2008

4th Lone Star Regional Native Plant Conference

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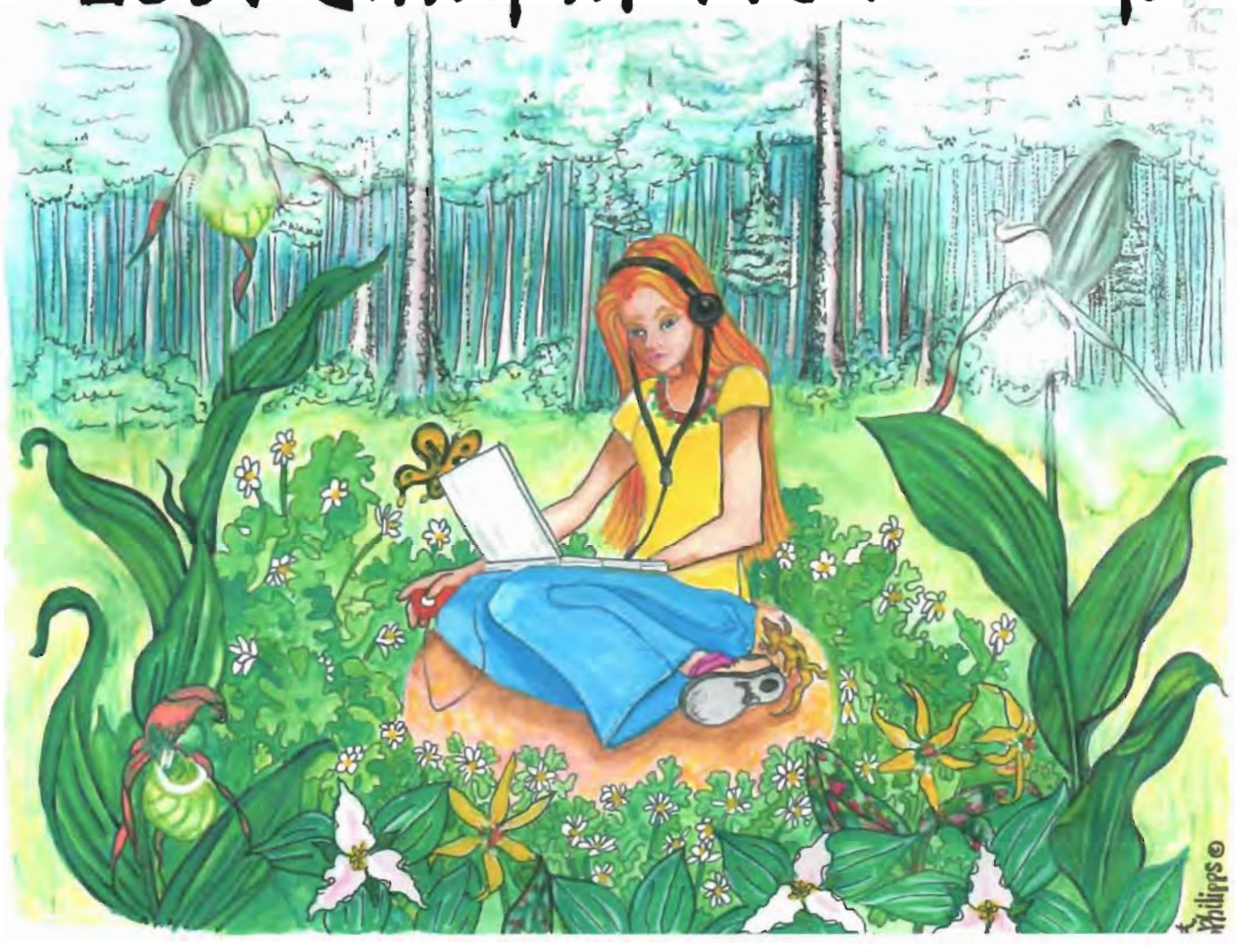
Lost Child in the Woods



In Association with the Cullowhee Native Plant Conference

Proceedings

of the

4th Lone Star Regional Native Plant Conference

Hosted by

Stephen F. Austin State University

Pineywoods Native Plant Center

Nacogdoches, Texas

May 28-31, 2008

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Garden Evolution: A Personal Experience

A Panel Discussion

By Gail Barton, Bill Fontenot and Peter Loos

Each of the three panelists will give a short presentation about his/her personal garden space. An open discussion will follow. A summary of each garden situation is given below.

Garden of Gail Barton and Richard Lowery

Our garden is located in Meridian, Mississippi which is in East Central Mississippi (Zone 7b) near the Alabama state line. We live in the city limits in a residential neighborhood. The house on a 90'x150' lot was purchased in 1984. At that time, the predominant plant materials were St. Augustine grass, existing pine and hardwood trees and a few exotic shrubs and ground covers (nandina, evergreen barberry, Indica azalea, cast iron plant, English ivy and liriope).

The site was mostly wooded prior to Hurricane Katrina. Currently the back garden is sheltered by large (100'+) white oaks and other hardwoods including mockernut hickory, water oak, Southern red oak and flowering dogwood. The terrain is basically a graded hilltop with disturbed urban fill dirt in some areas and native clay loam in others.

The indigenous plants that appeared in the garden and began to thrive after a few years of gentler management include beautyberry (*Callicarpa americana*), devil's walking stick (*Aralia spinosa*), partridge berry (*Mitchella repens*), hairy sunflower (*Helianthus tomentosus*), Joe Pye

weed (*Eupatorium purpureum*), mistflower (*Eupatorium colestinum*), hydrangea vine (*Decumaria barbara*), wood oats (*Chasmanthium sesiliflorum*), elephant's foot (*Elephantopus tomentosus*), wild petunia (*Ruellia caroliniana*), and turk's cap mallow (*Malvaviscus arboreus*).

Other natives from the adjacent 6 acres were incorporated into the landscape including: American beech (*Fagus grandiflora*), sweetbay magnolia (*Magnolia virginiana*), Indian pink (*Spigelia marilandica*), Piedmont azalea (*Rhododendron canescens*), arrow-wood viburnum (*Viburnum dentatum*) and ironwood (*Carpinus caroliana*).

The main advantage of the site has been the existing trees especially the large oaks. Since the site is more or less upland, drainage is decent in spite of the heavy clay. Even though the land is located in the city of Meridian, six adjoining acres have been purchased a little at a time. This allows a view of the woods including a large stand of piedmont azaleas and a view of a soggy bottom where cypress, sweet bay magnolias, native iris and other wetland species thrive. The garden benefits greatly from the borrowed scenery which serves as a soothing backdrop.

The site has been challenging because house is located about 50 feet from a busy street. Quick screening was desperately needed. Since the garden is in town and has been described by many as "growed up", there have been various unpleasant interactions with the city zoning department and with neighbors who were fearful of snakes that might be hiding in the plantings. The original owner bequeathed English ivy which has been a terrible and ongoing maintenance problem. Our last land purchase included an acre of mostly Chinese privet and a half acre of Chinese wisteria. The most recent dilemma was putting the place back together after Hurricane Katrina came to town. Most of the large pines in the front yard had to be removed and so the garden is in transition from a gently shaded spot to one that bakes in sun. Some plants have made the transition and others have not.

The following understory trees have been incorporated into the garden – ironwood (*Carpinus caroliniana*), red buckeye (*Aesculus pavia*), bigleaf magnolia (*Magnolia macrophylla*), American beech (*Fagus grandiflora*) and flowering dogwood (*Cornus florida*). Screening needs are being fulfilled by evergreen starbush (*Illicium floridanum*), Florida leucothoe (*Agarista populifolia*), southern magnolia (*Magnolia grandiflora*), spruce pine (*Pinus glabra*) and titi (*Cyrilla racemiflora*). Native shrubs include native azaleas, Virgiania sweetspire (*Itea virginica*), silverbell (*Halesia* spp.), witch hazel (*Hamamelis virginiana*), wahoo (*Euonymus americanus*), Alabama croton (*Croton alabamensis*), possumhaw holly (*Ilex decidua*) and palmetto (*Sabal minor*). Favorite herbaceous groundcovers include woodland phlox (*Phlox divaricata*), southern shield fern (*Thelypteris kunthii*), atamasco lily (*Zephryanthes atamasco*), black eyed Susan (*Rudbeckia hirta*), beard tongue (Penstemon *digitalis*), green and gold (*Chrysogonum virginianum*).

The front yard is now totally screened from the street by a planting of starbush, small anise tree, and southern magnolia. Indigenous groupings of sweetbay magnolia and wild honeysuckle azalea on the perimeter of the site impart enticing floral scents.

A tiny garden pond with spitting frogs provides soothing water sounds and a realistic habitat for a specimen titi. Small pieces of native rock are used to border beds and larger pieces serve as specimen rocks. Yard art including gazing balls and Marc Pastorek's ceramic faces grace the garden. The house is intimately integrated with the garden. Three sliding glass doors open onto an elevated deck that overlooks the back garden. A broken concrete path defines the backyard trails. A series of arbors mark the transition between different parts of the garden.

The garden is all about transitions from one season to another and from one garden room to another.

Garden of Bill and Lydia Fontenot

Lafayette Parish, South-Central Louisiana

We are located just north of Lafayette, in south-central Louisiana. We're in the western edge of the Atchafalaya Swamp (ca. 14' above mean sea level) about a half-mile east of Bayou Vermilion, a lazy north-south stream which empties into the Gulf of Mexico a little over an hour due south of us.

We live at the dead-end of a gravel road. We moved there in the spring of 1982, and began gardening in earnest by the following year. Our plant hardiness zone is 8b.
The place was a cow pasture when we first moved in. The gravel road was a cow path. There were no power poles present either. We waited several months for phone and electricity.

Over the years we've had the privilege of watching the cow pasture succeed into a bottomland hardwood forest, dominated by sweetgum, American elm, hackberry, water oak, and green ash, with lesser amounts of coast live oak, sweet pecan, and swamp red maple. Herbaceous species are numerous. Forested areas are dominated by a groundcover of Cherokee sedge (*Carex cherokeensis*). We began on two-thirds of an acre, and over the years have purchased an additional 49+ acres surrounding us.

In November of 1987 we began operating our little backyard native plant nursery, which has given us access to hundreds of species of southern U.S. native species. Over the past 25 years, we've trialed somewhere between 500-1,000 plant species and cultivars, including around 200 species/cultivars of southern native plants.

Soil is the primary limiting factor with our gardens. The native soil is a circumneutral silty-clay with the consistency of modeling clay when wet, and cinder block or lava rock when dry. Lacking any sand whatsoever, the shrink-swell ratio of this soil is ferocious.

It took a few years before we came to understand the crucial nature of organic mulch to our gardens. After all this time, we still mulch heavily, mostly with hardwood leaves topped with a thin layer of pine straw. It is a combination of the breakdown products of this mulch and the soil flora and fauna which thrive in it that has conditioned our soil and made it possible to plant and cultivate it. The soil is naturally rich and water retentive, often causing non-site-native trees (eastern redbud, for example) to grow so fast and so large that they topple under their own weight.

As with all gardens and gardeners, we were quite ambitious when we were young, and spent massive amounts of time trialing plants, weeding, mulching, etc. Over time, however, we've all matured. The gardens are now mostly shady, with only a few locales expressly maintained for sunlight. In our garden, sunlight definitely equates to weeds – and lots of them – dozens and dozens of species.

Over time, we're really come to appreciate the many showy species of site-generated natives that grace our gardens – by now comprising well over half of our plant total. Similarly, time has allowed us to winnow out an elite list of non-site-generated plants from other habitats, states, and nations which thrive on our site with little or no care – surviving the numerous floods, dry spells, cold snaps, heat waves, etc. which it seems are occurring with greater frequency and intensity at our place.

Featured Showy Site-generated Natives

Green Hawthorn (*Crataegus viridis*)

Deciduous Holly (*Ilex decidua*)

Red Buckeye (*Aesculus pavia*)

Dwarf Palmetto (*Sabal minor*)

Copper Iris (*Iris fulva*)

Short-stemmed Iris (*Iris brevicaulis*)

Woolly Rose-mallow (*Hibiscus moscheutos*)

Spider-wort (probably *Tradescantia ohioensis*)

Dayflower (probably *Commelina virginica*)

Mistflower (*Eupatorium coelestinum*)

American Germander/"Wood Sage" (*Teucrium canadense*)

Featured Non-site-generated "Natives"

Durand Oak (*Quercus sinuate*)

Swamp Cyrilla (*Cyrilla racemiflora*)

Little-leaf Viburnum (*Viburnum obovatum*)

Eastern Coralbean (*Erythrina herbacea*)

Alabama Snow-wreath (*Nevusia alabamensis*)

Strawberry Bush (*Euonymus americana*)

Swamp Rose (*Rosa palustris*)

Turk's Cap (*Malvaviscus drummondii*)

Doll's Eyes (*Boltonia diffusa*)

Purple Coneflower (*Echinacea purpurea*)

Salt-marsh Mallow (*Kosteletzkya virginica*)

Morning-glory (*Ipomea* spp.)

Tropical Sage (*Salvia coccinea*)

Meadow Rue (*Thalictrum* spp.)

Indian Pink (*Spigelia marilandica*)

La. Iris 'Cherry Bounce'

La. Iris 'Dixie Deb'

La. Iris 'Black Widow'

La. Iris (Dwarf "Black" *Iris brevicaulis*)

La. Iris "Fancy Fulva"

La. Iris "Evergreen"

Garden of Peter and Cassandra Loos

We are located on the south end of Chireno which is east of Nacogdoches along the El Camino Real in Deep East Texas. We are 2 miles west of the Attoyac River which feeds into Lake Sam Rayburn 8 miles to our south. We are blessed to have Polysot Creek, which feeds into the Attoyac, run through our property which includes the only bluff on Polysot.

The property has been in Cassandra's family for numerous generations and includes a total of 371 acres. The garden in the traditional sense, what one would call the yard, is approximately 3 acres.

When we moved to the property in September of 2003, there were numerous scattered mature shade trees (1 Red Maple, 4 Live Oak, 1 Water Oak, 2 Siberian Elms, 1 Southern Sugar Maple, 8 Eastern Red Cedar and several Hackberry). There were only a few ornamental shrubs (2 Crepe Myrtle, 3 Flowering Quince, 1 Nandina, 1 Burford Holly and 5 Rose of Sharon

Hibiscus). There were also a few naturally occurring wildflowers (several dozen Spiderwort plants, a couple of Black-eyed Susan and large sweeping patches of Spring Beauty).

The Mowing of the lawn over the past 5 years has been adjusted to benefit existing herbaceous wildflowers and this has increased total numbers of all species. The method and results have been such that there is no early season mowing so, in Jan-Feb the yard is white with Spring Beauty and therefore looks like it's covered in a blanket of snow. In March after the Spring Beauty is past peak (and fading) the Spiderwort begins and mowing starts. We mow around the larger Spiderwort groupings. This allows the Black-eyed Susans to become established and larger patches of them are also left unmown. We maintain mown paths only directly in front of the house at this time of year. In May-June the Spiderworts finish blooming and the Black-eyed Susans begin. With the mowing of Spiderwort the paths become less obvious and so the Black-eyed Susan patches look more like islands. Spring blooming Quaking Grass (*Brizia minor*) has responded well to the mowing schedule utilized and has added to the lawn 'show'. We have begun adding daffodil varieties, narcissus varieties and other early spring bulbs into the lawn in a few locations. To the side (south) of the front yard we have also created a prairie garden. It is a 100' x 20' rectangle that is home to Big Bluestem, Switch Grass and Eastern Gamma Grass collections with over a dozen different varieties of each. There are several Monarda species as well as several Silphium species. Also to be found include Winecup, American Germander, several yellow flowering composites (including *Bidens* spp., *Helianthus mollis*, *Rudbeckia maxima* and *Helianthus hirsuta*), Verbena, False Indigo, Bush Pea, Death Cammas, Gayfeather and 2 species of wild onion.

We have added numerous small flowering trees to the landscape. Most were incorporated as spot plantings - that is they were not part of a 'bed'. A number of genera have

more than one species utilized. There are 2 species of Buckeye (*Aesculus arguta* and *A. pavia*). We have added a Chalk Maple to go with the existing Southern Sugar Maple and Red Maple. Also we have planted several fruit trees to include Mexican Plum, Southern Crabapple, Louisiana Crabapple and Blanco Crabapple to complement an existing Pear tree. Each was spot planted but in a straight line to create a screen to divide that part of the yard and to give the feel of an orchard. Parallel to the fruit trees is a row of 5 posts each of which supports a different variety of native Wisteria. Currently there are 3 species of Hawthorn (*Crataegus* spp.) with plans to add a few more, each in a different area of the yard. To date we have only utilized a few Antique Roses but each is a different variety.

We have added five border type beds in the yard and all are mixed shrub/perennial plantings. Each has a theme based on the dominant plant groups. Along part of the driveway we have the flowering Quince/Mint garden. It is home to several *Monarda* spp. (Beebalm) as well as numerous *Pycnanthemum* spp. (Mountain Mints). As of now there are 3 Quinces, 2 existing when we moved here are the traditional fire engine red and the third that we added is a peach colored form. There are plans to add a white flowered form and a dark red form. The bed also has several *Salvia* spp., mainly to stretch out flowering times in the bed while sticking to the mint theme. There are a couple of composites such as Silphium and Asters to add color. Another bed is home to more hydric plants and includes variety collections of *Lyonia lucida* (Fetterbush), native Azaleas and Palmettos including the naturally occurring hybrid of *S. minor* x *S. mexicana* from Brazoria, TX. The perennials include 2 species of Iris, native Canna and Hibiscus 'Moy Grande'. A third bed, located under the very large existing Water Oak is home to a Viburnum collection. Each of the 5 Arrowwood Viburnums is from a different source (1 from Alabama, 1 from Louisiana and 3, each from a different counties in Texas). There is also a

collection of Turkscap varieties (white, red, pink and a hybrid). The herbaceous plants in this bed are trial plants (mostly species from the southeast US that may need some shade to survive in East Texas). The next border is located on a berm at the end of the driveway near the street (FM 95 or Main St.) and is home to Central and West Texas. Plants include *Yucca* spp., a Mexican Redbud, Texas Sage, 3 species of Salvia and Agrita. The last border bed, which frames a parking area near the house, started as a small slope and was a previous fence line. To soften the slope, a dry stack rock wall (made of smaller pieces of petrified wood) was added to the low side. The high end was lined with larger pieces of petrified wood to frame the whole bed. This bed is home to our Sweetspire collection. 5 plants all from different sources, 3 are named varieties. There is also a Phlox collection and an Elliot Blueberry collection. Other shrubs in this bed include a dwarf Agrista, a Florida Anise, Red Cedar variety and Chinese Buttonbush. There are also several mixed perennials for additional color.

There are other parts of the property that are not part of a traditional garden but are worthy of mention and a tremendous source of pride. The southwest corner of the property (76.3 acres) is an older growth mixed hardwood forest with some Loblolly Pine. Here one can find numerous 10' – 15' Piedmont Azaleas, 2 species of Trillium, acre sized sweeps (patches) of Mayapple, several small patches of Solomon Seal, numerous Violet species, several species of Fern (Cinnamon, Royal, Lady, Sensitive, Virginia Chain, Netted Chain, Wood, Bracken and Ebony Spleenwort), Fringe Tree, Southern Sugar Maple, Red Maple, Witch Hazel, Possum Haw Viburnum, Maple-Leaf Viburnum, Rusty Black Haw Viburnum, Arrowwood Viburnum, Hop-Horn Beam, Hornbeam, Sweetbay Magnolia, Southern Magnolia, Sweetleaf, several species of Blueberry and Beech. There are also several patches of Featherbells, 3 patches of Wood Betony and on the bluff overlooking Polysot Creek there is dwarf Paw Paw and a dozen specimens of

Tall Catchfly (*Silene subcilliata*). There are also several species of Hickory as well as Black Walnut and Paw Paw, although the largest specimens are located elsewhere along the creek on the property. The Oaks to be found include White Oak, Overcup Oak, Water Oak, Southern Red Oak, Willow Oak, Swamp Chestnut Oak and Laurel Oak.

Another part of the property worthy of mention is the north creek bottom pasture which is home to an over 50 acre stand of Cabbage Leaf Giant Coneflower (*Rudbeckia maxima*) and is also home to hundreds of Ironweed and Spring Lady Tresses (*Spiranthes vernalis*). Nothing in these 2 areas was added by us though there are plans to try and introduce Lady Slipper Orchids to the 'back woods' at the bluff. We continue to try to time pasture mowing to best benefit the Coneflowers and Ironweed.

The overall theme of the traditional garden is actually a reflection of Peter's strong belief not only in diversity but also in bio-diversity and therefore there are not only genera collections but also species collections. An added bonus to this is that the garden serves as a holding area for seed and cuttings for nursery stock. There are plans not only to continue to add plant material where space allows and increase genera and species diversity, but also to continue to trial new plant material.

With all the plant diversity incorporated into the garden to date has come an increased diversity of wildlife which only adds to our enjoyment. We eagerly look forward to the spring and fall migrations of song birds and butterflies. With the spring arrival of hummingbirds passing through, we know it's only a matter of time before the Blue Birds arrive, nest and bring their young into the world only to be followed by our mating pair of woodpeckers and the start of the arrival of numerous species of butterflies that visit each year.

Invaders of the plant kind in East Texas

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We all agree that kudzu, Chinese tallow, and Johnson grass are invasive plant species that cause serious problems, both ecologically and economically. But exactly what is an invasive plant? Does it have to be introduced? — and if so, introduced from where? And, what do we mean by the terms naturalized, weed, or invasive? Further, why should we care about introduced plants in our ecosystems? Some clarification is in order.

Some definitions

We define **introduced species** as those *non-natives introduced from outside the U.S.* These non-native taxa are also variously referred to as alien, exotic, non-indigenous, or foreign. This definition is somewhat of a compromise—if a species native to the eastern U.S. is introduced into Texas and subsequently becomes a problem (e.g., black locust—*Robinia pseudoacacia*), by our definition it is not considered an introduced species. Bluebonnets (*Lupinus* sp.) were not originally (in presettlement times) found in many Texas counties, but nonetheless we consider them native (All six Texas species of *Lupinus* are considered the state flower---see Andrews 1986 or Diggs et al. 1999 for a discussion). Some plants are not indigenous to Texas, but are native just across the border in adjacent states (e.g., oak-leaf hydrangea—*Hydrangea quercifolia* native in western Louisiana). Many of us, however, plant them in our landscapes and value them as native plants. A purist (and we are certainly not purists) might only want plants native to their particular county—but even in this case, a county has arbitrary boundaries. At the practical level (e.g., preventing importation of problematic exotic species, legal implications, etc.), using an "origin outside the U.S." definition for introduced species seems to make the most sense. They are thus species native somewhere outside the U.S. that have gotten here most likely with human help—either intentional or unintentional.

A **naturalized species** is simply *a non-native that is reproducing in the area without human assistance* (see Nesom 2000 for a more detailed definition). This term is thus less inclusive than the concept of an introduced species. We need to distinguish naturalized species from those that are *simply capable of growing here*, in gardens, landscapes, etc. To be naturalized, they must actually be reproducing on their own. Many important introduced cultivated plants are therefore not considered naturalized. We should note that some problematic naturalized plants do not necessarily reproduce by seeds—*Arundo donax*, giant reed, which is an aggressive invader in some areas, apparently does not set fertile seed in Texas, but still effectively spreads vegetatively (for example, by pieces of rhizome scattered by road equipment, water, etc.).

The word **weed** can have a variety of different meanings (Baker 1974; Randall 1997). From the sociological or human perception standpoint, a weed is *a plant growing where it is not wanted*, a "plant-out-of-place" (Stuckey & Barkley 1993), or simply a plant that someone doesn't want or like where it is. It should be obvious here that one person's weed is another person's treasure. In fact, in one of our (GD) "yards" there are many highly valued native wildflowers that neighbors definitely consider weeds. When defined in this way, many but not all weeds are naturalized introduced species. From an agricultural perspective, weeds are *plants that reduce agricultural yields*—again many introduced species do so (Holm et al. 1977), but so do some natives. Biologically, weeds (sometimes termed colonizing plants or colonizers) are species that "*have the genetic endowment to inhabit and thrive in places of continual disturbance, most especially in areas that are repeatedly affected by the activities of humankind*" (Stuckey & Barkley 1993). Many introduced plants fall within any of the above definitions of weedy species (as would some native species). However, it should be noted that the above sociological, agricultural, and biological definitions of weeds partially overlap with, but are not synonymous with our definitions of either introduced or naturalized species.

Invasive species

Introduced species include some of our most beautiful ornamentals (e.g., daffodils, tulips, and many rhododendrons and roses), provide most of our important food crops (e.g., corn, soybean, and wheat), are the source of most of our herbs (e.g., rosemary, oregano, basil), and are among the most widely used landscape plants in East Texas today. On the other hand, some are also extremely aggressive organisms that become serious problems. An **invasive species** is

sometimes defined as "*one that becomes so well adapted to its new environment that it interferes with native species*" (Tellman 2002). More specifically, invasive species can be defined as those that are 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Invasivespecies.gov 2004). More simply an invasive is *a non-native species that adapts to and invades its new environment to the point that it interferes with native species*. We need to point out that while several of these definitions limit invasives to non-native species, from the practical standpoint *we also consider some native species to be invasive*. For example, in Texas the exclusion of fire has radically changed the ecology of many originally fire-adapted ecosystems (e.g., Blackland Prairie, Cross Timbers, long-leaf pine forests). As a result, under conditions of fire suppression native species such as mesquite (*Prosopis glandulosa*) and juniper (*Juniperus ashei, J. virginiana*) have become extremely invasive and have taken over large areas of native ecosystems. In fact, from the agricultural standpoint, some Texas landowners would consider mesquite or juniper to be their most serious plant invaders. Ecologically, the same can sometimes be said to be true. For example, on Blackland Prairie remnants in North Central Texas invasion by junipers (eastern red cedar) is one of the most serious long-term threats. In fact, without mowing or controlled burns junipers will in several decades completely eliminate native Blackland Prairie. It is important to note that these native species have become invasive only due to the human-caused changes in the naturally occurring ecosystems—under presettlement conditions they would not have been problematic.

Why should we care about introduced species in our ecosystems?

One answer is ecological. Globally, nationally, and in Texas, invasive species are considered the second most important threat to species of concern (following only habitat destruction) (Simberloff 2000; Pimentel 2002). In other words, the most basic answer is that many of us want to preserve at least some remnants of our native flora and native ecosystems. By the most recent estimates, approximately 10% of East Texas' plant species are of conservation concern (Diggs et al. 2006). While many if not most of these owe their precarious position to habitat destruction, invasive species are now a serious threat. Since many species of conservation concern currently exist only in scattered remnant habitats or in precariously small populations, they are particularly susceptible to adverse effects caused by introduced invasives.

To understand the severity of the problem, one only has to think about the impact of Chinese tallow (*Triadica sebifera*) on Texas Coastal Prairie remnants.

A second answer is economic. Invasives include serious agricultural weeds, damaging parasitic plants, and extremely problematic aquatics—the economic cost to deal with these invasive species is often large. What will the economic costs be if the root parasite *Orobanche ramosa,* branched broom-rape, (now known from at least 23 Texas) becomes an agricultural pest here as it has in some parts of the world? This federal noxious weed, which is apparently being spread by highway mowing equipment, is capable of causing total crop failure. Unfortunately, in Texas the "horse is out of the barn" and it remains to be seen if it adapts to the local situation and becomes economically problematic (Texas Cooperative Extension 2003; TAMU 2008; J. Quayle, pers. comm.).

Why are invasive exotics (invasive introduced species) so problemtic?

Invasive exotics are an example of the phenomenon of *ecological release*—an introduced species is *released from the ecological constraints of its native area* (e.g., diseases, parasites, pests, predators, nutrient deficiencies, competition, etc.) and is consequently able to undergo explosive population growth in its new home. Elton (1958), one of the founders of the field of invasion ecology, used the term "ecological explosion" for this phenomenon, because the invasions display a "bursting out from control of forces that were previously held in restraint by other forces." Unfortunately, ecological release is well known in East Texas. For example, *Pueraria montana* var. *lobata*, kudzu, is an aggressive vine which can completely cover native forests and is already well-established in a number of East Texas counties (e.g., Colorado, Grayson, and Lamar). *Festuca arundinacea*, tall fescue, is capable of invading intact native tall grass prairies and is considered by some (e.g., Fred Smeins, pers. comm.) to be the most serious invasive threat to some tall grass Blackland Prairie remnants such as the Nature Conservancy's Clymer Meadow in Hunt County. The eastern Asian *Triadica sebiferum*, usually known as Chinese tallow tree or as popcorn tree, is now widely recognized as one of the most serious invasive exotics in East Texas and in the adjacent Gulf Prairies and Marshes (e.g., Barrilleaux & Grace 2000; Keay et al. 2000; Loos 2002). It is particularly problematic in invading and destroying native Coastal Prairie habitats, and is showing a rapid increase in sapling populations in some floodplain forests of the Big Thicket National Preserve (Harcombe et al. 1998; Keay et

al. 2000). In the Big Thicket we have seen a "battle of the invasives"—*Lygodium japonicum* (Japanese climbing fern) swarming wildly over Chinese tallow—crowding out native species in the process. Aquatic examples include *Hydrilla verticillata* (hydrilla) and *Salvinia molesta* (giant salvinia, kariba weed)—these plants can displace native aquatics and can reduce oxygen content, degrade water quality, and can cause physical problems including hindering boats, clogging irrigation and drainage canals, and blocking water intakes. Virtually every Texas biologist can give personal examples of invasive exotics that demonstrate ecological release—in Grayson county, for example, the native understory of some remnant native forests has been almost completely replaced by the combination of *Ligustrum sinense* (Chinese privet) and *Lonicera japonica* (Japanese honeysuckle). Unfortunately, there are numerous other examples in East Texas of ecological release. Some of the most serious include *Bothriochloa ischaemum* var. *songarica* (King Ranch bluestem), *Lespedeza cuneata* (sericea lespedeza or Chinese bush-clover), and *Sorghum halapense* (Johnson grass).

Numbers of introduced/exotic species in the flora

Of the 3,402 total species known for East Texas, 619 species or 18% of East Texas' flora, have been introduced since the time of Columbus and become naturalized (Diggs et al. 2006). This number seems reasonable based on data from other parts of the U.S. For example, Stuckey and Barkley (1993) indicated that in states in the northeastern U.S. the percentage of foreign species ranges from 20% to over 30%, while the numbers vary in western states with some being a bit lower (e.g., California 17.5%, Colorado 16%, Iowa 22.3%, Kansas 17.4%, and North Dakota 15%) (Stuckey & Barkley 1993; Rejmánek & Randall 1994). The higher percentages are in states that have been occupied the longest by non-native humans and in those with most extensive agriculture/disturbance.

Another way to think about introduced species

As noted above, as of the publication of the *Illustrated Flora of East Texas*, 619 of 3,402 native and naturalized species known for East Texas had been introduced. Further, a table in Diggs et al. (2006) lists 41 species recently (since 1997) introduced into East Texas. This is a very conservative estimate because these 41 are species that are both recently introduced into East Texas and new to the state. Between the "cut-off" date for that book (part way through

2004) and the end of 2006, an additional seven species were documented for the area (2 native, 5 introduced—see Table 1) that were not included in the counts for the East Texas flora. Those bring the East Texas totals, as of the end of 2006, to 3209 species with 624 introduced. Thus, within the 1997 to 2006 decade a total of 46 additional introduced species were documented (It should be noted that several species included in the book, due to the gracious sharing of information by various colleagues, have since been officially published in various journals—e.g, *Ctenium aromaticum* and *Alstroemeria pulchella*—Singhurst et al. 2005; we should also note that we have included species to the best of our knowledge based on when they were discovered and/or reported or published). How does this number of 46 species introduced in the past decade compare with previous decades? One might hypothesize that there were probably more introductions early on, for example in the 1800s or early 1900s, since fewer non-natives had already been introduced. Certainly we know that introduced species were making their way into Texas quite early. For example, by 1879 Reverchon had documented for Dallas County "66 introduced species that have taken such a foothold that they may be considered indigenous" (Reverchon 1879). He later (Reverchon 1880) listed more in "Notes on Some Introduced Plants in Dallas County, Texas" including *Adonis autumnalis* (pheasant's-eye), *Capsella bursa-pastoris* (shepherd's-purse), *Marrubium vulgare* (horehound), and *Nasturtium officinale* (water cress). Alternatively, one might argue that 20th century agriculture, with the extensive movement of seeds and materials, might have resulted in more introductions in the middle to late 1900s. Or one might argue that the most introductions have occurred quite recently, because of greatly improved modern transportation and shipping systems and the associated ease of importation of plant material from all over the world. In order to calculate the relative rate of introductions one must make some assumptions. First, when to start—in other words how long have introduced plants (defined as those from outside the U.S.) been able to make their way into East Texas. The answer is almost certainly dependent on where in East Texas one is talking about. For this discussion we are choosing 1779 (the permanent settlement of Nacogdoches, the oldest town in Texas). This is a conservative choice—if the date of the establishment of the first mission in Nacogdoches (1716) was chosen, the argument we are going to present would be even stronger. Thus using our 1779 starting point, there have been approximately 23 decades for introduced species to become naturalized in East Texas. Based on our total of 624 introduced species, that means an average of 27 per decade. Therefore, our figure of 46 species introduced in the past

decade (7.4% of the total) is well above the long term per decade average of 27 (4.3% of the total). The number of introduced species documented since 2006 further strengthens the point—7 additional introduced species (for a total of 631) have been added to the East Texas flora between the end of 2006 and the end of 2007 making the number added in the last 11 years 53 or 8.4% of the total (see Table 1). Additionally, unpublished data complied by Lipscomb show that in the 1990 to 1999 decade 83 species were added to the flora of Texas as a whole, including 56 introduced naturalized species—again, a surprisingly high number. Clearly, significant numbers of introduced species are continuing to naturalize in Texas.

What are some possible explanations for the above average rate of introduction in recent years? Some possibilities include the following:

1) More collecting and research recently (i.e., more botanists discovering things that are introduced).
2) More introduced plants being imported recently (and thus more that can potentially naturalize).
3) More habitat disturbance recently (thus allowing more invasion into the disturbed ecosystems).
4) Technological and behavioral changes (e.g., modern highway mowing techniques).

We speculate that all of these explanations probably contribute. 1) There has been an increased interest in Texas floristics in recent years. However, botanists in the state have long been aware of and interested in the effects of introduced species (e.g., Reverchon 1879, 1880; Cory 1940—Six thistles recently introdued into Texas"; Cory 1950; the publication of the *Manual of the Vascular Plants of Texas*—Correll & Johnston 1970; see Geiser 1948). Further, unpublished data gathered by one of us (BL) indicates that plant collecting has actually dramatically declined (Fig. 1). 2) Many plants are being brought into the state at present, but this is not new—huge numbers of ornamental plants have intentionally been brought into the area over many decades and likewise for many years large numbers of alien species have arrived as weeds (through agriculture and other means). Further, at present there is increased awareness about the problems of invasive exotics and at least some care is being taken to prevent the most problematic exotics from being introduced. It is thus extremely hard to judge the relative impact of recent importation. 3) Without doubt there is continuing extensive habitat disturbance—and it is known that invasives have an easier time gaining a foothold in stressed ecosystems. The role of

this factor is unclear—tremendous areas of native East Texas ecosystems were disturbed or destroyed in the late 1800s and early 1900s by conversion to agriculture and by logging. However, today, while almost no pristine habitat remains to be disturbed, vast areas devoted to agriculture and other human-dominated habitats as well as large amounts of secondary vegetation receive almost constant disturbance. Further, agricultural methods are becoming increasingly intensive. Sorting out the relative effects of these disturbance factors on invasion biology is not easy. 4) Finally, technological and behavioral changes clearly affect some (but not all) invasions. For example, in the cases of *Orobanche ramosa* (branched broomrape) and *Scabiosa atropurpurea* (pincushions) highway mowing equipment seems likely as the proximal cause for the rapid spread of these species in some areas. Branched broomrape, for example, rapidly spread over a 23 county area in the early 2000s. In Collin County, within a few year span, pincushions came to be the dominant roadside vegetation. In Grayson County, one of us (GD) has observed the rapid spread along local roadsides of a number of invasives over the past two decades including *Scabiosa atropurpurea, Carduus nutans* (musk thistle), and *Daucus carota* (Queen Anne's-lace).

Unfortunately, there is little hard data to allow insight into which of the four factors mentioned above or some other undiscussed factors are contributing most to the recent high rate of introduction of exotic species into East Texas—as noted above, probably all have some effect.

What does the future hold? Data from Missouri may be instructive—when comparing tallies from 1963 and 1999 (a 35 year interval), the proportion of non-natives in the Missouri flora increased from 22.8 to 27.7% (Yatskievych & Raveill 2001). A similar increase will probably occur in East Texas. As noted by Turner et al. (2003), "newly introduced aliens are likely to increase in diversity and geographic range as urban areas are expanded and new crop and grazing plants introduced, along with their baggage of weeds."

Implications/Conclusions

There is no question that introduced invasive species have tremendous costs. The economic costs of introduced invasive plants have been estimated nationally at $34 billion (Pimentel 2002) (much of this in the agricultural sector). In addition, the potential economic costs of invasive plants recently introduced into Texas (e.g., *Cuscuta japonica*—Japanese love-vine, *Orobanche ramosa*—broomrape, *Salvinia molesta*—kariba weed, *Solanum viarum*—tropical soda-apple),

can only be speculated on, but are potentially huge. Likewise, the ecological costs are very significant. Huge areas of East and coastal Texas have already been negatively impacted by *Triadica sebifera*—Chinese tallow, and dozens of other examples of ecologically devastating invasive exotics could be given.

Texas was until recently (2003) one of only 16 states without a noxious plant program—leaving it unable to act in an effective manner against potentially serious invasive species. As a result, the state was left vulnerable to costly effects caused by invasive exotics. Fortunately, initial legislation was passed in 2003 establishing a "Noxious and Invasive Plant List" (Texas Administrative Code 2007) and the "Pulling Together Initiative," a cooperative venture focusing on invasive plants, is in place. Further, there is now a Texas Invasive Species Coordinating Committee (TISCC), which exists by memorandum of agreement between eight state agencies (Waite 2007) and extensive information is available on-line (TexasInvasives.org 2007). Still, the state has no single authority in charge of dealing with invasive species—a fact that may prove costly in the future.

