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Texas Chapter of the
Society for Ecological Restoration

15th ANNUAL CONFERENCE

November 5 – 7, 2010
Camp Tyler
15143 Camp Tyler Road
Whitehouse, Texas 75791

RESTORATION IN FORESTS & WOODLANDS

PROGRAM NOTES

Keynote Address by

Dr. Dave Creech
Regent's Professor
Stephen F. Austin State University
Nacogdoches, Texas

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Texas Chapter of the Society for Ecological Restoration

2010 Conference Schedule

Saturday, November 6, 2010

6:30 - 7:30	**Breakfast**	
8:00	Welcome and Announcements	Chris Best
8:15	**Keynote Address** – To Be Announced	Dr Dave Creech
9:15	Trail Design in Sensitive Landscapes	Michelle Bertelsen
9:30	Upland Mixed Pine-Hardwood Forest Restoration in Tyler State Park	Kay Jenkins
9:55 - 10:15	**Break**	
10:15	Compost for Restoration	John Hart Asher
10:35	Trail Restoration in Woodland Environments	Susan Stormer
12 -1:00	**Lunch**	
1:00	Member's Meeting & Elections	
1:30	Remnant Prairies: Evaluation, Conservation & Management Challenges	Leslie Cook
1:50	From Farmers to Conservationists, Natural Resource Managers to Citizen Scientists: working with all stakeholders on the invasive species problem in Oklahoma	Pricilla Crawford
2:10	Relative differences in establishment and persistence of native grassland species restored from seeds and plugs?	Kelly Lyons

Utilizing Plant Functional Groups in Guiding Native Plant Materials Development for Landscapes Dominated by Exotic Grasses

Forrest S. Smith[1], John Lloyd-Reilley[2], William R. Ocumpaugh[1]

1. *South Texas Natives Project, Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville*
2. *USDA NRCS E. "Kika" de la Garza Plant Materials Center, John.Reilley@tx.usda.gov, (361) 595-1313*

In south Texas, loss of biodiversity and concerns about maintaining diverse and economically productive wildlife enterprises as a result of exotic grass invasion necessitates efforts to develop native plant materials for restoration. We have focused our efforts on developing seed releases from a variety of native plant functional groups. We have also worked to identify good existing competitors among native communities that can be planted to promote plant species and structural diversity in exotic grass dominated habitats. Plant releases with broad ecological and geographic adaptation have been made that can be used to provide specific competitive pressures on exotic grasses at all periods of their life cycle. To date, we have made 12 plant releases, including plants from cool/warm season, annual/perennial, grass/forb, and invader/dominant plant functional groups. In some exotic grass dominated habitats, the use of extremely competitive early successional grasses and forbs at full-stand seeding rates (i.e. as native cover crops) in addition to other seed mix components may be warranted. The consistent establishment and rapid resource capture by early successional functional groups suppresses the immediate reinvasion of the restoration site by exotic grasses; however, other functional group representatives from more dominant guilds must also be introduced on the site to provide later resistance to invasion by exotic grasses once the early successional natives decline in vigor in the absence of disturbance. Late successional native plants are naturally slow-to-establish on restoration sites, but may be facilitated in establishment by the early competitors such as gramas, windmillgrasses, and annual forbs. Even though complete exclusion of exotic grasses is nearly impossible in our region, through our methods a more suitable plant community for wildlife and biodiversity conservation can be established where exotic grasses formerly dominated.

