2 EARTHWORKS LANDSCAPE MANAGEMENT PRINCIPLES

INTRODUCTION

Earthworks are historic structures which are often the only visible remnants of an important military event. Earthworks, which can form vast networks, have often evolved to be functioning parts of broader ecological systems. Earthworks management, therefore, integrates in a unique and sometimes complex way, natural and cultural resource management values. Within this integrated landscape philosophy, three general principles for earthworks management emerge that address protection, sustainability, and interpretation:

1. Historic earthworks are protected and preserved.
2. Historic earthworks are managed using sustainable practices that consider the associated ecological system.
3. Historic earthworks that are presented to the public are legible.

The rationale supporting these principles of earthworks management is advanced in this chapter along with a discussion of the earthworks management components embodied in each of them.

PROTECTION/ PRESERVATION

The mandate for preservation of earthworks is stated strongly and clearly in legislation that established national battlefield parks. An example is provided in the U.S. Congress declaration of July 3, 1926, designating the Petersburg National Battlefield:

> In order to commemorate the campaign and siege and defense of Petersburg, Virginia in 1864 and 1865 and to preserve for historical purposes the breastworks, earthworks, walls, and other defenses or shelters used by the armies therein, the battle fields of Petersburg, in the State of Virginia, are declared a national battlefield...

Like Petersburg, many battlefield parks recognize the preservation and protection of the earthworks as the highest management priority. This in no way however precludes the possibility of letting people see them, or of interpreting them to the public. It simply makes clear that interpretation and appreciation of these sites not be at the expense of the protection of these irreplaceable structures.

There are three major management components embodied in the principle of earthworks preservation/protection:

a. Perpetuate and/or establish a vegetative cover that stabilizes the soil and protects the earthworks from the direct impacts of wind and water erosion;

b. Minimize the impact of human activities on the earthworks, whether they result from recreational, interpretive, or actual landscape maintenance and management activities;

c. Minimize the deleterious action of natural phenomena on the earthworks, e.g., windthrow of trees, burrowing of animals, or invasion of plant species that reduce natural diversity and erosion-controlling cover.

Perpetuate or Establish a Vegetative Cover

Perpetuating vegetative cover on earthworks involves one of two basic scenarios: earthworks are either in open (grassed) conditions and are actively maintained, or earthworks are in forested conditions and are minimally maintained. The critical difference is that forests and grasslands function differently to protect the earthworks and therefore require individualized management planning strategies to be successful. Under forest cover, it is the forest floor—layers of leaf litter built up over many years—that prevents erosion. In a grass/herbaceous condition, it is the network of roots and living leaf cover that reduces erosion. Each scenario can successfully protect the earthworks from wind and water erosion but each requires its own management strategy and associated tools and techniques. The tools and techniques associated with open and forested conditions will be discussed in detail in the following chapters.

The greatest challenge is establishing a functioning, erosion-controlling grass/herbaceous cover on earthworks that have been cleared of trees. Earthworks are generally cleared for one or more of the following reasons: (a) to be more visible for interpretive opportunities, (b) to maintain the public perception of being well maintained, and (c) to more closely resemble the historic scene.

The logical vegetative cover to establish on sites that have been cleared is a diverse herbaceous mix in which native grasses predominate. Native grasses as a group are probably the most effective plants for protecting soils from runoff and erosion. Moreover, once native grasses are established, they require less intensive maintenance than most exotic grass species. This lessens the chance of adversely impacting earthworks during routine maintenance activities. There is a growing number of successful examples of the use of native prairie grasses and other types of cover to protect sites from erosion.

In Georgia, the Oglethorpe Power Corporation conducted experimental planting of native grass species in test plots between 1987 and 1992. In October of 1990, based on this experimental work, a power line right-of-way in Smarr, Georgia, adjacent to Interstate Highway 75, was planted with a mix of Little Bluestem, Indiangrass, Switchgrass, Blackeyed Susan and Lanceleaf Coreopsis with a cover crop of annual ryegrass. In May of 1992, this planting was reported as providing greater than 80% cover. In July, 1996, Mr. Vince Howard Environmental Specialist at OPC, Atlanta, reported the continuing success of this planting in terms of cover and erosion control.