It is unfortunate that ecological problems like the one posed by invasive species often do not gain political traction or get significant attention or resources—yet, they can have profound costs. Without major emphasis on prevention, there will almost certainly be additional problematic introduced species added to the Texas flora in the years to come—with their associated economic and ecological costs.

REFERENCES

ANDREWS, J. 1986. The Texas bluebonnet. Univ. of Texas Press, Austin.

BAKER, H.G. 1974. The evolution of weeds. Ann. Review Ecol. Syst. 5:1–24.

BARRILLEAUX, T.C. and J.B. GRACE. 2000. Growth and invasive potential of *Sapium sebiferum* (Euphorbiaceae) within the coastal prairie region: The effects of soil and moisture regime. Amer. J. Bot. 87:1099–1106.

BROWN, L.E., E.L. KEITH, D.J. ROSEN, and J. LIGGIO. 2007. Notes of the flora of Texas with additions and other significant records. III. J. Bot. Res. Inst. Texas 1:1255–1264.

CLEMANTS, S.E. 2004. *Alternanthera*. In: Flora of North America Editorial Committee, eds. Fl. North Amer. 4:447–451. Oxford Univ. Press, New York and Oxford.

CORRELL, D.S. and M.C. JOHNSTON. 1970. Manual of the vascular plants of Texas. Texas Research Foundation, Renner.

CORY, V.L. 1940. Six thistles recently introduced into Texas. Madroño 5:200–202.

CORY, V.L. 1950. Additional records of plants introduced into Texas. Field & Lab. 18:89–92.

DIGGS, G.M., JR., B.L. LIPSCOMB, and R.J. O'KENNON. 1999. Shinners and Mahler's illustrated flora of North Central Texas. Sida, Bot. Misc. 16.

DIGGS, G.M. JR., B.L. LIPSCOMB, M.D. REED, and R.J. O'KENNON. 2006. Illustrated flora of East Texas, Vol. 1. Sida, Bot. Misc. 26.

ELTON, C.S. 1958. The ecology of invasions by animals and plants. Originally published by Methuen and Co.; republished in 2000 with a new forward (D. Simberloff) by Univ. of Chicago Press, Chicago, IL.

GEISER, S.W. 1948. Naturalists of the frontier, 2nd ed. Southern Methodist Univ. Press, Dallas, TX.

HARCOMBE, P.A., R.B.W. HALL, J.S. GLITZENSTEIN, and D.R. STRENG. 1998. Sensitivity of Gulf Coast forests to climate change. In: G.R. Guntenspergen and B.A. Vairin, eds. Vulnerability of coastal wetlands in the southeastern United States: Climate change research results, 1992–97. Biological Science Rep. USGS/BR/BSR–1998-002. U.S. Dept. of the Interior, U.S. Geol. Survey, National Wetlands Research Center, Lafayette, LA.

HILL, S., R. LOPER, J.R. SINGHURST, and W.C. HOLMES. 2007. *Vicia lathyroides* (Fabaceae): new to the flora of Texas. J. Bot. Res. Inst. Texas 1:1253–1254.

HOLM, L.G., J. DOLL, E. HOLM, J. PANCHO, and J. HERBERGER. 1997. World weeds: Natural histories and distribution. John Wiley, New York.

HOLM, L.G., D.L. PLUCKNETT, J.V. PANCHO, and J.P. HERBERGER. 1977. The world's worst weeds: Distribution and biology. Published for the East-West Center by the Univ. of Hawaii Press, Honolulu.

INVASIVESPECIES.GOV. 2004. A gatewate to federal and state invasive species activities and programs. http://www.invasivespecies.gov. Accessed Mar 2004.

KEAY, J., W.E. ROGERS, R. LANKAU, and E. SIEMANN. 2000. The role of allelopathy in the invasion of the Chinese tallow tree (*Sapium sebiferum*). Texas J. Sci. 52(4) Suppl.:57–64.

KEITH, E.L. 2004. *Tagetes erecta* (Asteraceae), a new escape to the flora of Texas. Phytologia 86:104–106.

LEMKE, D.E. and J.L. APLACA. 2006. *Erodium malacoides* (Geraniaceae), new to Texas. Sida 22:1245-1249.

LOOS, P.M. 2002. An alien among us. Newsletter Native Plant Soc. Texas 20:6.

NESOM, G.L. 2000. Which non-native plants are included in floristic accounts. Sida 19:189–193.

PIMENTEL, D., ed. 2002. Introduction: Non-native species in the world. In: Biological invasions: Economic and environmental costs of alien plant, animal, and microbe species. Pp. 3–8. CRC Press, Baca Raton, FL.

QUAYLE, J. (JEFF). Personal communication, 2004. Plant collector, discoverer of the recently described *Senecio quaylii* (Asteraceae), naturalist, and botanical consultant of Fort Worth, TX.

RANDALL, J.M. 1997. Defining weeds of natural areas. In: J.O. Luken and J.W. Thieret, eds. Assessment and management of plant invasions. Springer-Verlag, New York.

REJMÁNEK, M. and J.M. RANDALL. 1994. Invasive alien plants in California: 1993 summary and comparison with other areas in North America. Madroño 41:161–177.

REVERCHON, J. 1879. Flora of Dallas County, Texas. Bot. Gaz. 4:210–211.

REVERCHON, J. 1880. Notes on some introduced plants in Dallas County, Texas. Bot. Gaz. 5:10.

ROSEN, D.J. and R.B. FADEN. 2005. *Gibasis pellucida* (Commelinaceae), a new and potentially weedy genus and species for Texas. Sida 21:1931–1934.

SMEINS, F. (FRED). Personal communication. 1998. Professor of Ecology in the Department of Rangeland Ecology and Management, Texas A&M University. Expert on structure and dynamics of rangeland (grassland, wetland, savannah) ecosystems including the Blackland Prairie.

SIMBERLOFF, D. 2000. Foreward. In: C.S. Elton. The ecology of invasions by animals and plants. Originally published by Methuen and Co.; republished in 2000 by Univ. of Chicago Press, Chicago, IL.

SINGHURST, J.R., E.L. KEITH, and W.C. HOLMES. 2005. Three species of vascular plants new to Texas. Phytologia 87:124–128.

STUCKEY, R.L. and T. M. BARKLEY. 1993. Weeds. In: Flora of North America Editorial Committee, eds. Fl. North Amer. 1:193–198. Oxford Univ. Press, New York and Oxford.

TELLMAN, B. 2002. Introduction. In: Tellman, B., ed. Invasive exotic species in the Sonoran region. Pp. xvii–xxvi. Univ. of Arizona Press and Arizona-Sonora Desert Museum, Tuscon.

TEXAS ADMINISTRATIVE CODE. 2007. Quarantines and Noxious Plants, Chapter 19. State of Texas. http://info.sos.state.tx.us/pls/pub/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=4&pt=1&ch=19&rl=300. Accessed Mar 2008.

TEXAS COOPERATIVE EXTENSION. 2003. Keep watch for branched broomrape (*Orobanche ramosa*): A major threat to U.S. crops. http://www-aes.tamu.edu/mary/brmrape/brmrape.htm 2002. Accessed Jan 2003.

TEXASINVASIVES.ORG. 2007. Texas Invasives.org. http://www.texasinvasives.org/. Accessed Mar 2008.

TAMU. 2008. Keep watch for branched broomrape (*Orbanche ramosa*). Texas A&M Univ. Agric. Exten. Service. College Station, TX. USDA. http://www-aes.tamu.edu/mary/brmrape/brmrape.htm. Accessed Mar. 2008.

TURNER, B.L., H. NICHOLS, G. DENNY, and O. DORON. 2003. Atlas of the vascular plants of Texas, Vol. 1: Dicots, Vol. 2: Ferns, gymnosperms, monocots. Sida, Bot. Misc. 24.

USDA NATURAL RESOURCES CONSERVATION SERVICE. 2002. Federal noxious weeds. http://plants.usda.gov/cgi_bin/topics.cgi?earl=noxious.cgi. Accessed Dec 2002.

WAITE, D. 2007. Executive summary: 2007 Texas Invasive Plant Conference. http://www.necis.net/necis/files/2007_texas_invasive_plant_conference.pdf. Accessed Mar. 2008.

YATSKIEVYCH, G. and J.A. RAVEILL. 2001. Notes on the increasing proportion of non-native angiosperms in the Missouri flora, with reports of three new genera for the state. Sida 19:701–709.

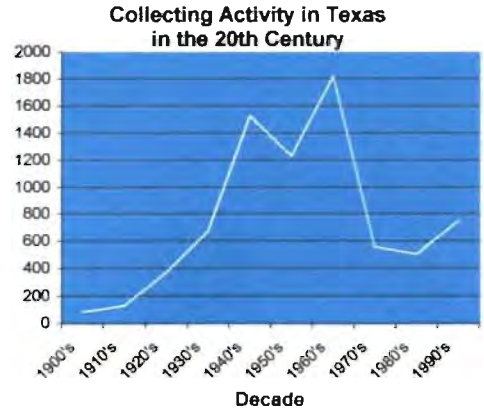

Fig. 1. Collecting activity in Texas in the 20th century based on 7,685 herbarium specimens selected randomly from the DIGITAL FLORA OF TEXAS HERBARIUM SPECIMEN BROWSER. 2001. http://www.csdl.tamu.edu/FLORA/tracy2/main1.html. Accessed Nov 2001.

Table 1. Introduced species added to Texas from mid 2004 to 2006 and during 2007 (Clemants 2004; Keith 2004; Rosen & Faden 2005; Lemke & Aplaca 2006; Brown et al. 2007; Hill et al. 2007)

Introduced species reported mid-2004-2006	Introduced species reported 2007
Alternanthera ficoidea (calico plant, Joseph's-coat)	*Lepidium campestre* (field pepperweed)
Erodium malacoides (Mediterranean stork's bill)	*Orobanche minor* (small broomrape, hellroot)
Gibasis pellucida (bridal veil)	*Pavonia hastata* (pale pavonia, spearleaf swampmallow)
Tagetes erecta (marigold)	*Sphagneticola trilobata* (wedelia, creeping oxeye
As yet unpublished report of a South African Iridaceae	*Valerianella locusta* (corn salad, lamb's-lettuce
	Vicia lathyroides (spring vetch)
	Zephranthes grandiflora (pink rain lily, rosepink zephyrlily)

Table 2. Data on the number of introduced species in the flora of East Texas.

Time Frame	# of Introduced Species Added & Totals
1779-1996	total 578
1997-mid 2004	41 (total 619)
mid 2004-2006	5 (total 624)
2007	7 (total 631)
# and % added 1997-2007	53 or 8.4% of total # of introduced species

Allowing Beauty and the Interconnectedness of All Things to Infiltrate Our Hearts and Yards

(The following are ideas that I touch upon during my presentation, as well as showing slides that guide my talk.)

What is Wild?

Changing our perspective and then recognizing our needs from that perspective. Example: If I morph into a Wood Thrush, my quest becomes seeking the food my body requires, searching for shrubby undergrowth where I desire to build my nest, always being on guard for predators, and where might be the most advantageous perch...one that best allows my glorious song to carry when I open my throat to sing?

From the flowers, seeds, stalks and roots of many plants with the general human derived title of "weeds" comes sustenance to a bounty of critters...whereas Nature names her weeds, exotic invassives.

Allowing beauty.

Recognizing the majestic wonder of the simple.

Recognizing the majestic wonder of those entities we deem annoying (ever watch a mosquito steal/borrow your blood?).

To observe a flower...giving it no name or physical attribute...when the mind quiets and the spirit opens we come to recognize the essence of flower and self as one in the same!

The clutter of modern day life keeps us occupied and ignorant to the realization of our connection with all life.

Through the landscape of our yards, we can create sanctuary...a place that invites those entities who speak not with a human voice (be it plant or any critter)...then each step we take within this place becomes breathtaking, for we realize that every action has an outcome and we know that all things are connected...and ultimately, with arms open wide we sing, "life is beautiful"!

COLLECTING AND HANDLING SEEDS OF SPRING BLOOMING WILDFLOWERS

by
Jan Midgley

Spring brings to mind words like vernal, fresh and new. These words also describe the seeds of spring wildflowers. Many of these seeds must be collected and handled with more care than seeds collected from plants that bloom and fruit in the summer and fall. For most spring blooming native plants, desiccation is deleterious or deadly.

Many native plants that bloom and fruit in late winter and spring have seeds that are commonly referred to as "wet" seeds. The term wet just means they should be kept moist and never allowed to dry. Some of these seeds have a fleshy attachment called an aril or elaiosome which is cream colored and oily. This aril is attractive to ants and they disperse the seeds, a method of seed dispersal called myrmecohory. The ants carry the seeds to their nests, eat the aril or feed it to their larvae and then toss the seeds back out on the ground far from the mother plant. You may have noticed bloodroot seedlings appearing all around your yard if you have that species in your garden.

Collect arillate seeds in a plastic bag that can be closed securely. If you cannot begin to process them immediately, add some moist construction sand or peat moss to the bag. Sand works well with small seeds that might not be visible in the strands of the moss. The seeds can be held for a few days or even weeks in a refrigerator while you continue to collect seeds of that species.

Seed collection of some species may take a few weeks. Seeds of rue anemone and false rue anemone can be rubbed off their receptacles directly onto potting soil in cells or in a pot as you collect over time. Leave the pot outside in the shade and water it regularly. Collect seeds of wood poppy and bleeding heart in plastic sandwich bags containing 2 tablespoons of moist sand and keep them in the refrigerator. They will stay in a refrigerator for about 4 months before sowing.

Examples of seeds that have arils include: *Anemonella thalictroides* (rue anemone), *Actaea pachypoda* (doll's eyes), *Asarum canadense* (deciduous ginger), *Cardamine* spp. (syn. *Dentaria*, toothwort), *Claytonia* spp. (spring beauty), *Dicentra* spp. (bleeding heart and dutchman's britches), *Erythronium* spp. (trout lily), *Hepatica* spp., *Hexastylis* spp. (evergreen ginger), *Jeffersonia diphylla* (twinleaf), *Sanguinaria canadensis* (bloodroot), *Stylophorum diphyllum* (wood poppy), and *Trillium* spp. (trillium)

A fleshy coat around a seed can be considered a type of aril. The fleshy material contains a germination inhibitor. The natural process is for the seeds to pass through the digestive tract of some animal to remove the flesh and slightly scarify the seeds. We can simulate that process by soaking and cleaning the seeds and even roughing them up a bit with a handheld quick prep device (like the ones used to cream soup in the pot on the stove). Seeds from herbaceous plants, other than dry legumes, rarely need scarification. The seeds from woody plants may have a tougher seed coat that requires abrasion to hasten germination.

Examples of seeds that have fleshy coverings include: *Arisaema* spp. (jack-in-the-pulpit, green dragon), *Caulophyllum thalictroides* (blue cohosh), *Maianthemum*

racemosum (syn. *Smilacina racemosa*, false solomon's seal), *Polyganatum biflorum* (solomon's seal), and *Prosartes lanuginosa* (syn. *Disporum lanuginosum*, yellow mandarin).

Lastly, there is a group of seeds that have no visible aril or fleshy covering. They just do not tolerate drying out or long term storage. Some lose viability more rapidly than others. The best way to handle them is to sow them as soon as possible. The flowering/ fruiting branches can be collected in paper bags to allow the seeds to fall in the bag but should be sown within 7-10 days. Bill Cullina of the New England Wildflower Society has coined the term "hydrophilic" or water loving to describe these seeds.

Examples of "hydrophilic" seeds include: *Actaea racemosa* (syn. *Cimicifuga racemosa*, black cohosh), *Camassia scilloides* (wild hyacinth), *Delphinium* spp., (wild larkspur), *Phlox divaricata* (wild blue phlox), *Polemonium reptans* (jacob's ladder), *Spigelia marilandica* (indian pink), and *Tiarella cordifolia* (foamflower).

Fruiting and the collection date(s) usually occur within six weeks of flowering. Some species (ex. blue phlox, jacob's ladder, foamflower) will be flowering and fruiting at the same time. Many spring blooming plants have explosive devices to disperse the seeds (ex. toothwort, wood poppies). One must collect these capsules when the color changes from green to pale yellow, before the capsules fling the seeds far and wide. A few species take many months to ripen their seeds (ex. black cohosh and fairy wand). The last two examples are interesting because the black cohosh seeds are hydrophilic and the fairy wand seeds can be stored dry. Why would the black cohosh ripen in late October and yet need a warm moist stratification? Just one of the mysteries about seeds and their germination that keep me fascinated.

Seed treatments after collection are highly variable. Most of the seeds of spring blooming plants would naturally go through a warm moist period (late spring and summer) before they enter a cold period (winter). If one has no specific information about how to germinate a certain species, replicating natural seasonal changes is a reliable guide. What makes seed germination so interesting is the multitude of variables that influence germination. Some seeds don't need to undergo the first warm moist period (ex. alabama delphinium) and others absolutely require it (ex. black cohosh). Some seeds germinate within 1 month (ex. foamflower) and some germinate in 2 years after repeated warm-cold cycles (ex. trillium). Some seeds will germinate the first fall (ex. toothwort, jacob's ladder) and some will germinate the following spring (ex. ginger, hepatica). Messing around with seeds will entertain you for a lifetime.

If you are interested in specific information for collecting and germinating seeds of herbaceous plants including grasses and vines, you can order " Native Plant Propagation", a manual by Jan Midgley. Send a check for $14.00 (includes shipping) to her at 234 Oak Tree Trail, Wilsonville, AL 35186. email: jwildflwr@aol.com

PROPAGATING NATIVE PLANTS FROM SEEDS

Lone Star Regional Native Plant Conference - Jan Midgley
May 30, 2008

"Wet" Seeds

"Wet" seeds have an aril or a fleshy covering or just do not tolerate drying out. Sow ASAP or keep moist in close-able plastic bag with a bit of sand or spagnum.

Anemonella thalictroides (rue anemone)

Actaea pachypoda (doll's eyes)

Actaea racemosum (black cohosh)

Arisaema triphyllum (jack-in-the-pulpit)

Cardamine douglassii (mountain cress, toothwort)

Delphinium alabamicum (alabama delphinium)

Erythronium spp. (trout lilies)

Hepatica rotundiloba (round-lobed hepatica) - syn. Anemone americana

Hexastylis arifolia (evergreen ginger, little brown jugs)

Hymenocallis caroliniana (spiderlily)

Mitchella repens (partridgeberry)

Polemonium reptans (jacob's ladder)

Sanguinaria canadensis (bloodroot)

Spigelia marilandica (indian pink)

Tiarella cordifolia var. collina (wherryii's foamflower)

Trillium decumbens (bent-stalk trillium)

Myrmecochory (ant dispersal)

"Dry" Seeds

Aster family and phlox species are not self-fertile. You must have two or more seed grown plants to get fertile seeds.

Eustoma exaltatum (seaside gentian) - annual

Seed storage

Amsonia tabernaemontana (bluestar)

Asclepias tuberosa (butterfly weed)

Baptisia alba (white wild indigo)

Senna marilandica (wild senna, cassia)

Camassia scilloides (wild hyacinth)

Echinacea purpurea (purple coneflower) - Asteraceae

Gentiana saponaria (soapwort ginger)

Hibiscus laevis (halbard-leaved marshmallow)

Liatris earlii (gayfeather) - Asteraceae

Lilium canadensis 'Springville' (canada lily)

Penstemon calycosus (smooth beardtongue)

Phlox paniculata (garden phlox)
P. divaricata (wild blue phlox)

Sarracenia leucophylla (white-topped pitcher plant)

Silene virginica (firepink)

Silphium asteriscus (rosinweed) - Asteraceae

Symphyotrichum georgianum (georgia aster) - Asteraceae

Zephyranthes atamasco (atamasco lily)

Zizia aurea (golden alexander)

STREAM RESTORATION – THE ROLE OF VEGETATION

There's more to a stream than the rushing or meandering water. A stream is a complex and valuable ecosystem which includes the land, animals, and plants. Stream corridors are increasingly recognized as critical ecosystems supporting interdependent uses and values. Today, interest in stream restoration is expanding. This is evident with the inception of NC's Ecosystem Enhancement Program (EEP) and the Tennessee Stream Mitigation Program.

Vegetation plays a crucial role in the success of the projects both in the initial phases, as bank stabilization, and in the completion of the project, in creating successful ecosystems. During the initial phases of the stream restoration, reduction of invasive trees, shrubs, and vines is essential to establish a native riparian habitat. Construction of the channel and bank stabilization include using a number of bio-engineering practices and the completion of projects relies on the successful establishment of both herbaceous and woody plants in the riparian buffer. Post restoration will depend on working with partners to establish a long range maintenance program to ensure a successful stream restoration project. It's also about the biology!

George Morris, River Works, Inc

VASCULAR FLORA OF A LONGLEAF PINE UPLAND IN SABINE COUNTY, TEXAS

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ABSTRACT

We describe the vascular flora of select plots within longleaf pine uplands at Fox Hunter's Hill in the Sabine National Forest in eastern Texas. The eight established 0.1 ha plots contained a total of 196 species and averaged 87.25 species (range 71 to 112) per plot; sixteen 0.001 ha plots averaged 28.75 species (range 17 to 46); and sixteen 0.0001 ha plots averaged 12.44 species (range 5 to 25). A comparison between longleaf pine uplands in central Louisiana and Fox Hunter's Hill shows that they have similar floristic composition.

KEY WORDS: longleaf pine, *Pinus palustris*, longleaf pine uplands, Sabine National Forest, Sabine County, Texas.

Longleaf pine uplands are among the most extensively studied and best known ecosystems in the southeastern United States (Marks and Harcombe 1981, Platt et al. 1988, Frost 1993, Peet and Allard 1993, Ware et al. 1993, Streng et al. 1993, Glitzenstein et al. 1995, Noel et al. 1998, Platt 1999, Christensen 2000, Conner et al. 2001). Surprisingly, considering the amount of attention given to this ecosystem and its eponym, relatively little is known about the

herbaceous layer. Either little or no information has been collected or only partial descriptions are available. This is especially true of longleaf pine communities in the West Gulf Coastal Plain (Streng and Harcombe 1982, Bridges and Orzell 1989, Orzell 1990, Harcombe et al. 1993, MacRoberts and MacRoberts 1998, Turner et al. 1999, Haywood et al. 1998, 2001, Haywood and Harris 1999, Van Kley 1999a, 1999b, 2006, MacRoberts et al. 2004a, Lester et al. 2005, Diggs et al. 2006), where far less research has been done than in the Atlantic and East Gulf Coastal Plain (Peet and Allard 1993, Platt 1999, Christensen 2000). In our search of the literature, we were able to find only one detailed study of the floristic composition of longleaf pine uplands in the West Gulf Coastal Plain (MacRoberts et al. 2004a).

If management of longleaf pine communities is to be undertaken effectively, more than just eliminating offsite woody vegetation and reintroducing fire may be needed. At a minimum, the herbaceous layer must be known, for historical evidence indicates that many currently rare species were more common prior to recent anthropogenically influenced declines, and if current trends continue, today's common species may become rare in the near future (Glitzenstein et al. 2001). In order to reconstruct any plant community, whether by adding rare species to intact communities or by restoring badly degraded sites, one must know what was there initially and, while we cannot go back to pre-settlement vegetation, we can at least begin by studying or by documenting today's best managed sites.

Gathering information on the herbaceous layer of longleaf pine uplands is not always easy, since virtually all West Gulf Coastal Plain longleaf pine was cut during the last two centuries (Noss 1988, Frost 1993, Outcalt 1997, Platt 1999, Diggs et al. 2006). At best, second growth exists but even where there is second growth, there is seldom much, if any, herbaceous layer because of shading by shrub growth resulting from fire suppression (Platt et al. 1988, Streng et al. 1993, Olson and Platt 1995, Brewer 1998, Frost 1998, Platt 1999, Haywood et al. 1998, 2001, Drewa et al. 2002).

In pre-European North America, longleaf pine extended from Virginia to Texas (Schwarz 1907, Ware et al. 1993, Platt 1999, Conner et al. 2001). In the West Gulf Coastal Plain, it occurred in Louisiana

and Texas. In central and southwestern Louisiana and southeastern Texas there were large tracts of longleaf pine (Eldredge 1934, Smith 1991, Evans 1997, Outcalt 1997), which were cut in the late 19th and early 20th centuries. Over the total original range of longleaf pine, less than 3 percent remains in a semi-natural condition, and most of this is on public land (Frost 1993, Peet and Allard 1993, Bezanson 2000, Van Kley 2006).

Information about longleaf pine uplands before the arrival of Europeans can be gleaned from historical descriptions, lumber company records, and from the few acres that have miraculously survived logging, for example, the Wade Tract in Georgia (Evans 1997, Platt 1999). Early travelers write of monospecific longleaf pine uplands in central Louisiana and eastern Texas (MacRoberts et al. 2004a, Diggs et al. 2006). They depict a landscape with widely spaced uneven aged pines, an open canopy with frequent gaps, and a rich herbaceous layer of grasses, composites, and other forbs. There was little or no midstory and little or no woody vegetation. Every one to three years low intensity fires moved through these pinelands, usually in the spring and summer.

Since documentation of floristic composition can be found only for a small portion of this community --- notably lacking is documentation for the herbaceous layer --- it was the purpose of this study to locate a longleaf pine upland where the understory appeared to be intact and to obtain a floristic list. While the aim was to gather baseline data, the question of the quality of longleaf pine uplands in the West Gulf Coastal Plain is also briefly addressed (see Conner et al. 2001 for detailed discussion).

STUDY SITE

Previous surveys of the Texas National Forests and Grasslands in Texas, notably the Sabine National Forest and Angelina National Forest, have pinpointed several high quality longleaf pine uplands (Orzell 1990). One of these is Fox Hunter's Hill in southern Sabine County, Texas.

Fox Hunter's Hill is situated in the Mayflower Uplands Landtype Association (LTA). This LTA is associated with the Catahoula formation overlain with sandstones, sandy clays, and volcanic tuffs. Clay outcrops are present as are deep sands and loams. The topography is generally a rolling hill landscape with some steep hills. The LTA is noted for the longleaf-little bluestem herbaceous community, Catahoula barrens (glades), and hillside seeps/bogs (Figure 1).

However, Fox Hunter's Hill, like the remainder of longleaf pine uplands in the West Gulf Coastal Plain, is not pristine. Pine stands are generally young, over-stocked, and even-aged; the canopy is dense, with insufficient gaps, and there is often too much shrub and mid-story woody vegetation. Forest Service records indicate that prescribed fire has been introduced mainly in the non-growing season (however, recent

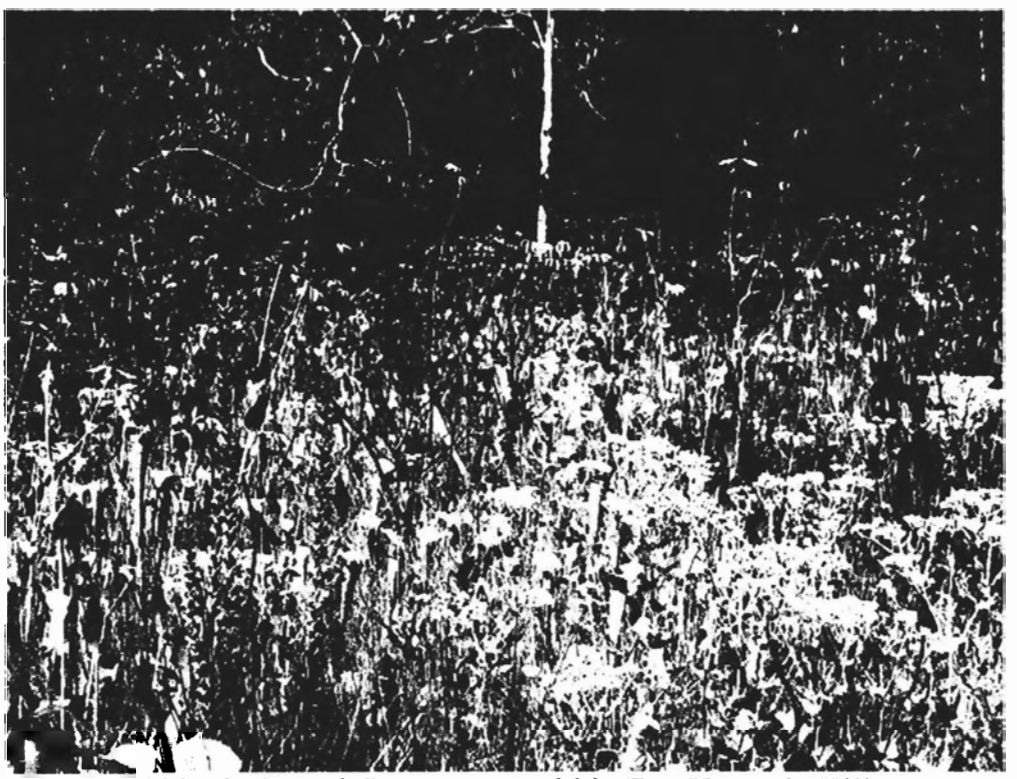

Figure 1: Shingle Branch Bog occurs within Fox Hunter's Hill

burns have been applied as late as May) and often with long intervals (2-4 years) between ignitions. In spite of these problems, Fox Hunter's Hill (Figure 2) has a diverse ground layer in many places.

Community types at Fox Hunter's Hill include extensive areas of arenic dry uplands, loamy dry mesic uplands, and small patches of xeric sandylands and glades. Along creeks are herbaceous seeps, particularly bogs and baygalls (Orzell 1990, Diggs et al. 2006, Van Kley 2006). High-quality longleaf pine upland is habitat for such

Figure 2: Upland Longleaf Community at Fox Hunter's Hill

federally listed animals as the Red-cockaded Woodpecker and the Louisiana Pine Snake (Connor et al. 2001), and rare plants such as *Liatris tenuis* Shinners (Figure 3), *Silene subciliata* B.L. Robins., and *Rudbeckia scabrifolia* L. Brown (Carr 2004).

Few logging and other silvicultural activities have been conducted at Fox Hunter's Hill in the recent past. In the past 17 years, two prescriptions have been written for the area (S. Walker unpubl. data); however, one of the projects was not carried out and the other project included only a small area of patch clear-cut that was necessary due to scorch from a prescribed burn. That area was replanted with longleaf pine. Prescribed fire has been the main management tool used in Fox Hunter's Hill for the past 15 years. With the exception of 2000-

Figure 3: Liatris tenuis Shinners

2003, when no prescribed burning occurred, Fox Hunter's Hill has been burned on a 2-3 year rotation (T. Zimmerman pers. comm.). The timing of burns alternated between fall and late winter to early spring. However, the latest prescribed burn applied to Fox Hunter's Hill occurred in May 2006 because of a desire to implement a growing season fire pattern.

METHODS

We established eight 20 m x 50 m (0.1 ha) plots in areas representative of the various longleaf pine upland habitats (Figure 4). Included were extensive areas of arenic dry uplands and loamy dry mesic uplands. Plots 1, 3, and 5 were mostly herbaceous and plots 2, 4, 6, and 8 were mostly shrubby. Plot 6 contained a small area of xeric sandylands; plots 3 and 7 had Catahoula glade elements. Within each 0.1 ha plot, we established two nested 3.16 m x 3.16 m (0.001 ha) plots

and two1 m x 1 m nested (0.0001 ha) plots (see Peet et al. [1998] for plot design). We surveyed these plots on 21 and 22 June 2005, 12 July 2005, 26 and 27 October 2005, and 5 and 6 April 2006, and recorded all species in each. We estimated canopy cover for each 0.1 ha plot.

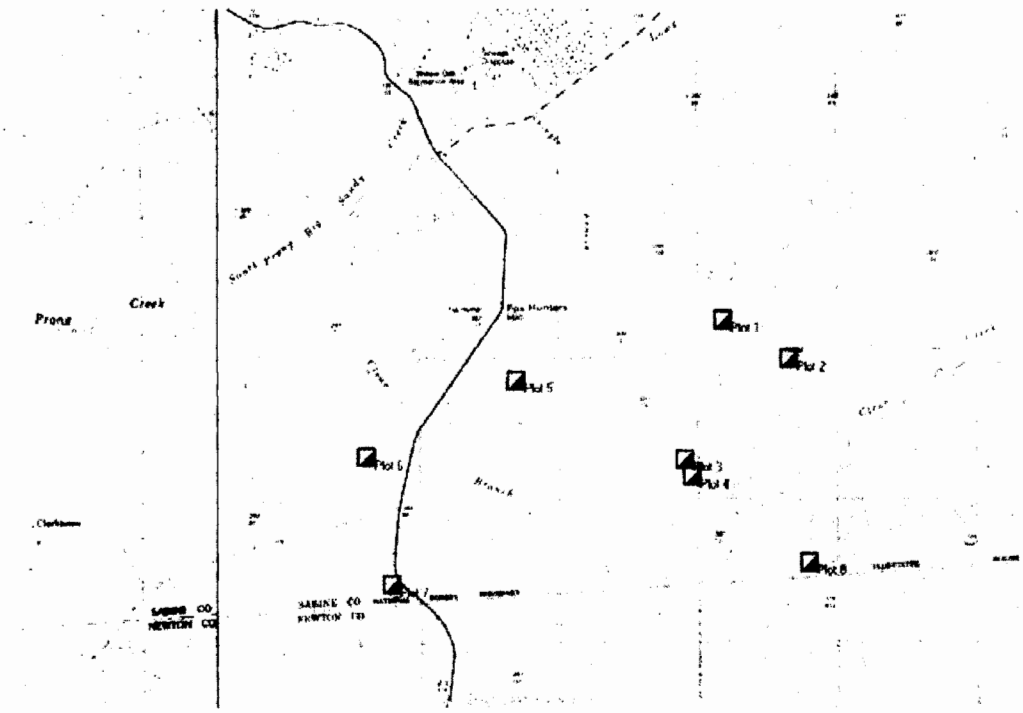

Figure 4: Plot locations at Fox Hunter's Hill

Throughout this paper, plant nomenclature follows Kartesz and Meacham (1999), Diggs et al. (2006), or USDA (2006).

RESULTS

Table 1 lists the vascular flora of the eight 0.1 ha plots. 1-8 refer to the 0.1 ha plot in which the species occurred.

