



5.4.2 Improve Native Landscape Cover Types

Description

In an integrated stormwater management plan, the “natural” landscape is an important tool to reduce stormwater runoff volume and velocity and to improve water quality. This BMP requires that the site have a remnant native plant community (forest, field, hedgerow, etc.), which can be an important contributing part of the stormwater management system.

Remnants of native plant communities found on development sites are frequently degraded, damaged, transformed, or partially destroyed. In some cases, impacts to ecosystems are caused or aggravated by natural processes such as wildfires, floods, storms, or hurricanes. In most cases however, degradation is the direct or indirect result of human activities. The objective of this BMP is to initiate or accelerate the recovery of ecosystem health for water quality function.

“Restoration” implies returning a landscape to a former, more pristine state. In reality, historic conditions cannot be replicated. For most development and redevelopment projects, a realistic goal is to remove or mitigate destructive impacts and reintroduce significant missing processes and components, where possible. The intent of these actions is to allow natural processes to bring about gradual recovery. Interventions can include:

- Reintroduction of a characteristic assemblage of species.
- Reintroduction of “keystone” species, where missing. (Keystone species are plants or animals that play a critical role in maintaining the structure and function of an ecological community.)
- Improvement of soil structure, chemistry, and biology.
- Reintroduction of basic natural processes by a controlled burn.

BMP Functions Table

BMP	Applicability	Volume Reduction	Water Quality	Peak Rate Reduction	Recharge	Runoff Temperature Mitigation	Heat Island	Habitat Creation	Maintenance Burden	Cost
Improve Native Landscape Cover Types	U/S/R	H	H	M	M	H	H	H	L	L

KEY: U = Urban; S = Suburban; R = Rural; H = High; M = Medium; L = Low





While there are many benefits to improving existing native cover types, the primary purpose of this BMP is to increase the potential for effective stormwater management on a site and to provide the developer with another means of stormwater management. This BMP functions by reestablishing a healthy plant community with thick, spongy soil layers that:

- Generates less runoff.
- Absorbs a greater volume of water through infiltration, evaporation, and evapotranspiration.
- Improves soil conditions through the addition of organic material, which increases soil pore space.
- Reduces the need for maintenance by fertilizers, herbicides, and pesticides.
- Reduces the force of precipitation by leaf interception.

Key Design Guidelines

- Shift conventions and practices and revise plans to favor preservation and reuse of remnant natural areas to allow nature to do some of the work of stormwater management.
- Identify key remnant landscape cover types on the site to be protected or enhanced, such as meadows, woodlands, and forests.
- Evaluate the condition of these areas, and establish strategies for increased stormwater management functions.
- Where possible, use or create these areas as site amenities.

Advantages

- Improving and sustaining remnant natural areas can provide additional stormwater management capacity.
- Native cover types require less maintenance than manicured, ornamental landscapes.
- A native landscape can be an attractive alternative.
- These areas can be used to structure the site, screen unsightly views, and provide visual interest and recreational opportunities.

Disadvantages

- Enhancement efforts have a level uncertainty, as it is difficult to guarantee a specific condition, appearance, or functionality.





- Acceptance of an evolving landscape (adjusted by management interventions over time) requires a willingness to employ unfamiliar management techniques.
- Native landscapes have an aesthetic that not all may find attractive.

Applications

- Any development or redevelopment site where native vegetation already exists
- Even an extremely small area can contribute to stormwater quality; however, the larger the area, the greater the contribution

Where there are remnant native plant communities onsite, this BMP can be used in a wide range of contexts—from urban to rural—and at very different sizes, from hedgerows between vacant lots to forests of several acres and larger.



Figure 5.4.2-1. Replanting understory layer in existing forest.



Figure 5.4.2-2. Aerial with kudzu infestation indicated.





Figure 5.4.2-3. Highly disturbed woodland. Note the presence of invasive vines (English ivy and Multiflora rose) but also healthy ground cover (May Apples – *Podophyllum peltatum*).



Figure 5.4.2-4. Reforestation with whips in tube guards.





Applicable Protocols and Specifications

Protocol 5 Planting Guidelines

Design Considerations

Restoration is an incremental process that proceeds in phases. It is almost impossible to amend a natural landscape in a single, large effort. Instead, smaller interventions, at regular intervals, should be planned and management techniques adjusted according to what is working.

To minimize cost, intervene minimally. Take only those actions that are necessary to counteract disturbance. Take no actions that will inhibit important natural processes onsite.

