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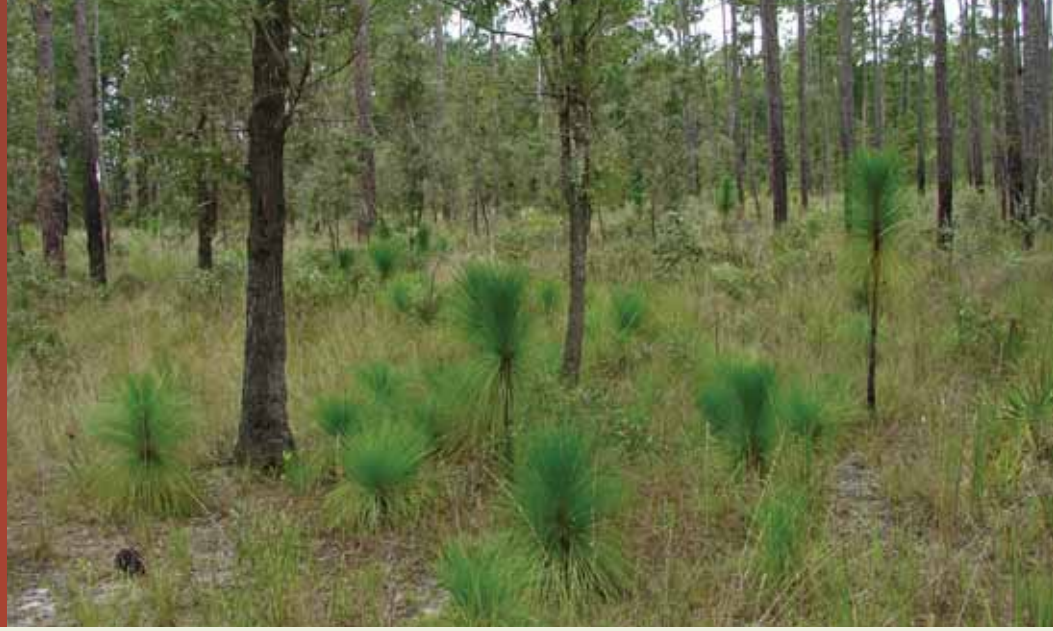
# Palmetto


Reading Your Landscape • Preserving Pawpaws at the Cincinatti Zoo • Biodiversity and Genetics

No. 2 In The Series

# Getting Started With Ecosystem Restoration



## Reading Your Landscape

What you will need to do to restore a natural ecosystem in your back yard or back 40 depends on the conditions with which you are initially faced. For example, if you have large pines but only sparse native ground cover due to hardwood invasion and past overgrazing, the restoration techniques called for are very different than if you are faced with a pine-less lawn, a weed-encroached garden, or an abandoned pasture that earlier suffered the plow. In severely disturbed areas where the challenge is essentially one of ecosystem re-creation rather than restoration, it is also important to determine at the outset which native species are present that deserve protection and encouragement. In some cases it may make sense to wipe the slate clean and to start from scratch. You should also consider that due mostly to the presence of neighbors, restoration in the suburbs is quite different than restoration in more isolated rural settings. Finally, the way one goes about restoration depends greatly on the size of the area to be restored as well as on the amount of time and money you are willing to spend (note that "time" should be reckoned in decades; I recommend against any consideration of money matters).

By Dr. Francis E. Putz

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*Top: Longleaf Pine Restoration at Morningside Nature Center, Gainesville, Florida. Photo © Dr. Merle Kuns*

## Ecological Starting Points

The paths of least resistance to restoration diverged well before you first considered whether to move towards a breezy savanna with mega-diverse understory or a hardwood hammock with 25 species of overstory trees. If savanna is your destination, then from the start your problem may very well be excessive shade. Pine savannas typically have widely spaced mature trees, perhaps as few as 10-20 per acre, with lots of light and air movement in the understory. [Fig. 1] Natural pine regeneration is mostly restricted to places under gaps in the canopy created by the death of large trees. If you are faced with the task of opening the canopy of your restoration site, you may have to girdle, herbicide, bulldoze, or fell large numbers of trees. Be warned that such activities might precipitate a major public relations challenge (Gobster 1994). Furthermore, some trees may be protected by state law, local stature, or tree-hugging family members. If you are unwilling or unable to open the canopy so that at least 50% of your area is in full sun, perhaps you should reconsider your plans for savanna restoration and think about more shady options, of which there are many.