Table 1: Fox Hunter's Hill Plant Species List 2005-2006

ACANTHACEAE
Ruellia humilis Nutt. (1)(2)(4)(5)(6)

ACERACEAE
Acer rubrum L. (1)(2)(4)

AGAVACEAE
Yucca louisianensis Trel. (2)(8)

ANACARDIACEAE
Rhus copallinum L. (1)(2)(4)(5)(6)(8)
Toxicodenron pubescens P. Mill. (1)(2)(3)(4)(5)(6)(7)(8)

ANNONACEAE
Asimina parviflora (Michx.) Dunal (1)(2)(5)(6)

APIACEAE
Eryngium yuccifolium Michx. (1)(5)(6)(7)

AQUIFOLIACEAE
Ilex opaca Ait. (2)(6)(8)
Ilex vomitoria Ait. (1)(2)(3)(4)(5)(6)(8)

ARISTOLOCHIACEAE
Aristolochia reticulata Jacq. (1)(2)(3)(5)(6)
Aristolochia serpentaria L. (1)(4)(5)

ASCLEPIADACEAE
Asclepias amplexicaulis Sm. (6)
Matelea cynanchoides (Engelm.) Woods. (6)

ASTERACEAE
Ambrosia artemisifolia L. (1)(2)(5)(8)
Baccharis halimifolia L. (1)(5)
Berlandiera pumila (Michx.) Nutt. (1)(2)(5)(6)
Bigelowia nuttallii L.C. Anders. (3)(4)
Boltonia diffusa Ell. (2)(4)
Chrysopsis pilosa Nutt. (1)(3)(4)(5)(6)(7)(8)
Cirsium sp. (6)
Croptilon divaricatum (Nutt.) Raf. (6)
Echinacea pallida (Nutt.) Nutt (7)
Elephantopus tomentosus L. (4)

Erigeron strigosus Muhl. ex Willd. (1)(6)(8)
Eupatorium capillifolium (Lam.) Small (5)(6)
Eupatorium compositifolium Walt. (1)(2)(5)(6)
Eupatorium rotundifolium L. (1)(2)(3)(4)(5)(6)
Eurybia hemisphaerica (Alex.) Nesom (7)
Gaillardia aestivalis (Walt.) H. Rock (1)(5)(6)
Helianthus angustifolius L. (1)(2)(3)(4)(5)(7)(8)
Helianthus hirsutus Raf. (4)
Hieracium gronovii L. (1)(2)(3)(4)(5)(6)(7)(8)
Hymenopappus artemisiifolius var. *artemisifolia* DC. (1)(2)(5)(6)
Ionactus linariifolius (L.) Greene (1)(3)(4)(5)(6)(7)
Krigia sp. (6)
Lactuca canadensis L. (1)(2)(5)
Liatris elegans (Walt.) Michx. (1)(2)(5)(6)(8)
Liatris pycnostachya Michx. (6)
Liatris squarrosa (L.) Michx. (4)(5)(8)
Liatris tenuis Shinners (3)(4)(7)
Pityopsis graminifolia (Michx.) Nutt. var. *graminifola* (1)(2)(3)(4)(5)(6)(7)(8)
Pseudognaphalium obtusifolium (L.) Hilliard & Burtt (5)(6)
Rudbeckia grandiflora (D. Don) J.F. Gmel ex DC. (1)
Rudbeckia hirta L. (1)(2)(3)(4)(5)(6)(7)(8)
Silphium gracile Gray (1)(2)(5)(6)
Solidago nitida Torr. & A. Gray (1)(2)(6)(7)
Solidago odora Ait. (1)(2)(3)(4)(5)(6)(7)(8)
Solidago petiolaris Ait. (2)(3)(5)(8)
Symphyotrichum dumosus (L.) Nesom (3)(4)(6)(7)
Symphyotrichum patens (Ait.) Nesom var. *patens* (1)(2)(3)(6)(7)(8)
Symphyotrichum pratensis (Raf.) Nesom (3)(4)(7)
Vernonia texana (A. Gray) Small (1)(2)(3)(4)(6)(7)(8)

BIGNONIACEAE
Bignonia capreolata L. (1)(7)

BORAGINACEAE
Lithospermum caroliniense (Gmel.) MacM. (1)(2)(5)(6)

CAMPANULACEAE
Lobelia appendiculata A. DC. (6)

Lobelia puberula Michx. (1)(2)(3)(4)(5)(6)

CAPRIFOLIACEAE
Viburnum rufidulum Raf. (8)

CISTACEAE
Helianthemum georgianum Chapm. (1)(6)
Lechea mucronata Raf. (1)(3)(4)(5)(7)
Lechea tenuifolia Michx. (3)(5)

CLUSIACEAE
Hypericum crux-andreae (L.) Crantz (3)(4)
Hypericum gentianoides (L.) B.S.P. (3)(6)(7)
Hypericum hypericoides (L.) Crantz (1)(3)(4)(5)(6)(7)(8)

COMMELINACEAE
Commelina erecta L. (1)(2)(5)(6)
Tradescantia reverchonii Bush (1)(5)(6)

CONVOLVULACEAE
Ipomoea pandurata (L.) G.F.W. Mey. (5)

CORNACEAE
Cornus florida L. (1)(2)(4)(5)(6)(8)
Nyssa sylvatica Marsh. (2)(3)(4)(5)(7)(8)

CYPERACEAE
Carex caroliniana Schwein. (4)
Cyperus echinatus (L.) Wood (1)(2)(5)(6)(8)
Cyperus filiculmis Vahl. (6)
Cyperus retrofractus (L.) Torr. (5)
Rhynchospora globularis (Chapm.) Small. (3)(4)(7)(8)
Rhynchospora grayi Kunth (1)(2)(3)(4)(8)
Scleria ciliata Michx. (2)(3)(4)(5)(6)(8)
Scleria oligantha Michx. (8)
Scleria triglomerata Michx. (1)(5)(6)

DENNSTAEDTIACEAE
Pteridium aquilinum L. (1)(7)(8)

DROSERACEAE
Drosera brevifolia Pursh (3)(4)(7)(8)

EBENACEAE
Diospyros virginiana L. (4)(7)

ERICACEAE
Vaccinium arboreum Marsh. (1)(2)(3)(4)(5)(7)(8)
Vaccinium corymbosum L. (1)(2)(3)(4)(6)(7)(8)
Vaccinium stamineum L. (1)(2)(3)(4)(5)(7)(8)

EUPHORBIACEAE
Acalypha virginica L. (5)(6)
Cnidoscolus texanus (Muell.-Arg.) Small (5)(6)
Croton argyranthemeus Michx. (1)(3)(4)(5)(6)
Croton willdenowii G.L. Webster (3)(6)
Croton michauxii G.L. Webster (7)
Euphorbia sp. (8)
Euphorbia corollata L. (1)(2)(3)(4)(6)(7)(8)
Stillingia sylvatica L. (2)(5)(6)(8)
Tragia smallii Shinners (1)(2)(5)(6)(8)
Tragia urens L. (1)(2)(5)(6)(8)
Tragia urticifolia Michx. (1)(2)(5)(6)(8)

FABACEAE
Baptisia bracteata Muhl. ex Ell. var *laevicaulis* (Gray ex Canby) Isely (1)(3)(4)(6)
Centrosema virginiana (L.) Benth. (2)(5)(6)
Chamaecrista fasciculata (Michx.) Greene var. *fasciculata* (1)(3)(5)
Clitoria mariana L. (5)
Crotalaria sagittalis L. (1)(5)(6)
Desmodium sessilifolium (Torr.) T.&G. (2)(3)(4)(5)(6)(7)(8)
Desmodium ciliare (Muhl. ex Willd.) DC. (1)
Erythrina herbacea L. (6)
Galactia volubilis (L.) Britt. (1)(2)(3)(5)(6)(7)(8)
Lespedeza sp. (5)(6)
Lespedeza procumbens Michx. (3)
Lespedeza repens (L.) Barton (7)

Lespedeza virginica (L.) Britt. (3)
Mimosa hystricina (Small) B.L. Turner (5)(7)
Rhynchosia latifolia Nutt. ex. Torr. & Gray (1)(6)
Rhynchosia reniformis DC. (1)(2)(3)(5)(6)
Strophostyles umbellata (Muhl. ex Willd.) Britt. (1)(2)(3)(5)(6)
Stylosanthes biflora (L.) B.S.P. (3)(4)(5)(6)(7)(8)
Tephrosia onobrychoides Nutt. (1)(2)(3)(4)(5)(6)(7)
Tephrosia virginiana (L.) Pers. (1)(2)(3)(4)(5)(6)(7)(8)

FAGACEAE
Quercus alba L. (3)(4)(8)
Quercus falcata Michx. (1)(2)(3)(6)(7)(8)
Quercus incana Bartr. (2)(5)(6)
Quercus marilandica Muenchh. (1)(3)(4)(6)(7)(8)
Quercus nigra L. (2)(8)
Quercus stellata Wang. (3)(4)(7)(8)

GENTIANACEAE
Sabatia campestris Nutt. (6)

HAMAMELIDCEAE
Liquidambar styraciflua L. (2)(3)(4)(5)(6)(7)(8)

IRIDACEACE
Alophia drummondii (Graham) Foster (1)(5)(6)(8)
Sisyrinchium albidum Raf. (3)(4)(7)(8)

JUGLANDACEAE
Carya alba (L.) Nutt. ex Ell. (6)
Carya texana Buckl. (1)(2)(6)(8)

LAMIACEAE
Monarda fistulosa L. (6)
Pycnanthemum albescens Torr. & A. Gray (4)(5)(6)
Salvia azurea Michx. ex Lam (8)
Scutellaria sp. (3)
Scutellaria cardiophylla Engelm. & A. Gray (6)(8)
Scutellaria parvula Michx. (3)

LAURACEAE
Persea palustris (Raf.) Sarg. ,(1)(2)(6)(8)
Sassafras albidum (Nutt.) Nees (1)(2)(5)(6)(7)

LILIACEAE
Allium canadense L. (4)
Hypoxis hirsuta (L.) Coville (5)
Nothoscordum bivalve (L.) Britt. (3)(4)(7)

LINACEAE
Linum medium (Planch.) Britt. (1)(3)(4)(5)

LOGANACEAE
Gelsemium sempervirens (L.) Ait. f. (1)(2)(3)(4)(5)(6)(7)(8)

MAGNOLIACEAE
Magnolia grandiflora L. (6)
Magnolia virginiana L. (1)

MYRICACEAE
Morella cerifera (L.) Small (1)(2)(3)(5)(7)(8)

OLEACEAE
Chionanthus virginicus L. (4)(7)(8)

OXALIDACEAE
Oxalis dillenii Jacq. (1)(2)(6)(7)
Oxalis violacea L. (1)

PASSIFLORACEAE
Passiflora lutea L. (2)

PINACEAE
Pinus echinata P.Mill. (1)(2)(3)(4)(6)(7)(8)
Pinus palustris P.Mill. (1)(2)(3)(4)(5)(6)(7)(8)
Pinus taeda L. (1)(2)(5)(6)(7)(8)

POACEAE
Agrostis sp. (1)(2)

Andropogon gerardii Vitman (2)(3)(6)(7)
Andropogon ternarius Michx. (1)(2)(6)(7)
Andropogon virginicus var.*virginicus* L. (1)(6)(7)
Aristida lanosa Muhl. ex Ell. (1)(3)(6)
Aristida longespica Poir (1)(2)(3)(6)(7)
Chasmanthium laxum (L.) Yates (4)(6)
Coelorachis cylindrica (Michx.) Nash (1)(5)(6)(8)
Dichanthelium aciculare (Desv. ex Poir) Gould & Clark (3)(4)(5)(6)(7)
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark (1)(2)(4)(5)(8)
Dichantheliuam oligosanthes (J.A. Schultes) Gould (1)(6)
Dichanthelium scoparium (Lam.) Gould (2)(3)
Dichanthelium sphaerocarpon (Ell.) Gould (1)(3)(4)(5)(6)(8)
Digitaria cognata (J.A. Schult.) Pilger (8)
Eragrostis spectabilis (Pursh) Steud. (2)(4)(7)
Gymnopogon ambiguus (Mich.) B.S.P. (1)(2)(5)(6)
Panicum sp. (8)
Panicum anceps Michx. (4)
Paspalum floridanum Michx. (3)(4)(7)
Paspalum setaceum Michx. (2)(5)
Schizachyrium scoparium (Michx.) Nash (1)(2)(3)(4)(5)(6)(7)(8)
Sorghastrum elliottii (C. Mohr) Nash (3)(6)
Sporobolus junceus (Beauv.) Kunth (1)(2)(6)(8)
Tripsacum dactyloides (L.) L. (5)

POLEMONIACEAE
Phlox pilosa L. (1)(2)(3)(5)

POLYGALACEAE
Polygala mariana Mill. (3)
Polygala nana (Michx.) DC. (2)(3)(5)
Polygala polygama Walt. (8)

RANUNCULACEAE
Delphinium carolinianum subsp. *vimineum* (D. Don) Warnock (5)(6)

RHAMNACEAE
Berchemia scandens (Hill) K. Koch (4)
Ceanothus americanus L. (2)(3)(5)
Frangula caroliniana (Walt.) A. Gray (8)

ROSACEAE
Crataegus brachyacantha Sarg. & Engelm. (3)
Crataegus marshallii Egglest. (2)(3)(4)(7)(8)
Crataegus spathulata Michx. (4)(7)
Rubus argutus Link (2)(3)(4)(6)(7)(8)

RUBIACEAE
Diodia teres Walt. (3)(6)
Galium pilosum Ait. (1)(2)(3)(5)(6)
Hedyotis nigricans (Lam.) Fosberg (1)(2)(5)(6)
Houstonia micrantha (Shinners) Terrell (4)
Mitchella repens L. (4)(8)

SAPOTACEAE
Sideroxylon lanuginosum Michx. (2)

SCROPHULARIACEAE
Agalinis homalantha Pennell (4)(6)(7)(8)
Penstemon laxiflorus Pennell (4)(5)(8)

SMILACACEAE
Smilax bona-nox L. (2)(4)(7)
Smilax glauca Walt. (2)(3)(4)(6)(8)
Smilax rotundifolia L. (4)(7)
Smilax smallii Morong (4)(7)(8)

SOLANACEAE
Physalis pumilla Nutt. (1)(6)

SYMPLOCACEAE
Symplocos tinctoria (L.) L'Her. (8)

VERBENACEAE
Callicarpa americana L. (1)(2)(3)(4)(5)(6)(8)
Glandularia canadensis (L.) Nutt. (1)(2)

VIOLACEAE
Viola pedata L. (3)(4)(7)(8)

VITACEAE
Parthenocissus quinquefolia (L.) Planch. (1)(3)
Vitis aestivalis Michx.(1)(2)(3)(5)(6)(8)
Vitis rotundifolia Michx.(1)(2)(4)(6)

Table 2 gives information on species richness in the 0.1 ha, 0.001 ha, and 0.0001 ha plots.

Table 2. Number of species in plots

		Nested plots within 0.1 plots			
		0.001 ha plots		0.0001 ha plots	
Plot No.	0.1 ha plot	average	range	average	range
1	96	32.5	27-38	12.5	8-17
2	88	25.5	25-26	7.0	5-9
3	83	24.0	20-28	9.0	7-11
4	80	22.0	17-27	11.5	9-14
5	93	31.5	28-35	17.5	15-20
6	112	45.5	45-46	24.5	24-25
7	71	23.0	21-25	7.0	5-9
8	75	26.0	21-31	10.5	9-12

Canopy cover of the eight 0.1 plots were as follows: plot 7 (20 percent); plot 3 (40 percent); plots 1, 2, 4, 5, 6 (50 percent); plot 8 (70 percent). The average was 48 percent.

DISCUSSION

The eight 0.1 ha plots had 196 species and averaged 87.25 species (range 71 to 112); while the sixteen 0.001 ha plots averaged 28.75 species (range 17 to 46); and the sixteen 0.0001 ha plots averaged 12.44 species (range 5 to 25).

MacRoberts et al. (2004a) provide the most complete West Gulf Coastal Plain longleaf pine uplands data set for comparison with the Fox Hunter's Hill plots. They established four 0.1 ha plots in

longleaf pine uplands (arenic dry uplands) in the Winn and Catahoula ranger districts of the Kisatchie National Forest, Louisiana, about 150 km northeast of Fox Hunter's Hill, and recorded all species in them. Their plots had between 82 and 113 species (average 100). An Index of Similarity (Sorenson's) between the eight 0.1 ha plots at Fox Hunter's Hill and the four 0.1 ha plots Kisatchie National Forest gives a figure of 63, a relative high degree of similarity. This degree of similarity is interesting considering the small amount of area sampled in both studies (0.8 ha at Fox Hunter's Hill, 0.4 ha at Kisatchie), unequal sample size (196 species at Fox Hunter's Hill, 158 species at Kisatchie), the distance between study sites (150 km), and the fact that Fox Hunter's Hill included plots with dryer (xeric) and wetter (loamy dry-mesic uplands) elements than the Kisatchie sample (arenic dry uplands only). This suggests that longleaf pine uplands in the West Gulf Coastal Plain may be very similar floristically over their range.

Data on species richness in the West Gulf Coastal Plain are scanty. Open habitat such as bogs, prairies, xeric sandylands, and old fields average about 15-25 species in 0.0001 ha plots, 30-40 in 0.001 ha plots, and 75-120 in 0.1 ha plots (MacRoberts and MacRoberts 2001, MacRoberts et al. 2002). In closed (shaded) habitat, the numbers drop dramatically (Brewer 1998, MacRoberts et al. 2004b, MacRoberts unpublished data). The data for Fox Hunter's Hill are therefore encouraging, with averages of 12.44, 28.75, and 87.25 for 0.0001 ha, 0.001 ha, and 0.1 ha plots.

Recommendations for the future management of Fox Hunter's Hill would include more frequent fire mainly in the growing season, lower stocking in many places, the creation of gaps so that natural regeneration will occur, and the creation of an uneven distribution of pines.

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LITERATURE CITED

Bezanson, D. 2000. Natural vegetation types of Texas and their representation in conservation areas. MS Thesis, University of Texas, Austin.

Brewer, J.S. 1998. Patterns of plant species richness in a wet slash-pine savanna. Bull. Torr. Bot. Soc. 125:216-224.

Bridges, E.L. and S.L. Orzell. 1989. Longleaf pine communities of the West Gulf Coastal Plain. Natural Areas Journal 9:246-263.

Carr, W.R. 2004. An annotated list of the G3/T3 and rarer plant taxa of Texas. Unpublished report, The Nature Conservancy, Austin Texas.

Christensen, N.L. 2000. Vegetation of southeastern coastal plain. Pp. 397-448. *In* M.G. Barbour, and W.D. Billings (Eds.). North American terrestrial vegetation. Cambridge U. Press, New York.

Conner, R.N., D.C. Rudolph, and J.R. Walters. 2001. The Red-cockaded Woodpecker: surviving in a fire-maintained ecosystem. Univ. Texas Press, Austin.

Diggs, G.M., B.L. Lipscomb, M.D. Reed and R.J. O'Kennon. 2006. Illustrated flora of East Texas. Sida, Bot. Misc. 26:1-1594.

Drewa, P.B., W.J. Platt, and E.B. Moser. 2002. Fire effects on resprouting of shrubs in headwaters of southeastern longleaf pine savannas. Ecology 83:755-767.

Eldredge, I.F. 1934. Areas characterized by the major forest types state of Louisiana. U.S.D.A. Forest Service. Washington, D.C. Map.

Evans R.E. 1997. Distribution and composition of historical forests in two east Texas counties, with special reference to longleaf pine. Thesis. Stephen F. Austin State University, Nacogdoches, Texas.

Frost, C.C. 1993. Four centuries of changing landscape patterns in the longleaf pine ecosystem. Proc. Tall Timbers Fire Ecology Conference 18:17-43.

Frost, C.C. 1998. Presettlement fire frequency regimes of the United States: a first approximation. Proc. Tall Timbers Fire Ecology Conference 20:70-81.

Glitzenstein, J.S., W.J. Platt, and D.R. Streng. 1995. Effects of fire regime and habitat on tree dynamics in north Florida longleaf pine savannas. Ecol. Monogr. 65:441-476.

Glitzenstein, J.S., D.R. Streng, D.D. Wade, and J. Brubaker. 2001. Starting new populations of longleaf pine ground-layer plants in the outer coastal plain of North Carolina, USA. Natural Areas Journal 21:89-110.

Harcombe, P.A, J.S. Glitzenstein, R.G. Knox, S.L. Orzell, and E.L. Bridges. 1993. Vegetation of the longleaf pine region of the West Gulf Coastal Plain. Proc. Tall Timbers Fire Ecology Conference 18:83-104.

Haywood, J.D., W.D. Boyer, and F.L. Harris. 1998. Plant communities in selected longleaf pine landscapes of the Catahoula Ranger District, Kisatchie National Forest, Louisiana. Proc. 9th Biennial Southern Silvicultural Research Conference. U.S.D.A. Forest Service. Tech. Rept. SRS-20:86-91.

Haywood, J.D. and F.L. Harris. 1999. Description of vegetation in several periodically burned longleaf pine forests on the Kisatchie National Forest. Proc. 10th Biennial Southern Silvicultural Research Conference. U.S.D.A. Forest Service Tech. Rept. SRS-30:217-227.

Haywood, J.D., F.L. Harris, H.E. Grelen, and H.A. Pearson. 2001. Vegetative response to 37 years of seasonal burning on a Louisiana longleaf pine site. South. J. Appl. For. 25:122-130.

Kartesz, J.T. and C.A. Meacham. 1999. Synthesis of North American flora. Version 1.0. North Carolina Botanical Garden. Chapel Hill, North Carolina.

Lester, G.D., S.G. Sorenson, P.L. Faulkner, C.S. Reid, and I.E. Maxit. 2005. Louisiana comprehensive wildlife conservation strategy. Louisiana Department of Wildlife and Fisheries. Baton Rouge.

MacRoberts, B.R. and M.H. MacRoberts. 1998. Floristics of wetland pine savannas in the Big Thicket National Preserve, Texas. Phytologia 85:40-50.

MacRoberts, M.H. and B.R. MacRoberts. 2001. Bog communities of the West Gulf Coastal Plain: a profile. Bog Research Papers in Botany & Ecology 1:1-151.

MacRoberts, B.R., M.H. MacRoberts, and J.C. Cathey. 2002. Floristics of xeric sandylands in the post oak savanna region of east Texas. Sida 20:373-386.

MacRoberts, B.R., M.H. MacRoberts, and L.S. Jackson. 2004a. Floristics of upland longleaf pine savanna in central Louisiana. Proc. Louisiana Acad. Sci. 65:1-13.

MacRoberts, B.R., M.H. MacRoberts, and L.S. Jackson. 2004b. Floristics of baygalls in central Louisiana. Phytologia 86:1-22.

Marks, P.L. and P.A. Harcombe. 1981. Forest vegetation of the Big Thicket, southeast Texas. Ecol. Monogr. 51:287-305.

Noel, J.M., W.J. Platt, and E. Moser 1998. Structural charateristics of old and second growth stands of longleaf pine (*Pinus palustris*) in the Gulf Coastal region of the U.S.A. Conservation Biology 12:533-548.

Noss, R.F. 1988. The longleaf pine landscape of the southeast: almost gone and almost forgotten. Endangered Species Update 5:1-8.

Olson, M.S. and W.J. Platt. 1995. Effects of fire and growing season fires on resprouting of shrub in longleaf pine savannas. Vegetatio 119:101-118.

Orzell, S.L. 1990. Texas Natural Heritage Program inventory of National Forests and National Grasslands in Texas. Unpublished report. Texas Parks and Wildlife Department, Austin, Texas.

Outcalt, K.W. 1997. Status of the longleaf pine forests of the West Gulf Coastal Plain. Texas J. Sci. 49:5-12.

Peet, R.K. and D.J. Allard. 1993. Longleaf pine vegetation of the southern Atlantic and eastern Gulf Coastal regions; a preliminary classification. Proc. Tall Timbers Fire Ecology Conference 18: 45-80.

Peet, R.K., T.R. Wentworth, and P.S. White. 1998. A flexible, multipurpose method for recording vegetation composition and structure. Castanea 63:262-274.

Platt, W.J. 1999. Southeastern pine savannas. Pp. 23-51. *In* R.C. Anderson, J.S. Fralish, and J.M. Baskin (Eds.). Savannas, barrens, and rock outcrop plant communities of North America. Cambridge Univ. Press, New York.

Platt, W.J., G.W. Evans, and S.L. Rathbun. 1988. The population dynamics of a long-lived conifer (*Pinus palustris*). American Naturalist 131:491-525.

Schwarz, G.F. 1907. Longleaf pine in virgin forest. John Wiley, London.

Smith, L.M. 1991. Louisiana longleaf an endangered legacy. Louisiana Conservationist May/June:24-27.

Streng, D.R. and P.A. Harcombe. 1982. Why don't east Texas savannas grow up into forests? American Midl. Naturalist 108:278-293.

Streng, D.R., J.S. Glitzenstein, and W.J. Platt. 1993. Evaluating the effects of season of burn in longleaf pine forests: a critical literature review and some results from an ongoing long-term study. Proc. Tall Timbers Fire Ecology Conference 18:227-263.

Turner, R.L., J.E. Van Kley, L.S. Smith, and R.E. Evans. 1999. Ecological classification system for the national forests and adjacent areas of the West Gulf Coastal Plain. The Nature Conservancy, Nacogdoches, Texas.

USDA NRCS. 2006. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge.

Van Kley, J.E. 1999a. The vegetation of the Kisatchie sandstone hills, Louisiana. Castanea 64:64-80.

Van Kley, J.E. 1999b. The vegetation of the high terrace rolling uplands, Louisiana. Castanea 64:318-336.

Van Kley, J.E. 2006. The pineywoods. Pp. 76-106. *In* Diggs, G.M., B.L. Lipscomb, M.D. Reed and R.J. O'Kennon. 2006. Illustrated flora of East Texas. Sida, Bot. Misc. 26:1-1594.

Ware, S., C.C. Frost, and P.D. Doerr. 1993. Southern mixed hardwood forest: the former longleaf pine forest. Pp. 447-493 *In* W.H. Martin, S.G. Boyce, and A.C. Echternacht (Eds.). Biodiversity of the southeastern United States: lowland terrestrial communities. John Wiley & Sons, New York.

WATCHING HUMMMINGBIRDS IN TEXAS: BETTER THAN REALITY TV

CLIFF SHACKELFORD, NONGAME ORNITHOLOGIST, TEXAS PARKS AND WILDLIFE DEPARTMENT, NACOGDOCHES, TX

The state of Texas can boast of many records that start with "Most" or "Largest," and that includes its share of hummingbirds: 18 species of the diminutive but colorful birds are regular residents. And in the case of hummingbirds, "colorful" applies not only to their typically brilliant plumage but also their outsized behavior: Almost in inverse proportion to their size, these tiny birds are feisty, often aggressive and fly incredibly fast (up to 55 mph).

This presentation provides a twist on the book *Hummingbirds of Texas* (Texas A&M University Press Nature Guide Series, 110 pages), a new book by Texas Parks and Wildlife Department employees (including the presenter). Proceeds of the book benefit hummingbird conservation. It is the first work devoted to the 19 species of hummingbirds seen in Texas and surrounding states and it is written for a general audience, with color images for birders and nature enthusiasts at every level to help reveal the big appeal of the little hummingbird.

All royalties from the sale of this book go back into the department's Hummingbird Roundup Program. The Texas Hummingbird Roundup enlists Texans to help biologists track and study the birds. The program provides participants with a kit that includes a survey form and a booklet with information on Texan species, how to clean and maintain feeders, and suggestions on additional plants for the garden.

As plant pollinators, hummingbirds are important because they are a good indication of the health of our wildflower population and the impact of urbanization on our native ecosystems. The book focuses on hummingbirds, their habitats and their human appeal in Texas, plus Arizona and New Mexico because the rich diversity of hummingbirds is almost identical in the three states. The information is presented in two sections. The first is provides information about hummingbird biology; finding hummingbirds; food, water and shelter; feeders; visitors, pests, and predators; overwintering hummingbirds; migratory behavior; and photographing the hummingbirds. The second section of *Hummingbirds of Texas* contains a two-page spread on each species that includes identification hints, a range map for Texas as well as adjacent New Mexico and Arizona, and some excellent illustrations.

Texas had recorded 18 hummingbird species, more than any other state. (Arizona has since recorded the same number, albeit with a different species list. The book includes a 19th species, the plain-capped starthroat, not yet seen in Texas). This hummingbird diversity is a testimony to

Texas' size and diversity of habitat types—from coastal wetlands to central hills and prairies to eastern forests to western deserts and mountains—which in turn host diverse birds and wildlife.

Since all but two hummingbirds that occur in the United States are found in Texas, Arizona and New Mexico, the book is useful anywhere in the nation. The book will appeal to anyone interested in hummingbirds, including birders, gardeners, and photographers.

Nongame Ornithologist Clifford E. Shackelford and Information Specialist C. Mark Klym, are TPWD employees. The third author, Madge M. Lindsay, is a former agency employee who helped develop the Great Texas Coastal Birding Trail, the World Birding Center and the Great Texas Birding Classic and now is director of Audubon Mississippi. Primary illustrator, Clemente Guzman, is also a TPWD employee. The book includes around 90 color photos taken by Texans Sid and Shirley Rucker and more than 40 illustrations by Clemente Guzman III.

Birds featured:

Allen's Hummingbird • Anna's Hummingbird • Berylline Hummingbird

Black-chinned Hummingbird • Blue-throated Hummingbird

Broad-billed Hummingbird • Broad-tailed Hummingbird • Buff-bellied

Hummingbird • Calliope Hummingbird • Costa's Hummingbird

Green-breasted Mango • Green Violet-ear • Lucifer Hummingbird

Magnificent Hummingbird • Plain-capped Starthroat • Ruby-throated

Hummingbird • Rufous Hummingbird • Violet-crowned Hummingbird

White-eared Hummingbird

Land Conservation in a Changing Environment
Julie Shackelford, The Conservation Fund

For decades, land ownership in East Texas has been relatively stable, with industrial timber companies owning 32% of all East Texas lands. These traditional land owners provided sustainable land management, economic dependability, and healthy buffer lands to the region's relatively small but critically important federal conservation lands, including the Big Thicket National Preserve. Today, because a number of forces have caused the large-scale selloff of these commercial timberlands to investors, the East Texas land ownership map changes almost monthly.

Over 3.34 million acres of forestlands have changed hands at least once in East Texas alone since 2000. Most recently, the threat to East Texas forests became more immediate with the March, 2007 announcement that Temple-Inland would sell all of its East Texas holdings by the end of 2007. Prior to the sale, Temple-Inland was the only industrial forestry company remaining in Texas with substantial land holdings and strong historic ties to the region. Temple-Inland's announcement was a devastating blow to East Texas forestlands, of which millions of acres have been owned for decades by large commercial timber companies. These companies, including International Paper, Champion International, Louisiana Pacific and Georgia Pacific, have responded to the relentless pressures - for increased profits from Wall Street, international trade and tariff issues and a rethinking of a company's need to own its timber supply - with a wholesale divestiture of all of their forestlands.

Most of the acreage has been sold to timber investment or real estate investment companies, which are groups that buy, sell and manage timber on behalf of institutional investors (e.g., insurance companies, pension funds, foundations), because timber is generally considered a low risk investment. These groups' harvest practices are often geared toward short-term profit (10-15 year time horizon) as opposed to the long-term sustainable management typically employed by commercial forest products companies. This shorter management horizon may result in more aggressive harvest practices, since the groups have a fiduciary responsibility to maximize profit for their clients. An even more insidious effect, however, is the increased land fragmentation that results each time these lands trade hands. As a new owner examines its portfolio of holdings, frequently consideration is given to whether individual tracts could be sold to yield higher prices than they could generate from timber production. These tracts may be ideal for residential development, secondary home sites or as premier hunting camps. The result is that the formerly large contiguous land holdings are broken up into smaller and smaller pieces.

Even in today's downward market, land prices in East Texas continue to rise. As an example of how timberlands can yield a profit for investment companies, in 2006, International Paper sold all of its land holdings nationally, including 535,000 acres in Texas, to a real estate investment trust called TimberStar. Typically, these investment groups have a 10-15 year investment life; however, in April 2008,

TimberStar sold this same acreage to Hancock Timber. The sale, involving approximately 900,000 acres of timberland in the South, fetched $1.71 billion, including the assumption of debt, or $1,900/acre. TimberStar purchased the land from International Paper in October 2006 for approximately $1.19 billion, or $1,320/acre. This resale rewards TimberStar with net proceeds of approximately $400 million.

The Conservation Challenge

With this climate of change as a backdrop, Texas has been presented with a once-in-a-lifetime conservation challenge that will forever change the forest landscape of East Texas. Never again will there be an opportunity like now to protect entire river corridors, as is the case with the Neches and lower Sabine rivers – land which was previously owned predominantly by commercial timber companies. Although these tracts have now sold to different owners, they have not yet been divided to any great extent. Once they are, reassembling parcels becomes difficult and exponentially more expensive.

Since 2003, the Texas Office of The Conservation Fund has aggressively pursued land protection of East Texas' bottomland hardwoods and forests. Over the last four years we have protected over 55,000 acres of bottomland hardwood, cypress swamp, pine savannah and riparian buffer within the Big Thicket National Preserve, the Lower Trinity National Wildlife Refuge and the Middle Neches mitigation bank. Also, we are working toward the addition of more lands to the new Neches River National Wildlife Refuge (NWR), Little Sandy NWR, Caddo Lake NWR and the 4 national forests in Texas.

Most recently, The Conservation Fund was delighted to announce the June, 2007 acquisition of over 5,600 acres of cypress-tupelo swamp along the Neches River just north of Beaumont. These properties, which filter the river's water and act as a regional carbon sink, have tremendous untapped recreational potential that will be expanded after it is donated to the Big Thicket National Preserve.

In April, 2008, Congressman Kevin Brady announced the introduction of his bill to expand the boundary of the Big Thicket National Preserve by 100,000 acres (current boundary is capped at 97,000 acres). This exciting announcement will allow us to utilize federal funds and leverage new dollars as we work to purchase additional lands surrounding the Neches River and Village Creek, which provide the backbone to this unique and imperiled natural resource.

Texas Pineywoods Experience

As a bold but natural next step to complement our land protection work, in 2006, The Conservation Fund launched The Pineywoods Experience - the Lone Star State's most ambitious land conservation and economic development initiative. The Conservation Fund is therefore working with residents throughout the Pineywoods to redefine a vision for East Texas that brings local and regional stakeholders together to seek economic development solutions that support the long-term preservation and enhancement of the region's economic, cultural and ecological health. By highlighting the Pineywoods' lush forests and meandering rivers, as well

as its beginnings as the Cradle of Texas, the partnership uses the region's unique natural, cultural and historic assets to reposition the Pineywoods as a recreation destination for millions, building a new, sustainable economy for East Texas.

Coupled with The Conservation Fund's aggressive land protection activities along the Neches, Trinity and Sabine rivers, the Texas Pineywoods is poised to become a nationwide destination for cultural, historical and conservation experiences that highlight the best of East Texas.

In the short term, we are developing a website highlighting the region's natural, cultural and historic assets, assembling a natural, cultural and history resource inventory from which will be developed travel maps and thematic travel itineraries and an interpretive plan for East Texas destinations. We are initiating a major marketing campaign in the region, to highlight not only the availability of the new information, but also to reach communities around Houston and beyond to raise awareness about East Texas' destinations and attractions. Our website can be found at www.pineywoodsexperience.org.

About The Conservation Fund

The Conservation Fund is a national non-profit 501(c)(3) dedicated to balancing economic and environmental objectives to preserve America's land legacy – its natural, cultural and historic heritage – for current and future generations. The Fund is a non-membership, non-advocacy organization. Through its partnership-driven approach, the Fund works with corporations, governments and communities to develop innovative solutions for Texas' complex conservation challenges. The Fund has conserved more than 160,000 acres in Texas and over 5 million acres nationally. Unsurpassed in its effectiveness and efficiency, The Conservation Fund has been recognized for the past five years as the nation's top-rated environmental nonprofit by the American Institute of Philanthropy and named one of the best charitable investments by Worth and Forbes magazines and Charity Navigator.

The Conservation Fund, formed in 1985, has approximately 140 staff in twenty-two state offices nationwide. The Conservation Fund also operates the National Conservation Training Center and the Freshwater Institute, both in West Virginia. A complete overview of our organization's work can be found at www.conservationfund.org

The Conservation Fund's Texas office headquarters is in Austin. In August, 2007, the Nacogdoches office opened to better serve land conservation in East Texas.

Learning the Language of Vegetation: Native Plants as Indicators of the Natural Forest Environment

Introduction

I'm sure everyone has noticed how when you walk in the woods you see different plants in different places and that you need to look in specific places to find certain plants. Those who have spent time outdoors would probably laugh if someone told you they were looking for lady's slipper orchids in your neighbor's cow pasture or for Texas trailing phlox on stumps and logs in a swamp! Indeed, if you were to go anywhere in the Pineywoods and make a list of most of the plant species growing there, this list could tell someone who was never there much about the soil and other environmental conditions on the site as well as the human impact and land use history of the site....If that someone was able to read and speak the language—the language of vegetation.

A few years ago I met a colleague at an international meeting who was fond of saying that "species are the language of vegetation". In other words, since vegetation forms the basis for much of everything else that goes on in an ecosystem, knowing what species are growing in a given site will provide an enormous amount of information about the ecological conditions there.

Much of my research here in the Pineywoods has centered around learning this language---learning what the words—the species--mean in the context of the ecosystems and communities in which they grow. To do this, we turned to sample plots established in natural and semi-natural areas across a wide range of environmental conditions. The main source for untangling how Pineywoods species and sites are related comes from more than 400 plots that we sampled between 1994 and 2004 throughout the four National Forests in Texas and nearby Kisatchie National Forest in Louisiana. These plots were largely part of an effort to classify National forest lands into ecological units based on soils, topography, and potential natural vegetation (Van Kley et al. 2007). We selected these plots from the full range of habitats from deep water swamps to dry sandylands and recorded the abundance of all vascular plant species as well as a number of physical and chemical soil variables and topographic variables such as elevation, topographic position, and slope for each sample site.

In order to make sense of the massive amount of data that was collected we turned to multivariate analysis. Methods used include ordination (such as Detrended Correspondence Analysis, Hill & Gauch 1980,, cluster analysis (especially TWINSPAN, Hill 1979), and linear regression. One method that is particularly useful in showing what species tend to be found in what types of sites is TWINSPAN. It produces an "ordered two-way table" where the sample plots are classified in the arrangement of the columns of the table and the species are classified by the arrangement of the rows. Table 1is derived from a two-way table for a portion of our plots taken from Kisatchie National Forest. It is evident that species like poison ivy (no surprise here!!) occur across a wide range of sites while A*risaema triphyllum* (jack-in-the-pulpit) is restricted to mesic (moist but not wet) sites in small stream bottoms and protected lower slopes and post oak grows on

drier upland sites.

Table 1. A synoptic table derived from TWINSPAN classifying samples and species from the Caney Ranger District of Kisatchie National Forest. Values = mean occurrence rank (frequency). Only species with mean occurrence >1.8 in at least one ecotype are included. DMSU= dry-mesic shortleaf pine oak-hickory uplands, DMLU= dry-mesic loblolly pine uplands, MLSC= mesic lower slopes & stream bottoms, WMFL = wet-mesic floodplains, WMT = wet-mesic terraces, FS= forested seeps, and SWP = baldcypress swamp. * = *Dichanthelium acuminatum* (Sw.) Gould & C.A. Clark; # = *D. boscii* (Poir.) Gould & C.A. Clark.

