Longleaf pine ecosystem r&oration on small and mid-sired tracts

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Speaking of restoring the longleaf pine ecosystem, conservationists may present images of open stands trees, prescribed burning, grassy ground layers, and of providing habitat for red-cockaded woodpeckers. Unfortunately, planting a longleaf pine forest, using fire, and recovering an endangered woodpecker all seem require lands larger than a backyard. To many, restoring an ecosystem can be done only on large parcels of land. Little attention is given to the kinds of projects that have conservation value on small pieces of land. The purpose of this article is to identify the values that small-landowners can bring to restoring the longleaf pine ecosystem. First, I present a simplified concept or model of an ecosystem and relaterestoration td that concept. Secondly, I define and discuss restoration in a way that suggests a wic variety of restoration projects. I discuss issues related to the size and location of a potential restoration project, and give examples of restoration projects on small pieces of land. Finally, I suggest some information and funding sources available for planning and implementing restoration projects.

Ecosystem, a collection of elements and processes that are found toaether

In simple terms, an ecosystem consists of elements (species and habitat features) found in a designatec area and the processes that connect these things to each other and to their environments. Ecosystem elements include species of plants, mammals, invertebrates, soil microflora and fauna, and habitat elements like stumps or stump holes, cavities in dead or living trees, leaves and litter on the forest floor. Ecosystem processes include actions that result in moving elements in space or changing the form of elements. Examples of processes include the dispersal of seeds by animals, wind and water, and the decomposition of logs and leaves into forms of organic matter found in the forest floor. Ecosystem processes include disturbances like winds that blow down trees, changing standing live trees into down a dead wood. Fire catalyzes many processes, like decomposition, and stimulates various responses like increasing flowering and seed production in many species. Restoring an ecosystem may involve manipulating elements, processes, or both.

Restoration as incremental change along a continuum of site conditions

Restoration is often characterized as re-creating some historical condition. In the case of longleaf pine restoration; the target would be some set of conditions, present in the ecosystem sometime in the past. Alternatively, restoration has been described as converting an unnaturally disturbed condition to some natural condition. The "historical" and the "natural" definitions both suggest that there is a single, well-defined, correct end point. Trying to apply either of these restoration definitions leads to endless discussions about "what point in time?" or "what is natural?" In short, using either definition may end in argument rather than action. I'd like to suggest a different way to think about restoration.

Consider the lands once dominated by longleaf pine. On that regional landscape there are some areas most people would agree are disturbed or not natural (e.g. parking lots, golf courses); there are other ar that most would agree are more natural (e.g. national parks, nature preserves). There are many conditi that fall between these extremes, and such intermediate conditions represent a spectrum of continuous change, a continuum, from disturbed to natural. All parcels of land can be located somewhere on this continuum, but the exact location between disturbed and natural is not really so important. Using this continuum model, restoration can be defined as the process of making changes that move a piece of la from the current starting point toward the more natural condition.

Ecological restoration may involve either adding ecosystem elements or processes, for example re-plar native grasses if they have been lost; or removing elements, like Japanese honeysuckle or kudzu, or processes like cattle grazing in some places. This way of thinking about restoration defines a process t can begin with any starting condition on a piece of land and progress incrementally.

Considerations of size and spatial context

Recall the definition of ecosystem: a collection of natural elements (species and features) that are related by a variety of processes. It ***does not*** define the size of an ecosystem. Some might say that everything within the view from a mountain highway overlook is part of the extensive Southern Appalachian Ecosystem. Others would consider the leaf of a pitcher plant and the insects and processes inside it to be an ecological system. Both points of view are acceptable. The size of an ecosystem is arbitrary. For the purpose of defining feasible goals for a restoration project, the ecosystem of interest may be defined as the project area and immediate surrounding lands. It is necessary to consider two distinct aspects of space: size and spatial context (White and Walker 1997).

The size of a restoration project area can limit the kinds of ecosystem elements and processes the area can support. Consider an example of birds. Many studies have been conducted to determine how and if forest birds use fragmented habitats, and have reported that different species will use different sizes of habitat patches.(Robbins et al. 1989, Hamel 1992). For example, among forest birds, a Great Crested Flycatcher requires about one acre, while a Northern Parula requires 1300 acres (Hamel 1992). If a restored area provides only 10 acres of forested habitat, a manager cannot expect to support a breeding pair of Northern Parulas, but Great Crested Flycatchers might be possible. There are many explanations why some species may be absent from small parcels of land, The area may be too small to contain a particular kind of nesting habitat (limited resource quality), or the area may not be large enough to supply enough food resources (for example, not enough insects to eat; limited resource quantity). Alternatively, the area may provide ideal conditions for predators or parasites, which could affect the success of some species.

As the preceding discussion suggests, the size of an area to be restored will affect the kinds of objectives that are feasible for a project. However, in some cases the limits resulting from small size may be mitigated by the conditions on the surrounding lands, The conditions surrounding the project area provide the spatial context (White and Walker 1997). Considering, again, the bird example, if the habitat surrounding a restored forest is suitable for Northern Parulas, the combined area of the 10 acres restoration project plus surrounding suitable habitat may make it possible to support Northern Parulas.