Abandoned pastures and lawns may receive plenty of sunshine but nevertheless present their own challenges to savanna restorationists. First of all, many cultivated grasses are favored by lawn services and cattle ranchers for the very reasons that make them hard to eradicate; they are resilient, capable of rapid growth, and compete effectively with our natives for water and soil nutrients. Getting rid of introduced grasses may be difficult but its necessary lest they choke out the species you are trying to reintroduce (but don't eradicate the exotic grasses before you have established a sward of fire-carrying natives). Another problem with restoring pine savannas where exotic grasses were formerly cultivated derives from the residual effects of applied fertilizers.

**Fig. 1:** *Longleaf pine savanna at the Joseph W. Jones Ecological Research Center*

*Photo © Joseph W. Jones Ecological Research Center*

Most of our native species adapted over evolutionary time to harsh conditions, particularly nutrient scarcity. As such, they benefit less from fertilizer than a number of common native and exotic "weedy" species. While most of the nutrient elements included in commercial fertilizers tend to leach away rapidly (e.g., potassium), others, particularly phosphorus, tend to stick around for many years. And where there are abundant nitrogen-fixing legumes, like clover or hairy indigo, the nutrient excess problem can be particularly severe. Due in part to this problem of residual fertility, if you plant wiregrass you may end up growing Spanish needles, morning glory vines, pokeberries, and other garden-variety weeds favored by disturbed soil that is rich in nutrients.

Former vegetable gardens or otherwise plowed areas present another challenge – buried dormant seeds of weedy species. Remember that summer a few years back when it was just too hot and humid to weed your garden? Each of the weed plants that you failed to yank out by the roots probably contributed hundreds of seeds to the soil seed "bank." Disturb the soil when planting longleaf pine seedlings or wiregrass tublings and step back and watch the seeds of your sloth germinate and collect compound interest. Never fear, once you stop disturbing the soil, the buried dormant seed problem will diminish in just a few years.

## Reading Your Landscape

Before planting your first plant, weeding your first weed, or conducting your first burn, you need to employ (and perhaps hone) your skills as an ecological detective. What was your landscape like in the past? How did it get the way you found it? What can it become without a ridiculous amount of effort? To answer these questions you will need to search for clues above and below-ground, within and beyond your property boundaries. You will also benefit from exploring the memories of your older neighbors, searching out historical aerial photographs, and consulting county soil maps. The presence or absence of various indicator species can provide many clues, as does vegetation structure. But perhaps the best place to start with landscape reading is at the landscape or geographical level.

Where are you in the landscape? Are you on the top of what passes for a hill in our part of the world? How far is it to the nearest natural fire break, such as a lake or big river? Is your restoration site on the edge of any prominent landscape feature, like a marsh or ravine? These and related questions are important to answer because landscape location can overwhelm other environmental features in determining which sort of ecosystem develops on a site. For example, your restoration site may have the relatively rich soil characteristic of a hardwood hammock but never supported a magnolia because it is surrounded by acres and acres of deep coarse sands with extremely flammable vegetation.