Species	DMSU	DMLU	MLSC	WMFL	WMT	FS	SWP
Species of Dry-mesic Oak-Hickory communities							
Carya texana Buckl.	2.5 (64)	1.9 (43)	0.7 (17)	- -	- -	- -	- -
Desmodium paniculatum (L.) DC.	1.9 (64)	1.1 (43)	- -	- -	- -	- -	- -
*Dichanthelium acuminatum**	2.0 (64)	0.3 (14)	- -	0.8 (25)	- -	- -	
Euphorbia corollata L.	3.5 (91)	0.7 (29)	0.1 (6)	- -	- -	- -	- -
Galactia volubilis (L.) Britt.	2.0 (64)	0.4 (29)	- -	- -	- -	- -	- -
Hypericum hypericoides (L.) Crantz	3.1 (100)	0.4 (14)	0.5 (33)	0.8 (25)	- -	- -	- -
Lespedeza violacea (L.) Pers.	1.5 (45)	- -	- -	- -	- -	- -	- -
Pinus echinata P. Mill.	3.0 (82)	0.1 (14)	0.2 (6)	- -	- -	- -	- -
Pteridium aquilinum (L.) Kuhn	1.8 (45)	- -	0.7 (28)	- -	- -	- -	- -
Quercus stellata Wangenh.	1.8 (45)	- -	- -	- -	- -	- -	- -
Rhus copallinum L.	2.7 (91)	0.9 (43)	0.1 (6)	- -	- -	- -	- -
Vaccinium arboreum Marsh.	3.9 (100)	2.3 (86)	0.8 (39)	- -	- -	- -	- -
Vernonia texana (Gray) Small	1.9 (64)	- -	- -	- -	- -	- -	- -
Viburnum rufidulum Raf.	2.8 (91)	1.1 (43)	0.9 (44)	- -	- -	- -	- -
Species of dry-mesic & mesic sites							
Aesculus pavia L.	2.4 (73)	0.7 (29)	1.1 (56)	- -	- -	- -	- -
Celtis laevigata Willd.	0.4 (18)	2.0 (71)	0.5 (17)	- -	- -	- -	- -
Chasmanthium sessiliflorum (Poir.) Yates	4.5 (100)	4.6 (100)	2.7 (78)	0.1 (13)	- -	- -	- -
Chionanthus virginicus L.	2.6 (82)	1.7 (71)	1.7 (67)	- -	- -	2.3 (100)	- -
Clitoria mariana L.	2.4 (73)	2.6 (86)	0.8 (39)	- -	- -	- -	- -
Cornus florida L.	2.9 (100)	3.3 (86)	2.4 (89)	0.4 (25)	- -	1.7 (67)	- -
Desmodium obtusum (Muhl ex. Willd) DC.	3.0 (100)	3.0 (100)	1.9 (61)	0.4 (13)	- -	- -	- -
Dioscorea quaternata J.F. Gmel.	0.4 (18)	0.9 (29)	2.2 (72)	- -	- -	- -	- -
Fraxinus americana L.	1.1 (45)	0.4 (29)	2.2 (83)	0.3 (25)	- -	1.0 (33)	- -
Frangula caroliniana (Walt.) Gray	1.0 (45)	4.0 (100)	1.9 (78)	0.3 (13)	- -	0.7 (33)	- -
Gelsemium sempervirens St.-Hil.	2.5 (73)	2.7 (86)	0.5 (17)	- -	- -	- -	- -
Hamamelis virginiana L.	0.7 (27)	1.0 (29)	3.8 (100)	0.4 (13)	- -	1.3 (33	- -
Ostrya virginiana (P. Mill.) K. Koch	1.1 (27)	1.1 (43)	3.2 (94)	- -	- -	1.3 (33	- -
Prunus serotina Ehrh.	3.8 (100)	3.6 (100)	3.1 (89)	0.3 (13)	- -	0.7 (33)	- -
Quercus alba L.	4.0 (100)	3.4 (100)	3.6 (94)	- -	- -	3.3 (100)	- -
Quercus falcata Michx.	3.1 (82)	3.6 (100)	1.5 (56)	1.1 (25)	- -	0.7 (33)	- -
Sassafras albidum (Nutt.) Nees	2.4 (64)	3.1 (100)	3.1 (94)	0.3 (13)	- -	- -	- -
Scleria oligantha Michx.	3.3 (100)	2.6 (57)	1.9 (56)	- -	- -	0.3 (33)	- -
Smilax bona-nox L.	3.5 (91)	1.7 (43)	1.3 (44)	0.6 (25)	- -	1.0 (33)	- -
Smilax smallii Morong	2.0 (64)	1.0 (29)	1.0 (39)	0.3 (13)	- -	- -	- -
Vaccinium virgatum Ait.	3.8 (100)	2.9 (86)	2.2 (56)	0.1 (130	- -	- -	- -
Viburnum dentatum L.	3.1 (91)	0.7 (29)	1.7 (56)	- -	- -	1.0 (33)	- -
Vitis aestivalis Michx.	2.5 (91)	3.4 (100)	2.7 (94)	2.1 (88)	- -	- -	- -
Wide-ranging species							
Acer rubrum L.	3.6 (91)	4.7 (100)	3.7 (94)	1.3 (50)	3.5 (100)	3.3 (100)	1.0 (100)
Berchemia scandens (Hill) K. Koch	0.9 (45)	2.0 (57)	1.1 (39)	2.6 (88)	- -	1.7 (67)	- -
Bignonia capreolata L.	1.8 (64)	1.7 (57)	3.2 (100	4.1 (100)	2.0 (50)	3.3 (100)	- -
Callicarpa americana L.	3.9 (100)	3.4 (100)	3.6 (94)	1.4 (75)	- -	3.7 (100)	- -
Chasmanthium laxum (L.) Yates	0.3 (9)	0.3 (14)	1.8 (44)	3.1 (88)	3.5 (100)	3.7 (100)	- -
Dichanthelium dichotomum (L.) Gould	1.5 (55)	0.1 (14)	0.4 (17)	2.0 (63)	0.5 (50)	2.7 (67)	- -
Dichanthelium boscii #	3.2 (82)	2.1 (57)	3.1 (89)	3.4 (88)	- -	1.3 (33)	- -
Diospyros virginiana L.	1.4 (82)	2.0 (57)	0.8 (33)	0.5 (25)	3.0 (100)	- -	- -
Ilex opaca Ait.	1.2 (55)	2.9 (100)	3.4 (94)	2.6 (75)	2.5 (100)	3.7 (100)	- -
Liquidambar styraciflua L.	3.3 (82)	2.9 (71)	1.6 (67)	2.4 (75)	3.5 (100)	2.3 (67)	- -
Lonicera japonica Thunb.	0.5 (18)	2.4 (86)	1.6 (50)	1.3 (38)	- -	2.3 (67)	- -
Mitchella repens L.	1.8 (55)	2.4 (86)	2.2 (67)	4.1 (100)	2.5 (100)	2.7 (67)	- -
Nyssa sylvatica Marsh.	3.1 (91)	3.3 (100)	2.9 (94)	2.8 (100)	3.0 (100	2.3 (100)	- -

Table 1. (Continued)

Species	DMSU	DMLU	MLSC	WMFL	WMT	FS	SWP
Wide-ranging species							
Parthenocissus quinquefolia (L.) Planch.	3.8 (91	4.7 (100)	4.4 (100)	2.0 (63)	- -	2.0 (100)	- -
Pinus taeda L.	1.2 (36	1.9 (57)	1.7 (61)	- -	3.5 (100)	2.7 (67)	- -
Polystichum acrostichoides (Michx.) Schott	0.1 (9)	0.9 (43)	2.6 (72)	0.5 (13)	- -	- -	- -
Quercus nigra L.	2.9 (73)	4.3 (100)	3.4 (89)	2.9 (75)	4.0 (100)	3.0 (100)	- -
Rubus argutus Link	0.8 (27)	1.4 (43)	0.7 (22)	2.6 (75)	1.0 (50)	2.0 (67)	- -
Smilax glauca Walt.	3.5 (100)	3.6 (100)	3.4 (100)	2.6 (88)	2.5 (100)	2.3 (67)	- -
Smilax rotundifolia L.	1.9 (55)	2.1 (57)	2.3 (67)	3.3 (88)	3.5 (100)	4.0 (100)	- -
Toxicodendron radicans (L.) Kuntze	3.9 (91)	4.9 (100)	4.0 (100)	4.4 (100)	1.5 (50)	2.3 (67)	- -
Trachelospermum difforme (Walt.) Gray	0.3 (9)	0.3 (29)	0.3 (11)	2.5 (88)	1.5 (50)	- -	- -
Ulmus alata Michx.	1.7 (64)	3.1 (100)	2.7 (83)	1.8 (75)	- -	0.7 (33)	- -
Vaccinium elliottii Chapman	0.1 (9)	1.7 (57)	1.0 (33)	1.0 (38)	3.5 (100)	- -	- -
Vitis rotundifolia Michx.	4.5 (100)	4.4 (100)	4.3 (100	3.9 (100)	1.0 (50)	4.0 (100)	- -
Species of mesic, wet-mesic, & forested seep sites							
Acer barbatum Michx.	- -	0.6 (29)	1.9 (50)	0.9 (25)	- -	- -	- -
Arisaema triphyllum (L.) Schott	- -	1.4 (57)	1.7 (33)	0.9 (38)	- -	3.7 (100)	- -
Athyrium filix-femina (L.) Roth	- -	0.3 (14)	0.6 (17)	0.8 (38)	- -	4.7 (100)	- -
Carpinus caroliniana Walt.	- -	1.6 (43)	2.2 (61)	3.6 (100)	1.0 (50)	1.7 (67)	- -
Carex abscondita Mackenzie	- -	0.1 (14)	1.5 (39)	4.0 (88)	- -	- -	- -
Euonymus americana L.	- -	0.3 (14)	2.5 (89)	1.1 (38)	- -	1.0 (33)	- -
Fagus grandifolia Ehrh.	- -	1.7 (71)	2.2 (67)	0.5 (25)	- -	2.0 (67)	- -
Ligustrum sinense Lour.	- -	0.3 (14)	0.1 (6)	1.6 (88)	- -	2.3 (100)	- -
Quercus laurifolia Michx.	- -	0.3 (14)	0.3 (11)	- -	4.5 (100)	1.0 (33)	- -
Quercus michauxii Nutt.	- -	1.1 (29)	0.5 (17)	1.8 (63)	1.5 (50)	0.3 (33)	- -
Species of floodplains and wetlands							
Arundinaria gigantea (Walt.) Muhl.	- -	- -	0.3 (11)	2.0 (63)	- -	- -	- -
Bidens aristosa (Michx.) Britt.	- -	- -	0.2 (6)	1.5 (75)	- -	- -	5.0 (100)
Boehmeria cylindrica (L.) Sw.	- -	- -	0.3 (17)	2.6 (75)	1.5 (50)	2.0 (67)	4.0 (100)
Brunnichia ovata (Walt.) Shinners	- -	- -	- -	2.4 (75)	2.0 (50)	- -	2.0 (100)
Carex debilis Michx.	- -	- -	1.1 (28)	1.9 (50)	1.5 (50)	4.3 (100)	- -
Carex flaccosperma Dewey	- -	- -	0.3 (17)	2.0 (63)	1.5 (50)	- -	- -
Carex joorii Bailey	- -	- -	0.2 (6)	- -	4.5 (100)	- -	4.0 (100)
Carex louisianica Bailey	0.4 (9)	- -	0.2 (6)	3.8 (100)	2.5 (100)	- -	1.0 (100)
Carya glabra (P. Mill.) Sweet	- -	- -	1.7 (39)	2.1 (50)	- -	- -	- -
Cephalanthus occidentalis L.	- -	- -	- -	1.3 (63)	- -	2.0 (67)	5.0 (100)
Commelina virginica L.	- -	- -	0.2 (6)	2.9 (100)	- -	- -	- -
Itea virginica L.	- -	- -	0.2 (6)	0.4 (25)	- -	3.3 (100)	4.0 (100)
Justicia ovata (Walt.) Lindau	- -	- -	0.5 (17)	1.8 (63)	- -	- -	- -
Leersia oryzoides (L.) Sw.	- -	- -	0.2 (6)	1.9 (50)	- -	- -	- -
Leersia virginica Willd.	- -	- -	0.6 (22)	2.0 (63)	- -	1.7 (67)	- -
Lycopus rubellus Moench	- -	- -	0.1 (6)	1.0 (38)	- -	2.0 (67)	4.0 (100)
Quercus phellos L.	- -	- -	0.2 (6)	1.4 (38)	2.0 (50)	- -	- -
Saururus cernuus L.	- -	- -	0.1 (6)	2.1 (88)	2.5 (100)	2.0 (67)	2.0 (100)
Styrax americanus Lam.	- -	- -	- -	0.5 (25)	3.5 (100)	- -	4.0 (100)
Species of forested seeps							
Magnolia virginiana L.	- -	- -	0.1 (6)	- -	1.0 (50)	3.7 (100)	- -
Osmunda cinnamomea L.	- -	- -	- -	- -	- -	2.6 (100)	- -
Viburnum nudum L.	- -	- -	- -	- -	- -	4.0 (100)	- -
Woodwardia areolata (L.) T. Moore	- -	- -	0.1 (6)	- -	- -	4.7 (100)	- -
Wetland species							
Hydrolea uniflora Raf.	- -	- -	- -	- -	- -	- -	2.0 (100)
Lemna valdiviana Phil.	- -	- -	- -	- -	- -	- -	4.0 (100)
Ludwigia glandulosa Walt.	- -	- -	- -	- -	- -	- -	2.0 (100)
Planera aquatica J.F. Gmel.	- -	- -	- -	- -	- -	- -	3.0 (100)
Proserpinaca palustris L.	- -	- -	- -	- -	- -	- -	4.0 (100)

Another tool for understanding plant-site relationships is ordination. Ordination results can be plotted as a diagram where samples are represented as a series of points. Samples with similar species composition lie nearby on the ordination diagram while those with dissimilar species are far apart. It is also possible to use regression and correlation to observe relationships between the ordination and environmental measurements—thus providing insight into the environmental variables that affect plant species composition across the landscape. Figure1 shows an ordination diagram for a dataset from

Angelina National Forest in Texas. Samples plotted on the top the figure tend to be from uplands while samples plotted on the lower portion of the figure are from lower, wetter sites. The first axis (left-right dimension) of the ordination is related to soil texture and nutrient levels while the second axis is correlated with topographic position

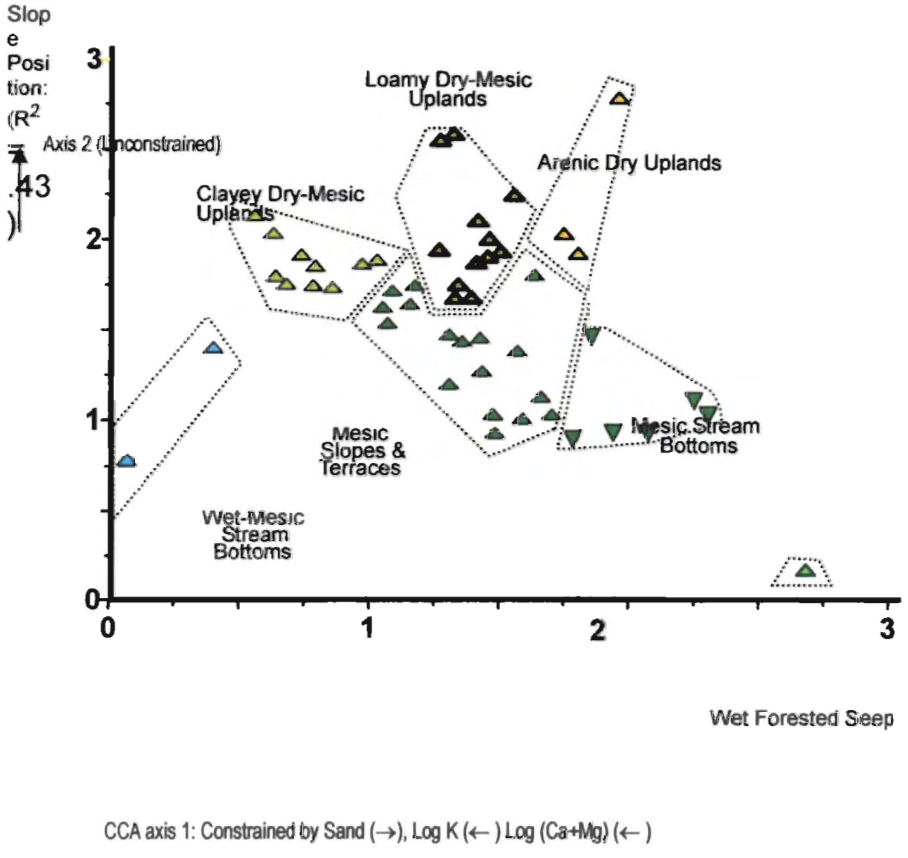

Figure 1: An hybrid CCA/ DCA ordination of samples based on ground layer plant species from the Clayey Uplands region of Angelina National Forest, Texas.

Interpretations of data such as these as well as observations from nearly 15 years of fieldwork in the Pineywoods, and literature such as the classic paper of Marks and Harcombe (1981) describing woody vegetation in the Big Thicket form the basis for a classification of east Texas forests into a series of ecological types and the generation of lists of species that are typical of each type. Much of this classification is presented on pages 90-106 in the new Illustrated Flora of East Texas Vol. I (Diggs et al. 2006). Although I have described about 20 generalized ecotypes for the Pineywoods (many more in the highly detailed ecological classification system (Van Kley et al. 2007), don't worry! I will combine similar ones and cover only the the main ones here.

The Three Principal Pineywoods Landscapes

Most natural Pineywoods habitats can be described as belonging to one of 3 main "landscape types", which are

essentially aggregations of closely related ecological types. Pine-dominated uplands typically occur on mid to upper slopes, ridgetops, and on broad, rolling upland interfluves. Most natural plant communities are dominated either by pines or by a mixture of pines and deciduous (hardwood) trees. This is the main landscape in most locales.

Mesic slopes and stream bottoms occur on mid and lower slopes, on higher, non-flooded terraces adjacent to streams and rivers, or in the valleys and ravines of small streams. They typically enjoy higher soil moisture and nutrient levels than pine-dominated uplands, were historically sheltered from fire, and natural stands usually consist of deciduous hardwoods or of mixtures of hardwoods and scattered pines--typically loblolly pine. Of all West Gulf Coastal Plain habitat types, these forests show the closest floristic relationship to the temperate deciduous forests of midwestern and northeastern USA.

River floodplains, the third major landscape, are associated with the broad floodplains of the major rivers that flow through the West Gulf Coastal Plain. Flood-tolerant deciduous hardwoods (many of which are lowland oaks) dominate most natural stands while baldcypress often dominates the deepest swamps.

The Natural habitats of the Pineywoods and the plants that characterize them

In terms of using species to describe a natural habitat, there basically two types of species. 1) indicator species: species which are often found in one or a few closely related habitat types but are rare or absent from all others. The presence of such a species is an excellent indicator of ecotype. 2) characteristic species: Species that are usually present and often common in a habitat type but are also common in other ecotypes as well. The presence of such species do not alone indicate the ecotype but in combination with other plants they can form a good description of it. In listing the species typical of our local ecotypes, I won't distinguish between these types of species in all cases.

1. Dry Sandy Uplands

In the interest of time I combine both the uplands on deep sands (Grossarenic Dry Uplands, xeric sandylands) and the less extreme arenic dry uplands. Sandy, drought-prone soils (the sand layer more than 100cm deep in extreme cases), upland or ridge top topographic positions, and an open canopy of small, stunted trees (even in the absence of fire and disturbance) characterize these sites. Trees include bluejack oak, sand post oak, blackjack oak, black hickory, sassafras, longleaf pine (chiefly in the southern and eastern part of the region currently on sites where regular prescribed burning is practiced), and shortleaf pine. Woody shrubs are often sparse, especially on frequently burned sites. Typical shrubs include dwarf pawpaw, fragrant sumac, and October flower (*Polygonella polygama*). *Schizachyrium scoparium* (Little bluestem), *Pityopsis graminifolia* (narrowleaf silkgrass), and other herbaceous species are important components of the often sparse ground cover-especially in areas with regular fire. Plants such as *Yucca louisianensis* (yucca), *Tagia urticifolia* (noseburn), *Cnidoscolus texanus* (Texas bulllnettle), and *Opuntia humifusa* (devil's tongue prickleypear) are indicators of these sites.

Stylisma pickeringii (Pickerings dawnflower), *Berlandiera pumila* (soft greeneyes), and *Pteridium aquilinum* (bracken fern) are also common.

2. Loamy Dry-Mesic Uplands

These sites have sandy loam or loam surface soils with loam or clay loam subsoils and are usually well-drained, moderately permeable and typically hold more moisture than those of sandy dry uplands. Loamy dry-mesic uplands are usually found on ridgetops broad interfluves, and gentle middle and upper slopes and are the most extensive ecotype in most of the Pineywoods. As with sandy uplands, there are two distinct natural plant communities that may develop on this ecological type depending on whether sites have had a history of regular fire and whether they are within the geographic range of longleaf pine.

Loamy Dry-Mesic Longleaf Pine Uplands:

These stands are open-canopied, nearly pure stands of longleaf pine. Woody understory plants are widely scattered within a dense, prairie-like community of grasses, composites, and other sun-loving species. S*chizachyrium scoparium* (little bluestem) dominates the ground layer and other important species include *Pityopsis graminifolia* (narrowleaf silkgrass), *Solidago odora* (anisescented goldenrod), *Tephrosia virginica* (goats rue), and *Panicum virgatum* (switchgrass). Repeated low-intensity surface fires (historically lightning-caused) prevent seedlings of most woody species from establishing--favoring the fire-resistant longleaf pine. In the absence of regular fire a dense shrub layer rapidly forms and the site subsequently succeeds to a mixed closed-canopy forest. Historically, these communities dominated large parts of the upland landscape across much of the West Gulf Coastal Plain. They are now rare as a result of human fire-suppression activity, persisting mainly on public lands in areas with prescribed burning programs.

Loamy Dry-Mesic Mixed Pine-Hardwood Uplands

Loblolly pine is abundant but usually co-occurs with a mixture of other trees including sweetgum, southern red oak, post oak, winged elm, black hickory, shortleaf pine, and mockernut hickory. Flowering dogwood, redbud, eastern hophornbeam, and winged elm are common understory trees. The shrub-layer is often dense. Common shrubs include yaupon, American beautyberry, farkleberry, and southern arrowwood. Woody vines, especially greenbriars *(Smilax* sp.) and summer grape (*Vitis aestivalis)* are common. A variety of species with a wide ecological range such as *Chasmanthium sessiliflorum* (narrow leaved wood oats), *Toxicodenron radicans* (poison ivy), *Parthenocissus quinquefolia* (Virginia creeper), and others dominate the ground layer. This is the most extensive forest community on much of the modern landscape.

3. Wet Herbacous Seeps

Herbaceous Seeps typically occur on water-saturated, nutrient-poor, sandy soils on upland hillsides and the upper

heads of small drainages where groundwater meets an impermeable layer (clay or rock) and seeps to the surface. The surrounding landscape usually consists of sandy soils, which have high infiltration and provide an ample water supply for the seeps. Typically embedded in longleaf pine communities (or in areas formerly dominated by longleaf pine), regular fires entering from the surrounding landscape inhibit establishment of woody plants. Woody shrubs are kept sparse by fire, but can include wax-myrtle, evergreen bayberry, redbay, possumhaw, and poison sumac. Sedges, most from the genus *Rhynchospora*, dominate the ground layer along with grasses (especially *Dichanthelium* sp.). In addition, the species-rich assemblage includes carnivorous plants such as *Drosera brevifolia* (sundew), *Sarracennia alata* (pitcher plant), and *Pinguicula pumila* (small butterwort). Other common species include *Eriocaulon decangulare* (tenangle pipewort), *Sabatia gentianoides* (pinewoods rose gentian), *Helianthus angustifolius* (swamp sunflower), *Lycopodiella appressa* (southern appressed clubmoss), and *Sphagnum* sp. mosses, Rare and sensitive species sometimes found in herbaceous seeps include *Calopogon tuberosus* (grass pink), *Pogonia ophioglossoides* (snake's mouth orchid), P*lantanthera integra* (yellow fringeless orchid), and *Rudbeckia scabrifolia* (bog coneflower). Herbaceous seeps are rare as a result of both the loss of longleaf pine woodlands and their associated fires and the lack of suitable soils and hydrology in many areas.

4. Prairies, Barrens, and Glades

Although forest vegetation develops in the absence of disturbance in most West Gulf Coastal Plain ecosystems, a variety of localized herbaceous-dominated communities where unusual soil properties inhibit woody plants exist in the region. Soils are often clayey or shallow to bedrock, and sometimes, calcareous. Overstory trees are widely scattered or absent and small trees and shrubs are often restricted to scattered thickets or to the margins of the site. Herbaceous species not common in most natural Pineywoods habitats such *Dalea compacta* (compact prarieclover), *Callirhoe papaver* (winecup), *Bouteloua rigidistea* (Texas grama), *Eustoma russellianum* (showy prarie gentian), and *Euphorbia bicolor* (snow on the prairie) are present on some sites. Often, there are rare or sensitive species such as *Schoenolirion wrightii* (Texas sunnybell) which occurs on "barrens" associated with the Catahoula Formation in the southern Angelina National Forest (Marrietta & Nixon 1984). Rare glades characteristic of outcrops of the Weches Formation where herb-dominated communities that include the rare white bladderpod (*Lesquerella pallida*) and Texas golden gladecress (*Leavenworthia texana*) occur on rocky Trawick soils between Nacogdoches and San Augustine, TX (George & Nixon 1990).

5 Mesic Slopes, stream bottoms, and Terraces

On lower slopes adjacent to rivers and streams, in the valleys and small, poorly-developed floodplains of minor streams, on steep slopes, and on the higher, inactive terraces of some rivers, there is a strong tendency for hardwood-dominated forests to develop in absence of logging and other disturbances. Steep slopes and proximity to streams historically protected these sites from fires, which usually would have had to burn downhill to reach them and Moreover,

lower hydrologic position on the landscape results in more available soil moisture and nutrients than for uplands. Natural stands develop a mixture of loblolly pine and various deciduous hardwoods including southern red oak, white oak, blackgum, sweetgum, water oak, and American basswood. American beech and southern magnolia often establish on undisturbed sites. American holly, winged elm, Florida maple, flowering dogwood, eastern hop hornbeam eastern redbud, and red buckeye, are important in the understory, while American beauty berry, Carolina buckthorn, common sweetleaf, and maple-leaved viburnum are common shrubs. *Chasmanthium sessiliflorum*, (long-leaf wood oats), *Parthenocussus quinquefolia* (Virginia creeper), *Mitchella repens* (Partridge berry), *Smilax pumila* (sarsparilla vine), and *Sanicula canadensis* (black snakeroot) are typical ground layer species species. Vines such as *Vitis rotundifolia* (muscadine grape) commonly festoon the trees. Less frequent are "vernal herbs" plants more typical of the deciduous forests of the Appalachians or the Midwestern USA: *Podophyllum peltatum* (mayapple), *Erythronium* sp (trout lilly), *Arisaema triphyllum* (Jack in the pulpit), *Arisaema dracontium* (green dragon), and *Sanguinaria candensis* (bloodroot), and *Polygonatum biflorum* (great Solomon's seal).

6. Wet Mesic stream bottoms

As one moves downstream, streams become larger, floodplains wider and better developed, and flood frequency and duration longer. Often associated with third-order perennial streams, wet-mesic stream bottoms are transitional between mesic stream bottoms and the downstream seasonally flooded river floodplains. Flooding is irregular and is not severe enough to eliminate many mesic species but flood-tolerant species also occur; the flora is a rich mixture of both mesic and wetland species. The overstory consists of a diverse mixture of mesic and wet-site hardwood species such as water oak, white oak, willow oak, laurel oak, swamp chestnut oak, cherrybark oak, blackgum, sweetgum, river birch, American basswood, American elm, sugarberry, and Loblolly pine. American holly, Florida maple, red maple , and American hornbeam, are typical understory trees. Many of the herbaceous species discussed above along with various wetland sedges and grasses make up the groundlayer.

7. Wet Forested Seeps

Also known as baygalls, these sites support a distinctive plant community where groundwater discharges on lower hillsides, headslopes, and along small streams. Soils are usually deep gray sands that are semipermanently to nearly permanently saturated. Surrounding uplands typically have sandy, soils which have rapid infiltration, low runoff, and provide an ample supply of groundwater. Tree species include Sweetbay magnolia, swamp tupelo, and red maple. Shrubs and vines include evergreen bayberry, poison sumac, laurel-leaf greenbriar, possumhaw, and redbay. Wild azaleas provide showy flowers in spring. *Woodwardia areolata* (netted chain fern) typically dominates the ground layer. Other groundcover species are *Osmunda regalis* (royal fern), *Osmunda cinamomea* (cinnamon fern), and *Eleocharis microcarpa* (smallfruit

spikesedge). Patches of *Sphagnum* sp. mosses may be present. Rare species that one may find in Forested Seeps include *Spiranthes* sp. (Lady's tresses) *Bartonia texana* (Texas screwstem), *Parnassia asarifolia* (kidney-leaf grass of Parnassus) and *Burmania biflora* (northern bluethread).

8. Irregularly Flooded Mesic Terraces and Bottomland Ridges

On the higher and drier portions of the broad floodplains of rivers in places such as crowns of natural levees, meander scrolls, and other slightly elevated areas, a plant community similar to that found on Wet-Mesic Stream bottoms develops. Soils are usually of coarser texture than soils on the rest of the floodplain because floodwaters deposit the coarse portion of their sediment load on the natural levees first when they overflow the riverbank and loose velocity (Mitsch & Gosselink 2007). Flooding is irregular, less frequent than for the adjacent lower portions of the floodplain. The overstory consists of mesic and moderately flood-tolerant species such as loblolly pine, water oak, sweetgum, white oak, cherrybark oak, blackgum, willow oak, laurel oak, and southern red oak. Understory trees and shrubs include American hornbeam, American holly, winged elm, flowering dogwood, yaupon, American beautyberry, farkleberry, flowering dogwood, and rusty blackhaw. "Canebreaks", thickets of *Arundinaria gigantea* (switch cane) are common especially on natural levees adjacent to the immediate riverbank. Ground Layer species composition can be quite variable, depending on micro-differences in elevation, soils, and local hydrologic conditions and include variety species also found both in non-flooded mesic sites and seasonally flooded river floodplains.

9. Seasonally Flooded River Floodplains

The most extensive ecological type on most bottomland landscapes are the broad, flat, main portions of the floodplains of major rivers. Soils, formed in recent alluvium, are generally loamy, silty, or clayey, the coarser particles usually having been deposited on the natural levees before floodwaters reach the main part of the floodplain. The sites are subject to seasonal flooding and are usually inundated for a significant portion (12.5-25%) of the growing season. Natural forests are a rich mixture of flood-tolerant deciduous hardwoods which include willow oak, laurel oak, overcup oak, swamp chestnut oak, sweetgum, American elm, swamp tupelo, green ash, and red maple. The lower, wetter portions (approaching a regularly-flooded hydrologically regime) often become dominated by nearly pure stands of overcup oak. Common understory trees and shrubs include common persimmon, American hornbeam, deciduous holly, American snowbell, mayhaw, and parsley hawthorn. Ground cover may be sparse, especially in the absence of openings in the normally dense canopy, but important species include *Boehmeria cylidrica* (false nettle), *Carex joorii* (cypress swamp sedge), *Rhynchospora corniculata* (beak sedge), and *Justicia ovata* (water willow) while *Saururus cernuus* (lizard tail), occurs in wetter areas. *Brunnichia ovata* (American buckwheat vine) is common as small, non-flowering individuals under the canopy, but may form dense tangles along with *Mikania scandens* (climbing hemp vine) in openings.

10. Swamps

Aassociated with backswamps, sloughs, and old stream channels on the lowest portions of the floodplains of rivers, these sites are regularly flooded (inundation lasting for 25-75% of a typical growing season) or semipermanently flooded with only rare periods of exposure during the driest years. Nearly constant saturation of soils creates anoxic conditions that favor obligate and facultative wetland plants. Natural overstory in shallower (regularly flooded) swamps is dominated by dense groves of water elm, Carolina ash, and/or Black willow with bald cypress or water tupelo often forming an emergent canopy. Eastern swamp privet and common buttonbush are the principal shrubs. Coverage of ground-rooted plants may be very sparse but *Carex* sedge species, *Brunnichia ovata* (American buckwheat vine), and *Panicum gymnocarpon* (savannah panic grass) are among the most common. The deeper (semi-permanently flooded) swamps are dominated largely by bald cypress (mixed further south and east with water tupelo). shrubs are uncommon, primarily common buttonbush growing on stumps and logs. *Ceratophyllum demersum* (coontail), *Cabomba carolinaina* (fanwort), *Hydrilla verticilat*a (hydrilla), *Lemna* sp. (duckweeds), *Spirodella* sp. (duck meat), *Wolfia columbiana* (water meal), *Nuphar luteum* (yellow pond lily) and *Nelumbo lutea* (American lotus) are among the floating and submersed plants that may grow in the shallow waters of semipermanently flooded swamps. Some sites are infested with dense mats of non-native *Eichhornia crassipes* (water hyacinth). Spanish moss (*Tillandsia usneoides*) often festoons the trees. Excellent examples of swamps are at Caddo Lake in northeastern Texas.

11. Marshes

Marshes are defined as non-forested wetlands. In the Texas Pineywoods where forest tends to develop on most wetlands, many marshes are temporary communities on the regularly-flooded and semi-permanently-flooded swamp ecological types resulting from human activities or from natural processes such as riverbank erosion and deposition, oxbow creation, beaver activity, and wind throw. Marsh vegetation is also common along the margins of the numerous artificial reservoirs in the region. *Typha* sp., (cattail), *Zizaniopsis miilacea* (marsh millet) rushes (such as *Juncus effusus*), *Sagittaria platyphylla* (delta arrowhead, and many of the non-woody species also found in swamps are typical of east Texas marshes.

12. Human-Dominated Ecosystems

While non-natural plant communities are outside the scope of this talk, much of east Texas is under varying degrees of human influence and vegetation may only partially or minimally reflect the potential natural plant communities for their ecosystem types as described above—although in the absence of continued disturbance sites may eventually revert to their potential natural communities. The many forms of human land management have produced a wide array of human-dominated ecosystems. Roadsides--maintained by mowing--often include a variety of planted wildflowers only occasionally encountered in natural local habitats. Cut-over forests, especially in the absence of silvicultural site-preparation and planting

develop a dense growth of perennial herbs such as *Solidago Canadensis* (Canadian goldenrod), vines, brambles, and residual or regenerating tree species--especially loblolly pine and sweetgum. Exotic grasses may dominate pastures. Even in natural areas, the virtual elimination of fire as an ecological force from many landscapes has profoundly affected the development of vegetation (see discussions of upland types in this presentation). Urban areas are characterized by a variety of vegetation, including mixtures of both cultivated and native species often occurring on ecological types in which they would ordinarily not be found. Elsewhere, large areas of former river floodplains have been converted to artificial reservoirs where the exotic weed *Hydrilla verticillata* is abundant.

So, It is clear that the plants of the Pineywoods have a story to tell to those who understand their language, and yes, even though the species is quirky and difficult to find anywhere, you are better off searching a rich, mesic forest for yellow Lady's slipper rather than your neighbor's pasture!

References:

Diggs, G.M.Jr., B.L. Lipscomb, M.D. Reed, and R.J. O'Kennon. Illustrated Flora of East Texas Volume I. Center for Environmental Studies, Austin College, Sherman, Texas and Botanical Research Institute of Texas (BRIT), Fort Worth, Texas. Sida, Botanical Miscellany 26.

George, R. J., and E. S. Nixon. 1990. The herbaceous flora of three Weches formation outcrops in eastern Texas. Sida 14(1):117-127.

Hill M.O. 1979. TWINSPAN--a FORTRAN program program for arranging multivariate data in an ordered two-way table by classification of the individuals and attributes. Department of Ecology and Systematics, Cornell Universty, Ithica, NY.

Hill, M.O., and H.G. Gauch Jr. 1980. Detrended correspondence analysis: an improved ordination technique. Vegetatio 42:47-50.

Marietta, K. L., and E. S. Nixon. 1984. Vegetation of an open, prairie-like community in eastern Texas. Texas Journal of Science 36(1):25-32.

Marks, P. L., and P. A. Harcombe. 1981. Forest vegetation of the Big Thicket, southeast Texas. Ecological Monographs 5(3):287-305.

Mitsch, W.J. and J.G. Gosselink. 2007. Wetlands 4th ed. John Wiley & sons, Hoboken.

Van Kley J.E., R.L. Turner, L.S. Smith, and R.E. Evans. 2007. Ecological classification system for the national forests and adjacent areas of the West Gulf Coastal Plain: 2nd approximation. The Nature Conservancy and Stephen F. Austin State University, Nacogdoches, Texas, USA. 379pp.

Meat, Salad and Microbes: Antimicrobial Plants of the Cajun Prairie

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Abstract

Prairie plants have a history of use in a large variety of ways. One of the most intriguing ways is the use of plants as medicine. *Escherichia coli* 0157:H7, a common pathogen found in meat products, and *Listeria monocytogenes*, a common pathogen found in vegetable salads, were used as target species for the study of antimicrobial activity of several prairie plants (native Cajun Prairie plants) and selected exotic plants (Old World plants). Antimicrobial properties of varied plants (often called herbs) and their components are found mostly in the essential oil fractions. In studies with *E. coli*, we clearly demonstrated that native prairie plant essential oils were more effective that Old World plant extracts at inhibiting the growth and development of bacterial colonies not only in agar media but also in ground meat. In further experiments, *L. monocytogenes* colony formation in agar media and in salad was also inhibited with essential oil extracts from several prairie plants. The prairie plant essential oils strongly inhibited colony development in two major bacterial pathogens contaminating our food supply.

Introduction

Herbs (native and Old World plants) have been used since ancient time by many cultures to preserve foods, to enhance the flavor/aroma of foods, and for their medicinal value. Scientific experiments since the late 19th century have documented the antimicrobial properties of some herbs and their components. Most of the food-borne bacterial pathogens are sensitive to extracts from herbs such as mints, garlic, and clove with the extent of sensitivity varying with the bacterial strain and environmental conditions imposed. The antimicrobial compounds in herbs are found mostly in the essential oil fraction. The importance of food quality is often taken for granted by a majority of consumers as they expect to purchase products that are safe for consumption. An estimated 76 million food-borne illnesses occur annually in the United States.

Most of these illnesses are undiagnosed and thus unreported. *Escherichia coli* 0157:H7 causes 270,000 reported cases of food-borne illnesses per year (Kalemba and Kunicka 2003 and Al Dujaili and Vidrine 2008). It is a gram-negative, almost ubiquitous, organism implicated in some famous cases of contaminated meat.

Listeria monocytogenes has become a major concern for the food industry in recent years (Seaberg et al. 2003). This is a gram-positive, facultative, anaerobic, non spore forming, rod shaped bacterium causing the disease listeriosis. This bacterium grows over a wide temperature range of 2.5-44.5°C, thus refrigerated foods are a large concern in regards to outbreaks in the food industry. *Listeria monocytogenes* grows best in the pH range of 6-8, causing another concern for the food industry since salads fall within this range. This organism has been found in raw and improperly pasteurized milk, soft cheese, fresh and frozen meat, poultry, and seafood products, as well as on fruits and vegetables.

The present study monitors the antimicrobial effects of Cajun Prairie plants on the growth and survival of *E. coli* 0157:H7 and *L. monocyotgenes*. The antimicrobial activity was initially compared to the activity of Old World plants and then tested in ground meat and salad.

Methods

Strains of *Escherichia coli* 0157:H7 employed in this study were isolated in our laboratory from meat and meat products. *Listeria monocytogenes* (American Type Culture Collection) ATCC 7 cultures were used in this study.

The plants (see Table 1) were either purchased and grown (Old World plants) or collected in restored prairie (native) in the Cajun Prairie Gardens of the first author (Vidrine et al. 2003). Names of all the plants used follow the nomenclature (scientific and common names) used in the USDA PLANTS database (NRCS 2007).

Table 1- Scientific and Common Names of Old World and Native plants.