In another example initiated in the spring of 1994, a mix of native grasses and the legume partridge pea, were installed at Ninety-Six National Historic Site at Ninety-Six, South Carolina. By September of 1995, staff members at Ninety-Six reported the best cover of the earthworks, including the Star Fort, in memory. Quantitative sampling at that time revealed an average cover on the Star Fort of over 82%, almost entirely provided by grasses. The berm surfaces there had been mowed to a height of 5"-6" monthly during the 1995 growing season, and demonstrated a refined aesthetic effect.

At Cades Cove in the Great Smoky Mountains National Park, restoration of native meadows has been underway since spring of 1995. A preliminary report in April of 1996 documents a successful initiation in terms of increasing natural diversity in restoration sites. Dana Soehn, coordinator of the Cades Cove restoration, in a letter dated July 27, 1996, makes the following observation: “In restoring these areas, we have worked in cooperation with our cultural resources division within the Park. Overall, the Park historian has been receptive to the native meadows and the eradication of grasses which were planted in the 1930s and later, such as tall fescue.” The project more generally provides a demonstration of cooperation and collaboration as well, with several federal agencies cooperating, and with volunteers, mainly students, donating over 1400 hours’ work on such tasks as extensive seed-collecting from unmown field within the cove.

Brian Lambert, Natural Resources Specialist at Valley Forge National Historical Park, Pennsylvania initiated a tallgrass meadow project in that park in 1991; it has in 1996 been expanded from 200 to 700 acres. Included within the meadow areas are several redoubts. The former turf has been successfully converted from turf to a mix of tall grasses and forbs which provide very effective erosion control on the redoubts. No planting has been done in this case; the management program includes an annual mowing, usually in late March, with selective spot application of glyphosate herbicide to treat invasive woody plants such as Multiflora Rose and Asian Bittersweet. While the grasses that have developed under this program include exotic grasses such as Orchard Grass, there is a large component of Little Bluestem and Purpletop present. The only short mowing done under this program occurs on pathways leading from parking lots to the redoubts, and a path around the base of the earthworks, successfully keeping visitors off. Public

response to the tall grass meadow is overwhelmingly positive, according to Mr. Lambert, who estimates nine positive reactions to one negative.

While these examples provide evidence of the potential for establishing native grasses on sites in the eastern United States, the most convincing evidence is in a number of sites within the seven parks in this study. Where mowing has been reduced to once or twice a year, richly diverse stands of predominantly native grasses appear, presumably from propagules present in the soil. These same stands provide an ideal source of seed to introduce on earthworks.

Minimizing the Impact of Human Activities On the Earthworks

There is a strong attraction for visitors to walk on or over earthworks in battlefield parks. The earthworks are typically higher than their surroundings and provide a vantage point from which to view the landscape. Some also enjoy recreating the battle scene from this vantage point. Children especially enjoy the experience of climbing on earthworks because the view attained and the physical challenge. Adolescents and adults, attracted to the topographic challenges presented by earthworks, may cause irreparable damage by riding mountain bikes and other recreational vehicles on earthworks. Still another detrimental recreational use is associated with equestrian activities. All these recreational activities are clearly in conflict with the goal of earthwork preservation. A variety of policies and practices can be adopted to reduce visitor abuse of these resources.

Walkways or mowed pathways that lead people along the base of earthworks generally need to be eliminated. Educational programs remind people of the fragility of earthworks but where signs prohibiting visitor trampling are in place, they are often ineffective. A program of signs, pamphlets, and instructive reminders from park staff may be the most effective wayto deter visitors from harming earthworks. Parks that provide viewing platforms, such as those at Fortress Rosecrans, Stones River National Battlefield, Murfreesboro, Tennessee, or at Cold Harbor at Richmond Battlefield Park, give visitors the opportunity to experience the height of the earthworks while making it clear that earthworks are not to be trampled.

