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The Cajun Prairie Restoration Project

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The Cajun Prairie is that part of the coastal tallgrass prairie found in southwestern Louisiana. With less than 40 ha remaining of the original 1,000,000 ha, it is possibly the most imperiled ecosystem in North America. A restoration project was initiated to see if prairie restoration techniques used elsewhere could be successfully employed in southwestern Louisiana. In 1988, restoration of 4 ha began in the city of Eunice. Seeds were hand-collected from local railroad prairie remnants. Seeds were broadcast following site preparation. Additional plants were propagated in containers from roots, stems, and seeds and then transplanted. Sods were removed from remnants to protect plants and to inoculate the site with the soil biota of native prairie. Prescribed winter burns of the site were conducted annually. In a 1995 census, more than 250 species of prairie plants were established. In a 2000 census, aggressive, early succession plants (native and exotic) had disappeared. In 2000, diameters of clumps of colonial prairie plant species were measured; average annual increase ranged from 8.3 cm to 91.3 cm. This experimental restoration project demonstrates that restoration of Cajun prairie is feasible. The project is an important repository for locally adapted prairie ecotypes and a model for other restoration efforts being attempted.

INDEX DESCRIPTORS: Cajun Prairie, tallgrass prairie, prairie restoration, Louisiana.

The western Gulf of Mexico coastal plain is known for its diverse habitats and wildflowers (Brown 1972, Ajilvsgi 1979, and Tveten and Tveten 1993). The region is characterized by marshes, prairies, savannas, bottomland hardwood, and upland pine forests. A major feature is the coastal tallgrass prairie (Allain et al. 1999, Smeins et al. 1992). The Cajun Prairie is part of the coastal tallgrass prairie found in southwestern Louisiana (Allen and Vidrine 1989, Allain and Johnson 1997, Allain et al. 1999 Allain and Castille 2000). Cajun Prairie annual rainfall frequently exceeds 1.25 m. Short winters and long summers expand current concepts of North American prairie. Several plant species occur in this prairie that do not occur in prairies elsewhere. Less than 40 ha of the 1,000,000 ha of presettlement prairie in southwestern Louisiana remain, making Cajun Prairie one of the most imperiled ecosystems in North America (Allain and Johnson 1997). The remaining prairie exists primarily as remnants along railroad rights-of-way, each sustaining its own assortment of native plants and animals and each surviving a variety of assaults. In a period of only five yrs, from 1995 to 2000, remnant area has been halved. Despite the scarcity of this ecosystem, our surveys of these remnants uncovered more than 600 species of plants and hundreds of insect species (Allen and Vidrine 1990, Vidrine and Allen 1993, Allain and Castille 2000). A restoration project was initiated to see if prairie restoration techniques used elsewhere could be successfully employed in southwestern Louisiana.

METHODS

In 1988, the city of Eunice, Louisiana leased a 4 hectare lot from Union Pacific Railroad for the purpose of reconstructing prairie in the city limits of Eunice (The Cajun Prairie Restoration Project). Also, the Cajun Prairie Habitat Preservation Society was created to preserve and restore this ecosystem. A number of local agencies cooperated in this effort (Allen and Vidrine 1989, Vidrine et al. 1995). In September, 1988, the site was mowed and herbicided with glyphosphate. After plant senescence, a prescribed burn was conducted to remove biomass.

In the fall of 1988, seeds were collected from local prairie remnants along railroad rights-of-way. Most of the seeds were collected by students from local schools and clubs. The seeds were stored dry at 4°C until the day of planting but received no other treatment. Since most of the seeds were collected during the autumn, the majority of the seeds were from summer and autumn bloomers. Sod was rescued from remnants in danger of destruction by hand digging. Plants were propagated in containers from cuttings and seeds.

On 9 December 1988, the seeds were distributed by hand by the individual who had collected them producing a heterogeneous distribution. The area was then harrowed in order to work the seeds into the soil. The following two winters, hand-collected seed was sown into bare areas. At the same times, plants grown in containers and sods from remnants were transplanted into sites that were selected based upon soil moisture patterns. The sods added additional species as well as inoculated the soil at the site with the soil biota of the native prairie.