Old World plants:
Anethum graveolens (dill)
Foeniculum vulgare (fennel/sweet fennel)
Ocimum basilicum (sweet basil)
Tulbaghia violacea (society garlic/wild garlic)

Native prairie plants :
Monarda fistulosa (bergamont/wild bergamont)
Monarda lindheimeri (Lindheimer's bee balm)
Monarda punctata (spotted bee balm/horsemint)
Pycnanthemum tenuifolium (narrowleaf mountain mint)
Pycnanthemum albescens (whiteleaf mountain mint)
Pycnanthemum muticum (clustered mountain mint)
Solidago odora (sweet goldenrod)
Nothoscordum bivalve (crowpoison/false garlic)

The herbs were ground and 100-140 grams of the final mass were mixed 1:1 with distilled water in a spherical flask. A continuous steam distillation extraction head was attached to the flask. The oil was collected after steam distillation for approximately 1 hour over a heating unit and stored at 4^0C. These products were then used in two sets of experiments. In the first set of experiments, six levels (1.0, 2.0, 4.0, 6.0, 8.0, and 10.0%) of essential oil of each of the 12 herbs were transferred into MSA. All MSA plates were inoculated with 0.1 ml of serial dilutions of *E. coli* 0157:H7 and incubated at 37^0C for 24 hours. In a second set of experiments, ground beef (80% lean, 20% fat) was mixed with (1.0, 2.0, 4.0, 6.0, and 8.0%) essential oils of whiteleaf mountain mint, crowpoison, sweet basil, and dill. The mixture was mixed thoroughly for 2 minutes. *E. coli* 0157:H7 then was added to these mixtures, and the samples were incubated at 37^0C for 24 hours. After incubation, the viable cell count (colony forming units (CFU)) of *E. coli* 0157:H7 in each mixture was determined by spread-plating on MSA plates followed by incubation at 37^0C for 24 hours.

MacConkey Sorbitol Agar (MSA) was the solid medium used to test the effects of herbs on the growth of *E. coli* 0157:H7. The controls were either MSA without herb extracts or ground beef without herb extracts. We used 80% lean and 20% fat ground meat in this study. Direct enumeration of living cells was performed by direct plating technique (viable count method).

Petri dishes for agar diffusion studies were filled with 10 ml of agar broth and inoculated with *L. monocytogenes*. Paper discs (6mm in diameter) were immersed in the oil solutions of various concentrations (0 μg, 2.5 μg, 3.0 μg, 4.0 μg, and 5.0 μg) and placed onto a cultured petri dish. The petri dishes were incubated for 24-48 hours at 37°C. The zone of inhibition was then measured. The effectiveness of the essential oil is demonstrated by the size of the zone of *L. monocytogenes* growth inhibition around the disc.

A loop full of stock culture of *L. monocytogenes* was inoculated in 10 ml Brain-Heart Infusion (BHI) media and incubated in a shaking incubator at 200 rev/min overnight at 37°C. From this overnight culture, 1.0 ml was pipetted into a sterile micro centrifuge tube and centrifuged for 5 minutes at 13,000 rpm. The supernatant was discarded, and the pellet was re-suspended with 1ml of 0.1% sterile phosphate buffer solution. This procedure was repeated two more times. One hundred microliters (µl) of desired initial inoculum was applied to a 10 g sample of salad. The cells were spread over the surface of the salad sample by using a sterile glass rod. Samples of 50:50 ethyl alcohol and distilled water along with 1.0 ml of essential oil for each of the five herbs were added to the surface of the sample salads at levels of 0 µg, 400 µg, and 800 µg. The samples were incubated for 48 hours at 37°C. Each sample was macerated in 90 ml of sterile 0.1% peptone water using a stomacher. Serial dilutions of 10-2 and 10-6 of each sample were made using sterile 0.1% peptone water. Spread plates were made of each sample using BHI agar, and all plates were placed in an incubator for 30 hours at 37°C. Plates with CFUs between 25 and 300 were utilized to calculate the CFU/gram for each sample.

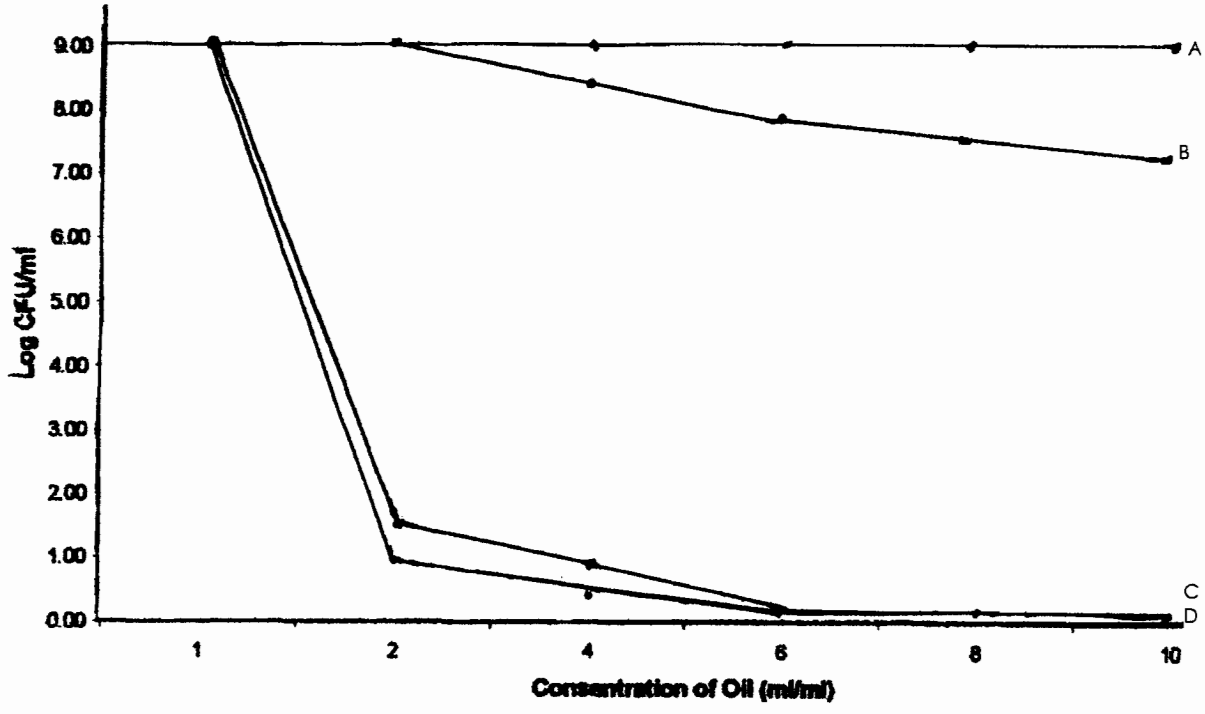
RESULTS

Effects of oils on *Escherichia* in MSA media

The essential oils of plants demonstrated significant effects ($p < .0001$) against *E. coli* 0157:H7 as indicated by changes in the viable counts (Fig. 1). The essential oils of all the native mint plants have the highest antagonistic effects inhibiting the growth of bacteria at 2% and higher. Although the essential oils of sweet goldenrod, society garlic, dill, fennel, and sweet basil

showed some inhibitory effects by reducing the initial number of bacteria, they were obviously less effective than the mints and crowpoison ($p < .0001$).

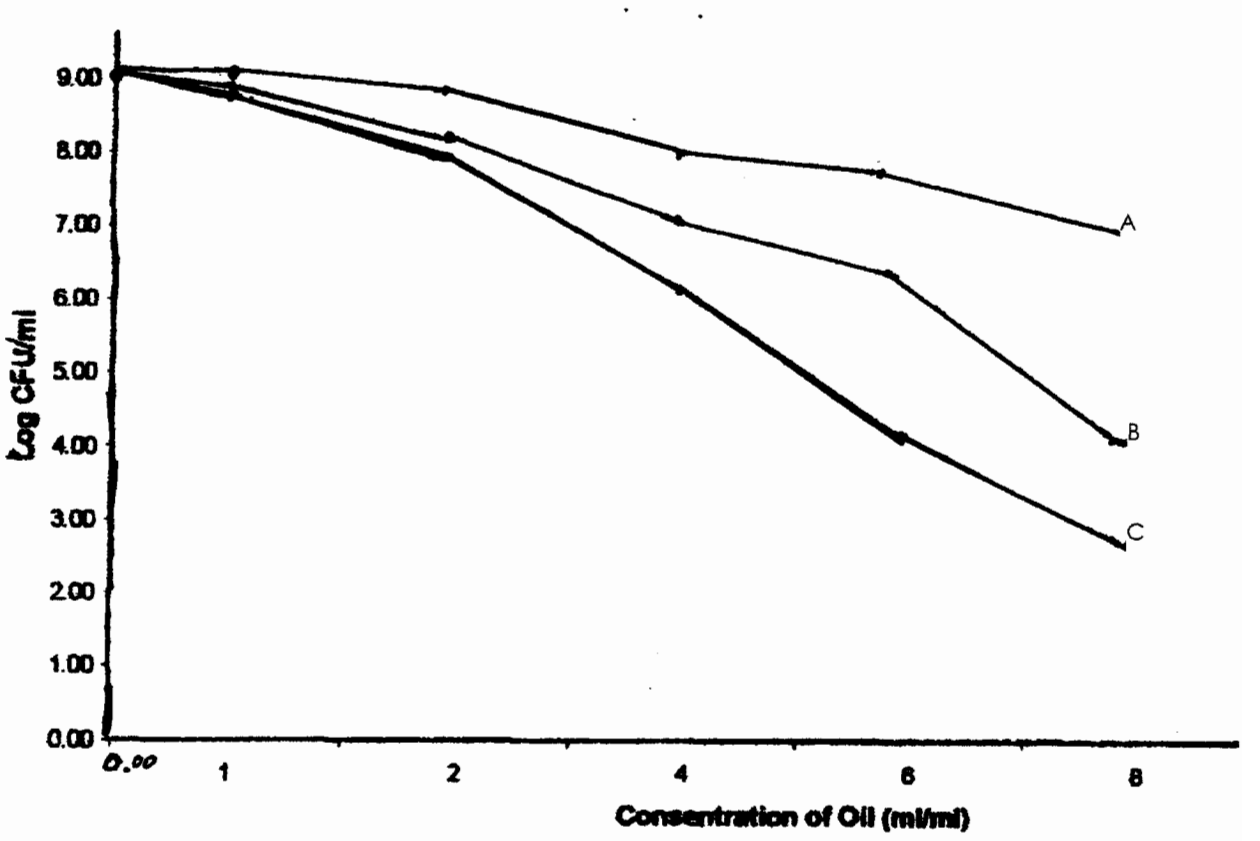
Figure 1. The effects of essential oils at different concentrations on viable cell counts (CFU/ml) of *Escherichia coli* 0157:H7 on MSA. A. Control. B. Sweet goldenrod, fennel, sweet basil and dill. C. Society garlic and crowpoison. D. All the mints (*Monarda spp.* and *Pycnanthemum spp.*).



Effects of oils on *Escherichia* in ground beef

In ground beef, the results showed that whiteleaf mountain mint and crowpoison had significant inhibitory effect ($p < .0001$), limiting the growth of bacteria to 6.2 log CFU/g, 7.2 log CFU/g, 4.2 log CFU/g , 6.8 log CFU/g, 2.00 log CFU/g, and 4.2 log CFU/g, at 4%, 6%, and 8% levels of essential oil, respectively (Fig. 2). Meanwhile, sweet basil and dill at 8% level showed significant reduced the growth of bacteria to 7.00 log CFU/g and 7.10 log CFU/g.

Figure 2. The effects of essential oils at different concentrations on viable cell counts (CFU/ml) of *Escherichia coli* 0157:H7 in ground beef at 37^{0}C after 24 hours of incubation. A. Dill and sweet basil. B. Crowpoison. C. Clustered mountain mint.



Effects of oils on *Listeria* in agar diffusion

With the Agar Diffusion Method and a viable plate count, all of the essential oils exhibited antimicrobial activity on *L. monocytogenes* (Table 2). Crowpoison had the highest inhibitory effectiveness on growth of *L. monocytogenes* as indicated by the size of the zone of growth inhibition around the disc. Bergamont and spotted bee balm showed the least inhibitory effects. This method is the most widespread technology of antimicrobial activity assessment.

Table 2. Inhibitory effects of various levels of essential oils on the growth of *L. monocytogenes*, using Diffusion Method Assay. Inhibition is estimated by the relative width of the inhibition zones in a range of '0-3' with '0' indicating 'no inhibition' and '3' indicating 'maximum inhibition.'

	Concentration of Plant's Essential Oil (µg)					
Essential Oil	**0 µg**	**2.5 µg**	**3.0 µg**	**4.0 µg**	**5.0 µg**	**10.0 µg**
P. tenuifolium	0	1	1	1	1	2
P. mutacum	0	1	1	1	1	2
M. fistulosa	0	1	1	1	1	1
M. punctata	0	1	1	1	1	1
N. bivalve	0	1	1	1	1	3

Effects of oils on *Listeria* in salad samples

The bactericidal activity of the essential oil fraction in herbs was tested using salad samples. Crowpoison and clustered mountain mint showed strong bactericidal effects at the concentrations of 400 and 800 ppm (Table 3). On the other hand, the other mints showed only moderate inhibition.

Table 3. Growth of *Listeria monocytogenes* in salad samples inoculated with five different essential oil extracts.

	CFU/G (Initial CFU of *L. monocytogenes* applied to salad = 4.80×10^5)		
Essential Oil	**0 ppm**	**400 ppm**	**800 ppm**
P. tenuifolium	2.9×10^{10}	9.6×10^6	8.2×10^6
P. mutacum	2.9×10^{10}	3.8×10^5	2.0×10^5
M. fistulosa	2.9×10^{10}	8.7×10^6	4.2×10^6
M. punctata	2.9×10^{10}	8.5×10^6	4.9×10^6
N. bivalve	2.9×10^{10}	2.9×10^5	1.8×10^5

DISCUSSION

The main constituents of essential oils are responsible for the fragrant and biological properties of herbs. The inhibitory effect of essential oil against food-borne bacteria has been reported in microbiological media and in real food (Al-Dujaili and Vidrine 2008).

Dry plant powders and essential oils have been used against *E. coli* 0157:H7 in earlier studies (Al-Dujaili and Vidrine 2008). In the MSA, native mints killed the bacteria completely, and crowpoison killed 95% of bacteria population. However, other herbs, including sweet goldenrod and Old World species, only moderately reduced the bacterial population in SMA. In ground beef, four selected herb essential oil extracts were tested. Whiteleaf mountain mint killed up to 80%, crowpoison killed up to 60%, and dill and sweet basil killed up to 40% (Al-Dujaili and Vidrine 2008). The results of the two sets of experiments clearly suggest that native plants from the Cajun Prairie are at the very least equal to if not better than their Old World species at inhibiting growth of the bacterium *E. coli* 0157:H7.

The results of additional experiments indicate that the essential oils also inhibit the growth of *L. monocytogenes*. In agar diffusion and salad, crowpoison and clustered mountain mint exhibited the greatest inhibition. We achieved very high levels of inhibition with the oils in specialized media in controlled experiments, but somewhat less inhibition in the more complex mini-ecosystems of ground meat and salad. These results confirm those of other authors (Al-Dujaili and Vidrine 2008), but do not reduce the potential of these oils in food preservation/protection.

These collective results indicate a potential for these native plants/herbs to be used in the food and medical industry. Further investigation needs to be done to identify the chemical, physical, and biological characteristics of these herbs and their oils. The future roles of these plants in public health are intriguing.

ACKNOWLEDGMENTS

Miranda Doucette and Charlotte LaVergne assisted in the projects. Undergraduate Summer Research Institute (URSI) and the LSUE Foundation contributed materials and support for the conduct of this research. We thank S. Renée Robichaux for critically reading the manuscript. This research was initiated as a result of the comment by Charles Allen that the smell of whiteleaf mountain mint reminded him of his grandmother's (Mamie Carter Allen) sausage indicating that she used this mint as a preservative in her meat.

LITERATURE CITED

Al-Dujaili, J. S. and M. F. Vidrine. 2008. Antimicrobial activity of Cajun Prairie herbs on the growth of pathogenic bacteria in foods. Proc. 20th North American Prairie Conference (2002). (in press).

Kalemba, D. and A. Kunicka. 2003. Antibacteria and antifungal properties of essential oils. Current Medicinal Chemistry 10: 813-829.

NRCS (Natural Resources Conservation Service). 2007. PLANTS database. U. S. Department of Agriculture, accessed in August 2007 at: http://plants.usda.gov/ .

Seaberg, A.C., R. G. Labbe, and K. Shetty. 2003. Inhibition of *Listeria monocytogenes* by elite clonal extracts of oregano (*Origanum vulgare*). Food BioTechnol. 17(2): 129-149.

Vidrine, M. F., G. J. Quillman-Vidrine, D. J. Vidrine, and C. E. Vidrine. 2003. The Cajun Prairie Gardens: Demonstrations of sustainable landscaping in southwestern Louisiana. Pp. 95-99. IN: S. Foré, ed. Proc. 18th North American Prairie Conference: Promoting Prairie (2002). Kirksville, MO: Truman State University Press. 256pp.

Field Trips

Dogwood Trails Plant List

Woody Plants:

Acer rubrum	Red Maple
Acer sacharinum	Sugar Maple
Aesculus pavia	Red Buckeye
Alnus serrulata	Hazel Alder
Arailia spinosa	Devil's Walking Stick
Aronia arbutifolia	Chokecherry
Asimina triloba	Dwarf Pawpaw
Betula nigra	River Birch
Callicarpa Americana	American Beautyberry
Carpinus caroliniana	Hornbeam
Carya cordiformis	Bitternut Hickory
Carya tomentosa	Mockernut Hickory
Cephalanthus occidentalis	Common Buttonbush
Cercis Canadensis	Eastern Redbud
Chionanthus virginicus	Fringetree
Cornus florida	Flowering Dogwood
Crataegus brachycantha	Blueberry Hawthorn
Crataegus marshalii	Parsley Hawthorn
Crataegus opaca	May Hawthorn
Cyrilla racemiflora	Leatherwood
Euonymous Americana	Strawberry Bush
Fagus grandifolia	American Beech
Fraxinis pensylvatica	Green Ash
Halesia diptera	Two-winged Silverbell
Hamamelis virginica	Witch Hazel
Ilex opaca	American Holly
Ilex vomitoria	Yaupon
Itea virginiana	Virginia Sweetspire
Juniperus virginiana	Eastern Redcedar
Liquidambar styraciflua	Sweetgum
Magnolia grandiflora	Southern Magnolia
Magnolia virginiana	Sweetbay Magnolia
Morus rubra	Red Mulberry
Myrica cerifera	Wax Myrtle
Ostrya virginiana	Hophornbeam
Persea borbonia	Red Bay
Pinus echinata	Shortleaf Pine
Pinus palustrus	Longleaf Pine
Pinus taeda	Lobloly Pine
Platanus occidentalis	Sycamore
Prunus mexicana	Mexican Plum
Prunus serrotina	Black Cherry

Quercus alba	White Oak
Quercus michauxii	Swamp Chestnut Oak
Quercus nigra	Water Oak
Quercus phellos	Willow Oak
Rhamnas caroliniana	Carolina Buckthorn
Rhododendron canescens	Piedmont Azalea
Rhododendron oblongifolia	White Azalea
Rhus copallina	Shining Sumac
Sabal minor	Palmetto
Sassafras albidum	Sasafras
Styrax Americana	American Snowbell
Symplocos tinctoria	Horse Sugar
Taxodium distichum	Bald Cypress
Ulmus alata	Winged Elm
Ulmus Americana	American Elm
Viburnum dentatum	Arrowood Viburnum
Viburnum rufidulum	Rustyblackhaw Viburnum

Herbaceous Plants

Arisaema dracontium	Green Dragon
Arisaema quinatum	Five Leaved Jack-in-the-pulpit
Tradescantia hirsutiflora	Hairy-flowered Spiderwort
Lilium michauxii	Carolina Lily
Erythronium rostratum	Trout Lily
Polygonatum biflorum	Great Solomon Seal
Hypoxis hirsute	Yellow Star-grass
Habenaria clavellata	Green Rein Orchid
Corallorhiza wisteriana	Spring Coral Root
Claytonia virginica	Spring Beauty
Podophyllum peltatum	May Apple
Cardamine bulbosa	Spring Cress
Oxalis violacea	Wood Sorrel
Viola walteri	Walter's Violet
Monotropa uniflora	Indian Pipe
Gelsemium sempervirens	Carolina jessamine
Asclepias variegata	White Flowered Milkweed
Salvia lyrata	Lyre-leaf Sage
Penstemon laxiflorus	Loose-flowered Penstemon
Bignonia capreolata	Cross-vine
Campsis radicans	Trumpet-creeper
Epifagus virginiana	Beech-drops
Ruellia nudiflora	Violet Ruellia
Mitchella repens	Partridge Berry

Lonicera sempervirens	Coral Honeysuckle
Wahlenbergia marginata	Wahlenbergia
Chasmanthium	Inland Sea Oats
Polystichum acrosticoides	Christmas Fern
Thelyteris kunthii	Wood Fern

Pitcher Plant Trail Plant List

Herbaceaus Plants

Aletris aurea	Colic Root
Allium canadense	Wild Onion
Asclepias viridis	Antelope Horn
Ascyrum hypericoides	St. Andrew's Cross
Ascyrum stans	St. Peter's Wort
Bartonia verna	Spring Bartonia
Bigelowia virgata	Slender Bigelowia
Buchnera Americana	American Bluehearts
Calapogon pulchellus	Grass-pink
Calopogon barbatus	Bearded-Grass-pink
Centella asiatica	Spadeleaf
Dichromena latifolia	White Top Sedge
Drosera annua	Annual Sundew
Duchesnea indica	Indian Strawberry
Eriocaulon decangulare	Ten Angle Pipewort
Eupatorium hyssopifolium	Hyssop-leaved Eupatorium
Gentiana saponaria	Bottle-gentian
Habenaria nivea	Snowy Orchid
Habeneria ciliaris	Yellow Fringed Orchid
Helianthus angustifolia	Swamp Sunflower
Hypericum fasciculatum	Sand-Weed
Hypericum mutilum	Small Flowered St. John's Wort
Hyptis alata	Desert-Lavender
Liatris pycnostachya	Kansas Gay Feather
Lobelia flaccidifolia	Soft-leaved Lobelia
Ludwigia hirtella	Spindle-root
Marshallia tenuifolia	Barbara's Buttons
Mayaca aubletii	Bogmoss
Nothoscordum bivalve	False garlic
Osmunda cinnamonum	Cinnamon Fern
Osmunda regalis	Royal Fern
Phyla incisa	Frogfruit
Physostegia digitalis	False Dragonhead
Pogonia ophioglossiodes	Rose Pogonia
Polygala nana	Batchelor's Button
Polygala ramose	Yellow Savannah Milkwort
Rhexia petiolata	Meadow Beauty
Rhexia virginica	Common Meadow Beauty
Sabatia angularis	Rose-pink
Sabatia gentianoides	Pine-woods Rose-gentian
Sagittaria graminea	Grassy arrowhead
Sarracenia alata	Pitcher-Plant

Schoenolirion croceum	Yellow Sunny Bell
Scutellaria integrifolia	Rough Skullcap
Scuttelaria ovata	Egg-leaf Skullcap
Sisyrinchium pruinosum	Dotted Blue-Eyed Grass
Sisyrinchium sagittiferum	Blue-Eyed Grass
Spiranthes vernalis	Spring Ladies' Tresses
Stachys floridana	Hedge-nettle
Tofieldia racemosa	Sticky Tofieldia
Viola lanceolata	Lance-Leaved Violet
Viola primulifolia	Primrose-leafed Viola
Xyris ambigua	Yellow-eyed Grass

Woody Plants

Callicarpa Americana	American Beautyberry
Cyrilla racemiflora	Swamp Titi Leatherwood
Hamamelis virginiana	Witch Hazel
Lyonia mariana	Staggerbush Lyonia
Magnolia virginiana	Sweetbay Magnolia
Myrica cerifera	Wax Myrtle
Nyssa sylvatica	Black Gum
Pinus taeda	Lobloly Pine
Rhododendron oblongifolia	White Azalea
Vaccinium arkansanum	Arkansas Blueberry

Nacogdoches Area Tour

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Preliminary Checklist of the Vascular Plants of
The Pineywoods Native Plant Center, Nacogdoches County, Texas
Spring Flora March 27 & 28 1999
Singhurst J.R., M. Norman, and H. Gaylord

Singhurst, Norman, and Gaylord (1999) base this checklist of the vascular plants Tucker Estate on reports and excursions on the property. Nomenclature follows Correll and Johnston (1970) and Johnston's update (1990). Common names follow Correll and Johnston or Hatch et al. (1990). The list is intended to document the species present immediately prior to PNPC development. Additions to this checklist are anticipated and in the absence of voucher specimens, this list should not be considered authoritative.

CONIFERS

CUPRESSACEAE	**CYPRESS FAMILY**
Juniperus virginiana	eastern red cedar
PINACEAE	**PINE FAMILY**
Pinus taeda	loblolly pine
Pinus echinata	shortleaf pine
TAXODIACEAE	**TAXODIUM FAMILY**
Taxodium distichum	bald cypress

FERNS AND FERN-ALLIES

ASPLENIACEAE	**SPLEENWORT FAMILY**
Asplenium platyneuron	ebony spleenwort
DENNSTAEDTIACEAE	**BRACKEN FERN FAMILY**
Pteridium aquilinum	tailed bracken fern
OPHIOGLOSSACEA	**ADDER'S TONGUE FERN FAMILY**
Botrychium dissectum	lace frond grape fern
Botrychium virginianum	rattlesnake fern
POLYPODIACEAE	**POLYPODY FERN FAMILY**

Anthrinum felix-femina	downy maiden fern
Polypodium plypodioides	resurrection fern
SCHIZAEACEAE	**CLIMBING FERN FAMILY**
Lygodium japonicum	Japanese climbing fern
WOODSIACEAE	**CLIFF FERN FAMILY**
Onoclea sensibilis	sensitive fern
Woodsia obtusa	blunt lobed cliff fern

FLOWERING PLANTS

ACANTHACEAE	**ACANTHUS FAMILY**
Ruellia humilis	low ruellia
ACERACEAE	**MAPLE FAMILY**
Acer negundo	boxelder
Acer saccharum	sugar maple
Acer rubrum	red maple
AIZOACEAE	**CARPETWEED FAMILY**
Mullugo verticillata	Indian chickweed
AMARANTHACEAE	**AMARANTH FAMILY**
Amaranthus sp.	amaranth
ANACARDIACEAE	**SUMAC FAMILY**
Rhus aromatica	fragrant sumac
Rhus glabra	smooth sumac
Rhus toxicodendron	poison ivy
ANNONACEAE	**CUSTARD APPLE FAMILY**
Asimina triloba	pawpaw
APIACEAE	**CARROT FAMILY**
Cicuta maculata	water hemlock
Hydrocotyle verticillata	whorled pennywort
Sanicula canadensis	Canada sanicle
AQUIFOLIACEAE	**HOLLY FAMILY**
Ilex opaca	American holly
Ilex decidua	deciduous holly
Ilex vomitoria	yaupon holly
ARACEAE	**ARUM FAMILY**

Arisaema dracontium	green dragon
Arisaema triphyllum	jack-in-the-pulpit
ARALIACEAE	**GINSENG FAMILY**
Aralia spinosa	Devil's walking stick
Hedra helix	English ivy (introduced)
AREACEAE	**PALM FAMILY**
Sabal minor	dwarf palmetto
ARISTILOCHIACEAE	**BIRTHWORT FAMILY**
Aristolochia seperentaria	Virginia dutchman's pipe
ASCLEPIADACEAE	**MILKWEED FAMILY**
Matelea gonocarpa	milkweed vine
ASTERACEAE	**SUNFLOWER FAMILY**
Achillea millifolium	common yarrow (intoduced)
Antennaria parlinii	pussytoes
Aster patens	skydrop aster
Bidens sp.	beggarticks
Chaetopappa asteroides	common least daisy
Cirsium sp.	thistle
Conyza canadensis	horse weed conyza
Elephantopus tomentosus	hairy elephant foot
Erigeron strigosus	prairie fleabane
Eupatorium capillifolium	dog fennel
Eupatorium coelistinum	blue mist flower
Eupatorium sp.	eupatorium
Gamochaeta purpureum	greenleaf cudweed
Gnaphilium obtusifolium	fragrant cudweed
Helenium amarum	bitter sneezeweed
Helianthus sp.	sunflower
Krigia caespitosa	weedy dwarf dandelion
Krigia dandelion	tuber dwarf dandelion
Lactuca ludoviciana	wild lettuce
Lactuca sp.	wild lettuce
Senecio obovatus	golden groundsel
Solidago auriculata	clasping leaf goldenrod
Solidago sp.	solidago
Soliva pterosperma	lawn burweed
Sonchus asper	spiny leaved sawthistle
Taraxacum officinale	common dandelion
Verbesina virginica	frostweed
Vernonia sp.	ironweed

BERBERIDACEAE	**BARBERRY FAMILY**
Nandina domestica	nandina
Podophyllum peltatum	may apple
BETULACEAE	**BIRCH FAMILY**
Carpinus caroliniana	blue beech
Ostrya virginiana	eastern hophornbeam
Betula nigra	river birch
BORAGINACEAE	**BORAGE FAMILY**
Myosotis macropsperma	spring forget me not
BRASSICACEAE	**MUSTARD FAMILY**
Capsella bursa-patoris	shepard's purse
Cardamine bulbosa	spring cress
Lepedium virginicum	poor man's peppergrass
CACTACEAE	**CACTUS FAMILY**
Opuntia stricta	southern spineless cactus
CAMPANULACEAE	**BLUEBELL FAMILY**
Lobelia cardinalis	cardinal flower
Triodanis perfoliata	clasping Venus lookingglass
CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**
Lonicera japonica	Japanese honeysuckle
Sambucus candensis	common elderberry
Viburnum rufidulum	blackhaw viburnum
CARYOPHYLLACEAE	**PINK FAMILY**
Cerastium brachypodum	shortstalk chickweed
Cerastium glomeratum	clustered flowered chickweed
Sagina decumbens	pearlwort
Spergula arvensis	corn spury
Stellaria media	common chickweed
CISTACEAE	**ROCKROSE FAMILY**
Lechea mucronata	hairy pinweed
Lechea tenuifolia	narrowleaf pinweed
CLUSSIACEAE	**ST. JOHN'S WORT FAMILY**
Hypericum hypericoides	St. Andrew's cross
Hypericum stans	St. Peterswort
Hypericum walteri	Walter's St. John's wort

COMMELINACEAE	**SPIDERWORT FAMILY**
Commelina erecta	erect dayflower
Commelina virginica	Virginia dayflower
Tradescantia hirsutiflora	hairy spiderwort
CONVOLVULACEAE	**MORNING GLORY FAMILY**
Dichondra carolinensis	ponyfoot
CORNACEAE	**DOGWOOD FAMILY**
Cornus florida	flowering dogwood
Nyssa sylvatica	black gum
CYPERACEAE	**SEDGE FAMILY**
Carex amphiloba	amphibious sedge
Carex caroliniana	Carolina sedge
Carex crus-corvi	crowfoot sedge
Carex sp.	sedge
Carex sp.	sedge
Cyperus esculentus	yellow nutsedge
Cyperus retroflexus	oneflower flatsedge
Eleocharis sp.	spikerush
Fimbristylis sp.	fimbry
Scirpus koilolepis	small bullrush
Scirpus sp.	bullrush
EBENACEAE	**PERSIMMON FAMILY**
Diospyrus virginiana	common persimmon
ERICACEAE	**HEATH FAMILY**
Vaccinium arboreum	farkleberry
EUPHORBACAE	**SPURGE FAMILY**
Acalypha gracilens	slender three seeded mercury
Acalypha ostrayefolia	three seeded mercury
Cnidosculus texanus	bull nettle
Croton capitatus	wooly croton
Sapium sebiferum	Chinese tallow tree
Tragia sp.	noseburn
FABACEAE	**LEGUME FAMILY**
Albizia julibrissin	mimosa tree
Cercis canadensis	red bud
Chamaecrista fasiculata	partridge pea
Desmodium sp.	beggar's ticks
Desmodium sp.	beggar's ticks
Galactia glabella	downy milkpea

Lespedeza sp.	bush clover
Trifolium campestre	low hop clover
Trifolium incarnatum	crimson clover
Trifolium repens	white clover
Viccia caroliniana	Carolina vetch
Viccia ludoviciana	deer vetch

FAGACEAE	**BEECH FAMILY**
Quercus alba	white oak
Quercus falcata	southern red oak
Quercus lyrata	overcup oak
Quercus marilandica	blackjack oak
Quercus michauxii	swamp chestnut oak
Qurcus nigra	water oak
Quercus nuttallii	Nuttall oak
Quercus phellos	willow oak
Quercus shumardii	shumard oak
Quercus similis	bottomland post oak
Quercus stellata	post oak
Quercus velutina	black oak

GERANIACEAE	**GERANIUM FAMILY**
Geranium carolinianum	Carolina geranium

HAMAMELIDACEAE	**WITCH HAZEL FAMILY**
Liquidambar styraciflua	sweetgum

HIPPOCASTANACEAE	**BUCKEYE FAMILY**
Aesculus pavia	red buckeye

IRIDACEAE	**IRIS FAMILY**
Sisyrinchium exile	blue-eyed grass

JUGLANDACEAE	**WALNUT FAMILY**
Carya cordiformis	bitternut hickory
Carya ovata	shagbark hickory
Carya texana	black hickory
Carya tomentosa	mockernut hickory
Juglans nigra	black walnut

LAMIACEAE	**MINT FAMILY**
Lamium amplexicaule	henbit
Prunella vulgaris	common selfheal
Scutellaria cardiophylla	heartleaf skullcap

LAURACEAE	**LAUREL FAMILY**
Sassafras albidum	sassafras
LILIACEAE	**LILY FAMILY**
Allium canadense	Canada garlic
Allium drummondii	Drummond's onion
Camassia scilloides	wild hyacinth
Erythronium albidum	white trout lily
Hypoxis hirsuta	common goldenstar
Lilium michauxii	Carolina lily
Nothoscordum bivalve	false garlic
Polygonatum biflorum	Solomon's seal
Smilax bona-nox	saw greenbriar
Smilax glauca	cat greenbriar
Smilax hispida	bristly greenbriar
Smilax laurifolia	laurel greenbrar
Smilax rotundifolia	common greenbriar
Yucca louisianensis	Louisiana yucca
LOGANIACEAE	**LOGONIA FAMILY**
Gelsemium sempervirens	Carolina jessamine
Polypremum procumbens	juniper leaf
MAGNOLIACEAE	**MAGNOLIA FAMILY**
Magnolia grandiflora	southern magnolia
MALVACEAE	**MALLOW FAMILY**
Modiola caroliniana	modiola
Sida rhombifolia	diamondleaf mallow
MENISPERMACEAE	**MOONSEED FAMILY**
Cocculus carolinus	Carolina snailseed
MORACEAE	**MULBERRY FAMILY**
Morus rubra	red mulberry
Maclura pomifera	Bois d'arc
MYRICACEAE	**WAXMYRTLE FAMILY**
Myrica heterophylla	waxmyrtle
OLEACEAE	**OLIVE FAMILY**
Fraxinus americana	white ash
Fraxinus pennsylvanica	green ash
Ligustrum sinense	Chinese privet

ONAGRACEAE	**EVENING PRIMROSE FAMILY**
Ludwegia sp.	seedbox
Oenothera laciniata	cutleaf evening primrose
Oenothera speciosa	showy evening primrose
OXALIDACEAE	**WOOD SORREL FAMILY**
Oxalis dillenii	yellow wood sorrel
Oxalis violacea	violet wood sorrel
PAPAVERACEAE	**POPPY FAMILY**
Corydalis micrantha	scrambled eggs
Sanguinaria canadensis	bloodroot
PASIFLORACEAE	**PASSION FLOWER FAMILY**
Passiflora lutea	yellow passion flower
PHRYMACEAE	**LOPSEED FAMILY**
Phryma leptostachya	lopseed
PHYTOLACACCEAE	**POKEWEED FAMILY**
Phytolacca americana	pokeweed
PLANTAGINACEAE	**PLANTAIN FAMILY**
Plantago lanceolata	English plantain
POACEAE	**GRASS FAMILY**
Andropogon glomeratus	bushy bluestem
Andropogon virginicus	broomsedge bluestem
Arundinaria gigantea	switch cane
Briza minor	little quaking grass
Chasmanthium latifolium	broadleaf chasmanthium
Chasmanthium sessiliflorum	sessile flowered chasmanthium
Cynodon dactylon	Bermuda grass
Digitaria ciliaris	southern crabgrass
Elymus virginicus	Virginia wildrye
Melica mutica	twoflower melic
Oplismenus hirtellus	basketgrass
Panicum sp.	panicum
Panicum sp.	panicum
Paspalum urvillei	vaseygrass
Poa annua	annual bluegrass
Stenotaphrum secundatum	St. Augustine grass
Stipa leucotricha	Texas wintergrass
Tridens flavus	purple top

PLANTANACEAE	**PLANE TREE FAMILY**
Plantanus occidentalis	sycamore
POLEMONIACEAE	**PHLOX FAMILY**
Phlox pilosa	downy phlox
POLYGONACEAE	**KNOTWEED FAMILY**
Polygonum sp.	Smartweed
Rumex hastatulus	heartwing dock
PORTULACACEAE	**PURSLANE FAMILY**
Claytonia virginica	spring beauty
RANUNCULACEAE	**BUTTERCUP FAMILY**
Ranunculus sp.	buttercup
RHAMNACEAE	**BUCKTHORN FAMILY**
Berchemia scandens	Albama supplejack
Rhamnus caroliniana	Carolina buckthorn
ROSEACEAE	**ROSE FAMILY**
Agrimonia microcarpa	slender agrimony
Crataegus marshallii	parsley hawthorn
Crataegus spathulata	pasture haw
Duchesni indica	Indian strawberry
Geum canadense	white avens
Prunus caroliniana	Carolina cherry laurel
Prunus mexicana	Mexican plum
Prunus serotina	black cherry
Rosa multiflora	Japanese rose
Rubus trivalis	southern dewberry
RUBIACEAE	**MADDER FAMILY**
Diodia teres	rough buttonweed
Diodia virginiana	Virginia buttonweed
Galium aparine	catcweed bedstraw
Hedyotis crassifolia	small bluets
Mitchella repens	partridge pea
RUTACEAE	**CITRUS FAMILY**
Zanthoxylum clava-herculis	prickly ash
SALICACEAE	**WILLOW FAMILY**
Salix nigra	black willow
Populus deltoides	eastern cottonwood