When reading your landscape, remember that over the past 500 years, virtually all of the uplands on the coastal plain have been grazed by cattle, rooted by hogs, tapped for turpentine, logged, and of course

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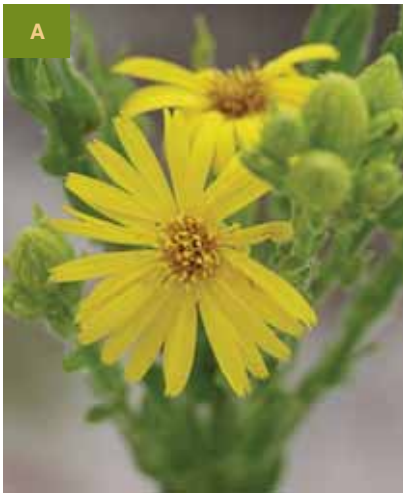



*Above: Photos © Shirley Denton*



*Right: Photos © Dr. Merle Kuns*

**Fig. 2:** *Some resistant, resilient, or otherwise durable survivors from former pine savannas*
A. *Chrysopsis scabrella* (goldenaster)
B. *Pityopsis graminifolia* (silkgrass)
C. *Asimina parviflora* (small-flowered pawpaw)
D. *Aristida stricta* var. *beyrichiana* (wiregrass)

repeatedly burned. Additionally, your restoration site might have been planted or plowed for cultivation. Fires were most likely suppressed, at least since the passing of livestock fencing laws in the 1950s. All of these environmental interventions leave clues, the finding of which will challenge you as an ecological detective and benefit you as a restorationist.

Although all species indicate something about your site's present and past environments, some plant species are typically used as indicators of underlying conditions and land-use histories. For example, species with notably thick bark such as longleaf and slash pines, and turkey and bluejack oaks, are characteristic of frequently burned sites. If fires have been suppressed, your site is more likely to host thin barked species such as sand and spruce pines, along with laurel and water oaks. Down in the understory, pawpaws, prickly pears, and milkweeds are good indicators of formerly open conditions. Amongst the herbaceous species, look for goldenaster, silkgrass, and scraggly clumps of wiregrass if you suspect that savanna was in your site's history. [Fig. 2]

The absence of a species sometimes is as informative as its presence, but the pitfalls of using negative evidence are many. If the canopy of your upland restoration site is moderately open but there is not a sprig of wiregrass to be found, chances are that it was plowed. Similarly, because longleaf pines were the focus of foresters and because they do not regenerate well without fire, their absence says little. Sometimes all that remains of longleaf pines are their resin-impregnated stumps, unless of course they were excavated for their high-quality resin.

Tree sizes and crown forms can also tell you a lot about what happened to your area over the past several decades. For example, trees with low branches and wide-spreading crowns are good indicators of open conditions. Multiple-stemmed trees are typically the result of sprouting from the stumps left by

**Profiles of landscapes crying out to be restored:**

**I: Fire supression**
- A few large longleaf or slash pines in the overstory
- No pine regeneration apparent. Mid-story choked by oaks and other hardwoods.
- *Count the annual rings on a laurel or water oak to judge when fires were first suppressed.*

**II: Site used for grazing livestock**
- Big pines are loblollies
- A few fire-sensitive hardwoods are scattered around
- Understory dominated by bahia grass, dog fennel, and hairy indigo.
- *Watch your step! You could tread on a petrified cow pie or tear your trousers on some old barbed wire.*

**III: Abandoned pasture**
- A big live oak with a once majestic crown is struggling amidst a sea of laurel oaks, black cherries, sweetgums, and other hardwoods. Other live oaks show only trunks with stubs of low branches.
- *Count the rings on hardwoods encroaching on the live oak to determine when grazing and mowing halted on this now-abandoned pasture.*

**IV: Logging, plowing, and fire supression**
- A dense forest of hardwoods dominated by laurel or water oak, sweetgum, and pignut hickory, with a few magnolias and hollies, all laced together with muscadine grapevines.
- *If clay is present a foot or so below the soil surface, you may have one of those rare sites that has been hardwood dominated for a long time. Otherwise, you are seeing the result of logging and plowing, followed by fire supression.*

loggers or after trees were top-killed by fires. And if there are a few large trees and many small ones, you have evidence that whatever process was responsible for keeping the site from being converted from savanna into forest was suspended at about the time that the small trees regenerated.

