwood</td>
<td>3, 5</td>
<td>Buxus sempervirens</td>
</tr>
<tr>
<td>Caladium</td>
<td>1, 5</td>
<td>Caladium species</td>
</tr>
<tr>
<td>Calendula officinalis</td>
<td>2, 5</td>
<td>Calendula species</td>
</tr>
<tr>
<td>California Poppy</td>
<td>1</td>
<td>Eschscholzia californica</td>
</tr>
<tr>
<td>Canna Lily</td>
<td>2</td>
<td>Canna generalis</td>
</tr>
<tr>
<td>Camellia Thea japonica</td>
<td>1</td>
<td>Camellia Thea japonica</td>
</tr>
<tr>
<td>Camphor Tree</td>
<td>4</td>
<td>Cinnamomum camphora</td>
</tr>
<tr>
<td>Canary Island Pine</td>
<td>1</td>
<td>Norfolk Island Pine</td>
</tr>
<tr>
<td>Canna Lily Canna generalis</td>
<td>1</td>
<td>Canna Lily Canna generalis</td>
</tr>
</tbody>
</table>

**Legend:**
- 1 = Non-toxic
- 2 = Oxalates
- 3 = Minor Toxicity
- 4 = Major Toxicity
- 5 = Dematitis
- 6 = Possibly Toxic
- 7 = Animal Toxicity
<table>
<thead>
<tr>
<th>Common Plants and Their Toxicity - UC Davis Medical Center Regional Poison Control Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carnation Dianthus caryophyllus</td>
</tr>
<tr>
<td>Carolina Jasmine Gelsemium</td>
</tr>
<tr>
<td>Castor Beans Ricinus communis</td>
</tr>
<tr>
<td>Catalpa Speciosa</td>
</tr>
<tr>
<td>Catnip Nepeta catia</td>
</tr>
<tr>
<td>Cedar Thuja species</td>
</tr>
<tr>
<td>Century Plant Agave</td>
</tr>
<tr>
<td>Cherry Tree Prunus</td>
</tr>
<tr>
<td>China Berry Melia azedarach</td>
</tr>
<tr>
<td>China Doll Lea coccinea</td>
</tr>
<tr>
<td>Radermachera pentandra</td>
</tr>
<tr>
<td>Chinese Evergreen Aglaonema modestum</td>
</tr>
<tr>
<td>Christmas Cactus Zygocatus truncates or Schlumbergera bridgesii</td>
</tr>
<tr>
<td>Chrysanthemum Species</td>
</tr>
<tr>
<td>Coffee Tree Plant Polyscias guilfoylei</td>
</tr>
<tr>
<td>Coleus Species</td>
</tr>
<tr>
<td>Coreopsis</td>
</tr>
<tr>
<td>Corn Plant Draceana fragrans massangeanaCosmos</td>
</tr>
<tr>
<td>Coleoreaster</td>
</tr>
<tr>
<td>Grape Myrtle Lagerstroemia indica</td>
</tr>
<tr>
<td>Creeping Charlie Glechoma hederacea</td>
</tr>
<tr>
<td>Creeping Charlie Lysimachia nummularia</td>
</tr>
<tr>
<td>Creeping Charlie Pit nummularisfolia</td>
</tr>
<tr>
<td>Creeping Fig Ficus pumilla</td>
</tr>
<tr>
<td>Crown of Thorns Euphorbia milii</td>
</tr>
<tr>
<td>Cyclamen</td>
</tr>
<tr>
<td>Daffodil Narcissus</td>
</tr>
<tr>
<td>Dahlia Species</td>
</tr>
<tr>
<td>Daisy Chrysanthemum</td>
</tr>
<tr>
<td>Dandelion Taraxacum officinale</td>
</tr>
<tr>
<td>Daphne</td>
</tr>
<tr>
<td>Delphinium Species</td>
</tr>
<tr>
<td>Devil's Ivy Epipremnum aureum</td>
</tr>
<tr>
<td>Dieffenbachia Species</td>
</tr>
<tr>
<td>Donkey Tail Sedum morganianum</td>
</tr>
</tbody>
</table>