SAPOTACEAE	**SAPODILLA FAMILY**
Bumelia lanuginosa	woolybucket bumelia
SAXIFRAGACEAE	**SAXIFRAGE FAMILY**
Lepuropetalon spathulatum	lepuropetalon
SCROPHORULACEAE	**FIGWORT FAMILY**
Castilleja indivisa	Texas Indian paintbrush
Veronica peregrina	purslane spedwell
SOLANACEAE	**NIGHTSHADE FAMILY**
Physalis sp.	ground cherry
Solanum carolinense	Carolina horse nettle
TILIACEAE	**LINDEN FAMILY**
Tilia americana	American basswood
ULMACEAE	**ELM FAMILY**
Celtis laevigata	Texas sugarberry
Ulmus americana	American elm
Ulmus crassifolia	cedar elm
Ulmus rubra	slippery elm
URTICACEAE	**NETTLE FAMILY**
Boehmeria cylindrica	false nettle
Urtica chamaedryoides	heartleaf nettle
VALERIANACEAE	**VALERIAN FAMILY**
Valerianella radiata	beaked cornsalad
VERBENACEAE	**VERVAIN FAMILY**
Callicarpa americana	American beautyberry
Phyla lanceolata	northern frog fruit
Verbena officinale	Texas verbena
VIOLACEAE	**VIOLET FAMILY**
Viola rafinesquii	field pansy
Viola walteri	Walter's violet
Viola sp.	violet
VITACEAE	**GRAPE FAMILY**
Ampelopsis arborea	peppervine
Parthenocissus quinquefolia	Virginia creeper
Vitis aestivalis	summer grape
Vitis mustangensis	mustang grape
Vitis rotundifolia	muscadine grape

Partial Plant List for Ivy Payne Wildlife Refuge Elkhart, Texas

Major contributors – Sonnia Hill, Kay Fleming, Heinz Gaylord – Additional contributions – Jason Singhurst, Walter Holmes, Ron and Ruth Loper, and David Bezanson

FORBS:

Botanical Name	Common Name
Acalypha gracilens	Copper Leaf
Achillea millefolium	Common Yarrow
Allium canadense	Wild Onion
Ambrosia artemisifolia	Common Ragweed
Ambrosia trifidia	Giant Ragweed
Antennaria fallax	Pussytoes
Argemone albiflora	Prickly-poppy
Arisaema dracontium	Green Dragon
Arisaema triphyllum	Jack-in-the Pulpit
Arnoglossum ovatum	Lance-leaf Indian Plantain
Asclepias tubersoa	Butterfly Weed
Asclepias variegata	White-flowered milkweed
Asclepias verticillata	Whorled Milkweed
Asclepias viridiflora	Green Antelope-horn Milkweed
Asperula arvensis	Woodruff
Aster ericoides	Heath Aster
Aster patens	Purple daisy
Aster pilosus	White-heath aster
Aster subulatus	Annual aster
Aster texanus	Texas Aster
Astragalus distortus	Bent-pod milk-vetch
Baptisia nuttalliana small	Cream False Indigo
Bidens aristosa	Beggarticks
Boehmeria cylindrica	Bog Hemp
Cacalia ovata	Indian Plantain
Callirhoe papaver (Cav.) Gray	Winecups
Cardamine bulbosa	Springcress
Castilleja indivisa	Indian Paintbrush
Chamaecrista fasciculate	Partridge Pea
Chamaecrista nictitanus	Sensitive Partridge Pea
Chamaesyce maculata (L)	Spotted Euphorbia
Cirsium carolinianum (walt.)	Purple Thistle
Cirsium horridulum michx.	Yellow Thistle/Bull Thistle
Cnidoscolus texanus	Texas bull-nettle
Commelina erecta L.	Erect Dayflower
Corallorrhiza wisteriana Conrad	Spring Coral Root Orchid
Coreopsis lanceolata	Lance Leaf Coreopsis
Coreopsis tinctoria	Plains Coreopsis
Corydalis micrantha	Southern Corydalis/Butter and Eggs
Croptilon divaricatum	Slender Golden Weed
Croton capitatus	Goatweed

Croton texensis	Texas Croton
Delphinium carolinianum	Blue Larkspur
Desmodium nudiflorum	Bare Stem Ticktrefoid
Desmodium paniculatum	Panicled Desmodium
Diodia virginiana	Button Weed
Echinacea sanguinea Nutt	Purple coneflower
Elephantopus carolinianus	Elephant's Foot
Erigeron philadelphicus L.	Philadelphia Fleabane
Erythronium albidum	White Trout Lily
Eupatorium capillifolium	Dog Fennel
Eupatorium coelestinum	Blue Mist Flower
Eupatorium album L.*	White Boneset
Eupatorium fistulosum	Joe-Pye Weed
Euphorbia dentata	Wild Poinsettia
Froelichia floridana	Cotton Weed
Galium pilosum Ait.	Bedstraw
Gaura longiflora	Tall Gaura
Geum canadense	Prairie Smoke
Glandularia canadense (L.)	Rose Vervain
Hedyotis nigricans	Prairie Bluets
Hedyotis crassifolia	Small Bluets
Hedyotis australis	Southern Bluets
Helenium flexuosum	Purple Head Sneeze Weed
Helianthus hirsutus	Sunflower
Heterotheca submaxillaris	Golden Aster
Hymenocallis liriosme	Spider Lily
Hymenopappus artemisi	Wooly white
Hypericum drummondi	St. John's Wort
Hypericum hypericoides (L.)	St. Andrew's Cross
Hypoxis hirsuta (L.)	Yellow Star Gras
Indigofera miniata	Scarlet Pea
Ipomopsis rubra	Standing Cypress
Krigia dandelion	Potatoe Dandelion
Kummerowia striata	Japanese Lespedeza
Lespedeza repens	Creeping Bush Clover
Lespedeza virginica	Slender Bush Clover
Liatris aspera	Rough Gay Feather
Linaria canadensis	Old-Field Toad Flax
Listera australis	Southern Tway-Blade Orchid
Lithospermum incisum	Fringed Puccoon
Lithospermum caroliniense	Golden Puccoon
Lobelia cardinalis	Cardinal Flower
Lobelia inflata	Indian Tobacco
Malvaviscis arboreus	Texas Mallow/Turk's Cap
Mitchella repens	Partridge Berry
Monotropa uniflora	Indian Pipe
Nemastylis geminiflora	Celestial or Ghost Iris
Nemastylis purpurea	Purple Pleat-Leaf Iris
Northoscrodum bivalve	False Garlic

Oneothera speciosa	Showy Primrose
Opuntia humifosa	Prickly Pear Cactus
Oxalis pricea	Yellow Wood Sorrel
Oxalis rubra	Woodsorrel
Oxalis violacea	Violet Wood Sorrel
Palafoxia rosea	Rose Palafoxia
Penstemon cobea	Foxglove
Penstemon laxiflorus	Piney Woods penstemon
Phlox drummondi	Drummond Phlox
Phlox pilosa	Prairie Phlox
Podophyllum peltatum L	May Apple
Polygala polygama	Bitter Milkwort
Polypremum procumberns	Juniper Leaf
Prunella vulgaris	"Heal All" or "Self Heal"
Pycnanthemum albescens	Mountain Mint
Ranunculus carolinianus	Carolina Buttercup
Ratibidia columnifera	Mexican Hat or Coneflower
Rhus aromatica	Aromatic Sumac
Rhynchosia latiflolia	Broad-Leaf Snout-bean
Rhynchosia minima	Least-Snout Bean
Rudbeckia hirta	Brown-eyed Susan
Rudbeckia grandiflora	Rough Coneflower
Ruellia humilis	Wild Petunia
Ruellia pedunculata	Wild Petunia
Sabatia angularis	Rose Pink Sabatia
Sabatia campestris	Meadow Pink
Salvia lyrata	Lyre-Leaf Sage
Sanicula canadensis	Black Snake Root
Saururus cernuus L.	Lizards Tail
Scutellaria cardiophylla	Heart-Leaf Skull Cap
Scutellaria integrifolia	Rough Skullcap
Scutellaria ovata	Egg-Leaf Skullcap
Senecio glabellus	Butterweed
Senecio sp	Groundsel
Sida spinosa	Prickly sida
Solanum carolinense	White Nightshade
Solanum dimidatum	Purple Nightshade
Solanum elaegnifolium	Silver Nightshade
Solidago canadensis	Common Goldenrod
Spiranthes cernua	Nodding Ladies Tress Orchid
Spiranthes vernalis	Spring Ladies Tress Orchid
Stylosanthes biflora	Pencil Flower
Taenidia integerrima *	Yellow Pimpernel
Tephrosia virginiana	Goat's Rue
Thalictrum dasycarpum	Meadow Rue
Tipularia discolor	Fall Crane Fly Orchid
Tradescantia hirsutiflora	Hairy Spiderwort
Tralescantia ohioensis	Ohio Spiderwort
Tridodanis perfoliatia	Venus' Looking Glass

Triosteum perfoliatum *	False Horse Gentian
Verbascum thapsus	Common Mullein
Verbena brasiliensis	Brazilian vervain
Verbena halei	Texas Vervain
Verbena rigida	Tuber Vervain
Verbensina virginica	Frost Weed
Vicia Caroliniana	Wood Vetch
Viola palmata	Trilobe violet
Viola pedata	Bird's Foot Violet
Viola rafinesquii	Field Pansy
Viola sororia	Wooly Blue Violet
Viola walteri	Walter's violet
Zigadenus nutallii	Death Camas
Zizia aurea	Golden Alexander

Ferns

Asplenium platyneuron	Ebony Spleenwort
Botrychium dissecta	Dissected Grape Fern
Botrychium virginianum	Rattlesnake Fern
Onoclea sensibilis	Sensitive Fern
Osmunda cinnamomea	Cinnamon Fern
Polypodium polypodioides	Resurrection Fern
Polystichum acrostichoides	Christmas Fern
Pteridium aquilinum	Bracken Fern
Woodsia obtusa	Blunt-Lobed Woodsia
Woodwardia areolata	Netted Chain Fern
Woodwardia virgincia	Virginia Chain Fern

Grasses

Androspogon gerardii	Big Bluestem
Andropogon glomeratus	Bushy Bluestem
Andropogon virginicus	Broomsedge Bluestem
Bothriochloa laguroides	Silver Bluestem
Carex sp	Carex
Chasmanthium laxum	Wood Oats
Chasmanthium latifolicem	Broadleaf Woodoats
Lolium perenne L.	Rye Grass
Melilotus officinalis	Yellow Sweet Clover
Oplismenus hirtellus	Basket grass
Panicum dichantheliem	Panic Grass
Paspalum dilatatum	Paspalum/Dallas Grass
Paspalum notatum	Bahia Grass (non-native)
Sorghum halepense	Johnson Grass (non-native)
Trifolium campestre	Low Hop Clover
Tridens flavus	Purple Top
Trifolium pretense L.	Red Clover
Tripsacum dactyloides	Eastern Gammagrass

Shrubs

Arundinaria gigantea	Bamboo (Switch Cane)
Baccharis halimifolia	Sea Myrle
Callicarpa Americana	American Beauty Berry or French Mulberry
Cephalanthhus occidentalis	Buttonbush
Euonymus americanus	Strawberry Bush
Ligustrum sinense	Chinese Privet/non-native
Myrica cerifera	Wax Mytrle
Nandina domestica	Nandina(escaped non-native)
Sambucus canadensis	Elderberry
Symphoricarpus orbiculata	Snow Berry

Trees

Acer barbatum	Florida Maple
Acer negundo	Box Elder
Acer rubrum	Red Maple
Acer saccharium L.	Sugar Maple
Albizia julibrissin	Mimosa(non-native)
Aralia spinosa	"Devils Walking Stick"
Catalpa speciosa	Northern Catalpa
Carpinus caroliniana	American Hornbeam
Carya alba (L.)	Mockernut Hickory
Carya cordiformis	Pig-Nut Hickory
Carya illinoiensis	Pecan
Carya myristiciformis	Nutmeg Hickory
Carya ovata	Shagbank Hickory
Carya texana	Black Hickory
Celtis laevigata	Sugar Hackberry
Cercis canadensis	Eastern Redbud
Chionanthus virginicus	Fringe Tree
Cornus florida	Flowering Dogwood
Cornus drummondi	Rough-Leaf Dogwood
Crataegus marshallii	Parsley Hawthorn
Diospyros virginiana	Eastern Persimmon
Frangula caroliniana	Carolina Buckthorn
Fraxinus americana	White Ash
Fraxinus	Green Ash
Gleditsia triacanthos	Honeylocust
Ilex deciduas	Deciduous Holly
Ilex opaca	American Holly
Ilex vomitora	Yaupon
Juglans nigra	Black Walnut
Juniperus virginiana	Eastern Red Cedar
Liquidamber styraciflua	Sweetgum
Liriodendron tulipifera	Yellow poplar
Maclura pomifera	Osage-Orange
Melia azedarach	Chinaberry
Morus rubra	Red Mulberry
Nyssa aquatica	Black Gum

Nyssa Sylvatica	Black Tupelo
Ostrya virginiana	Eastern Hophornbean
Pinus echinata	Short-Leaf Pine
Pinus taeda	Loblolly Pine
Platanus occidentalis	Sycamore
Prunus angustifolia	Chickasaw Plum
Prunus mexicana	Mexican Plum
Prunus caroliniana	Carolina Laurel Cherry
Prunus serotina	Wild Black Cherry
Quercus alba	White Oak
Quercus falcata	Southern Red Oak
Quercus lyrata	Overcup Ok
Quercus marilandica	Backjack Oak
Quercus nigra	Water Oak
Quercus phellos	Willow Oak
Quercus shumardii	Shumard Oak
Quercus stellata	Post Oak
Rhus copallinum	Winged Sumac
Rhus glabra	Smooth Sumac
Robinia pseudoacacia	Black Locust
Salix nigra	Black Willow
Sassafras albidum	Sassafras
Sideroxylon lanuginosum	Gum bumelia
Sophora affinis	Eve's Necklace
Ulmus americana	American Elm
Ulmus rubra	Slippery Elm
Ulmus elata	Winged Elm
Ulmus crassifolia	Cedar Elm
Vaccinium arborea	Farkleberry
Viburnum rufidulum	Rusty Blackhaw
Xanthoxylum clava	Prickly Ash
Xanthoxylum hirsutum	Toothache Tree

Vines

Ampelopsis arborea (L.) koehne	Pepper Vine
Aristolochia reticulate Jacq.	Dutchman's Pipe
Aristolochia tomentosa	Yellow Dutchman's Pipe
Berchemia scandens	Rattan Vine
Bignonia capreolata	Crossvine
Campsis radicans	Trumpet Creeper
Centrosema virginianum	Butterfly Pea
Clematis dioscoreifolia	White Clematis
Clitoria mariana L.	Pigeon Wings
Cuscuta compacta	Dodder
Gelsemium sempervirens	Carolina Jessamine
Ipomoea cordatotriloba	Heasrtshaped
Ipomoea pandurata (L.)	Morning Glory/Wild Potato Vine
Lonicera japonica	Japanese Honeysukle
Lonicera semperviren	Coral Honeysuckle

Matelea decipiens	Climbing Milkvine
Matelea gonocarpos	Climbing Milkvine
Parthenocissu quiquefolia	Virginia Creeper
Passiflora incarnata	Passion Flower
Passiflora lutea	Yellow Passion Flower
Rhus Toxicodenron	Poison Ivy
Rubus argutus	Blackberry
Rubus trivialis	Southern Dewberry
Smilax bona-nox	Saw Green Briar
Smilax glauca	Cat Green Briar
Smilax rotundiflora	Common Greenbriar
Smilax sarsapapilla	Sarsapanulla Vine
Strophostyles helvula	Amberique Bean
Vitis aestivalis	Summer Grape
Vitis mustangensis	Mustang Grape
Vitis rotondifolia	Muscadine
Wisteria frutescens	Kentucky Wisteria

* Rare or uncommon

Yucca cernua Plant List

by Eric Keith

Acer	rubrum	ACERACEAE	red maple
Yucca	cernua	AGAVACEAE	weeping or nodding yucca
Rhus	copallina	ANACARDIACEAE	wing rib sumac
Rhus	toxicodendron	ANACARDIACEAE	poison ivy
Sanicula	canadensis	APIACEAE	Canada sanicle
Ilex	vomitoria	AQUIFOLIACEAE	yaupon holly
Sabal	minor	ARECACEA	Dwarf palmetto
Asclepias	tuberosa	ASCLEPIADACEAE	butterfly milkweed
Ambrosia	bidentata	ASTERACEAE	two toothed ragweed
Baccharis	halimifolia	ASTERACEAE	eastern baccharis
Coreopsis	lanceolata	ASTERACEAE	lance leaf coreopsis
Echinacea	pallida	ASTERACEAE	purple cone flower
Erigeron	stigosus	ASTERACEAE	prairie fleabane
Iva	angustifolia	ASTERACEAE	narrowleaf sumpweed
Silphium	radula	ASTERACEAE	
Vernonia	texana	ASTERACEAE	Texas ironweed
Campsis	radicans	BIGNONIACEAE	trumpet creeper
Heliotropium	tenellum	BORAGINACEAE	pasture heliotrope
Lobelia	appendiculata	CAMPANULACEAE	earleaf mayapple
Lonicera	japonica	CAPRIFOLIACEAE	Japanese honeysuckle
Viburnum	dentatum	CAPRIFOLIACEAE	arrow wood viburnum
Hypericum	hypercoides	CLUSIACEAE	St. Andrews cross
Cornus	florida	CORNACEAE	flowering dogwood
Nyssa	sylvatica	CORNACEAE	black gum
Juniperus	virginiana	CUPRESSACEAE	eastern red cedar
Diospyros	virginiana	EBENACEAE	common persimmon
Vaccinium	arboreum	ERICACEAE	farkleberry
Cercis	canadensis	FABACEAE	red bud
Erythrina	herbacea	FABACEAE	coral bean
Gleditsia	tricanthos	FABACEAE	honey locust
Quercus	falcata	FAGACEAE	southern red oak
Quercus	nigra	FAGACEAE	water ioak
Quercus	stellata	FAGACEAE	post oak
Aesculus	glabra	HIPPOCASTANACEAE	Ohio buckeye
Carya	tomentosa	JUGLANDACEAE	mockernut hickory
Sassafras	albidum	LAURACEAE	sassafras
Smilax	bona-nox	LILIACEAE	saw greenbriar
Smilax	smallii	LILIACEAE	Smalls greenbriar
Yucca	louisianensis	LILIACEAE	Louisiana yucca
Gelsemium	sempervirens	LOGANIACEAE	Carolina jessamine
Magnolia	grandiflora		southern magnolia
Magnolia	pyramidata	MAGNOLIACEAE	pyramid magnolia
Pinus	taeda	PINACEAE	loblolly pine
Pinus	echinata	PINACEAE	short-leaf pine
Pinus	palustris	PINACEAE	long-leaf pine
Chasmanthium	sessiliflorum	POACEAE	sessile flowered chasmanthium

Panicum	flexile	POACEAE	wiry witchgrass
Schizacharium	scoparium	POACEAE	little bluestem
Crataegus	marshallii	ROSACEAE	parsley hawthorn
Rubus	louisianus	ROSACEAE	Louisiana blackberry
Bumelia	lanuginosa	SAPOTACEAE	woollybucket bumelia
Penstemon	laxiflorus	SCROPHULARIACEAE	pink penstemon
Vitis	aestivalis	VITACEAE	summer grape
Vitis	rotundifolia	VITACEAE	muscadine grape

Scrappin' Valley Plant List

by Eric Keith

Acer	rubrum	ACERACEAE	red maple
Mollugo	verticillata	AIZOACEAE	Indian chickweed
Froelichia	floridana	AMARANTHACEAE	Florida snakecotton
Rhus	copallina	ANACARDIACEAE	wing rib sumac
Rhus	toxicodendron	ANACARDIACEAE	poison ivy
Rhus	vernix	ANACARDIACEAE	poison sumac
Asimina	parviflora	ANNONACEAE	dwarf pawpaw
Sanicula	canadensis	APIACEAE	Canada sanicle
Ilex	vomitoria	AQUIFOLIACEAE	yaupon holly
Sabal	minor	ARECACEA	Dwarf palmetto
Asclepias	amplexicaulis	ASCLEPIADACEAE	blunt leaf milkweed
Asclepias	tuberosa	ASCLEPIADACEAE	butterfly milkweed
Asplenium	platyneuron	ASPLENIACEAE	ebony spleenwort
Ambrosia	psilostachya	ASTERACEAE	western ragweed
Baccharis	halimifolia	ASTERACEAE	eastern baccharis
Echinacea	pallida	ASTERACEAE	purple cone flower
Erigeron	stigosus	ASTERACEAE	prairie fleabane
Marshallia	tenuifolia	ASTERACEAE	marshallia
Rudbeckia	grandiflora	ASTERACEAE	rough coneflower
Rudbeckia	scabrifolia	ASTERACEAE	bog coneflower
Silphium	radula	ASTERACEAE	
Vernonia	texana	ASTERACEAE	Texas ironweed
Carpinus	caroliniana	BETULACEAE	blue beech
Ostrya	virginiana	BETULACEAE	eastern hophornbeam
Campsis	radicans	BIGNONIACEAE	trumpet creeper
Woodwardia	areolata	BLECHENACEAE	netted chain fern
Lobelia	appendiculata	CAMPANULACEAE	earleaf mayapple
Viburnum	dentatum	CAPRIFOLIACEAE	arrow wood viburnum
Viburnum	nudum	CAPRIFOLIACEAE	possumhaw viburnum
Hypericum	hypercoides	CLUSIACEAE	St. Andrews cross
Tradescantia	hirsutiflora	COMMELINACEAE	hairy spiderwort
Tradescantia	reverchonii	COMMELINACEAE	Reverchon's spiderwort's
Cornus	florida	CORNACEAE	flowering dogwood
Nyssa	sylvatica	CORNACEAE	black gum
Juniperus	virginiana	CUPRESSACEAE	eastern red cedar
Pteridium	aquilinum	DENNSTAEDTIACEAE	tailed bracken fern
Diospyros	virginiana	EBENACEAE	common persimmon
Rhododendron	canescens	ERICACEAE	hoary azalea
Vaccinium	amoenum	ERICACEAE	largecluster blueberry
Vaccinium	arboreum	ERICACEAE	farkleberry
Vaccinium	elliottii	ERICACEAE	Elliot blueberry
Vaccinium	stamineum	ERICACEAE	dewberry
Vaccinium	virgatum	ERICACEAE	rabbiteye bleberry
Croton	argyranthemus	EUPHORBIAACEAE	silver croton
Cercis	canadensis	FABACEAE	red bud
Erythrina	herbacea	FABACEAE	coral bean
Fagus	grandifolia	FAGACEAE	American beech

Quercus	falcata	FAGACEAE	southern red oak
Quercus	incana	FAGACEAE	bluejack oak
Quercus	margaretta	FAGACEAE	sand post oak
Quercus	marilandica	FAGACEAE	blackjack oak
Quercus	nigra	FAGACEAE	water ioak
Quercus	stellata	FAGACEAE	post oak
Hamamelis	virginiana	HAMAMELIDACEAE	common witch hazel
Liquidambar	styraciflua	HAMAMELIDACEAE	sweetgum
Aesculus	glabra	HIPPOCASTANACEAE	Ohio buckeye
Carya	tomentosa	JUGLANDACEAE	mockernut hickory
Physostegia	digitalis	LAMIACEAE	false draggonhead
Pycnantheum	albescens	LAMIACEAE	white bracted mountain mint
Sassafras	albidum	LAURACEAE	sassafras
Smilax	bona-nox	LILIACEAE	saw greenbriar
Smilax	laurifolia	LILIACEAE	laurel greenbriar
Smilax	smallii	LILIACEAE	Smalls greenbriar
Yucca	louisianensis	LILIACEAE	Louisiana yucca
Gelsemium	sempervirens	LOGANIACEAE	Carolina jessamine
Lycopodium	carolinianum	LYCOPODIACEAE	Carolina clubmoss
Lycopodium	prostratum	LYCOPODIACEAE	creeping clubmoss
Rhexia	mariana	MELASTOMATACEAE	Maryland meadow beauty
Mirabilis	albida	NYCTAGINACEAE	four o' clock
Osmunda	cinnamonea	OSMUNDACEAE	cinnamon fern
Osmunda	regalis	OSMUNDACEAE	royal fern
Pinus	taeda	PINACEAE	loblolly pine
Pinus	echinata	PINACEAE	short-leaf pine
Pinus	elliottii	PINACEAE	slash pine
Pinus	palustris	PINACEAE	long-leaf pine
Andropogon	gerardii	POACEAE	big bluestem
Chasmanthium	sessiliflorum	POACEAE	sessile flowered chasmanthium
Schizacharium	scoparium	POACEAE	little bluestem
Sorghastrum	elliottii	POACEAE	slender Indiangrass
Crataegus	marshallii	ROSACEAE	parsley hawthorn
Rubus	louisianus	ROSACEAE	Louisiana blackberry
Bumelia	lanuginosa	SAPOTACEAE	woollybucket bumelia
Sarracenia	alata	SARRACENIACEAE	yellow pitcher plant
Penstemon	laxiflorus	SCROPHULARIACEAE	pink penstemon
Selaginella	arenicola	SELAGINELLACEAE	Sand selaginella
Thelypteris	kunthii	THELYPTERIDACEAE	widespread maiden fern
Vitis	aestivalis	VITACEAE	summer grape
Vitis	rotundifolia	VITACEAE	muscadine grape
Athyrium	filix-femina	WOODSIACEAE	southern lady fern
Xyris	ambigua	XYRIDACEAE	yelloweyed grass
Xyris	baldwiniana	XYRIDACEAE	Badwin's yellow eyed grass
Xyris	difformis	XYRIDACEAE	southern yelloweyed grass
Xyris	drummondii	XYRIDACEAE	Drummond's yelloweyed grass
Xyris	scabrifolia	XYRIDACEAE	rough yelloweyed grass

Matlock Hills & Colerow Creek Field Trips
Joe Liggio

COMMON NAME	FAMILY	Matlock Hills (USFS-SABA)	Colorow Creek (SNF-SABA)
red maple	Aceraceae	x	x
southern sugar	Aceraceae	x	x
chalk maple	Aceraceae	x	x
sugar maple	Aceraceae		
red buckeye	Hippocastanaceae	x	x
beaked agrimony	Roseaceae	x	
hazel alder	Betulaceae	x	
sicklepod	Brassicaceae		
devil's walkingstick	Araliaceae	x	x
green dragon	Araliaceae		
jack-in-the-pulpit	Araceae	x	x(s)
Virginia snakeroot	Aristolochiaceae	x	x
Texas dutchman's pipe	Aristolochiaceae	x	x
groovestem Indian plaintain	Asteraceae		x(s)
giant cane	Poaceae	x	x
redring milkweed	Asclepiadaceae	x	
pawpaw	Annonaceae	x	x
smallflower pawpaw	Annonaceae		
ebony spleenwort	Aspleniaceae	x	x
common ladyfern	Dryopteridaceae	x(s)	x(s)
Alabama supplejack	Rhamnaceae	x	x
cross vine	Bignoniaceae	x	
smallspike false nettle	Urticaceae	x	
sparselobe grapefern	Ophioglossaceae	x	
rattlesnake fern	Ophioglossaceae	x	x
bearded shorthusk	Poaceae	x	x
American beautyberry	Verbenaceae	x	x
bulbous bittercress	Brassicaceae	x	
toothwort	Brassicaceae		x
Willdenow's sedge	Cyperaceae		
fringed sedge	Cyperaceae	x	
white edge sedge	Cyperaceae	x	x(s)
slender woodland sedge	Cyperaceae		
black edge sedge	Cyperaceae		
sharpscale sedge	Cyperaceae	x	
flat-spiked sedge	Cyperaceae		
reflexed sedge	Cyperaceae		
lined sedge	Cyperaceae		
American hornbeam	Betulaceae	x	x
mockernut hickory	Juglandaceae		
bitternut hickory	Juglandaceae	x	x
chinkapin	Fagaceae	x	x
sugarberry	Ulmaceae		x
eastern redbud	Fabaceae	x	x
Indian woodoats	Poaceae	x	

longleaf woodoats	Poaceae	x	x
fringe tree	Oleaceae	x	x
Virginia springbeauty	Portulacaceae	x	x
swamp leather flower	Ranunculaceae		
spring coralroot	Orchidaceae	x	x
flowering dogwood	Cornaceae	x	x
parsley hawthorne	Rosaceae	x	x
littlehip hawthorn	Rosaceae		
wild comfrey	Boraginaceae	x	x
Kentucky lady's slipper	Orchidaceae	x	x
swamp titi	Cyrillaceae		
nakedflower ticktrefoil	Fabaceae	x	x
sessileleaf ticktrefoil	Fabaceae	x	x
Bosc's panicgrass	Poaceae		
deertongue	Poaceae	x	
Ravenel's rosette grass	Poaceae	x	
fourleaf yam	Dioscoreaceae	x	x
wild yam	Dioscoreaceae		
spikerush	Cyperaceae	x	
elephant foot	Asteraceae	x	x
devil's grandmother	Asteraceae	x	
beech drops	Orobanchaceae	x	x
redcardinal	Fabaceae	x	
white trout lily	Liliaceae		
yellow trout lily	Liliaceae	x	x
strawberry bush	Celastraceae	x(s)	x(s)
American beech	Fagaceae	x	x
white ash	Oleaceae	x	x
erect milkpea	Fabaceae	x	
licorice bedstraw	Rubiaceae	x	x
hairy bedstraw	Rubiaceae	x	
evening trumpetflower	Loganiaceae	x	x
white avens	Rosaceae		
spring avens	Rosaceae	x	x
American witchhazel	Hamamelidaceae	x	x
Ozark witchhazel	Hamamelidaceae		
Carolina silverbell	Styracaceae	x	
queendevil	Asteraceae	x	
American alumroot	Saxifragaceae		
spiked crested coralroot	Orchidaceae		
spring spiderlily	Liliaceae		
St. Andrew's cross	Clusiaceae	x	
American holly	Aquifoliaceae	x	x
deciduous holly	Aquifoliaceae	x	
yaupon holly	Aquifoliaceae	x	
Georgia holly	Aquifoliaceae	x	
jewelweed	Balsaminaceae		
purple fiveleaf orchid	Orchidaceae		
Virginia sweetspire	Grossulariaceae	x	
veiny pea	Fabaceae	x	x
Carolina lily	Liliaceae	x	x
northern spicebush	Lauraceae		x(s)
sweetgum	Hamamelidaceae	x	x

twayblade orchid	Orchidaceae	x	
tuberous stoneseed	Boraginaceae		
Japanese honeysuckle	Caprifoliaceae	x	
bulbous woodrush	Juncaceae	x	x
southern magnolia	Magnoliaceae	x	x
sweetbay	Magnoliaceae	x	
green adder's-mouth orchid	Orchidaceae		
angularfruit milkvine	Asclepiadaceae	x	
twoflower melicgrass	Poaceae	x	
Florida Keys hempvine	Asteraceae	x	x(s)
sharpwing monkeyflower	Scrophulariaceae		
partridgeberry	Rubiaceae	x	x
Indianpipe	Monotropaceae	x	x
red mulberry	Moraceae	x	
largeseed forget-me-not	Boraginaceae	x	x
wax myrtle	Myricaceae	x	x
crowposion	Liliaceae	x	x
blackgum	Nyssaceae	x	x
Virginia pennywort	Gentianaceae		
basketgrass	Poaceae	x	x
cinnamon fern	Osmundaceae	x	x
royal fern	Osmundaceae	x	x
eastern hop hornbeam	Betulaceae	x	x
tufted yellow woodsorrel	Oxalidaceae	x	x
roundleaf ragwort	Asteraceae	x	x
Virginia creeper	Vitaceae	x	x
green passion flower	Passifloraceae	x	
Canadian lousewort	Scrophorulaceae	x	x
thicket bean	Fabaceae	x	
broad beechfern	Thelypteridaceae	x	x
downy phlox	Polemoniaceae		
American lopseed	Verbenaceae	x	x
shortleaf pine	Pinaceae		x
loblolly pine	Pinaceae	x	x
autumn bluegrass	Poaceae	x	x
mayapple	Berberidaceae	x	x
great solomon's seal	Liliaceae		
jumpseed	Polygonaceae		
hairy leafcup	Asteraceae		
resurrection fern	Polypodiaceae		
Christmas fern	Dryopteridaceae	x	x
tall rattlesnakeroot	Asteraceae		
barbed rattlesnakeroot	Asteraceae	x	x
black cherry	Roseaceae		x
white oak	Fagaceae	x	x
southern red oak	Fagaceae	x	x
laurel oak	Fagaceae		
chestnut oak	Fagaceae	x	x
chinquapin oak	Fagaceae		x
water oak	Fagaceae	x	x
willow oak	Fagaceae		

shummard oak	Fagaceae	x	
Carolina buckthorn	Rhamnaceae	x	x
peidmont azalea	Ericaceae	x	x
Carolina wild petunia	Acanthaceae		
sabal palmetto	Arecaceae	x	
lyreleaf sage	Lamiaceae	x	x
elderberry	Caprifoliaceae		
seaside brookweed	Primulaceae		
bloodroot	Papaveraceae	x	x
black snakeroot	Apiaceae	x	x
sassafras	Lauraceae	x	x
whip nutrush	Cyperaceae	x	
heartleaf skullcap	Lamiaceae	x	x
widowsfrill	Caryophyllaceae		
fire pink	Caryophyllaceae		
white blue-eyed grass	Iridaceae		
sawtooth greenbrier	Smilacaceae		
cat greenbrier	Smilacaceae	x	
roundleaf greenbriar	Smilacaceae	x	x
lanceleaf greenbrier	Smilacaceae	x	x
sasparilla vine	Smilacaceae	x	x
carionflower	Smilacaceae		
bristly greenbrier	Smilacaceae	x	
blue-stem goldenrod	Asteraceae	x	x
clasping leaf goldenrod	Asteraceae	x	x
woodland pinkroot	Loganiaceae	x	x
eastern featherbells	Liliaceae		
American snowbell	Styracaceae		
Grand snowbell	Styracaceae		x
Drummond's aster	Asteraceae	x	
calico aster	Asteraceae	x	
common sweetleaf	Symplocaceae	x	x
yellow pimpernel	Apiaceae	x	
purple meadow-rue	Ranunculaceae		
parsnip	Apiaceae	x	
American basswood	Tiliaceae	x	x
cranefly orchid	Orchidaceae	x	x
poison ivy	Anacardiaceae	x	
hairyflower spiderwort	Commelinaceae	x	x
heartleaf noseburn	Euphorbiaceae	x	
Sabine River wakerobin	Liliaceae	x	x
greater marsh St. Johnswort	Clusiaceae		
yellowfruit horse-gentian	Caprifoliaceae		
threebirds orchid	Orchidaceae		
American elm	Ulmaceae		
slippery elm	Ulmaceae		
perfoliate belwort	Liliaceae	x	x
sessileleaf belwort	Liliaceae		
farkleberry	Ericaceae		
Elliott's blueberry	Ericaceae	x(s)	x(s)
smallflower blueberry	Ericaceae	x	x
gravelweed	Asteraceae		

mapleleaf viburnum	Caprifoliaceae	x	x
southern arrowwood	Caprifoliaceae	x	x
possumhaw	Caprifoliaceae	x	
rusty blackhaw	Caprifoliaceae	x	x
Carolina vetch	Fabaceae	x	
sand violet	Violaceae		
southern coastal violet	Violaceae	x	x
common blue violet	Violaceae		x
prostrate blue violet	Violaceae	x	x
muscadine grape	Vitaceae	x	x
bluntlobe cliff fern	Dryopteridaceae		
netted chainfern	Blechnaceae	x	x

yellow bractspike	Acanthaceae
golden zizia	Apiaceae

Plant List for Weches Outcrop/ Stewart Ranch

Peter Loos
P.O. Box 520
Chireno, TX 75937

Weches Outcrop

1. Water Oak, *Quercus nigra*
2. Chinkapin Oak, *Quercus muhlenbergia*
3. Lanceleaf Buckthorn, *Rhamnus lanceolata*
4. Wild Privet, *Foresteria ligustrina*
5. Rusty Blackhaw, *Viburnum rufidulum*
6. Eve's Necklace, *Sophora affinis*
7. Roughleaf Dogwood, *Cornus drummondii*
8. Red Buckeye, *Aesculus pavia*
9. Eastern Red Cedar, *Juniperus virginiana*
10. Possumhaw Holly, *Ilex decidua*
11. Youpon, *Ilex vomitoria*
12. Hercules Club, *Zanthoxylum clava-herculis*
13. Green Haw, *Crataegus virdis*
14. Sweetgum, *Liquidambar styraciflua*
15. Locust, *gledistia triacanthos*
16. Wild Onion, *Allium canadense*
17. Windflower, *Anemone sp.*
18. Whorled Milkweed, *Asclepias verticillata*
19. Sundrops, *Calylophus drummondianus*
20. White Bladderpod, *Lesquerella pallida*
21. Gayfeather, *Liatris mucronata*
22. Beebalm, *monarda citridora*
23. Crow Posion, *Nothoscordum bivalve*
24. Showy Evening Primrose, *Oenothera speciosa*
25. Palafoxia, *Palafoxia rosea*
26. Lyreleaf Sage, *Salvia lyrata*
27. Prairie Clover, *Petelostemon pulcherrimum*
28. Meadow Pink, *Sabatia campestris*
29. Sedum, *Sedum pulchellum*
30. False Aloe, *Agave virginica*
31. Blue-eyed Grass, *Sisyrinchium spp.*
32. Butterfly Weed, *Asclepias tuberosa*
33. Prairie Phlox, ***Phlox pilosa***
34. Larkspur, *Delphinium sp.*
35. Wild Petunia, *Ruellia humilis*
36. Wild Petunia, *Ruellia pedunculata*
37. Aster, *Aster texanus*
38. Aster, *Aster subulatus*
39. Lady's Tress, *Spiranthes cernua*
40. Heal All, *Prunella vulgaris*
41. Violet, *Viola rafinesquii*
42. Violet, *Viola pratincola*
43. Dock, *Rumex pulcher*
44. Senna, *Cassia obtusifolia*
45. Hedeoma, *Hedeoma hispidum*
46. Arkansas Savory, *Satureja arkansana*
47. Side Oats Grama, *Bouteloua curtipendula*
48. Quaking Grass, *Briza minor*
49. Beaked Panicum, *Panicum anceps*
50. Panicum, *Panicum hallii*
51. Sedge, *Carex muhlenbergii*
52. Dropseed, *Sporobulus asper*
53. Purpletop Grass, *Tridens flavus*
54. Peppergrass, *Lepidium virginicum*
55. Leavenworthia, *Leavenworthia texana*
56. Poa Grass, *poa annua*
57. Love Grass, *Eragrostis hirsuta*
58. 3 Awn Grass, *Aristida spp.*