Guidance for successful implementation is as follows:

Priorities for Enhancement

Identify remnant natural areas that can contribute to the proposed stormwater management system or can provide volume reduction or water quality improvement for other impervious area onsite. Soil infiltration capacity is measured along a gradient of absorption and varies from poor performance (soil under well-maintained turf grasses) to good performance (spongy, absorbent soils under a mature forest). To choose which natural plant community remnant should be preserved, use the following list to help prioritize. In general, number 1 provides the least stormwater management benefits and number 4 provides the greatest benefits.

1. Annual, Biennial, and Perennial Meadows (primarily herbaceous, agricultural crops to native grasses, wildflowers, ferns, etc.)
2. Old Fields and Savannahs (woody vegetation within the matrix of a meadow)



Figure 5.4.2-5. Wildflower meadow.

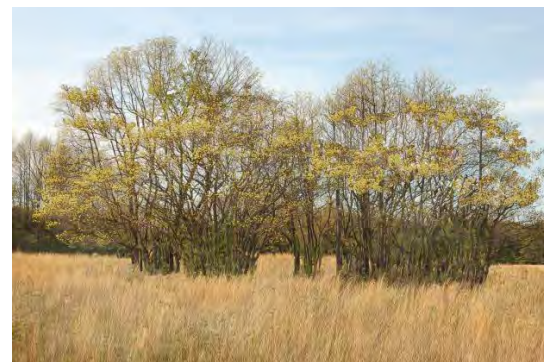


Figure 5.4.2-6. Sassafras savannah.





3. Young Woodlands and Mature Woodlands (woodlands generally have a few tree species growing densely together with only tree trunks and ground layer)
4. Mature Forest, Old Growth Forest (closed tree canopy, shade-tolerant plants, mixed species, mixed ages and many layers; Old Growth Forest returns to few tree species and two major layers: canopy and ground layer)



Figure 5.4.2-7. Young woodland – pole stage – approximately 10 years.



Figure 5.4.2-8. Mature forest.

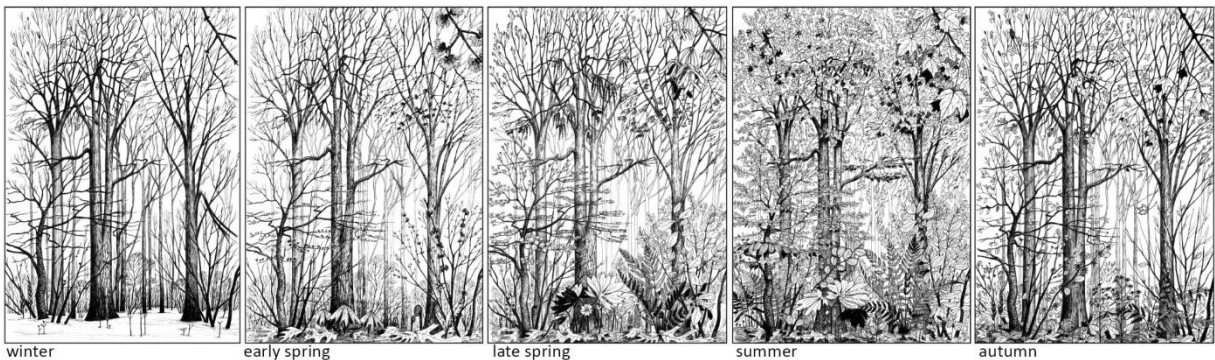


Figure 5.4.2-9. Mature forest layers through the seasons.





This BMP is eligible for SOV credits as defined in Chapter 7. A Criteria Checklist is provided at the end of this section as a summary of design and establishment considerations.

Restoration Steps

- Assess vegetation onsite and delineate areas to be preserved. Note landscape cover type, size, condition, and age.
- Integrate areas selected for protection into site and stormwater plans to meet multiple objectives and create environmental and social connections (trail systems, hedgerows, etc.)
- Identify glaring problems within the selected enhancement area, e.g., fill and soil pushed over the slope into the valley, extreme cut, exposed subsoil or bedrock, bare and eroded soil, invasive exotic plants, trash, and toxic materials. Particularly note erosion and sedimentation problems such as gullies and bare soil. Also note influences beyond the site that may undermine enhancement efforts.
- Identify and address factors that suppress regeneration of native plants or contribute to overall plant community decline before replanting or amending the soil. If these factors are not addressed, efforts spent on enhancement will be wasted.
- Where relevant, identify major cyclical processes that shape the site, e.g., floods, fire, etc. These recurring natural events may help to sustain the native plant community and prevent colonization by invasive exotics.
- Search for a healthy model in the neighborhood to serve as a design reference:
 - Plant community structure and pattern—Use the model to determine the arrangement, types, and density of plants.
 - Identify and protect desirable and sensitive species and any rare, threatened, or endangered plant (or animal) species. Particularly identify “keystone” species. If absent, replace these species where possible.