The Use of Inoculants in Grassland Restoration

Wendy Leonard[1] and Kelly Lyons[2]

1. *City of San Antonio Natural Area Division of Parks and Recreation, 210-372-9124, wendy.leonard@sanantonio.gov*
2. *Dr. Kelly Lyons, Trinity University, 210-999-8348, Kelly.Lyons@trinity.edu*

Phil Hardberger Park is a 311 acre park in the heart of San Antonio. In spring 2009, a 3 acre tract was targeted for grassland restoration. Woody species, mainly Texas persimmon (Diospyros texana) and Ashe juniper (Juniperus asheii), were removed. In September 2009 over 40, 000 plugs of big bluestem (Andropogon gerardii), little bluestem (Schizachyrium scoparium), Indiangrass (Sorghastrum nutans), sideoats grama (Bouteloua curtipendula), Upland switch grass (Panicum virgatum), Eastern gama grass (Tripsacum dactyloides), and Inland seaoats (Chasmanthium latifolium) were planted. Native prairie seed mixes, including numerous wildflower seeds, were also applied to the site. The 3 acres set aside for grassland restoration were divided into 10 plots. Half of these plots were inoculated with soil microbes and nutrients from a climax grassland community, and half of the plots were not. The goal is to see how the grasses and wildflowers (both planted on the volunteer day and seeded before and after the volunteer day) respond to these inoculants and if future grassland restoration projects would benefit from this type of application. Soil samples from the plots were taken in February 2010 and sent for analysis. The amount of nutrients as well as bacteria and fungi were tested. No general trends or differences were found between the inoculated plots and the un-inoculated plots. A second round of soil sampling will be conducted in October 2010 to see if the inoculants sprayed in May increased the amount of nutrients, bacteria, and fungi in the soil. The vegetation was sampled in April to see if there was a significant difference in vegetation between the plots. No significant difference was found between the inoculated and un-inoculated plots. This survey will be repeated in fall 2010 to see if the inoculants sprayed in May resulted in any significant difference in plant growth and response.

2:30	Comparing mulching and juniper clearing in bcv habitat restoration	Charlotte Reemts
2:50	Break	
3:10	Effects of repeated crown fires in oak-juniper woodlands	Charlotte Reemts
3:30	The relations between size and growth parameters in Arundo donax and infestation by the wasp	Megan Brown
3:50	Influence of Lake Palestine on hydrogeomorphology and biological communities in the upper Neches River	Lance Williams
4:10	Diatom succession in the Greens Bayou Wetland mitigation bank….	Brad Hoge
4:30	Mercury in the Caddo Lake avian ecosystem	Sarah Schulwitz
5-6:00	Break	
6:00	Posters	
7:00	**Dinner**	
Sunday, November 7, 2010		
7-8:00	**Breakfast**	
8-9:00	Members discussion meeting with 2010-2011 Board	Members
9:00	Board Meeting	

KEYNOTE ADDRESS:

Texas Springs: Leaking into an Uncertain Future

Dr. Dave Creech

Regent's Professor, Stephen F. Austin State University, Nacogdoches, Texas.
Director, Mast Arboretum and the Ruby M. Mize Azalea Garden, , Stephen F. Austin State University, Nacogdoches, Texas.
Co-Director, Stephen F. Austin Pineywoods Native Plant Center

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The China Connection
Dr. Dave Creech
Regent's Professor
Stephen F. Austin State University

China is more that a giant economic engine. Its current industrial growth as well as its history have produced considerable environmental problems, yet the economic boom is also allowing China to creatively address some of those problems. In southeast China many millions of North American native trees, including Taxodium distichum, are being planted in nurseries and evaluated for salt tolerance. Millions of trees from these selections are being planted throughout the country for urban reforestation, soil stabilization and coastal windbreaks. These projects illustrate an overlap of horticulture and ecological restoration

Dr. Creech received his BS in Horticulture from Texas A & M, MS in Horticulture from Colorado State, and PhD from TAMU. He joined SFA faculty in 1978 and has taught a wide array of courses including fruit & vegetable production, greenhouse & nursery management, landscape plant materials, plant propagation, CAD, and public garden management. His research has focused on blueberry germplasm, horticultural studies, alternative crop/technology, crop nutrition, ornamental plant introduction, endangered plant rescue, research & reintroduction, and sustainable solutions to environmental concerns. He has authored numerous scholarly and trade articles and lectures widely. As an outreach, Dr. Creech has accumulated a long list of international consultancies since 1981 to Pakistan, Guatemala, Mexico, Nepal, Israel and China. His latest work in China focuses on Taxodium (baldcypress) studies as part of an effort to reforest high salinity regions.