One could argue that visitors walking over reconstructed earthworks is acceptable because they are not original structures. However, there are two counter-arguments suggesting that even this is not a good practice, namely that (a) the public generally can not differentiate between original and reconstructed earthworks; and that (b) some reconstructed earthworks themselves now have historic value, and therefore are worthy of protection and preservation. An exception to this might be where "demonstration" earthworks are constructed, in an inconspicuous and nonhistoric location, to interpret to the public the likely condition of earthworks at the time of the battle. Both Fredricksburg and Petersburg have constructed such features with some success. Parks should promote appropriate access and use by visitors.

Vegetation can be used in various ways to discourage recreational activity on earthworks. At an open site, grasses left to grow taller than six inches can deter trampling; taller grasses are even more effective. Another example is where a mowed "interior" of an earthwork is surrounded by a tallgrass cover on the berms, such as the treatment at Battery Five at Petersburg National Battlefield. The taller grasses in these cases discourage trampling. In a wooded setting, a shrub cover of one to three feet in height could be effective. In parks that are adjacent to urban residential developments, more impenetrable barriers may be necessary at access points: logs or fallen trees; thorny shrubs and vines (e.g., blackberry and greenbrier); or in some cases, fences (ranging from split rail fences judiciously placed, as at Chancellorsville, to various heights and types of wire fencing in combination with dense vegetation) might be used.

Other activities that are often overlooked for their effect on earthworks are maintenance practices themselves. Maintenance and management activities, particularly mowing, have the potential to contribute to erosion and gradual degradation of the earthworks. With every pass of the mowing machinery, the potential for damage increases. If the mowing height is short—one or two inches—the potential for gouging the surface is increased. Hence, from the standpoint of erosion protection, the fewer mowings and the higher the mowing height the better because opportunities to gouge the surface of the earthworks is reduced.

Techniques to establish vegetation on earthworks can also damage the resources. Planting grass and shrub seedlings requires digging as well as considerable direct human trampling. This may be damaging to earthwork structures and any associated archeological resources. Wherever possible, planting techniques that require the least disturbance to the soil layer should be adopted.

Minimizing the Deleterious Action of Natural Phenomena

Natural phenomena can also greatly contrtibute to the destruction of earthworks. Three primary sources of damage are the windthrow of large canopy trees, the colonization of earthworks by undesirable plant species, and the burrowing of animals, particularly groundhogs.

The most dramatic of these natural processes that contributes to erosion and seriously damages earthworks, is the windthrow of large canopy trees. If a blown-down tree was growing on the earthworks, it pulls away layers of earth and rock that constitute the resource. Trees thrown down upon the earthworks can gouge out sections and expose bare earth to the process of erosion. Damage that resulted from a major windstorm was observed at Kennesaw Mountain National Battlefield Park. Here blown-down species of trees included mature oaks, hickories and blackgum. Fallen trees were pointed out at other parks in the study as well, which suggests that this is a recurring phenomenon.

Despite the damage that may result from major wind events, removal of all trees on earthworks in anticipation of a major storm is not a practical solution for a variety of reasons. Isolated mature trees growing directly on earthwork structures, however, may be targeted for gradual removal over time. Another solution may be a management program that removes saplings on the earthworks, which will prevent them from becoming major threats in the long run. Trees not growing directly on the earthworks should remain, with their canopies extending over the earthworks, perpetuating the forest floor and providing the general protective cover of a forest environment. (Management of earthworks in a forest environment is covered in more detail in Chapter 3.)

Figure 2.1. Damage resulting from the wind-fall of a large hickory tree at Kennesaw Mountain National Battlefield Park, Georgia.