Figure 5.4.2-10. Illegal dumping.



Figure 5.4.2-11. Prescribed forest burn for species management (Note: Controlled burns require proper safety precautions and may not be permitted).





- An unusual amount of dead or dying plants requires a determination of cause.
- Where necessary, remove masses of aggressive, invasive exotic species to expose the potential of the area.
 - Invasive exotic species often occur as dense shrub thickets or extensive, heaping vine cover. Vines in trees and climbing over shrubs suppress reproduction on the ground and shade older trees and shrubs, eliminating seed sources. Privet, Japanese honeysuckle, kudzu, mimosa trees, and tree of heaven are the most prevalent invasive exotics in Chattanooga.
 - Remove large tangles of aggressive exotic species to allow an accurate evaluation of the site and suggest appropriate repair strategies.
- General considerations:
 - Effective control treatments vary by species. In some cases, non-chemical options exist.
 - Emphasize techniques that minimize soil disturbance and that remove the exotic plants by the roots where possible, while leaving adjacent, desirable plants undamaged. When removing existing invasive plants, either pull up by the roots or eliminate re-sprouts later.
 - Some invasive exotics are more troublesome than others. For example, highly aggressive species such as kudzu and privet are particularly difficult to eradicate and should be removed as early as possible, before they are well established.
 - Phase removal of exotic canopy trees to keep a shady forest cover.
- Specific removal methods:
 - Hand pulling: Suggested for restricted areas of herbaceous weeds or small seedlings of woody plants.



Figure 5.4.2-12. Removing invasive exotics.



Figure 5.4.2-13. Forest edge before kudzu removal (photo credit V&V, LLC).



Figure 5.4.2-14. Forest edge after kudzu removal, ready for new plantings (photo credit V&V, LLC).





- Tools: A weed wrench allows the user to pull up young tree seedlings (too large to pull by hand) by the roots. This tool disturbs the adjacent areas only minimally.
- Mowing: In general, broadleaved herbaceous plants will diminish with regular mowing. Broadleaved herbaceous plants include both weeds and wildflowers, and a meadow mown more than three times a year will become predominantly grasses. Note: Kudzu has been removed successfully in some steep slope areas of Chattanooga through the use of goats that graze on the weed.
- Controlled burning: This technique can be used to manage any landscape cover type. However, in meadow management, fire is used to reduce the number of trees and increase the amount of grasses and wildflowers.
 - Burning can be used in two major ways: 1) If the remnant natural area is small, or only a small portion of it requires treatment, a single person, with a backpack propane torch, can burn small areas (approximately 10 feet by 10 feet). Generally, small-scale burns are done as a patchwork of squares, with unburned vegetation between burned patches. Extreme caution must be used to prevent wildfire; 2) Where a relatively large-scale burn is considered (approximately 1 acre or more), property managers should coordinate with the local fire department and state conservation agencies. Permits are required from the City of Chattanooga.
 - Caution: Some undesirable species, such as black locust, are “fire increasers.” If these species are already present, burning may encourage them. Conversely, successful regeneration of oak forests in the eastern United States has historically required fire.
 - The local branch of the (nonprofit) Nature Conservancy will burn a designated area for a small fee:

The Nature Conservancy
East Tennessee Program Office
625 Market Street, Suite 1201
Knoxville, TN 37902
(865) 546-5001
- Tilling: For large areas of infestation, tilling can uproot and kill undesirable species. However, tilling can also kill native species and encourage invasive plants that spread by underground rhizomes or stolons, such as kudzu (*Pueraria lobata*).



Figure 5.4.2-15. Weed wrench.





- Application of herbicides: This is a method of last resort, but necessary in some cases. Herbicide treatments should be applied **only** to a specific plant and **never broadcast**, especially near water bodies. Use a colored dye in the herbicide mix to identify areas that have been sprayed. Use the least persistent pesticide available to accomplish the job.