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Monitoring an Urban East Texas Riparian Forest Habitat for Restoration Potential

Markus Hodges, Ellen Denney, Damika Thomas, Mark Hammett, William Forbes, Margaret Forbes, William Godwin, Tena Banks, Scott Hagler, Thomas Harris, Zachary Lazarine, Joyce Preston, Matt Reynolds, Carl Strickler, David Wallace, Austin Zindler;

Geography Program, Stephen F. Austin State University, 936-468-2373; forbesw@sfasu.edu

This research estimates biological diversity, ecosystem health, and restoration potential in an urban, riparian forest habitat in East Texas. Banita Creek Preserve, located in Nacogdoches, Texas, is managed and owned by the Texas Land Conservancy (formerly the Natural Areas Preservation Association), based in Austin, Texas. Students in two different offerings of a biogeography class at Stephen F. Austin State University set up and measured vegetation transects in the Preserve. The most recent class also conducted surveys of stream health, measuring aquatic insects, riparian vegetation cover, streambed morphology, and amphibian (Anura) diversity. Stand history was also determined using county records. Results are compared with an adjacent, similarly disturbed riparian area, a portion of which has had invasive privet removal (Lanana Creek). It is also compared with a more rural riparian forest (SFA Experiment Forest) that has received less ground disturbance and relatively frequent prescribed fire. Consideration of restoration potential includes differences between stands and the landscape context of the urban forest.

POSTER ABSTRACTS:

Informing Restoration with Environmental History: Revisiting Aldo Leopold's Visits to East and South Texas

Mark Hammett; Michael Haven, William Forbes;

Geography Program, Stephen F. Austin State University, 936-468-2373; forbesw@sfasu.edu

Renowned conservationist Aldo Leopold visited East Texas near the beginning of his professional career in 1909, through a Yale Forestry School field camp in Woodville, located at the northern end of the Big Thicket. He also visited the King Ranch towards the end of his career in the 1940s. These visits were briefly noted in *Texas Land Ethics* (Gunter and Oelschlarger 1997), as well as in the most common secondary source on Leopold's career, *Aldo Leopold: His Life and Work* (Meine 1988). This poster summarizes Aldo Leopold's visits to Texas and offers examples of forest and rangeland conditions through archival details of his visits. Field data were also collected on reference and altered longleaf pine ecosystems in East Texas. Other primary and secondary historical sources are used to help describe landscape change in East Texas since 1909 and changes in rangeland conservation issues on the King Ranch since the 1940s. The resulting summary provides a broad picture of forest and rangeland restoration targets in the context of a famous conservation figure. It also provides context for re-interpreting concepts expressed in Leopold's major work, *A Sand County Almanac* (1949), as applied to East and South Texas.

PRESENTATION ABSTRACTS:

Compost for restoration

John Hart Asher, MLA, *Lady Bird Johnson Wildflower Center, 512.232.0109, jasher@wildflower.org*

Many restoration projects deal with soils that have been significantly degraded resulting in poor soil structure, nutrient loss, and a general weakening of the soil food web. Many native Texas grass and forb species evolved in nutrient poor conditions. The use of compost itself is beneficial for the land in many ways, due to its ability to act as a soil conditioner, fertilizer, microbial inoculant, a natural pesticide, and because compost provides vital humus or humic acids. In ecosystem restoration projects compost is useful for erosion control, land and stream reclamation, wetland construction, and native plant re-vegetation efforts. However, the current compost industry has created standards that result in high nutrient loads, high bacteria vs. fungal counts, and low to no Protozoa populations. Additionally, much of the feedstock is comprised of biosolids which can contain anti-fungal and anti-bacterial components and manures or plant material that has traces of herbicide. Much of the compost is created with the windrow technique, a method that results in low to no fungal growth and an extremely short cooking time which is far from sufficient to ensure complete breakdown of any medicines or herbicides. The Lady Bird Johnson Wildflower Center (LBJWC) has recently consulted on two restoration projects which specify low nutrient compost as soil amendment, erosion control, and seeding medium. Unfortunately, laboratory analysis has revealed that a majority of compost suppliers and manufacturers create products that qualify more as reduced waste than compost. This presentation will include a discussion of low nutrient specifications developed by the LBJWC vs. standard compost specifications, the implications of using standard compost specifications within restoration projects, future compost research to be carried out by LBJWC, and the development of restoration grade compost.