1=Non-toxic  2=Oxalates  3=Minor Toxicity  4=Major Toxicity  5=Dematitis  6=Possibly Toxic  7=Animal Toxicity
# Common Plants and Their Toxicity

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dumbcane</td>
<td>2 Oxalates</td>
</tr>
<tr>
<td>Dieffenbachia amoena</td>
<td>1 Non-toxic</td>
</tr>
<tr>
<td>Dracaena</td>
<td>1 Non-toxic</td>
</tr>
<tr>
<td>Emerald Ripple Peperomia species</td>
<td>1 Non-toxic</td>
</tr>
<tr>
<td>English Ivy Hedera helix</td>
<td>4 Major Toxicity</td>
</tr>
<tr>
<td>Eucalyptus globulus Species</td>
<td>3 Minor Toxicity</td>
</tr>
<tr>
<td>Escallonia</td>
<td>1 Non-toxic</td>
</tr>
<tr>
<td>Elderberry</td>
<td>4 Major Toxicity</td>
</tr>
<tr>
<td>Elm Tree Ulmus species</td>
<td>5 Dematitis</td>
</tr>
<tr>
<td>Ficus Benjamina</td>
<td>5 Dematitis</td>
</tr>
<tr>
<td>Fiddleleaf Fig Ficus lyrata</td>
<td>5 Dematitis</td>
</tr>
<tr>
<td>Fritillaria Meleagris</td>
<td>1 Non-toxic</td>
</tr>
<tr>
<td>Foxglove Digitalis purpurea</td>
<td>4 Major Toxicity</td>
</tr>
<tr>
<td>Four-o'clocks Mirabilis jalapa</td>
<td>5 Minor Toxicity</td>
</tr>
<tr>
<td>Fraxinus</td>
<td>1 Non-toxic</td>
</tr>
<tr>
<td>Fragrant Orange Pomegranate Pelargonium</td>
<td>3 Minor Toxicity</td>
</tr>
<tr>
<td>Geranium Pelargonium</td>
<td>3 Minor Toxicity</td>
</tr>
<tr>
<td>Geranium, California Senecio petraeus</td>
<td>3 Minor Toxicity</td>
</tr>
<tr>
<td>Grevillea Species</td>
<td>1 Non-toxic</td>
</tr>
<tr>
<td>Hellebores</td>
<td>1 Non-toxic</td>
</tr>
<tr>
<td>Honeysuckle Lonicera</td>
<td>1 Non-toxic</td>
</tr>
<tr>
<td>Hyacinth Hyacinthus orientalis</td>
<td>3, 5, 7 Wax Plant</td>
</tr>
<tr>
<td>Hydrangea Species</td>
<td>3 Minor Toxicity</td>
</tr>
<tr>
<td>Ice Plant Aptenia cordifolia or Lampranthus</td>
<td>1 Non-toxic</td>
</tr>
<tr>
<td>Impatiens</td>
<td>1 Non-toxic</td>
</tr>
<tr>
<td>Indian Hawthorn Rhamnus Indica</td>
<td>4, 5 Wax Plant</td>
</tr>
<tr>
<td>Indian Hawthorn Rhamnus Indica</td>
<td>1 Non-toxic</td>
</tr>
<tr>
<td>Indian Hawthorn Rhamnus Indica</td>
<td>2 Oxalates</td>
</tr>
<tr>
<td>Indian Hawthorn Rhamnus Indica</td>
<td>3 Minor Toxicity</td>
</tr>
<tr>
<td>Indian Hawthorn Rhamnus Indica</td>
<td>4 Major Toxicity</td>
</tr>
<tr>
<td>Indian Hawthorn Rhamnus Indica</td>
<td>5 Dematitis</td>
</tr>
<tr>
<td>India Hawthorn Rhamnus Indica</td>
<td>6 Possibly Toxic</td>
</tr>
<tr>
<td>Indian Hawthorn Rhamnus Indica</td>
<td>7 Animal Toxicity</td>
</tr>
<tr>
<td>Indian Hawthorn Rhamnus Indica</td>
<td>80 Wax Plant</td>
</tr>
<tr>
<td>Indiana Hawthorn Rhamnus Indica</td>
<td>1 Non-toxic</td>
</tr>
<tr>
<td>Indiana Hawthorn Rhamnus Indica</td>
<td>2 Oxalates</td>
</tr>
<tr>
<td>Indiana Hawthorn Rhamnus Indica</td>
<td>3 Minor Toxicity</td>
</tr>
<tr>
<td>Indiana Hawthorn Rhamnus Indica</td>
<td>4 Major Toxicity</td>
</tr>
<tr>
<td>Indiana Hawthorn Rhamnus Indica</td>
<td>5 Dematitis</td>
</tr>
<tr>
<td>Indiana Hawthorn Rhamnus Indica</td>
<td>6 Possibly Toxic</td>
</tr>
<tr>
<td>Indiana Hawthorn Rhamnus Indica</td>
<td>7 Animal Toxicity</td>
</tr>
<tr>
<td>Indiana Hawthorn Rhamnus Indica</td>
<td>80 Wax Plant</td>
</tr>
</tbody>
</table>