A second natural phenomenon that diminishes the erosion-controlling capability of an herbaceous cover on cleared earthworks is the colonization of undesirable woody plant species. Two problems associated with this condition are: (a) the undesirable woody species do not provide good year-around erosion control; and (b) woody species shade out many of the desirable grasses and forbs. The most pernicious woody plant observed in many parks is Japanese Honeysuckle (*Lonicera japonica*). (See Figure 3.3) This invasive exotic plant spreads by way of trailing stems that sporadically root as well as through germination of its abundant seeds, which are eaten and eliminated by birds and small mammals. Blackberry (*Rubus allegheniensis*) may similarly invade a predominantly herbaceous cover and spread rapidly

outward through sprouts, layers, underground stems, and seeds. Like the Japanese Honeysuckle, Blackberry shades out low-growing herbaceous plants, exposing bare earth beneath its arching canes.

Chinese Privet (*Ligustrum sinense*) has a more upright growth form, but it too may effectively eliminate most other species in its path. Privet has a very high stem density, which prevents other herbaceous plants from competing for light and moisture. Furthermore, it is able to grow in conditions ranging from full sun to full shade, and from dry-mesic sites to floodplains with periodic inundation.

Management programs to inhibit the colonization and spread of these and other invasive species are necessary in order to promote the highest degree of protection for earthworks from erosion. Technical Support Topic #7, *Invasive Plant Species and Control Measures*, provides a summary of current knowledge on the control of these and other invasive species that tend to diminish the plant diversity once they are established.

Finally, another naturally-occurring phenomenon that represents a threat to earthworks is the burrowing of groundhogs. During this study, groundhog burrows, with their identifiable mounds of compacted earth at the entrance to the burrow, were observed on all types of sites—open sites with frequent visitation, wooded sites where visitors rarely go and even sites that had recently been cleared of Kudzu. To date, the preferred management recommendations regarding the problem of burrowing animals are: (a) trapping and removal; or (b) extermination.

SUSTAINABILITY IN EARTHWORKS MANAGEMENT PRACTICES

The National Park Service's own 1993 publication, Guiding Principles of Sustainable Design, states that "cultural resource treatment and maintenance methods should be both environmentally and culturally sensitive and sustainable over the long term" (p. 31). There are several components implicit to the principle of sustainability as it applies to earthworks management:

a. Minimize the expenditure of energy resources required such as the number of mowings or other maintenance treatments requiring motorized equipment.

b. Restrict the need for irrigation to small areas or rare occasions such as extreme droughts or plant establishment periods.

c. Minimize the need for soil amendments such as chemical fertilizers and lime through the use of plant species that are naturally adapted to the site conditions.

d. Minimize labor-intensive practices of plant establishment such as planting grass seedlings by hand.

e. Employ natural processes whenever possible to help rejuvenate and revegetate the site.

f. Minimize the use of pesticides and herbicides, consistent with the National Park Service Integrated Pest Management (IPM) guidelines.

A key consideration in the development of sustainable management practices for vegetation on earthworks is the use of a diversity of species predominantly native to the site. As noted in the discussion of earthworks protection/preservation, a management strategy that favors a diverse cover will lead to a complex mix of vegetation that will be adaptable to the heterogeneous environment of earthworks. A diverse mix of species will be resilient to climatic fluctuations, such as periods of heat and drought, or to infestations of a disease or insect. Plants native to a region, which have been observed on earthworks or on similar sites in the area, provide a logical pool of species to draw from when revegetation is necessary. Plant species that have persisted for centuries in a particular area are adapted to the climatic vagaries of that zone. Stands of native species are not management-free, however. Management practices associated with perpetuating diverse grass/herbaceous stands relate to arresting succession and suppressing diversity-diminishing invasive species. When herbicide treatment is necessary to suppress invasive species, targeted application through the use of a wick applicator or paintbrush is recommended over broadcast spraying. A diverse stand of forest also requires some maintenance to ensure that hazardous trees will not damage earthworks.

Legibility and Aesthetic Acceptability

There is a wide range of opinion among site managers as to what constitutes acceptable aesthetic standards for earthworks vegetation. Opinions also vary on the degree of visual refinement of earthworks necessary as it relates to the degree of interpretation. For example, one school of thought puts earthworks that are key interpretive points in an open condition under a monoculture of turf. It is therefore useful to develop a range of acceptable aesthetic standards or goals for the range of conditions: from open, non-forested, highly-interpreted earthworks, to forested, minimally-interpreted examples.