There are different improvement techniques for every landscape cover type. Consult the Society for Ecological Restoration International at <http://www.ser.org/> for specific directions for your site:

SER Southeast Chapter
c/o SER International
1017 O Street NW
Washington, D.C. 20001
Phone: (202) 299-9518
Fax: (270) 626-5485

- General Recommendations

- In healthier systems with minimal disturbance, native seeds may be present in the soil. Areas adjacent to other healthy natural areas can benefit from seeds transported by wind, water, and animals. If time is not a factor, and rapid cover is not critical, these areas can be left to regenerate on their own.
- Plant tough, vigorous, generalist species, which will create immediate cover and discourage invasive species.
- Stabilize edges. Where a remnant natural area meets a manmade landscape, the design should create a graceful, smooth transition. Construction often leaves these transition areas highly disturbed. Repair of these newly exposed edges is critical.
- Regrade where necessary, stabilize the soil, and replant with fast-growing, tough, native edge species. Repair of damaged edges will protect the health of the natural landscape and enhance its stormwater benefits.
- Newly exposed, existing trees are often vulnerable to wind throw. Replant a strip along newly formed edges (where a portion of the natural landscape has been cut away) to buffer the remaining native landscape from increased wind, light, noise, and other impacts.



Figure 5.4.2-16. Tree planting at edges and lawn conversion to meadow.





Figure 5.4.2-17. Invasive exotic vines (kudzu) cover the forest edge.



Figure 5.4.2-18. Forest edge planted with flowering understory and shrubs.

Operations and Maintenance

A number of different techniques may be needed to sustain a healthy native cover.

Watering

Watering or irrigation may be required during the period of establishment and during severe droughts.

Erosion Control

Erosion should be monitored before, during, and after enhancement efforts, until the site is stabilized.





Control of Invasive Plant and Animal Species

Look for signs of takeover by aggressive, exotic plants. Also look for (usually very obvious signs of) a population explosion of herbivores.

- Monitor the property regularly for invasive plant species. When they do appear, remove them as soon as possible, before they have a chance to become established and spread. Rapid removal will prevent formation of extensive root systems, which make eradication of invasive species difficult, if not impossible.
- Long-term invasive species monitoring and management should be considered part of a holistic landscape management program that is coordinated with herbivore control and follow-up planting.
Key areas to monitor:
 - Look for regeneration of native plants specifically on the ground layer. If there are no seedlings or the seedlings are predominantly non-native, reevaluate the problem and repair.
 - If invasive exotic plants do not diminish significantly, reevaluate the problem and change management techniques.
 - Monitor newly stabilized edges to ensure that invasive species are under control, planted material is surviving and thriving, and there is evidence of natural regeneration.
- Herbivore control:
 - Ongoing control of extra abundant herbivores (white-tailed deer, rabbits, geese, etc.) is an important adjunct to landscape enhancement, preventing plant damage from browsing, rubbing, and grazing.
 - Eastern Tennessee has experienced slow growth in deer population due to less productive habitat and other factors. If deer predation becomes a problem, consider the following strategies:
 - Plant large caliper trees with branches above 6 feet.
 - Protect trunks of young trees with plastic tubes.
 - Protect shrub and herbaceous plant material, as hungry deer will eat everything and prefer wildflowers.




Figure 5.4.2-19. Seedling regeneration on forest floor.



Figure 5.4.2-20. Deer-fenced protected area to the right – unprotected area to the left (photo credit Nature Conservancy).



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- Fence enhancement areas with effective deer fencing. A strong plastic mesh is adequate. Fencing must be tall enough to keep deer out, 12 to 18 feet high.
 - Organize an official “cull” with private bow hunters or professional sharp shooters, with the Tennessee Wildlife Resource Agency (TWRA).

Fertilization

Over-fertilization increases weeds and nutrient loads in runoff. Test the soil before fertilizing. Organic compost is preferred over chemical fertilizers.

Integrated Pest Management

To reduce the environmental impact of herbicides, pesticides, and fungicides, use a pest management program, also referred to as an integrated pest management (IPM) program. IPM strategies combine a number of techniques including knowledge of the lifecycle of targeted pests (e.g., disrupting breeding cycles), known predators, and microorganisms that are pathogens to the pest species; selection of the best local growing conditions; mechanical controls such as quarantine; physical removal of diseased plants and traps; establishment of an acceptable level of pests; and responsible herbicide and pesticide use.