Elements that depend on each other may have different spatial requirements. For example, plants don't move around much, but their pollinators do. If pollinators cannot be supported in the project site plus the surrounding areas, the restored plant populations may not survive either.

Although some kinds of restoration projects or natural conditions can be sustained only on large tracts, even those on smaller pieces of land make valuable contributions to conserving biological diversity. As an example, less than an acre of moist wiregrass meadow or a seepage bog may harbor many species of native plants, invertebrates, soil flora and fauna, small mammals. If such a small piece of species rich habitat is all that remains of that habitat type in an area, that small habitat may represent unique genotypes, and therefore would be an especially important component of biological diversity.

Examples of restoration projects for areas of various sizes

Table 1 lists and briefly describes some projects that may be suited to small properties (<2 acres), and to mid-sized tracts (10s of acres). This list is not exhaustive, but gives a few examples to stimulate thought or discussion. All of the projects have direct effects on restoring pieces of the longleaf pine ecosystem, in the sense of moving the conditions on a piece of land from less natural to more natural. Others have additional indirect values for restoring longleaf pine systems by preserving the existing biological diversity.

Resource needs: Expertise, Materials, Funds

Planning and implementing restoration projects require some specific kinds of information, native plant materials, and funds. Given the simplest intention of increasing the naturalness of a site, a project planner must be able to describe the current conditions on the site and have some information about what conditions would be more natural. As previously discussed, the size of the area and the conditions of

surrounding lands (spatial context) will influence the likelihood of success. Sources of information about the natural community, such as what species are typical of a site and what processes might have occurred in the natural ecosystem, include knowledgeable naturalists, books (e.g. natural history books, field guides), the staffs of conservation organizations and public botanical gardens, members of a Native Plant Society or the Society for Ecological Restoration, which is professional society for restoration ecologists. Useful information may be obtained by visiting and observing nearby natural areas.

Native plant materials may be offered by some specialized nurseries and some botanical gardens, but it is important to think about where the nurseries materials come from. For example, it is preferable that local seeds sources are used. A useful rule of thumb is to use plant materials that are grown from seeds from the sites as near as possible to the restoration project site. Collecting local seeds may be possible if permissionof the landowner is secured. The ecological issues surrounding the collection and uses of native plant materials are complicated, and if large scale plantings are considered it is important to understand such issues (Falk et al. 1996, Pfaff and Gonter 1996, Harker et al. 1999). Previously listed information sources may provide additional guidance for the collection and use of native species.

Funding for restoration projects is always needed. For projects that involve forest or wildlife habitat management landowner assistance program administered by Federal or State forestry or wildlife agencies may help plan or fund projects that achieve land restoration objectives. Table 2 lists some these programs. Administering agencies should be contacted for more information and to explore the opportunities for longleaf pine ecosystem restoration.

Summary

In this paper I have suggested that we think of restoration as a process that changes a site from current conditions to a condition that is more similar to a natural system. Even small changes contribute to restoration. Restoration may include adding species or habitat elements that have been lost, or reintroducing processes, like fire, that are no longer working. The kinds of species that can persist and ecological processes that can occur are limited by the size of an area to be restored and by the spatial context, that is the conditions of the surrounding lands. Though small projects areas may be limited in some ways, they can still sustain important elements of biological diversity, and indirectly improve the spatial context for surrounding lands. Thus, the cumulative effects of many small restoration projects will be greater than the sum of all the individual efforts.

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Table 1. Examples of restoration and conservation projects suitable for small and mid-sized project areas. Brief descriptions of projects and conservation values of projects are provided.

Brief description	Restoration goals-Conservation values
Small properties (c 2 acres)	
Horticultural use of native plants	Maintain genetic diversity of native species; avoid use of potentially invasive exotics. Native species could be planted in backyard gardens, butterfly gardens, botanical gardens.
Habitat gardens/projects of native species	Recreate habitats showing relationships among species provide habitat for as many native animals as possible. An example of this kind of project is being developed in the front yard of the Carolina Sandhills National Wildlife Refuge (CSNWR) Office. The diversity of birds using this habitat garden is much higher than those using the nearby bahia grass lawn.
Native grasses to re-vegetate sites	Provide resources for species that eat or live in native grasses; restore fire (an ecosystem process) by restoring fuel. An example is found near Pool A on the CSNWR where wiregrass was established by direct sowing.
Native species seed source	Increase seeds available for local restoration projects by planting seeds collected in nearby natural areas. Such a project has conservation directly, and makes it easier for others to use native species in restoration.
Mid-sized tracts (1 O-l 00 acres)	
Return native herbs to disturbed sites	Increase native species diversity in a site where species have been lost (e.g. as a result of fire exclusion or plantation establishment). Such projects are often experimental because managers do not know all there is to know about growing native species. Such projects may be good sites for demonstration and for learning from successes or failures.
Restoring longleaf pine forest structure	Improve or create habitat for species of open longleaf forests. Projects may involve planting longleaf pine trees, removing midstory hardwoods by chopping, cutting, or burning. The specific kinds of species that can persist in a restored area will depend on the size of the project area.