Burns were conducted annually beginning in 1989. Minimal weeding was done. Removal of Chinese tallow trees (*Sapium sabifera*) is proving to be the greatest obstacle, requiring a tremendous amount of time. Tallow trees initially invade wet areas where there is often little fuel. They also invade disturbed areas in prairie. At only three to five yrs of age they suppress fuel and are no longer controlled by fire (Grace 1998). If the trees are left to grow, they are

Table 1. Plant species suitable for use in planting matrix for prairie restoration in Louisiana. In some cases, several species in a genus are listed as a single entry and separated by a front-slash. An asterisk indicates aggressive colonizers.

Grasses:
Andropogon gerardii
Panicum virgatum
Paspalum plicatulum
*Schizachyrium scoparium**
Sorghastrum nutans
Tripsacum dactyloides
Forbs:
Arnoglossum ovatum
*Aster concolor/hemisphericus/patens**
*Baptisia alba/bracteata/nutalliana/sphaerocarpa**
*Bidens aristosa**
*Chamaecrista fasciculate**
Coreopsis lanceolata/pubescens/tripteris
*Eryngium yuccifolium**
*Euthamia leptocephla/tenuifolium**
*Gaura lindheimeri**
*Helianthus angustifolius/mollis**
*Lespedeza capitata/virginica**
Liatris acedota/squarosa
*Liatris pycnostachya/spicata**
*Monarda fistulosa/lindheimeri/punctata**
Pityopsis graminifolia
*Pycnanthemum tenuifolium**
*Rudbeckia hirta**
Silphium gracile/lacinatum
Solidago nitida/odora/rugosa
*Tephrosia onobrychoides**

very difficult to eradicate. Birds eat their seeds and disperse them in their droppings, providing ample opportunity for this invasive weed to get established (Grace 1998).

The project was evaluated by conducting a census in 1995 and again in 2000. Relative abundance of plant species was determined from observation and analysis of photographs. Also, in 2000, diameters of clumps of colonial prairie plant species were measured along their greatest axes. Average annual increase in clump diameter was determined for six species (four grasses and two forbs).

RESULTS

The 1995 census estimated that half of the site was dominated by native prairie plants (Vidrine et al. 1995). More than 250 plant species of the nearly 600 known from nearby remnants were established. Remaining portions of the site, most at lower elevations, succumbed to exotic vegetation, primarily the Chinese tallow tree. Exotic species that became established at higher elevations were eventually excluded from the site. General evaluations in 1995 and 2000 demonstrated that succession was occurring. A number of aggressive, early succession natives were either no longer evident or greatly reduced. Some of these included: *Agalinis* spp., *Ambrosia* spp., *Aster praealtus, Bidens aristosa, Croton capitatus, Chamescrista fasciculata, Erigeron philadelphicus, Eupatorium* spp., *Euthamia* spp., *Helianthus angustifolius, Ipomoea* spp., *Passiflora incarnata, Ranunculus* spp., *Senecio glabellus,* and *Solidago canadensis* (Vidrine et al. 1995 and 2000, Allen 2000). Exotics that were excluded from well-drained sites include *Verbena brasiliensis* and *Paspalum urvillei* (Vidrine et al. 1995 and 2000, Allen 2000).

Several new species have appeared and flowered in the last five yrs including *Asclepias longifolia, Asclepias obovata, Ctenium aromaticum,* and *Pteroglossaspis ecristata.* Due to the isolation of the site, these conservative species are thought to have been present either in the original seed mix or in the sod. However, germination and/or flowering was delayed.

Borsari and Vidrine (1997) examined the clump-size increase in six major species of plants in the site. These clumps were again evaluated in 2000, and the resulting data are summarized in Table 2. Ten growing seasons have been completed since the original sods were placed at the site. No fertilizer, watering, or other intervention other than fire have affected the plants to our knowledge. The results clearly depict that the sod-forming plants that appear as clumps can be readily examined and measured. The larger clumps have disintegrated in their centers, and numerous other native plants are now growing in and among the separate sprouts. Of the measured species, the fastest growing grass was *Tripsacum dactyloides* (eastern gama grass) with an average annual increase of 15.6 cm. The fastest growing forb was *Pycnanthemum muticum* (mountain mint) with an average annual increase of 91.3 cm. The slowest growing grasses were *Andropogon gerardii* (big bluestem) and *Sorghastrum nutans* (Indiangrass) with average annual increases of 8.3 and 8.4 cm, respectively. All six species appeared to increase in diameter continuously; thus, measurements were confined to plants with this life history strategy. In contrast many other species, e.g., *Coreopsis lanceolata* (lanceleaf tickseed), *Schizachyrium scoparium* (little bluestem), and *Schizachyrium tenerum* (slender bluestem), formed distinctive clumps of a limited size. Recruitment by seed may be more important for these species. The two life history strategies are obviously important in the overall restoration process as evidenced by events in plant succession at the site.