In cases when earthworks were hastily constructed at the time of the battle, they were bare earth or mud, with timber components in some situations for reinforcement. For these types of earthworks, the recreation of an authentic historic scene is not a viable option. Earthworks kept in such a condition would soon erode out of existence. As an alternative to bare earth, the establishment and perpetuation of a vegetative cover that might naturally have colonized in the years following the battle is appropriate. This “natural

look" is a complex of vegetation and can be a logical management goal. The natural evolution for most abandoned sites in the southeast begins with a community of herbaceous plants and evolves slowly to a mixed hardwood forest with multiple layers of vegetation. Between the extremes of this evolutionary continuum, there is a period when the vegetation seems an inconsistent and chaotic mix of grasses, broad-leaved herbaceous plants, vines, brambles, and tree seedlings and saplings. In the period soon after the Revolutionary or Civil Wars, it is important to note that there would have been less likelihood than there is today of invasive exotic species dominating the vegetation at any stage, since many of them were not yet so pervasive as they are today.

Figure 2.2. A mixed stand of tall native grasses provides excellent legibility as well as erosion control benefits as in this example at Colonial National Historical Park, Virginia.

Documentation shows that earthworks built to last for a period longer than the battle were often "sodded" with field grasses for the same reason that earthworks are vegetated today: to prevent erosion. In the case of sodded earthworks, plant succession, once the earthworks were abandoned, was the same as in the bare earth scenario, only proceeding more rapidly because of the head start that sodding provided.

For highly-interpreted sites, the early-successional "look" could be reasonably and successfully achieved by a mix of native grasses, given their fine texture and average two- to three-foot mature height. Notwithstanding the desirability of species diversity for sustainable reasons, too much visual

diversity, as represented by a variety of growth forms (e.g., grasses, forbs, vines, shrubs, and saplings) leads to visual chaos and a loss of earthworks legibility. A management goal in this situation would to perpetuate the dominance of the fine-textured grasses.

For earthworks that are only minimally interpreted, or where the interpretive message includes the story of successional change from open field to a mature forest, the central visual goal will be to maintain legibility of the earthworks, by reducing the number of different growth forms in the understory and groundlayer. This can be done by encouraging relatively low plant cover on the earthworks themselves.

To facilitate the public's appreciation of the "new aesthetic" of tall grasses where previously there was a highly-manicured turf, two strategies may be useful:

a. Some manicured turf cover may be perpetuated in selected zones. Examples include maintaining turf on the interior of a fort or battery, such as Battery Five at Petersburg, or in bands alongside trails to diminish the perception of neglect, which some people associate with native tall grasses.

b. During a transitional period, a mowing frequency of once every four to five weeks during the growing season, at a height of five to six inches, will gradually prepare people, for a mowing frequency of only once a year, and an average grass height of 18"-36".

CONCLUSION/ SYNTHESIS

By examining these three principles it can be concluded that they are compatible with one another. For example, the establishment of a diverse cover of herbaceous vegetation dominated by grasses in open, sunny situations represents one of the best possible means of providing erosion control. At the same time, a diverse cover of herbaceous vegetation can be perpetuated through management as simple as annual or semiannual mowing to a height of five or six inches. The visual effect of infrequent mowing permits the visitor to understand the earthwork form, but without the temptation to walk over it. Aesthetically, the effect of a fine-textured grass cover, increasing in height as the growing season progresses, and changing to warm color tones during the fall and winter, is a positive prospect.

Earthworks existing under forest conditions can exceed the protection offered by an established herbaceous cover if an intact forest floor is perpetuated. The only maintenance required in a forested condition is the removal of hazardous tree. In the following chapters, the application of these principles to the management of earthworks in both forested and open conditions is explored and technical information is provided that will assist in implementing a management plan for earthworks.