Stewart Ranch

1. Loblolly Pine, *Pinus Taeda*
2. Georgia Holly, *Ilex longipes*
3. Rusty Blackhaw, *Viburnum rufidulum*
4. Possunhaw Viburnum, *Viburnum nudum*
5. Arrowwood Viburnum, *Viburnum dentatum*
6. Willow Oak, *Quercus phellos*
7. White Oak, *Quercus alba*

8. Overcup Oak, *Quercus lyrata*
9. Water Oak, *Quercus nigra*
10. Blueberry, *Vaccinium anomeum*
11. Deerberry, *Vaccinium staninium*
12. Farkleberry, *Vaccinium arboreum*
13. Mapleleaf Viburnum, *Viburnum acerifolia*
14. Witch Hazel, *Hamamelis virginiana*
15. Sassafras, *Sassafras albidium*
16. Black Hickory, *Carya texana*
17. Mockernut Hickory, *Carya tomentosa*
18. Red Maple, *Acer rubrum*
19. Florida Sugar Maple, *Acer barbatum*
20. Paw Paw, *Asimina triloba*
21. Muscadine Grape, *Vitis rotundifolia*
22. American Holly, *Ilex opaca*
23. Hop Tree/ Wafer Ash, *Ptelea trifoliata*
24. Green Ash, *Fraxinus pennsylvatica*
25. Youpon, *Ilex vomitoria*
26. Hoary Azalea, *Rhododendron canescens*
27. Hazel Alder, *Alnus serrulata*
28. Southern Magnolia, *Magnolia grandiflora*
29. Sweetbay Magnolia, *Magnolia virginiana*
30. Beech, *Fagus grandiflora*
31. Blackgum, *Nyssa sylvatica*
32. Strawberry Bush, *Euonymous americana*
33. Virginia Sweetspire, *Itea virginica*
34. Mayhaw, *Crataegus opaca*
35. Hawthorn, *Crataegus sp.*
36. Parsley Hawthorn, *Crataegus marshallii*
37. Sweetleaf, *Symplocos tinctoria*
38. Devil's walking Stick, *Aralia spinosa*
39. Palmetto, *Sabal minor*
40. Cat Briar, *Smilax bona-nox*
41. Cat Briar, *Smilax laurelifolia*
42. Cat Briar, *Smilax pumila*
43. Dogwood, *Cornus florida*
44. Swamp Privet, *Foresteria acuminata*
45. Royal Fern, *Osmunda regalis*
46. Cinnamon Fern, *Osmunda cinnamonea*
47. Elderberry, *Sambucus canadensis*
48. Crossvine, *Bignonia capreolata*
49. Red Buckeye, *Aesculus pavia*
50. Silverbell, *Halesia diptera*
51. Fringe Tree, *Chionanthus virginiana*
52. Ironwood, *Carpinus caroliniana*
53. Hop Hornbeam, *Ostyra virginiana*
54. Sweetgum, *Liquidambar styraciflua*
55. Sumac, *Rhus copallina*
56. Aromatic Sumac, *Rhus aromatica*
57. Indian Cherry, *Rhamnus caroliniana*
58. New Jersey Tea, *Ceanothus americanus*
59. Red Bay, *Persea borbonia*
60. Netted Chain Fern, *Woodwardia areolata*
61. Violet, *Viola sp.*
62. Walter's Violet, *Viola walterii*
63. Partridge Berry, *Mitchella repens*
64. Cardinal Flower, *Lobelia cardinalis*
65. Dewberry, *Rubus sp.*
66. Lady Fern, *Athyrium felix-femina*
67. Bracken Fern, *Pteridium aquilinum*
68. Jack-in-the-pulpit, *Arisaema triphyllum*
69. Solomon's Seal, *Polygonatum biflorum*
70. Wake Robin, *Trillium gracile*
71. Mayapple, *Podophyllum peltatum*
72. Southern Twayblade, *Listera australis*
73. Spring Coralroot, *Corallorhiza wisteriana*
74. Indian Pipe, *Monotropa uniflora*
75. Carolina Jessamine, *Gelsemium sempervirens*
76. White-flowered Milkweed, *Asclepias variegata*
77. Mountain Mint, *Pycnanthemum albescens*
78. Beech Drops, *Epifagus virginiana*
79. Catchfly, *Silene subcillata*
80. Cabbageleaf Coneflower, *Rudeckia maxima*
81. Pink Scale Gayfeather, *Liatris elegans*
82. Asters (numerous), *Aster spp.*
83. Goldenrods (several) *Solidago spp.*
84. Camphor Weed, *Pluchea camphorata*
85. Eastern Gamma Grass,*Tripsacum dactyloides*
86. Switch Grass, *Panicum virgatum*
87. Panicum Grass (several), *Dichantheliu*

Little Sandy National Wildlife Refuge

Little Sandy National Wildlife Refuge is a 3,802 acre conservation easement held by the U.S. Fish and Wildlife Service and owned by the Little Sandy Hunting and Fishing Club. The site is about 6 miles west of Hawkins, Texas and is bounded on the west by Little Sandy Creek and on the South by the Sabine River. The area contains about 600 acres of lakes (modified oxbows); we will only briefly look at the vegetation on the lakes. A small portion of the property has mesic hardwood forests with some seeps. Old growth, bottomland hardwood forests occupy the vast majority of the property. Several state champion trees and trees approaching national champion status are present on the site. The bottomlands have wet, shrub swamps and flats and higher ridge sites supporting some cane breaks. The majority of the trip will be in the bottomland forest habitat.

Vegetation List *
Little Sandy National Wildlife Refuge
Wood County, Texas

Acer rubrum
Aesculus pavia
Ampelopsis arborea
Apios americana
Apocynum sibiricum
Arundinaria gigantea
! Arundo donax
Baccharis sp.
Bacopa caroliniana
Bacopa caroliniana
Bechemia scandens
Betula nigra
Bidens laevis
Bignonia capreolata
Boehmeria cylindrica
Boehmeria cylindrica var. cylindrica
Briza minor
Bromus japonicus
Brunnichia ovata
Cabomba caroliniana
Callicarpa americana
Campsis radicans
Carex alata
Carex amphibole
Carex crus-corvi
Carex decomposita
Carex flaccosperma
Carex frankii
Carex hyalinolepis
Carex intumescens
Carex louisianica
Carex lousianica
Carex lupulina
Carex lurida
Carex muhlenbergii
Carex reniformis
Carex triangularis
Carex tribuloides
Carex typhina
Carex vulpinoidea
Carpinus caroliniana
Carya aquatica

Carya illinoiensis
Celtis laevigata
Cephalanthus occidentalis
Ceratophyllum demersum
Cercis canadensis
Chasmanthium latifolium
Cocculus carolinus
Commelina virginica
Cornus florida
Cornus foemina
Crataegus marshallii
Crataegus opaca
Cynosciadium digitatum
Cyperus echinatus
Cyperus pseudovegetus
Cyperus spp.
Cyperus virens
Decodon verticillatus
Dicliptera brachiata
Diospyros virginiana
Echinodorus cordifolius
Eclipta alba
Eleocharis baldwinii
Eleocharis macrostachya
Eleocharis montana
Eleocharis montevidensis
Eleocharis obtusata
Eragrostis hypnoides
Erianthus strictus
Fimbristylis autumnalis
Fimbristylis vahlii
Forestieria acaminata
Fraxinus pennsylvanica
Galium tinctorium
Gallium obtusum
Geum canadense
Gledetsia sempervirens
Gledetsia triacanthos
Gleditsia aquatica
Hibiscus leucophyllus
Hibiscus miliaris
Hydrocotyle umbellate
Hydrolea uniflora
Hypericum mutilum
Ilex decidua
Ilex opaca

Ilex vomitoria
Jugulans nigra
Juncus diffusissimus
Juncus effusus
Juncus tenuis
Juniperus virginiana
Justicia lanceolata
Lemna minor
!Ligustrum spp.
Limnobium spongia
Liquidambar styraciflua
Lolium perenne
! Lonicera japonica
Lonicera sempervirens
Ludwigia decurrens
Ludwigia leptocarpa
Ludwigia peploides
Lycopus rubellus
Magnolia grandiflora
Matelea gonacarpa
Mitchella repens
Morus rubra
Myrica cerifera
Najas guadalupensis
Nelumbo lutea
Nuphar luteum
Nymphaea odorata
Nyssa sylvatica
Onoclea sensibilis
Ophioglossrum vulgatum
Ostrya virginiana
Parthenocissus quinquefolia
Paspalum dactyloides
Paspalum fluitans
Passiflora incarnate
Peltandra virginica
Persicaria coccinea
Persicaria densiflora
Persicaria hudropiperoides
Persicaria pennsylvanica
Pinus echinata
Pinus taeda
Planera aquatica
Polygonum spp.
Pontederia cordata
Potamogeton diversifolius var diversifolius

Potemogeton diversifolius var trichophyllus
Prunus caroliniana
Prunus mexicana
Prunus serotina
Quercus falcata
Quercus lyrata
Quercus nigra
Quercus phellos
Quercus pagoda
Quercus similis
Rhynchospora corniculata
Rosa setigera
Rotala ramosoir
Rudbeckia hirta
Sabal minor
Sacciolepis striata
Sagittaria graminea
Sagittaria lancifolia
Sagittaria latifolia
Sagittaria platyphylla
Salix nigra
Sambucus canadensis
Sapindus saponaria
Sassafras albidum
Saururus cernuus
Scirpus validus
Scleria oligantha
Sesbania macrocarpa
Smilax bona-nox
Smilax glauca
Smilax rotundifolia
Smilax smallii
Smilax tamnoides
Smilax walteri
Solanum carolinense
Symplocos tinctoria
@ Taxodium distichum
Teucrium canadense
Thelypteris kunthii
Toxicodendron radicans
Trachelospermum difforme
Trifolium sp.
Trifolium vesciculosum
Triodanis biflora
Tripsacum dactyloides
Typha angustifolia

Ulmus americana
Ulmus crassifolia
Utricularia purpurea
Utricularia radiata
Vaccinium arboretum
Vernonia baldwinii
Viburnum rufidulum
Viburnum nudum
Vitis aestivalis
Vitis cinerea
Vitis palmata
Vitis rotundifolia
Vulpia myuros var. myuros
Vulpia octoflora
Wolffia spp.
Woodwardia areolata
Zizaniopsis miliacea

@ Introduced
! Invasive exotic

* Note! This list is from various sources, some of which are unverified. Contributors to the list include Stanley and Gretchen Jones, Texas A&M University, Bob Keeland and John McCoy, USGS National Wetlands Research Center, and Elray Nixon, Retired, Stephen F. Austin State University. This list was compiled by Jim Neal, US Fish and Wildlife Service, and any errors are the responsibility of the compiler and not the individual contributors.

Birding 101

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Bird List for SFA Pineywoods Native Plant Center
Compiled by David E. Wolf
May 2002

____ Great Blue Heron
____ Snowy Egret
____ Cattle Egret
____ Green Heron
____ Yellow-crowned Night Heron
____ Black Vulture
____ Turkey Vulture
____ Wood Duck
____ Mississippi Kite
____ Sharp-shinned Hawk
____ Cooper's Hawk
____ Red-shouldered Hawk
____ Broad-winged Hawk
____ Red-tailed Hawk
____ American Kestrel
____ American Woodcock
____ Mourning Dove
____ Inca Dove
____ Yellow-billed Cuckoo
____ Barred Owl
____ Common Nighthawk
____ Chimney Swift
____ Ruby Throated Hummingbird
____ Belted Kingfisher
____ Red-headed Woodpecker
____ Red-bellied Woodpecker
____ Yellow-bellied Sapsucker
____ Downy Woodpecker
____ Hairy Woodpecker
____ Northern Flicker
____ Pileated Woodpecker
____ Eastern Wood-Pewee
____ Acadian Flycatcher
____ Eastern Phoebe
____ Great Crested Flycatcher
____ Eastern Kingbird
____ Scissor-tailed Flycatcher

____ White-eyed Vireo
____ Yellow-throated Vireo
____ Blue-headed Vireo
____ Warbling Vireo
____ Red-eyed Vireo
____ Blue Jay
____ American Crow
____ Purple Martin
____ Barn Swallow
____ Carolina Chickadee
____ Tufted Titmouse
____ Red-breasted Nuthatch
____ White-breasted Nuthatch
____ Brown-breasted Nuthatch
____ Brown Creeper
____ Carolina Wren
____ House Wren
____ Winter Wren
____ Golden-crowned Kinglet
____ Ruby-crowned Kinglet
____ Blue-gray Gnatcatcher
____ Eastern Bluebird
____ Grey-cheeked Thrush
____ Swainson's Thrush
____ Hermit Thrush
____ Wood Thrush
____ American Robin
____ Gray Catbird
____ Northern Mockingbird
____ Brown Thrasher
____ European Starling
____ Cedar Waxwing
____ Blue-winged Warbler
____ Golden-winged Warbler
____ Tennessee Warbler
____ Orange-crowned Warbler
____ Nashville Warbler
____ Northern Parula
____ Yellow Warbler
____ Chestnut-sided Warbler
____ Magnolia Warbler
____ Yellow-rumped Warbler
____ Black-throated Green Warbler
____ Blackburnian Warbler
____ Yellow-throated Warbler
____ Pine Warbler
____ Bay-breasted Warbler
____ Black-and-white Warbler
____ American Redstart

____ Prothonotary Warbler
____ Ovenbird
____ Northern Waterthrush
____ Kentucky Warbler
____ Mourning Warbler
____ Common Yellowthroat
____ Hooded Warbler
____ Wilson's Warbler
____ Canada Warbler
____ Summer Tanager
____ Scarlet Tanager
____ Eastern Towhee
____ Chipping Sparrow
____ Field Sparrow
____ Song Sparrow
____ Lincoln's Sparrow
____ White-throated Sparrow
____ Dark-eyed Junco
____ Northern Cardinal
____ Rose-breasted Grosbeak
____ Indigo Bunting
____ Painted Bunting
____ Red-wing Blackbird
____ Common Grackle
____ Brown-headed Cowbird
____ Orchard Oriole
____ Baltimore Oriole

Naconiche Creek

Larry Shelton
15449 FM 1878
Nacogdoches, TX 75961

WOODY PLANTS

Scientific Name	**Common Name**
Acer rubrum	red maple
Alnus serrulata	witch alder
Betula nigra	river birch
Bartonia spp.	screw stems
Cornus florida	flowering dogwood
Euonymous americanus	spindletree
Fagus grandifolia	American beech
Itea virginica	Virginia sweetspire
Ilex glabra	gallberry holly
Ilex opaca	American holly
Liquidambar styraciflua	sweetgum
Lycopodium spp.	clubmoss
Lyonia ligustrina	huckleberry
Lyonia mariana	stagerbush
Magnolia virginiana	sweetbay magnolia
Myrica spp.	wax myrtle
Nyssa sylvatica	black gum
Pinus taeda	loblolly pine
Quercus alba	white oak
Quercus nigra	water oak
Quercus phellos	willow oak
Rhus toxicodendron	poison ivy
Rhus vernix	poison sumac
Sambucus canadensis	elderberry
Rubus spp.	dewberry
Smilax spp.	greenbriar
Vacciniun corymbosum	elliott's blueberry
Viburnum nitidum	shiny viburnum
Viburnum nudum	possumhaw viburnum
Vitis spp.	grape

HERBACEOUS PLANTS

Scientific Name	**Common Name**
Apteria aphylla	nodding nixie
Ariseama triphyllum	jack-in-the-pulpit
Bartonia texana	Texas screwstem

Boehmeria cylindrica	small-spike false nettle
Burmannia biflora	two flower burmannia
Burmannia capitata	cap burmannia
Carex spp.	sedge
Commelina spp.	day flower
Eupatorium fistulosum	joe pye weed
Hydrocotyle spp.	penny wort
Hypericum walteri	Walter's St. John's wort
Hypericum spp.	St. John's worts
Listera australis	tway blade orchid
Mayaca aublettii	bog moss
Melanthium virginicum	bunch flower
Osmunda cinnomomea	cinnamon fern
Osmunda regalis	royal fern
Onoclea sensibilis	sensitive fern
Plantanthera ciliaris	yellow fringe orchid
Plantanthera clavellata	small wood orchid
Habenaria repens	Nuttall habenaria
Pogonia ophioglossoides	rose pogonia
Saururus cernuus	common lizard tail
Solidago spp.	goldenrod
Viola spp.	violets
Woodwardia areolata	chain fern

Workshops

EDIBLE/USEFUL PLANTS

From: "Edible Plants of the Gulf South" by Allen, Allen and Winters, 2005

Dr. Charles M. Allen; CEMML, Fort Polk, LA 71459 www.nativeventures.net
email = native@camtel.net; phone 337-531-7535 or 337-328-2252

EDIBLE PLANTS

Scientific Name	Common name	part used
Acer spp.	Maple	inner bark, seeds, & leaves
Allium spp.	Onions	bulbs & leaves
Alternanthera philoxeroides	Alligatorweed	leaves
Amaranthus spp.	Amaranth	seeds, shoots, & leaves
Ambrosia	Ragweed	seeds
Amelanchier arborea	Service Berry	fruits
Amphicarpaea bracteata	Hog Peanut	underground fruits
Apios americana	Ground Nut	tubers
Arisaema dracontium	Green Dragon	corms
Arisaema triphyllum	Jack in the Pulpit	corms
Arundinaria gigantea	Cane/Bamboo	shoots & seeds
Asclepias spp.	Milkweed	flower buds, leaves, & fruits
Asimina triloba	Pawpaw	fruits
Brasenia schreberi	Water Shield	leaves, mucilage, roots
Callicarpa americana	French Mulberry	fruits
Callirhoe spp.	Wine Cup	roots & leaves
Capsella bursa-pastoris	Shepherd's Purse	stem tips, leaves, seeds, roots
Cardamine spp.	Native Water-Cress	leaves
Carya spp.	Hickory Nut	fruits
Castanea pumila	Chinquapin	seeds
Celtis spp.	Hackberry	fruits
Centella erecta	Centella	leaves
Cerastium spp.	Mouse-Eared Chickweed	leaves
Cercis canadensis	Red Bud	young pods & flowers
Chenopodium album	Lamb's Quarters	seeds & whole plant
Chionanthus virginica	Fringe Tree	fruits
Cichorium intybus	Chicory	roots, leaves, flowers
Cirsium spp.	Thistle	roots, leaves, & pith
Claytonia virginica	Spring Beauty	leaves & corms
Commelina spp.	Day Flower	shoots
Corylus americana	hazelnut	seed
Crataegus spp.	Hawthorn	fruits
Cryptotaenia canadensis	wild chervil	leaves, seed
Cyperus esculentus, rotundus	Chufa/Nut Grass	tubers
Dalea candida, purpurea	Prairie Clover	roots
Diospyros virginiana	Persimmon	fruits
Duchesnea indica	wild strawberry	fruits
Eclipta prostrata	Eclipta	tips
Elaeagnus spp.	Elaeagnus	fruit, seed
Erodium cicutarium	Stork's Bill	leaves, stems, roots
Fagus grandifolia	Beech	bark, leaves, & fruits
Foresteria acuminata	Swamp Privet	fruits
Fraxinus spp.	Ash	fruits
Galium aparine	Bedstraw	tips
Gaylussacia spp.	huckleberry	fruit
Gleditsia triacanthos	Honey Locust	fruits
Halesia diptera	Silver Bell	fruits
Helianthus spp	Sunflower	seeds, tubers
Hemerocallis fulva	Day Lily	flower buds
Impatiens capensis	Touchmenot	seeds
Ipomoea spp.	Morningglory	leaves, stem tips, roots

Edible Plants (Cont).

Scientific Name	Common name	part used
Iva annua	Sumpweed	seeds
Juglans nigra	Black Walnut	fruits
Krigia dandelion	False Dandelion	tubers
Lactuca spp.	Wild Lettuce	leaves
Lamium spp	Henbit	tips
Laportea canadensis	Wood Nettle	stem tips, leaves
Lepidium virginicum	Peppergrass	shoots
Lespedeza spp.	Lespedeza	leaves
Liatris spp.	Blazing Stars	corms
Liquidambar styraciflua	Sweetgum	resin
Lonicera japonica	Japanese Honeysuckle	flowers, leaves, buds
Lycopus spp.	Bugleweeds	tubers
Malus(Pyrus)angustifolia	Crab Apple	fruits
Medeola virginiana	Indian Cucumber	rhizome
Mitchella repens	Partridgeberry	fruits
Mollugo verticillata	Carpet Weed	plant
Morus spp.	Mulberry	fruits
Myriophyllum spicatum	Water Milfoil	roots, leaves
Nelumbo luteum	Water Chinquapin	young leaves, seeds & rhizomes
Nuphar spp.	Splatterdock	rhizomes & seeds
Nymphaea spp.	Water Lily	leaves & rhizomes
Nyssa spp.	Black Gum	fruits
Oenothera biennis	Evening Primrose	leaves & roots
Opuntia spp.	Cactus	fruit, stem, seeds
Oxalis spp.	Wood Sorrel	roots & leaves
Passiflora incarnata	May Pop	fruits
Peltandra virginica	Arrow Arum	seed, flowering stem, rhizome
Perilla frutescens	Perilla	leaves, flower clusters, seeds
Photinia pyrifolia	Red Chokecherry	fruit
Phragmites communis	Reed	rhizome tips & seeds
Phyllostachya aurea	Yellow Bamboo	stem tips
Physalis spp.	Groundcherry	fruits
Phytolacca americana	Pokeweed	leaves
Pinus spp.	Pines	seeds
Plantago spp.	Plantain	leaves
Platanus occidentalis	Sycamore	sap
Podophyllum peltatum	Mayapple	fruit
Polygonatum biflorum	Solomon's Seal	rhizomes & stem tips
Polygonum spp.	Knotweed/Smartweed	shoots & seeds
Poncirus trifoliata	Trifoliate Orange	fruit
Pontederia cordata	Pickerel Weed	shoots & seeds
Populus deltoides	Cottonwood	inner bark, seeds, sap, leaves
Portulaca oleracea	Purslane	leaves & seeds
Proboscodea louisianica	Unicorn Plant	fruit, seeeds
Prunus angustifolia	Chickasaw Plum	fruit
Prunus americana & umbellata	Wild Plum (Sloe)	fruit
Prunus serotina	Blackcherry	fruit
Psoralea spp.	Sampson's SnakeRoot	root
Pteridium aquilinum	Bracken Fern	fiddleheads & rhizomes
Pueraria lobata	Kudzu	root, young stem & leaves
Pyracantha coccinea	Firethorn	fruit
Quercus spp.	Oak	acorns
Rhexia virginica	Meadow Beauty	tubers & leaves
Rhus spp.	Sumac	fruit
Rosa spp.	Rose	petals, hips, & seeds
Rubus spp.	Blackberry	fruits & stem tips

Edible Plants (Cont).

Scientific Name	Common name	part used
Rumex spp.	Dock	leaves
Sagittaria spp.	Wapato/Arrowhead	tubers
Sambucus canadensis	Elderberry	fruit, flowers,& stem tips
Sassafras albidum	Sassafras	leaves
Scirpus spp.	Bulrush	rhizome, stem, seed, pollen
Smiliciana racemosa	False Solomon's Seal	fruit, leaves, stem tips, roots
Smilax spp.	Saw Brier	tubers & shoots
Sonchus spp.	Sow Thistle	leaves
Stachys floridana	Woundwort	tubers
Stellaria media	Chickweed	leaves
Symplocos tinctoria	Horsesugar	leaves
Taraxacum officinale	Dandelion	rootstock & leaves
Tilia spp.	Basswood	inner bark & young buds
Tradescantia spp.	Spiderwort	shoots
Trifolium spp.	Clover	young leaves, flower buds
Trillium spp.	Trillium	young leaves
Tripsacum dactyloides	Eastern Gamma Grass	fruits-seeds
Typha latifolia	Cattail	stem tips, rhizomes, inflorescence & pollen
Ulmus rubra	Slippery Elm	inner bark
Urtica spp.	Stinging Nettle	leaves
Uvularia spp.	Bellwort	leaves, stem tips, rhizomes
Vaccinium spp.	Blueberry, Huckleberry	fruits
Valerianella radiata	Corn Salad	leaves
Viburnum spp.	Possum haw	fruits
Viola spp.	Violet	leaves & flowers
Vitis spp.	Grapes	tendrils, leaves, & fruits
Yucca spp.	Beargrass/Yucca	root, fruit, flowers
Zizania aquatica	Wild Rice	seeds
Zizaniopsis miliacea	Rice Cut Grass	rhizome tips

SPICE PLANTS

Scientific Name	Common name	part used
Allium spp.	Onion	leaves, bulbs
Capsella bursa-pastoris	Shepherd's Purse	roots, seeds
Cardamine bulbosa	Spring Cress	rootstock
Celtis spp.	Hackberry	pits
Centella erecta	Centella	leaves
Chenopodium ambrosioides	Mexican Tea	whole plant
Cryptotaenia canadensis	Wild Chervil	leaves
Geum canadense	White Avens	roots
Juniperus virginianum	Juniper, Cedar	fruits
Lepidium virginicum	Peppergrass	seeds
Lindera benzoin	Spice Bush	leaves & fruits
Magnolia spp.	White Bay, Magnolia	leaves, flowers
Monarda spp.	Bee Balm	whole plant
Myrica cerifera	Wax Myrtle	leaves
Perilla frutescens	Perilla	leaves, flower clusters, seeds
Persea palustris	Red Bay	leaves
Polygonum spp.	Knotweed/Smartweed	leaves
Poncirus trifoliata	Trifoliate Orange	fruit peels
Prunus serotina	Black Cherry	fruit
Pycnanthemum spp.	Mountain Mint/Sage	whole plant
Sassafras albidum	Sassafras	roots & leaves
Trifolium spp.	Clover	flowers
Yucca spp.	Beargrass/Yucca	flowers
Xanthoxyllum clava-herculis	Toothache Tree	fruits

TEA/DRINK PLANTS

Scientific Name	Common name	part used
Ceanothus americanus	New Jersey Tea	leaves
Chenopodium album	Lamb's Quarters	whole plant
Cyperus spp.	Chufa/Nut Grass	tubers
Dalea candida, purpurea	Prairie Clover	leaves
Diospyros virginiana	Persimmon	leaves
Elaeagnus spp.	Elaeagnus	fruit
Galium spp.	Bedstraw	whole plant
Gleditsia triacanthos	Honey Locust	seed pulp
Hamamelis virginiana	Witch Hazel	leaves
Ilex opaca	American Holly	leaves
Ilex vomitoria	Yaupon	leaves
Ilex spp.	Holly	leaves
Juniperus virginiana	Juniper, Cedar	twigs
Laportea canadensis	Wood Nettle	leaves
Lespedeza capitata	Lespedeza	leaves
Lindera benzoin	Spicebush	leaves & twigs
Lonicera japonica	Japanese Honeysuckle	flowers, leaves, buds
Magnolia virginiana	White Bay	leaves
Monarda spp.	Oswego Tea	leaves
Monarda fistulosa	Wild Bergamot	leaves
Morus spp.	Mulberry	young stem tips
Myrica cerifera	Wax Myrtle	leaves
Oxalis spp.	Wood Sorrel	leaves
Pinus spp.	Pines	needles
Plantago spp.	Plantain	leaves
Polygonum spp.	Smartweed/Knotweed	leaves
Poncirus trifoliata	Trifoliate Orange	fruit
Prunus serotina	Black Cherry	fruit
Pueraria lobata	Kudzu	flowers
Pycnanthemum spp.	Mountain Mint	whole plant
Rhexia virginica	Meadow Beauty	leaves & stems
Rhus copallina	Sumac	fruits & flowers
Rubus spp.	Blackberry	young stem tips
Rumex spp.	Dock	leaves
Sambucus canadensis	Elderberry	flowers
Sassafras albidum	Sassafras	roots
Solidago odora	Sweet Goldenrod	leaves & flowers
Stellaria media	Chickweed	leaves
Taraxacum officinale	Dandelion	leaves
Tilia spp.	Basswood	flowers & leaves
Trifolium spp.	Clover	flowers
Ulmus spp (rubra)	Elm	inner bark
Urtica spp.	Stinging Nettle	leaves
Viola spp.	Violet	leaves, flowers
Vitis spp.	Grapes, Muscadines	fruits, sap

COFFEE PLANTS

Scientific Name	Common name	part used
Cichorium intybus	Chicory	root
Cyperus esculentus	Chufa/Nut Grass	tubers
Diospyros virginiana	Persimmon	seeds
Fagus grandifolia	Beech	fruits
Galium aparine	Bedstraw	seeds
Gleditsia tricanthos	Honey Locust	seeds
Helianthus spp.	Sunflower	seed-shells
Quercus spp.	Oak	acorns
Rumex spp.	Dock	seeds
Taraxacum officinale	Dandelion	rootstock
Ulmus spp. (rubra)	Elm	inner bark

MISCELLANEOUS USE PLANTS

Scientific Name	Common name	part used	Use
Arundinaria gigantea	Cane/Bamboo	stem	fishing poles, flutes,
Arundinaria gigantea	Cane/Bamboo	stem	whistles, pipe stems, baskets
Asimina triloba	Pawpaw	bark	rope, cloth
Ceanothus americanus	New Jersey Tea	roots	dye
Erodium cicutarium	Stork's Bill	roots	chewing gum
Hamamelis virginiana	Witch Hazel	twigs	divining rods
Impatiens capensis	Touchmenot	whole plant	poison ivy cure
Liquidambar styraciflua	Sweet Gum	resin	chewing gum
Myrica cerifera	Wax Myrtle	berries	candles, soaps
Nyssa spp.	Black Gum	twigs	toothbrush
Phytolacca americana	Pokeweed	berries	dye
Sambucus canadensis	Elderberry	stems	popgun barrel
Sassafras albidum	Sassafras	twigs	toothpicks
Silphium laciniatum	Compass Plant	resin	chewing gum
Symplocos tinctoria	Horsesugar	leaves, twigs	dye
Ulmus rubra	Slippery Elm	inner bark	string
Urtica spp.	Stinging Nettle	roots	dye
Yucca spp.	Beargrass/Yucca	leaves	string

Carbon Sequestration in East Texas

By
John Boyette
Texas Forest Service

Whether or not you believe in global warming, or more specifically human caused global warming, the fact is that there is growing momentum worldwide to take steps to reduce the amount of carbon dioxide emissions that we produce. While the exact mechanisms and long-term effects are still not well understood, the fact that atmospheric levels of carbon dioxide are increasing is not in dispute.

There are many sources of carbon dioxide. We produce it every time we take a breath. Volcanoes produce massive amounts of it. It is a natural part of our environment. However, man has been producing significant amounts of CO_2 ever since the beginning of the industrial revolution. The burning of fossil fuels, coal, oil, natural gas, is the main source of man-made CO_2 emissions.

There are two ways to reduce CO_2 levels in the atmosphere, or more realistically, slow the rate of growth. One is to reduce emissions from our cars, factories, etc., and the other is to actually remove CO_2 from the atmosphere. This is referred to as "carbon sequestration". Probably the most efficient method for doing this is by growing trees. Trees capture CO_2 during photosynthesis and transform it into a variety of carbohydrates, most of which are turned into wood. Wood is about half carbon, all of which comes from atmospheric CO_2.

This is not news to anyone, in fact, we have been hearing for a long time about how some day there would be financial incentives for landowners to practice forest management on their land for just this reason. The Europeans have been doing this for some time now and have a well developed system for buying and trading carbon credits. The concept is simple. Companies that produce large amounts of CO_2 can buy these credits from someone that grows trees since those trees are actually taking those emissions back out of the atmosphere. In practice, the process is complex. Calculating the amount of CO_2 that a forest removes over time can be tricky, and the value of the credits is based on free market economics which can be unpredictable.

What is new, is the fact that there is now a market for carbon credits right here in East Texas. A little over a year ago, the Iowa Farm Bureau came to Nacogdoches to talk about carbon credits. Those of us that went to the meeting were expecting the usual "some day" discussion, but these guys actually had contracts in their hands and were looking for landowners to sign up for the program. The "some day" had come.

The Iowa Farm Bureau had been working with landowners in Iowa for some time, all of whom are farmers. Farmers can earn credits by changing their tilling procedures which can sequester carbon in the soil. They had pretty much exhausted that market and

were looking to branch out into other areas and made a trip to East Texas. This was a real learning experience for many of us.

There is an organization called the Chicago Climate Exchange or CCX. The CCX has a system of rules that form the basis for calculating how much carbon an agricultural or forestry practice sequesters, or removes from the atmosphere. The price per ton is set daily in the Exchange by traders in a free market similar to the stock exchange. At the beginning, the price was about $1.00 per ton. It rose to about $4.00 by the time of the meeting in Nacogdoches, then fell back to less than $2.00. But as of now, the price is up to about $6.50 per ton which shows just how volatile and unpredictable this market is.

The money comes from a large number of corporations such as Ford, IBM, and Amtrac, just to name a few. These corporations have voluntarily set goals for themselves to reduce carbon emissions by 6% by the end of 2010. If one of these companies falls short of their goal, they can buy carbon credits from the CCX to offset the shortfall. It is worth noting that this program is voluntary and no one was required to participate.

The original pilot program for forest landowners in Texas and elsewhere was limited in scope and duration. It expires in 2010. They were only interested in signing up landowners that had converted open pasture land to trees since 1990. This made the calculations relatively simple. A well stocked loblolly pine plantation can be expected to sequester 1.51 tons of CO_2 in its first five years, 1.86 from age 5 to 10, 6.99 from age 10 to 15, and 6.17 from age 15 to 20. As an example, a landowner with a 12 year old plantation that was planted on open land could expect to receive $45.43 per acre per year at the current price level.

When the news of this program hit East Texas, some of the consulting foresters got busy and started forming co-operative groups to find potential landowners and sign them up. These groups are referred to as "aggregators". They sign up individual landowners and present a package of these to the CCX. The first package of submissions is almost completed and will be sent to the CCX very soon. Independent verification is a necessary component of this program. The Texas Forest Service (TFS) has been certified by the CCX to be the official "verifier" in Texas.

The pilot program is well under-way, and has evidently succeeded, so far, in the eyes of the CCX. They have already initiated a more advanced and long-term program. It is now possible to sign up land that has had timber on it, and is currently being managed for timber. Even hardwood forests are eligible under the new program. The rules and procedures are more complicated, but this opens up huge opportunities for landowners that have timberlands and are actively managing them.

Time will tell where this will lead, but the potential is undeniable.

NRCS
Natural Resources Conservation Service
United States Department of Agriculture

Farm Bill 2002

Fact Sheet

October 2004

Environmental Quality Incentives Program

Overview

The Environmental Quality Incentives Program (EQIP) is a voluntary program that provides assistance to farmers and ranchers who face threats to soil, water, air, and related natural resources on their land. Through EQIP, the Natural Resources Conservation Service (NRCS) provides assistance to agricultural producers in a manner that will promote agricultural production and environmental quality as compatible goals, optimize environmental benefits, and help farmers and ranchers meet Federal, State, Tribal, and local environmental requirements.

EQIP is reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill). Funding for EQIP comes from the Commodity Credit Corporation.

Benefits

Since EQIP began in 1997, USDA has entered into 117,625 contracts, enrolled more than 51.5 million acres into the program, and obligated nearly $1.08 billion to help producers advance stewardship on working agricultural land. These efforts have concentrated on improving water quality, conserving both ground and surface water, reducing soil erosion from cropland and forestland, and improving rangeland. EQIP also was used to improve riparian and aquatic areas, improve air quality, and address wildlife issues. The increased funding for EQIP in the 2002 Farm Bill greatly expands program availability for optimizing environmental benefits.

How EQIP Works

The objective of EQIP, optimize environmental benefits, is achieved through a process that begins with the definition of National priorities. The National priorities are:

- Reduction of non-point source pollution, such as nutrients, sediment, pesticides, or excess salinity in impaired watersheds, consistent with Total Maximum Daily Loads (TMDLs) where available, as well as reduction of groundwater contamination and conservation of ground and surface water resources;
- Reduction of emissions, such as particulate matter, nitrogen oxides (NOx), volatile organic compounds, and ozone precursors and depleters that contribute to air quality impairment violations of National Ambient Air Quality Standards;
- Reduction in soil erosion and sedimentation from unacceptable levels on agricultural land; and
- Promotion of at-risk species habitat conservation.

These priorities are used by the Chief of NRCS to allocate available EQIP funds to State Conservationists. The State Conservationist, with advice from the State Technical Committee, then identifies the priority natural resource concerns in the State that will be used to help guide which applicants are awarded EQIP assistance. After identifying the priority natural resource concerns, the State Conservationist, with advice from the State Technical Committee, decides how funds will be allocated, what practices will be offered, what the cost-share rates will be, the ranking process used to prioritize contracts, and which of these

authorities will be delegated to local level. The local designated conservationist, with the advice of local work groups, adapts the State program to the local conditions. As a result, EQIP can be different between states and even between counties.

The selection of eligible conservation practices and the development of a ranking process to evaluate applications are the final steps in the optimization process. Applications will be ranked based on a number of factors, including the environmental benefits and cost effectiveness of the proposal.