Monitoring

To evaluate the success of enhancement efforts, look for:

- Health of planted plants
- Regeneration/recruitment of native seedlings
- An increase in the abundance and diversity of native plants
- More visibly ordered structure in forests: ground layer, shrub layer, understory trees, canopy
- Fewer invasive exotics
- No bare soil patches

References

Society for Ecological Restoration International Science & Policy Working Group. 2004. *The SER International Primer on Ecological Restoration*. www.ser.org.





Criteria Checklist BMP 5.4.2

ITEM DESCRIPTION	YES	N/A
The following checklist provides a summary of design guidance for the owner/applicant for successful implementation.		
<ul style="list-style-type: none"> Assess vegetation onsite and delineate areas to be preserved. Note landscape cover type, size, condition, and age. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> Integrate areas selected for protection into site and stormwater plans to meet multiple objectives and create environmental and social connections (trail systems, parks, etc.). 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> Identify glaring problems within the selected enhancement area, for example, fill and soil pushed over the slope into the valley; extreme cut, exposing subsoil or bedrock fill; bare and eroded soil; invasive exotic plants; trash; toxic materials, etc. Particularly note erosion and sedimentation problems such as gullies and bare soil. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> Identify and address factors that suppress regeneration of native plants or contribute to overall plant community decline before replanting or amending the soil. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> Where relevant, identify major cyclical processes that shape the site, for example, floods, fire, etc. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> Plant Community Structure and Pattern—Use a healthy neighborhood model to determine the arrangement, types, and density of plants. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> Identify and protect desirable and sensitive species and any rare, threatened or endangered plant (or animal) species. Particularly identify “keystone” species. If absent, replace these species where possible. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> Where necessary, remove masses of aggressive, invasive exotics. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> – Remove large tangles of aggressive exotic species to allow a clear evaluation of the site and suggest appropriate repair strategies. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> – Hand pulling: Suggested for restricted areas of herbaceous weeds or small seedlings of woody plants. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> – Tools: “Weed Wrench,” allows user to pull up young tree seedlings (too large to pull by hand) by the roots. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> – Mowing: In general, broadleaved herbaceous plants will diminish with regular mowing. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> – Controlled burning: This technique can be used to manage any landscape cover type. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> – Tilling: For large areas of infestation, tilling can uproot and kill undesirable species. 	<input type="checkbox"/>	<input type="checkbox"/>





<ul style="list-style-type: none"> – Application of herbicides is a method of last resort, but necessary in some cases. Herbicide treatments should be applied only to a specific plant and never broadcast, especially near water bodies. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> • Stabilize edges where a remnant natural area meets a manmade landscape for a smooth transition. Construction often leaves these transition areas highly disturbed. Repair of these newly exposed edges is critical. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> • Newly exposed, existing trees are often vulnerable to wind throw. Replant a strip along newly formed edges (where a portion of the natural landscape has been cut away) to buffer the remaining native landscape from increased wind, light, noise, and other 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> • Water or irrigate during the period of establishment and during severe droughts. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> • Erosion should be monitored before, during and after enhancement efforts, until the site is stabilized. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> • Monitor property regularly for invasive plant species. Remove them before they become established and spread. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> • If deer browsing is an issue: 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> – Plant large caliper trees with branches above 6 feet. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> – Protect trunks of young trees with plastic tubes. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> – Protect shrub and herbaceous plant material, as hungry deer will eat everything and prefer wildflowers. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> – Fence enhancement areas with effective deer fencing. A strong plastic mesh is adequate. Fencing must be tall enough to keep deer out, 12 – 18 feet high 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> – Organize an official “cull” with private bow hunters, or with professional sharp shooters, with the State Fish and Wildlife agency and in coordination with the USDA. 	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> • Test the soil before fertilizing. Use organic compost before using chemical fertilizers. 	<input type="checkbox"/>	<input type="checkbox"/>





<ul style="list-style-type: none">• To reduce the environmental impact of herbicides, pesticides and fungicides, use a pest management program.	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none">• Monitor success of enhancements by determining the health of plants, the apparent regeneration/recruitment of native seedlings, an increase in the abundance and diversity of native plants, a more visibly ordered structure in forests (ground layer, shrub layer, understory, canopy), if there are fewer invasive exotics, and if there are no bare soil patches.	<input type="checkbox"/>	<input type="checkbox"/>