## Soil Matters

In our region, fire frequency and intensity coupled with flooding depth and duration mostly govern what grows where, but soil does matter. Since all Floridians live on what is or was beach, sand is the primary constituent of most of our soils, but sand is surprisingly variable. Whether you have fine sand or coarse sand, white sugar sand or yellow coated sand, pure sand or sand mixed with a little bit of clay really makes a difference. Throw in some organic matter and perhaps a chunk of limestone, and you have the soils of Florida (Collins 1997). Some basic knowledge about soil classification might help you to work with your site's natural tendencies. [Fig. 3] Here are some key characteristics used in soil classification:

1. Sand, sand, and more sand. If you have sand beneath the litter layer and sand when you refuse to dig any deeper, you probably have an Entisol. Usually the sand in this soil type is yellowish without any differentiation into obvious horizons (layers of soil differing in texture or color) below the top 6-12 inches into which organic matter has been thoroughly incorporated. Entisols are droughty, so be prepared to irrigate your transplants until their root systems are fully developed.

2. If your soil starts out looking like an Entisol, but then digging gets harder a foot or three beneath the surface due to some clay, you have an Ultisol. That little bit of clay helps retain water and nutrients, which sounds good but usually means that savanna restoration requires a great deal of beating back the lush growth of hardwoods.

3. If there are drainage canals in your neighborhood, your sand is covered by an inch or so of organic matter, and beneath the surface layer is a foot or more thick of coarse and extraordinarily white sand, then suspect a Spodosol. If the white sand horizon and your excavation efforts terminate abruptly at a black or dark brown hardpan, then you are indeed dealing with a Spodosol. The hardpan is composed of consolidated organic matter, and aluminum with some iron leached down from the now white layer above. If you are persistent and chip your way down through it (palmetto roots do it all the time) you'll get back into sand, but this time of yellow-brown shades and generally moist. The hardpan "perches" the water table during the rainy season, often making for squishy walking for several months per year. Spodosols generally develop in seasonally wet areas on sands with very low nutrient contents – they are great for slash pines, pitcher plants, saw palmettos, and salamanders.

## Geographical, Political, and Social Settings

Your restoration options will vary depending on whether your site is in a suburban neighborhood or in a more remote area. Ecosystem restoration will some day be encouraged everywhere, but in the meantime, many would-be restorationists have to grapple with neighborhood bans on burning, notions of nature corrupted by the lawn care industry, and scarcity of planting materials. Nevertheless, due to growing recognition of the excessive water needs of many horticultural endeavors, xeriscaping is becoming increasingly favored. Similarly, the on-going eutrophication of lakes, rivers, and below-ground aquifers should have everyone worried about the environmental effects of leached lawn fertilizers. At the same time, exotic species, many of which were introduced for horticultural purposes, are homogenizing our gloriously diverse ecosystems. Finally, in contrast to the hot wildfires that burn down houses in areas where fires have been long suppressed, pine savanna fires are easy to control. Your restoration efforts will therefore be appreciated when it is realized that established pine savannas require no irrigation or fertilizer, do not need to be mowed weekly with noise-making and air-polluting machines, and represent effective fire breaks when adjacent unburned areas eventually and unavoidably do go up in flames.

### References Cited

Collins, M.E. 1997. Key to soil orders in Florida. http://edis.ifas.ufl.edu/SS113

Gobster, P.H. 1994. The urban savanna: Reuniting ecological preference and function. Restoration and Management Notes 12: 64-71.

1: Entisol

2: Ultisol

3: Spodosol

**Fig. 3:** *Three common soils of Florida*

***1: Entisol –*** *Sand, generally yellowish in color. No obvious horizon layers below the top 6–12 inches into which organic matter is incorporated.*

***2: Ultisol –*** *An upper layer of sand covers a layer of clay, found one to three feet below the surface.*

*Photos courtesy of Dr. Mary E. Collins, University of Florida*

***3: Spodosol –*** *Organic matter in the top soil layer covers coarse white sand, which terminates in a hardpan layer composed of organic matter, aluminum and iron leached down from the white layer above.*

*Photo © Shirley Denton*