DISCUSSION

Successful establishment of a diverse perennial prairie community on the well-drained portion of this site clearly demonstrated that

Table 2. Clump-size estimates for six major matrix plants at the Cajun Prairie Restoration Project in Eunice, Louisiana. The diameters for the initial sod plugs were estimated in 1989 as they were planted. In 2000, the mean and standard deviation of the clumps for each species, the range of diameters measured, and the average increase in diameter per year of growth for each species are provided. The number is the number of clumps measured; all other measurements are in centimeters.

Species	Number	1989	2000	2000	Average
Andropogon gerardii	34	20	103 ± 29	58–194	8.3
Sorghastrum nutans	9	20	104 ± 37	53–180	8.4
Panicum virgatum	26	20	145 ± 33	67–200	12.5
Tripsacum dactyloides	15	20	176 ± 32	120–240	15.6
Pycnanthemum muticum	7	20	933 ± 269	660–1400	91.3
Helianthus mollis	24	20	332 ± 88	190–520	31.1

restoration of Cajun Prairie is feasible. However, it appeared that determining site suitability and matching species to site conditions are critical parts of restoration planning (Allain and Castille 2000). Most exotic and early succession plant species have been displaced as succession occurs in the restoration (Allen 2000, Vidrine et al. 2000). After six yrs, insect diversity in the restoration site resembled that of remnant prairies (Allen and Vidrine 1990, Vidrine and Borsari 1999). This indicated that, to some extent, ecosystem complexity was recovering.

The process of planting prairies involves both the selection of plants and the proper placement of plants in the site. An initial planting of seeds of native species that rapidly colonize cultivated restoration sites is referred to as a restoration matrix (Betz 1986). These early succession species facilitate future colonization of the site by conservative prairie plant species typical of later successional seres (McClain 1997). Table 1 provides a list of Cajun Prairie matrix species for future prairie restorations in southwestern Louisiana. These native plant species were very successful during the first 10 yrs of restoration in Eunice. Some of these species have already disappeared from the restoration project in Eunice. An alternate model for restoration involves simultaneously sowing seeds of both early succession and conservative, late succession species (Schramm 1990). This latter method hypothesizes that the more conservative species will germinate by successfully competing with the early successional species after the site has matured. Further, this latter hypothesis contends that conservative species cannot be successfully introduced into a perennial matrix that excludes newcomers.

Either of the two methods or a combination of these strategies is recommended for future research avenues in the search for better methods of restoring prairies in Louisiana.

The Cajun Prairie Restoration Project provides a model for other restoration efforts in southwestern Louisiana. One of the greatest drawbacks for further projects is the availability of local seeds and propagules of native plants. Because there are no remnant prairies in Louisiana being preserved, the importance of restorations as reservoirs of locally adapted ecotypes is immeasurable. Remnants are rarely burned, facilitating the rapid spread of Chinese tallow, a great cause for alarm (Grace 1998).

The Cajun Prairie Restoration Project provides a habitat for the development of a diverse and dynamic biological community. The project has provided opportunities for varied kinds of research. Borsari and Shirley (1993) examined the soil profiles after only three yrs into the restoration process of development and clearly demonstrated an accumulation of organic matter in the restoration site. This evidence indicates the impact that the prairie plants have upon soils in maintaining and generating soil fertility nutrients. Vidrine and Borsari (1998 and1999) developed philosophical models for agriculture and for integrated pest management using Cajun Prairie vis-à-vis the Cajun Prairie Restoration Project for small farms and landscapes. The development of diverse insect and arachnid communities is obvious in the restoration site (Allain and Johnson unpubl. data, Vidrine and Allen 1993).

The paradigm of restoring habitat was developed by Aldo Leopold (Leopold 1949, 1999), and we continue this paradigm. However, there is a great need for more and larger projects, from gardens to farms to landscape scale restorations (Vidrine and Borsari 1998 and 1999, Jackson 1999, Vidrine et al. 1999a, b, and c, Semar and Vidrine 2000). This experimental project demonstrates that restoration of Cajun prairie is feasible. The project is an important repository for locally adapted prairie ecotypes and a model for other restoration efforts being attempted. Additional studies are critical if restoration and maintenance of this valuable community are to be succesful.

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