**Legend:**
- 1: Non-toxic
- 2: Oxalates
- 3: Minor Toxicity
- 4: Major Toxicity
- 5: Dematitis
- 6: Possibly Toxic
- 7: Animal Toxicity
- 80: Wax Plant
<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Laurel Ficus nitida</td>
<td>5</td>
</tr>
<tr>
<td>Yew Taxus species</td>
<td>4</td>
</tr>
<tr>
<td>Ivy Hedera Helix</td>
<td>3, 5</td>
</tr>
<tr>
<td>Yucca</td>
<td>1</td>
</tr>
<tr>
<td>Zebra Plant Aphelandra squarrosa</td>
<td>1</td>
</tr>
<tr>
<td>Jack in the Pulpit Arisaema triphyllum</td>
<td>2, 5</td>
</tr>
<tr>
<td>Zinnia</td>
<td>1</td>
</tr>
</tbody>
</table>

1=Non-toxic  2=Oxalates  3=Minor Toxicity  4=Major Toxicity  5=Dematitis  6=Possibly Toxic  7=Animal Toxicity
While most of us are familiar with common poisonous plants that cause dermatitis (skin irritations) such as Poison Ivy or Poison Oak, we fail to recognize common ornamental plants in the landscape that may cause internal poisoning when ingested. Although most adults would not intentionally eat the leaves or fruit of ornamental plants in the landscape, young children or pets sometimes do.

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

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

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

Internal poisons are a group of chemically different substances that, when ingested:
- Act on the brain causing narcotic reactions and other mental disturbances.
- Affect the spinal cord resulting in paralysis and convulsions.
- Act as heart depressants and stimulants.
- Irritate the digestive tract and nervous system.

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

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

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

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

Be prepared to give:

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

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

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

Ornamental plants reported to be toxic when ingested by humans

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Botanical Name</th>
<th>Toxic Plant Part</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air potato</td>
<td>Dioscorea bulbifera</td>
<td>raw fruit</td>
<td>abdominal pain, nausea</td>
</tr>
<tr>
<td>Algerian Ivy**</td>
<td>Hedera canariensis</td>
<td>all parts</td>
<td>diarrhea, nervousness, labored respiration, convulsions</td>
</tr>
<tr>
<td>Allamanda</td>
<td>Allamanda spp.</td>
<td>all parts</td>
<td>nausea, high temperature, dryness of the mouth</td>
</tr>
<tr>
<td>Amaryllis</td>
<td>Amaryllis spp.</td>
<td>bulbs and seeds</td>
<td>gastrointestinal problems, vomiting, diarrhea</td>
</tr>
<tr>
<td>American Arborvitae**</td>
<td>Thuja occidentalis</td>
<td>leaves</td>
<td>low blood pressure, convulsions</td>
</tr>
<tr>
<td>Angel’s Trumpet**</td>
<td>Datura spp.</td>
<td>all parts</td>
<td>blurring of vision, delirium</td>
</tr>
<tr>
<td>Anise-tree**</td>
<td>Illicium floridanum, Illicium anisatum</td>
<td>leaves</td>
<td>abdominal pain, vomiting, convulsions, death</td>
</tr>
<tr>
<td>Azalea</td>
<td>Rhododendron spp.</td>
<td>all parts</td>
<td>nausea, vomiting, weakness, dizziness, breathing difficulty, coma</td>
</tr>
<tr>
<td>Barberry</td>
<td>Berberis spp.</td>
<td>all parts</td>
<td>depressant action on the heart muscle</td>
</tr>
<tr>
<td>Black Locust</td>
<td>Robinia pseudoacacia</td>
<td>bark, seeds</td>
<td>nausea, weakness, depression</td>
</tr>
<tr>
<td>Boxwood</td>
<td>Buxus sempervirens</td>
<td>leaves</td>
<td>gastric, vomiting</td>
</tr>
<tr>
<td>Buckeye</td>
<td>Aesculus spp.</td>
<td>all parts</td>
<td>digestive irritant, nausea, vomiting</td>
</tr>
<tr>
<td>Caladium</td>
<td>Caladium bicolor</td>
<td>all parts</td>
<td>burning in mouth and throat, vomiting</td>
</tr>
<tr>
<td>Calla-lily</td>
<td>Zantedeschia spp.</td>
<td>all parts</td>
<td>burning and inflammation of the mouth and throat</td>
</tr>
<tr>
<td>Castor bean</td>
<td>Ricinus communis</td>
<td>seeds</td>
<td>burning in mouth and throat, gastric and intestinal problems</td>
</tr>
<tr>
<td>Century Plant</td>
<td>Agave americana</td>
<td>leaves</td>
<td>vomiting, diarrhea</td>
</tr>
<tr>
<td>Cherry (all species)</td>
<td>Prunus spp.</td>
<td>leaves, bark, seeds</td>
<td>gasping, nervous disorder</td>
</tr>
<tr>
<td>Clematis</td>
<td>Clematis spp.</td>
<td>all parts</td>
<td>gastrointestinal irritation</td>
</tr>
<tr>
<td>Eranthis Lily</td>
<td>Crinum spp.</td>
<td>bulb</td>
<td>vomiting, diarrhea</td>
</tr>
<tr>
<td>Delphinium**</td>
<td>Delphinium spp.</td>
<td>all parts</td>
<td>digestive upset, nervous excitement or depression</td>
</tr>
<tr>
<td>Elderberry</td>
<td>Sambucus canadensis</td>
<td>root, bark, stem, leaves</td>
<td>Has caused nausea and vomiting in children who have used stems as toys. Raw berries may cause nausea. Fruit commonly made into pies, jelly and wine - not harmful when cooked.</td>
</tr>
<tr>
<td>Elephant Ear**</td>
<td>Colocasia esculenta</td>
<td>all parts</td>
<td>intense burning and irritation of the tongue</td>
</tr>
<tr>
<td>English Ivy**</td>
<td>Hedera helix</td>
<td>leaves, stems, fruits</td>
<td>headache, fever, anxiety, breathing difficulty, coma</td>
</tr>
<tr>
<td>Eucalyptus**</td>
<td>Eucalyptus spp.</td>
<td>leaves</td>
<td>nausea, vomiting, diarrhea, weakness, respiratory difficulty</td>
</tr>
</tbody>
</table>
### Poisonous Plants in the Landscape

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

### References:


Texas A&M University Web Site, “Poisonous Plants.”

Mississippi State Extension Web Site, “Poisonous Plants.”

Georgia Poison Control Center fact sheet.