More information regarding State and local EQIP implementation can be found at http://www.nrcs.usda.gov/programs/eqip/EQIP_signup/2004_EQIP/2004_EQIP.html

New Provisions

The 2002 Farm Bill added EQIP funding for Ground and Surface Water Conservation (GSWC) which provides cost-share and incentive payments to producers where the assistance will result in a net savings in ground or surface water resources in the agricultural operation of the producer. In Fiscal Year (FY) 2002, eight states, considered high plains aquifer states, received funding (Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming). In FY 2003, in addition to the high plains aquifer states, eight western drought states (Arizona, California, Idaho, Montana, North Dakota, Oregon, Utah, and Washington) also received GSWC funding. GSWC provided $45 million for FY 2003. An additional $50 million was appropriated for fiscal years 2002-2007 to support use and installation of ground and surface water conservation practices in the Klamath River Basin, located on the Oregon and California state boundary.

Eligibility

Persons engaged in livestock or agricultural production are eligible for the program. Eligible land includes cropland, rangeland, pasture, private non-industrial forestland, and other farm or ranch lands. Persons interested in entering into a cost-share agreement with the U.S. Department of Agriculture (USDA) for EQIP assistance may file an application at any time. To be eligible to participate, applicants must:

- Be an agricultural producer;
- Be in compliance with the highly erodible land and wetland conservation provisions of the 1985 Farm Bill;
- Provide the Social Security number of all individuals who will benefit from the assistance; and
- Develop an EQIP plan of operations, including:
  - The participant's specific conservation and environmental objectives to be achieved;
  - One or more conservation practices in the conservation management system to be implemented to achieve the conservation and environmental objectives; and
  - The schedule for implementing the conservation practices.

If an EQIP plan of operations includes an animal waste storage or treatment facility, the participant must provide for the development and implementation of a comprehensive nutrient management plan.

NRCS works with the participant to develop the EQIP plan of operations. This plan becomes the basis of the cost-share agreement between NRCS and the participant. NRCS provides cost-share payments to landowners under these agreements that can be up to 10 years in duration.

The 2002 Farm Bill limits the total amount of cost-share and incentive payments paid to an individual or entity to an aggregate of $450,000, directly or indirectly, for all contracts entered into during fiscal years 2002 through 2007.

The Adjusted Gross Income provision of the 2002 Farm Bill impacts eligibility for EQIP and several other 2002 Farm Bill programs. Individuals or entities that have an average adjusted gross income exceeding $2.5 million for the three tax years immediately preceding the year the contract is approved are not eligible to receive program benefits or payments. However, an exemption is provided in cases where 75 percent of the adjusted gross income is derived from farming, ranching, or forestry operations.

Practice Payments

Cost-sharing may pay up to 75 percent of the costs of certain conservation practices, such as grassed waterways, filter strips, manure management facilities, capping abandoned wells, and other practices important to improving and maintaining the health of natural resources in the area. The EQIP cost-share rates for limited resource producers and beginning farmers and ranchers may be up to 90 percent. USDA has established a self-determination tool for applicants to determine eligibility as a limited resource producer. The tool can be found at: http://www.nrcs.usda.gov/programs/smlfarmer/tool.asp.

Incentive payments may be made to encourage a producer to perform land management practices, such as nutrient management, manure management, integrated pest management, irrigation water management, and wildlife habitat management. These payments may be provided for up to three years to encourage producers to carry out management practices that they otherwise might not implement.

How to Apply for EQIP

Applications may be obtained and filed at any time with your local USDA Service Center or conservation district office. Applications also may be obtained through USDA's e-gov Web site at: http://www.sc.egov.usda.gov. Enter "Natural Resources Conservation Service" in the Agency field, "Environmental Quality Incentives Program" in the Program Name field, and "CCC-1200" in the Form Number field. Applications also may be accepted by cooperating conservation partners approved or designated by NRCS.

Applications are accepted through a continuous sign-up process. The local decision makers periodically will announce a ranking date when applications received will be ranked.

For More Information

If you need more information about EQIP, please contact your local USDA Service Center, listed in the telephone book under U.S. Department of Agriculture, or your local conservation district. Information also is available on the World Wide Web at: http://www.nrcs.usda.gov/programs/farmbill/2002/

Visit USDA on the Web at: http://www.usda.gov/farmbill

Note: This is not intended to be a definitive interpretation of farm legislation. Rather, it is preliminary and may change as USDA develops implementing policies and procedures. Please check back for updates.

NRCS
Natural Resources Conservation Service
United States Department of Agriculture

Farm Bill 2002

Program Description

Environmental Quality Incentives Program

October 2004

Overview

The Environmental Quality Incentives Program (EQIP) is a voluntary program that provides assistance to farmers and ranchers who face threats to soil, water, air, and related natural resources on their land. Through EQIP, the Natural Resources Conservation Service (NRCS) provides assistance to agricultural producers in a manner that will promote agricultural production and environmental quality as compatible goals, optimize environmental benefits, and help farmers and ranchers meet Federal, State, Tribal, and local environmental requirements.

Authority

Section 1241 of the 1985 Food Security Act (16 U.S.C. 3841), as amended by the Farm Security and Rural Investment Act of 2002 (2002 Farm Bill), provides the funds, facilities, and authorities of the Commodity Credit Corporation (CCC) to NRCS for carrying out EQIP and working with landowners to implement conservation practices on their property.

Scope

EQIP is available in all 50 States, the Caribbean Area (Puerto Rico and the Virgin Islands), and the Pacific Basin Area (Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands).

New Provisions

The 2002 Farm Bill added EQIP funding for Ground and Surface Water Conservation (GSWC) which provides cost-share and incentive payments to producers where the assistance will result in a net savings in ground or surface water resources in the agricultural operation of the producer. In Fiscal Year (FY) 2002, eight states, considered high plains aquifer states, received funding (Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming). In FY 2003, in addition to the high plains aquifer states, eight western drought states (Arizona, California, Idaho, Montana, North Dakota, Oregon, Utah, and Washington) also received GSWC funding. GSWC provided $45 million for FY 2003. An additional $50 million was appropriated for fiscal years 2002-2007 to support use and installation of ground and surface water conservation practices in the Klamath River Basin, located on the Oregon and California state boundary.

Eligibility

Producers: Agricultural producers—individuals or entities engaged in livestock or agricultural production—may participate in EQIP. There are, however, circumstances that may limit an individual's or entity's participation; these include:

- Federal and State governments and their political subdivisions are not eligible.
- The applicant must be in compliance with highly erodible land and wetland conservation provisions.
- The adjusted gross income provision of the 2002 Farm Bill impacts eligibility for EQIP and several other 2002 Farm Bill programs. Individuals or entities that have an average adjusted gross income exceeding $2.5 million for the three tax years immediately preceding the year the contract is approved are not eligible to

receive program benefits or payments. However, an exemption is provided in cases where 75 percent of the adjusted gross income is derived from farming, ranching, or forestry operations.

- The 2002 Farm Bill limits the total amount of cost-share and incentive payments paid to an individual or entity to an aggregate of $450,000, directly or indirectly, for all contracts entered into during fiscal years 2002 through 2007.

  All individual producers, entities, or other applications with multiple beneficiaries must provide Social Security numbers at the time of application for purposes of monitoring payment limitations.

Land: Eligible land means land on which agricultural commodities or livestock are produced. This includes:

- Cropland;
- Rangeland;
- Grassland;
- Pasture land;
- Private, non-industrial forestland; and
- Other land determined to pose a serious threat to soil, air, water, or related resources.

How EQIP is Implemented in Your State

EQIP uses the locally led process to adapt National priorities to address local resource concerns and achieve its objective of optimizing environmental benefits. To accomplish this, EQIP uses a four-part process:

- Allocation of funds from the National level to State NRCS offices based on National priorities;
- Identification of State and local priority resource concerns and allocation from the State level to the local level using the National priorities as guidance;
- Selection of conservation practices and practice cost lists to address the priority resource concerns; and
- Development of a ranking process that prioritizes those applications that addresses the priority resource concerns in the most cost effective manner.

The State Conservationist and designated conservationist implement the locally led process for EQIP by considering the advice of the State Technical Committee and local work groups when making decisions about State and local priorities, practice cost lists, and ranking.

More information regarding State and local EQIP implementation can be found at: http://www.nrcs.usda.gov/programs/eqip/EQIP_signup/2004_EQIP/2004_EQIP.html

Eligible Practices and Cost-Share Rates

The State and local decision makers determine which conservation practices are eligible for EQIP assistance. Selected practices are those that address the identified resource concerns in a most cost effective manner.

Cost-sharing may pay up to 75 percent of the costs of certain conservation practices, such as grassed waterways, filter strips, manure management facilities, capping abandoned wells, and other practices important to improving and maintaining the health of natural resources in the area. The EQIP cost-share rates for limited resource producers and beginning farmers and ranchers may be up to 90 percent. USDA has established a self-determination tool for applicants to determine eligibility as a limited resource producer. The tool can be found at: http://www.nrcs.usda.gov/programs/smlfarmer/tool.asp.

Incentive payments may be made to encourage a producer to perform land management practices, such as nutrient management, manure management, integrated pest management, irrigation water management, and wildlife habitat management. These payments may be provided for up to three years to encourage producers to carry out

management practices that they otherwise might not implement.

Criteria Used to Evaluate Applications

Each State or locality develops a ranking system to prioritize the applications that will ensure EQIP will address priority natural resource concerns. The ranking process assists the State and local decision makers in determining which applications merit EQIP enrollment. The ranking systems developed are size neutral, meaning that the rank is not influenced by the size (whether large or small) of an operation.

Application Process

The EQIP application process consists of the following five steps:

1. A landowner submits an application to a local USDA Service Center, NRCS office, conservation district office, or office of a designated cooperating entity.

2. The NRCS State Conservationist or designee works with the applicant to develop an EQIP plan of operations.

3. The State Conservationist or designated conservationist ranks each application using the locally developed ranking process.

4. When funds are allocated, the State Conservationist or designated conservationist commits allocated funds to high ranking landowner offers and enters into contracts with selected participants.

5. Following contract signature by NRCS and the selected entity, funds are obligated to the project and the participant may begin to implement the EQIP plan of operations.

Standard Program Contracts

Once an applicant is selected, the participant works with the appropriate NRCS office to finalize and sign EQIP contracts, incorporating all EQIP requirements. An EQIP contract is the legal contract with which the NRCS establishes its relationship with the participant. The EQIP contract details the practices the producer will implement, when they will be implemented, and what level of assistance USDA will provide to the participant. The length of an EQIP contract is, at minimum, one year after the last scheduled practice is installed and may not exceed ten years.

For More Information

If you need more information about EQIP, please contact your local USDA Service Center, listed in the telephone book under U.S. Department of Agriculture, or your local conservation district. Information also is available on the World Wide Web at:
http://www.nrcs.usda.gov/programs/farmbill/2002/.

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TEXAS LAND CONSERVANCY

What is TLC?

- Land Trust - nonprofit conservation organization aimed to:
  - Assist landowners in conserving land
  - Participate in local conservation education
  - Offer land planning assistance

TEXAS LAND CONSERVANCY

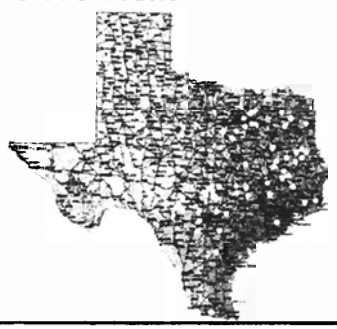
Our Mission

- Secure permanent protection of natural and unique landscapes
- Provide the public with outdoor opportunities
- Educate the public on environmental issues

TEXAS LAND CONSERVANCY

Where We Work

- 59 Easements
- 32 TLC Owned
- 54 Counties
- 51,114 Acres



TEXAS LAND CONSERVANCY

Why We Protect Land

- Prevent land fragmentation
- Provide ecological services
- Conserve open space
- Protect wildlife habitat

TEXAS LAND CONSERVANCY

Why Conservation Easements?

- Habitat Conservation
- Estate Planning
- Tax Benefits

TEXAS LAND CONSERVANCY

What is a Conservation Easement

- Legal agreement between a property owner and a "qualified entity" to limit type and amount of development on a property
- Allows landowner to maintain ownership while protecting land in perpetuity

TEXAS LAND CONSERVANCY

Conservation Easement History

- History
  - 1880's – First easements used (Boston)
  - 1891 – First regional land trust (New England)
  - 1930's – Used by the Federal Government
  - 1980's – Land trusts began forming and rise of CE
- California (198), Massachusetts, Connecticut, Pennsylvania, and New York

TEXAS LAND CONSERVANCY

Tax Code to Qualify

- Preservation of land areas for the general public
- Protection of a relatively natural wildlife habitat
- Open space preserved for the scenic enjoyment of the general public
- Preservation of a historically important land

TEXAS LAND CONSERVANCY

Conservation Easement Process

- Initial Discussion/ Site Visit
- Drafting an Easement
- Property Appraisal
- Baseline Documentation
- Monitoring/Endowments
- Executing the Easement

TEXAS LAND CONSERVANCY

Do's and Don'ts?

- Landowner can sell or pass to heirs
- Typically cannot subdivide
- Most allow for agriculture, hunting, outdoor recreation, and limited building
- Public does **not** have access

TEXAS LAND CONSERVANCY

Landowner Responsibilities

- Manage the land, consistent with the easement terms
- Pay property taxes
- Allow the land trust to monitor the easement
- Notify the land trust before transferring the land

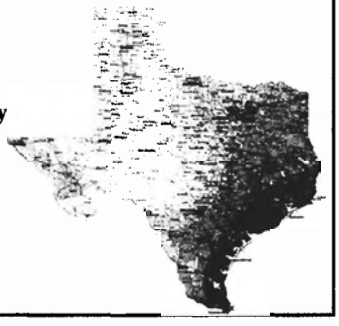
TEXAS LAND CONSERVANCY

Land Trust Responsibilities

- Monitoring yearly
- Easement administration and record keeping
- Enforcing the easement when necessary

TEXAS LAND CONSERVANCY

1.4 Million acres currently protected by land trusts in the state



TEXAS LAND CONSERVANCY

1.4 Million acres

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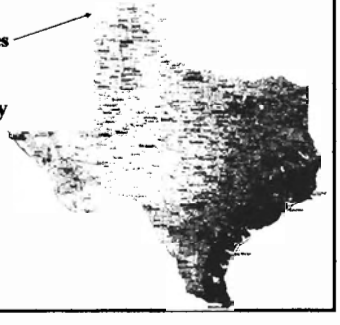

Speakers and Tour Leaders

BIOS OF SPEAKERS AND TOUR LEADERS

Jeff Abt, a longtime Nacogdoches resident and a big fan of horticulture at SFA, began his collegiate career at SFA in the College of Forestry. From there he answered a higher calling transferring to Dallas Baptist University and then to Southwestern Baptist Theological Seminary to become an Ordained Southern Baptist Minister. His studies at seminary helped prepare Jeff for the Latin and Greek he would use in his practice as a horticulturist, which he has been for over 20 years.

Jeff has written the gardening column for the Nacogdoches Daily Sentinel for the past 14 years, and his passion for photography has led to assignments for the Sentinel photographing news and sporting events. Jeff and his wife Leabeth share a profound love of literature, and his own writings can be found in numerous gardening magazines as well as historic journals. Most recently, Jeff decided to create his own neighborhood where he built three New Orleans style row houses and designed the landscaping to suit his tastes.

Charles Allen is a Research Associate with Colorado State stationed at Fort Polk, Louisiana. He is a retired Professor of Biology from the University of Louisiana at Monroe and a charter member of the Louisiana Native Plant Society (LNPS). He served as a President of LNPS from 1995-1997 and has organized and led many field trips throughout Louisiana. He is the coauthor of *Edible Plants of the Gulf South, Trees, Shrubs and Woody Vines of Louisiana* and *Grasses of Louisiana, 3rd edition*. He has presented *Edible and Useful Plants* to many groups.

Gail Barton is an award winning Horticulture instructor who has taught at Meridian Community College for over 25 years. She is an ISA Certified Arborist and a Licensed Landscape Gardener. She is President of the Mississippi Native Plant Society and former owner of Flowerplace Plant Farm, a retail mail order nursery specializing in native plants, perennials and tough old-fashioned flowers. She has spoken to many regional and state conferences and authored a gardening book called *Basic Gardening: A Guide for the Deep South*. She is a gardening columnist with a web site at www.gailbarton.com .
Gail Barton and her husband, Richard Lowery, live on 6 acres of land in Meridian, Mississippi. They have an intimate relationship with the land and enjoy exploring it with their pack of happy dogs.

John Boyette is the Nacogdoches District Forester for the Texas Forest Service. John is a graduate of Stephen F. Austin State University with a B.S.F in Forest Management in 1977 and a M.S.F. in Wood Science & Technology in 1980. He worked for 13 years for the TFS as a Wood Technologist at their Forest Products Laboratory before being transferred to his current position in Nacogdoches in 1993. John is a Certified Forester through the Society of American Foresters and a Certified Arborist through the International Society of Arboriculture. He is the recipient of the Director's Award for Technical Forestry from TFS, the Outstanding Tree Farm Inspector from Texas Forestry Association, and the Canopy Award for outstanding service as a Project Learning Tree facilitator. John's wife, Dr. Cheryl T. Boyette, is also a graduate forester from SFASU.

Mark Bronstad received a BS in Horticulture from SFA in 1989 and has been with Doremus Nursery, Warren, Texas, ever since. The nursery specializes in native plants of the Southeast, bamboo, as well as general nursery stock.

Paul Cox received both his BS and MS from Stephen F. Austin State University. He has worked at San Antonio Botanical Garden in various capacities for 30+ years. He is the senior author of *Texas Trees—A Friendly Guide* and *Macmillan's Wildflower Gardening.* He is also the father of five children ages 27 to 4.

Dr. Dave Creech, Regents Professor of Agriculture and Professor Emeritus, has been at Stephen F. Austin State University since September 1978. He is currently directs the activities of the SFA Mast Arboretum and is co-director of the Pineywoods Native Plant Center.

George M. Diggs, Jr. has been a faculty member in the Biology Department of Austin College since 1981 and is active in the College's Center for Environmental Studies. He was made a Research Associate at the Botanical Research Institute of Texas in 1994. His research specialties include the plants of Texas and tropical Latin America, and taxonomic studies on the Ericaceae (blueberry family). He has done fieldwork in Africa, Australia, Central and South America, Mexico, Canada, and the United States. He co-authored the *Illustrated Flora of North Central Texas* (1999) and the *Illustrated Flora of East Texas, Vol. I* (2006).

Bill Fontenot has dedicated his career in biology to restoring the ecological integrity in lands from the smallest urban gardens to the largest wildlife management areas since 1986

Fontenot's desire to alternate school semesters with jobs led him in and out of an intriguing array of establishments, from bars and cafes to research labs, supply ships, and oilrigs. In 1980, he received his M.S. in freshwater fish ecology from the University of Louisiana at Monroe. In 1986 he began his career with Lafayette Parish Municipal Government, working first as curator of natural sciences at the Lafayette Natural History Museum, then as manager of the Acadiana Park Nature Center, where he where he retired in 2008. Since 1987, he and wife Lydia have also operated Prairie Basse, a wildlife/native/heirloom plant nursery, design, and ecological consulting business.

As a professional naturalist, he has led thousands of guided tours, and has lectured at dozens of universities, botanic gardens, arboretums, and other research institutions from Austin to Atlanta and north to New York. He serves as a member of the Louisiana Nature Conservancy's Technical Advisory Board and as Past President of the Louisiana Native Plant Society and the Louisiana Ornithological Society, past member of the Louisiana Bird Records Committee, past Director of the Gulf Coast Native Plant Conference, and past Program Director for the Cullowhee, NC Landscaping With Native Plants Conference. He has published over 1000 natural history-related articles in various newspapers, magazines, and scientific journals. To date, he has also authored/coauthored several award-winning publications, along with four books: Native Gardening in the South (1992), A Cajun Prairie Restoration Chronicle (1995), Gulf Coast Birds (2001), and Louisiana Birdwatching (2003).

In 2001, Fontenot was honored in receiving the Louisiana Wildlife Federation's ***Professional Conservationist of the Year*** award.

Heinz Gaylord is a retired Professor of Psychology at Stephen F. Austin State University. He has memberships and strong interests in a variety of environmental and nature-oriented organizations such as the North American and Gulf State Mycological Societies, Native Plant Society of Texas, Audubon Societies at the national, state, and local levels, Texas Conservation Alliance and Texas Land Conservancy. He is a land steward for several TLC preserves including Ivy Payne Wildlife Refuge in Elkhart, Texas.

William Godwin's family has lived in Wood County and Van Zandt County for six generations. He grew-up in Mineola, Texas and graduated from SFA in 1992. He received the PhD in entomology from Texas A&M in 2002 after studying coevolution between dung beetles and their pocket gopher hosts. Since 2003, he has worked at SFA teaching ecology, mammalogy and managing the William W. Gibson Entomarium, which is the only large public collection of invertebrates in East Texas. In 2003, he discovered the endangered American burying beetle in East Texas and has spent summers conducting surveys for this rare species. He also volunteers as adjunct curator of entomology at the Houston Museum of Natural Science.

Greg Grant is Research Associate at the SFA Pineywoods Native Plant Center in Nacogdoches, Texas. He has degrees in floriculture and horticulture, both from Texas A&M University and has attended post-graduate classes at Louisiana State University, North Carolina State University (under the late J.C. Raulston), and Stephen F. Austin State University. He has experience as a horticulturist at Mercer Arboretum and San Antonio Botanical Gardens, an instructor at Stephen F. Austin and Louisiana State Universities, an award-winning horticulturist with the Texas Agricultural Extension Service, director of research and development at Lone Star Growers, and with the Antique Rose Emporium.

Greg has introduced a number of successful new plants to the Texas nursery industry including: Blue Princess and Pinwheel Princess verbenas, Texas Maroon bluebonnet, Gold Star esperanza, Laura Bush and VIP petunias, John Fannick phlox, Stars and Stripes pentas, Pam's Pink honeysuckle, LeCompte and Salinas pink vitex, Henry and Augusta Deulberg sages, Helen Fredel crossvine, Pam Puryear and Big Momma Turk's cap, and the Marie Daly and Nacogdoches roses.

He has traveled extensively to hundreds of botanical gardens throughout the United States and Europe and is a popular and entertaining speaker. He is a graduate of the Benz School of Floral Design, a member of the Garden Writers Association of America, and a lifetime member of The Native Plant Society of Texas, The Big Thicket Association and The Southern Garden History Society. His garden and farm have been featured in a number of books and periodicals including *Texas Gardener, Woman's Day*, and *The Dallas Morning News*.

Greg, who is the seventh generation in his family to live in nearby Shelby County, resides in his great-grandparent's recently restored dogtrot house. He tends to his terriers (Rosie and Molly), chickens, a forest full of *Trillium recurvatum,* and over 100 bluebird boxes.

Jackie Emanis Grant was born in Arcadia, Texas and is a descendant of early Spanish settlers in East Texas and western Louisiana. She has long been a fan of the outdoors and is active in the Center Garden Club, particularly in children's environmental education. She also serves as a volunteer at the Pineywoods Native Plant Center where she helps with the Go Wild program. She is Greg Grant's mother and is an accomplished cook and seamstress. She received her BS from Stephen F. Austin State University where she was in the band and has attended the Benz School of Floral Design at Texas A&M University. She has a particular interest in home grown and native cut materials. She gardens and resides on a ranch in the Arcadia Community in Shelby County.

Eric Keith received his Bachelor of Science degree in Environmental Science from Stephen F. Austin State University in 1995. He has 13 years experience in natural resource management, consultation, and planning, including the areas of endangered species, ecological classification and assessments, plant identification and taxonomy, wetland regulations, and environmental compliance. After graduation, Eric worked three years at the environmental as a wildlife biologist and botanist intern. Since then he has worked at as a Project Manager at the environmental consulting company, Raven Environmental Services, Inc, in Huntsville, Texas.

Dr. James Kroll has a BS and MS in Biology from Baylor University. He went on to receive his doctorate from A & M University. Dr. Kroll has been with the College of Forestry at Stephen F. Austin State University since 1973. In 1975, he founded the Institute for White-tailed Deer Management and Research. He co-founded the Pineywoods Native Plant Center with Dr. David Creech; and in 1997, Kroll founded the Forest Resources Institute. He is currently Director, Columbia Regional Geospatial Service Center, Director, Forest Resources Institute, Professor of Forest Wildlife, Director, Institute f or White-tailed Deer Management and Research, and Co-Director, Pineywoods Native Plant Center.

Dr. Kroll has authored more than 200 technical and popular articles, has authored 10 books, and has produced videos for NBC, TNN, and the HSE networks, as well as a video management series. He currently contributes to more than 38 different magazines including North American Whitetail, Deer and Deer Hunting, Journal of the Texas Trophy Hunter, Texas Parks and Wildlife Magazine, American Hunter, and Texas Sportsman. Annually, he speaks to several thousand hunters and landowners on aspects of producing and harvesting whitetails.

Dr. Kroll has served on the Board of Directors for the Texas Wildlife Association, Sportsman's Conservationists of Texas, Texas Forestry Association, and the Texas System of Natural Areas. He currently serves on the board and as president of the Texas Deer Association.

Kristin Lamberson is the Interpretive Gardens Specialist at Strawberry Plains Audubon

Center in Holly Springs, Mississippi. She has worked on staff at Strawberry Plains for over 5 years, prior to that she served there as a volunteer while employed by Morgreen Nursery in Collierville, Tennessee. She steals her landscape design ideas from nature, which is also her source of solace, learning and joy! "By allowing the wild into our life through the venue of the home landscape, we give ourselves the opportunity to experience magnificence in the small and grandeur in the common, enabling our souls to sing."

Joe Liggio is the author of *The Wild Orchids of Texas* by the University of Texas Press. Joe received a BS in 1972 from Sam Houston State University in Biology and a MS from the University of Houston in Environmental Science. He is now working as a natural resource specialist with the Texas Department of Transportation.

Zoe Kirkpatrick. I call Lubbock, TX. my hometown. I am a graduate of Texas Tech University and a former Miss Lubbock. I met my husband, Jack, when we were freshmen at Tech. He was quarterback on the football team and a calf roper on the Rodeo team at Tech. I was on the women's fencing team. Fifty years later (in 2003), we petitioned Texas Tech and were finally officially recognized as the first female athletes to represent Texas Tech in intercollegiate competition. At that time we were awarded (at a women's basketball game) our Double T letters like football and basketball players, track athletes, etc. have always received. Jack and I married following our Sophomore year at Tech. After graduation, we moved to his family ranch near Post, TX. where we reared our five sons. We now have four lovely daughters-in-law and nine grandchildren. I began photographing wildflowers in the early 1960's. A personal wildflower library slowly evolved as my collection of slides grew. By the 1970's, I was presenting slide programs to various clubs and groups as well as conducting "wildflower walks" for schoolchildren. Through the years, I was encouraged to put the collection of wildflowers in a book but it took until 1985 to gather the courage to try and write it down. After seven years, my book, Wildflowers of the Western Plains, finally became a reality in 1992. It is rewarding to me that after all these years, I am still asked to share my programs with schoolchildren and adults alike. The book is presently in a third printing and doing well.

I consider myself a naturalist; therefore, my interests and hobbies are many and varied. Among them are archeology and paleontology. Because of my interest in paleontology and working with Dr. Sankar Chatterjee at Texas Tech, he chose to name a 200 million year old carnivorous reptile after me (*Postosuchus kirkpatricki*). What an honor! Of course, photography is another interest that has included "shooting" not only wildflowers, but also animals, wildlife, sports events, professional and amateur models. Dancing and choreography have been life-long interests as have swimming and diving, which I taught for many summers as an American Red Cross volunteer. Being a student of Native American lore, I prize my unique tipi, a buffalo skin rug and large arrowhead collection.

Dr. Ernest Ledger received his B.S. degree from SFA in 1970 in chemistry. He earned his M.S. and Ph.D. degrees in geology from Texas A&M University and returned to SFA in 1981. Dr. Ledger teaches Introductory Geology, Mineralogy, Geochemistry, Ground Water and Hydrogeology, and X-Ray Diffractometry (including clay minerals). His research interests include quantitative rock analysis, natural radioactivity, geochemistry, and ground

water quality. He is a member of the American Association of Petroleum Geologists (and a charter member of the Division of Environmental Geosciences) and the Clay Minerals Society. His hobbies include gardening and restoring old tractors.

Barney Lipscomb is the Assistant Director: Administration, Head of Library, Head of Press at the Botanical Research Institute of Texas. Barney is one of three authors of *Shinner's and Mahler's Illustrated Flora of North Central Texas* and the *Illustrated Flora of East Texas*. Barney serves on the Board of Consultants for the North Texas Poison Center in Dallas, and has research interests in the application of botany to forensic science. As editor of Sida, Contributions to Botany as well as Sida, Botanical Miscellany, Barney plays an integral role in disseminating some of the results of the BRIT research staff in our internationally distributed, peer-reviewed journals. Barney's personal taxonomic specialty is the family Cyperaceae. Barney has carried out fieldwork in various parts of the U.S., Mexico, and Central America. He is also representative to the Council of Botanical and Horticultural Libraries (CBHL).

Peter Loos is the owner/operator of Ecovirons, located in Chireno, Texas. He is a botanist by love, a horticulturist by trade, and a plant ecologist in his spare time. His professional experiences in various fields of the horticulture industry as well as his MS from SFASU have greatly contributed to his extensive knowledge of Gulf Coast native plants and related ecological issues. He is unyielding in his promotion of bio-diversity throughout our environment and is an active member of numerous organizations.

Jan Midgley is the owner of Wildflower, a nursery selling native herbaceous perennials and ferns. She is the author of *Nursery Sources of Native Plants of the Southeastern United States*, 1993, *Southeastern Wildflowers*, 1999 (currently available in 7 state versions) and *Native Plant Propagation*, 2006. She is a Past Director of the Cullowhee Native Plant Conference held in Cullowhee, North Carolina each July. She lectures and writes about the cultivation and propagation of native plants. Jan has been gardening with native plants for thirty-five years, challenged by soils and weather in Missouri, Michigan, Maryland and Alabama. She holds a BSN from the University of Missouri and a MSN from the University of Michigan.
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George Morris has a Bachelor of Arts degree in plant science from the University of Delaware. His previous experiences include Groundskeeper at Mt. Cuba Center for the Study of Piedmont Flora, Superintendent of Grounds at Davidson College, owner of Landscape Sanctuaries, a landscape company specializing in the use of native plants in the landscape, and Environmental Scientist for Habitat Assessment and Restoration Program (HARP), a habitat restoration firm in Charlotte NC. He is currently the Botanist/Vegetation Specialist for River Works, Inc., a stream restoration construction firm based in Cary, NC.

Jim Neal works for the U.S. Fish & Wildlife Service as a Migratory Bird Management Specialist. He serves on the USFWS Ivory-billed Woodpecker Recovery Team, Habitat Committee.

Glenn Olsen has had a passionate interest in nature, especially birds, since early childhood. He has been involved with organized birding and conservation efforts in Texas since 1988. In addition to bird identification, he has a special interest—and continues his studies—in the relationships of plants, birds, butterflies, and other insects. As a member of the Houston Audubon Society, he has served as vice president of education and is an instructor for Audubon's Birding Classes. Glenn also teaches nature related Classes at Rice University in the Continuing Studies Department, Mercer Arboretum and Botanic Gardens, and the Houston Arboretum and Nature Center.
Since1993, he has been actively involved with the Native Plant Society of Texas and has served as State President. Glenn has been and continues to be involved with various birding, habitat, and native plant projects with many different organizations.
Through his private tour company, he leads birding and nature tours for groups and individuals. Glenn supports the conservation of habitat and educational programs about birds through memberships in the American Birding Association, Houston Audubon Society, Gulf Coast Bird Observatory, Texas Ornithological Society, Houston Ornithology Group, and the Native Plant Society of Texas among others. Contact Glenn at h.glenn.olsen@gmail.com or 281.345.4151.

Thomas Philipps graduated from The University of Akron, Akron, Ohio with a BS with an area of specialization in botany. He is currently the Forest Botanist/Invasive Species Program Manager, USDA Forest Service, National Forests and Grasslands in Texas. He is also a member of the USDA Forest Service Region 8 Task Force-Non native Invasive Species and a member of the Texas Invasive Pest Plant Council.

Al Schmidt is District Conservationist with the USDA Natural Resources Conservation Service in Nacogdoches County. In this position, he works with local agricultural landowners on natural resource issues. The NRCS provides technical assistance to landowners to assist landowners manage and improve the use of their land to protect soil, water, and plant resources. He has been employed with the NRCS for 25 years and in Nacogdoches since 1989.

Al graduated in 1984 with a degree in Forestry and Soils from Stephen F. Austin State University. He is married to Nola and they have three children – Chris who is currently serving in the US Army, Jennifer, who is a sophomore at SFA, and David who is a senior at Nacogdoches High School.

Cliff Shackelford is a 4th generation Texan and was born in Dallas. He started bird watching there in the late 70's at the early age of nine. He holds both a B.S. and an M.S. degree in biology with an emphasis in avian ecology from Stephen F. Austin State University in Nacogdoches. His Master's thesis dealt with the habitat characteristics of five species of eastern Texas woodpeckers. Cliff has statewide duties as the Nongame Ornithologist for the Wildlife Diversity Program at the Texas Parks and Wildlife Department where he has been employed since 1997. One of his many duties is the coordination of the state Partners in Flight Program.

Cliff is the first author of the book *Hummingbirds of Texas* that was published in September 2005 by Texas A&M University Press. It has been a big seller for the Press. He was also first author of the Red-bellied Woodpecker Species Account published in 2000 for the Birds of North America Project. Due to his interest and contributions to our knowledge of woodpecker ecology, he was appointed to the National Recovery Team on the Ivory-billed Woodpecker by the U.S. Fish & Wildlife Service in 2005. He has authored over 50 publications on birds and birding. Over a dozen of these are peer-reviewed papers mainly on woodpeckers, raptors, and migratory land birds in journals like The Wilson Bulletin, The Journal of Raptor Research, The Southwestern Naturalist, the Bulletin of the Texas Ornithological Society, and more. His travels have taken him throughout the Western Hemisphere where collectively he has spent 6 months birding in seven different Latin American countries.

He and his wife, Julie, and their two children, Alex & Robin, live in Nacogdoches. They also have a busy "garage hobby" of building screech owl boxes known as *Owl Shacks*. Over the last several years, they have built and distributed hundreds of these *Owl Shacks* to folks across Texas and nearly two dozen other states.

Julie Shackelford has been with The Conservation Fund since 2004, working on land protection projects up and down the Neches River. She moved from Austin to Nacogdoches in August 2007 to open The Conservation Fund's East Texas office. Previously, Julie was the Regional Director of American Farmland Trust's Texas office from 1999 to 2003. She was the State Wetlands Planner at Texas Parks and Wildlife Department in Austin from 1994 to 1999. Julie is a 1998 National Wetlands Award recipient. She received and undergraduate degree in biology from Carleton College, Northfield, MN and a Masters Degree from Duke University's School of Forestry and Environmental Studies. Julie and her husband Cliff have two young children.

Larry Shelton has owned and operated Osage Woodworks, a custom woodworking business since 1984. Shelton is a naturalist who has been guiding interpretive nature walks since 1985. He has also been closely involved with citizen conservation groups such as the Texas Conservation Alliance and the Sierra Club, working on forest management and other resource conservation issues for over 20 years. Shelton has been the head of the stewardship committee for Naconiche Creek/Grass Lake preserves in Nacogdoches County since 1990.

Mark Steinbach is the executive director of the Texas Land Conservancy.

Dawn Stover is a Research Associate with the SFA Mast Arboretum in Nacogdoches, Texas. She earned a BS in biology from West Texas A&M in 1996, and an MS in Agriculture from Stephen F. Austin State University in 1999. Her initial horticulture experience began at Treesearch Farms in Houston. From there she entered graduate school at SFA and continued her horticultural experience in the Forestry Department with Dr. Shiyou Li's *Camptotheca acuminata* research project and later with the Agriculture Department at the SFA Mast Arboretum.

Mrs. Stover currently maintains the living plant collection within the SFA Mast Arboretum. Current research includes work with *Gaillardia aestivalis* var. *winkleri*, *Tricyrtis* species, *Farfugium japonicum*, as well as hardiness trials for many tropicals and gingers. She is responsible for maintenance of the Arboretum and the horticulture greenhouse facilities. She is responsible for two annual plant sales to raise money for the Arboretum, as well as coordinating student workers and volunteers. Very often, she can be found teaching labs for horticulture students, working with volunteers, or lecturing to a wide variety of gardening enthusiasts. She works closely with the horticulture industry as well as the public.

James Van Kley came to SFA in the fall of 1993 from West Lafayette Indiana, where he completed a Ph.D. in Forest ecology at Purdue University. He is originally from Grand Rapids, Michigan. He received his B.S. degree from Calvin College (Grand Rapids MI), and his M.S. degree from Central Michigan University (Mt Pleasant, MI).

Current research includes the development of an ecological classification system for the National Forests in Texas and Louisiana, analysis of portions of the Dutch National vegetation Database in collaboration with colleagues at the Alterra Institute for Green World Research in the Netherlands, and analysis and monitoring of the wetland plant communities of Caddo Lake in northeastern Texas. For more information of Dr. Van Kley's research, visit his research website.

Dr. Van Kley is also curator of the ASTC Herbarium at SFA, which includes more than 77,000 specimens

Caroline E. Vidrine completed high school in May 2008. She is coauthor of two papers, one on the Cajun Prairie Gardens and the other on the mussels of rivers of the Cajun Prairie. Caroline is a student at Louisiana State University at Eunice, where she is majoring in Forestry. She can literally say that she has been working with prairie restoration since the day she was born.

Malcolm F. Vidrine, PhD has been Professor of Biology at Louisiana State University at Eunice for 24 years. He is an aquatic ecologist with major research interests in freshwater mollusks and their parasites, especially water-mites belonging to the genus *Unionicola*.

Dr. Vidrine is creator and co-owner of the Cajun Prairie Gardens—a horticultural initiative at landscaping rural residential lots. Central emphasis of the gardens is the development of an insect garden—a garden for the conservation of insects. He is also co-developer of the Cajun Prairie Restoration Project in Eunice and the Prairie Restoration Project at LSUE. The central emphasis of the projects is the restoration of native prairie with local flora.

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