Trail design in sensitive landscapes

Michelle Bertelsen[1], Steve Windhager, Ph.D.[2] and Holly Zafian[2]

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2 Lady Bird Johnson Wildflower Center

A regional trail system is proposed to serve the Austin area. The trail will cross multiple jurisdictions and landscapes and involve numerous stakeholders in its development. A significant portion of this trail will pass through the environmentally sensitive Water Quality Protection Lands (WQPL), which are intended to protect aquifer recharge. These lands are not park lands and cannot be used in a way inconsistent with the core mission. In addition, the lands are being restored through the use of tools such as prescribed fire. The Lady Bird Johnson Wildflower Center was asked to work with the trail design firm to help identify a route through the WQPL that would minimize impacts to water quality and quantity and interference with restoration activities. The Wildflower Center's work consisted of a preliminary environmental assessment, a public involvement phase, an on the ground survey and trail impact mitigation recommendations. The preliminary environmental assessment was a desktop exercise which utilized GIS (Geographic Information Systems) to divide the WQPL into suitability zones based on known ecological (karst features, endangered species habitat, vegetative community), physical (soil, slope) and land management parameters (prescribed fire lines, research areas). The results of this analysis were used to aid in decision making during the trail routing process and as an educational tool during the public stakeholder process. The Wildflower Center then surveyed the proposed route and the information gathered during this survey was used to modify the route. This work is relevant to restoration professionals because one of the driving forces behind many restoration projects is rendering the system better able to provide ecosystem services. An important, and often expected, service is community access to open space. This work provides a methodology that could be used to begin to reconcile the often conflicting goals of access and restoration/conservation.

Influence of Lake Palestine on hydrogeomorphology and biological communities in the Upper Neches River

Lance R. Williams[1], Marsha G. Williams, Neil B. Ford, and Matthew Troia

1 Department of Biology, University of Texas at Tyler, Tyler, TX 75799, 903.565.5878, lwilliams@uttyler.edu

The goal of this project was to evaluate how geomorphology, hydrology, and land cover structure fish and mussel assemblages in the upper Neches River, below Lake Palestine. Data were collected in summer 2009 in the river mainstem at nine reaches (*i.e.*, 400 m), nested within three distinct geomorphic sections (~10 to 50 km). Overall, we observed 44 species of fish and 20 species of unionid mussels. Geomorphic cross sections at each site revealed differences in floodplain connectivity and channel width among the three regions. Reaches in the middle zone (near HWY 84) were narrow and connected to their floodplain while those in the upper zone were disconnected. Reaches in the lower zone were over-widened. Wood abundance was greatest in the middle zone. The structure of fish and mussel assemblages is likely determined by the interactive effects of (1) floodplain connectivity and hydrology and (2) channel width and wood abundance. The Neches River is impacted by Lake Palestine at least until the middle section of our study with evidence of extensive downcutting. Results from this study could be used to guide restoration efforts to improve water quality or habitat for rare species.

Trail restoration in woodland environments

Ryan Spates and Susan Stormer, PhD, *S&S Trail Services, 713.446.6610, Ryan@sstrails.com, Susan@sstrails.com*

S&S Trails' presentation will discuss symptoms of trail degradation typical of that found in East Texas and their causes. The presentation will include a slide show with example photos for discussion amongst the group. Also included will be a restoration project of an existing trail in Tyler State Park, with start to finish photos of the work that was done. This project will show steps needed to correct erosion damage and restore the trail to its original condition as well as steps taken to mitigate future erosion on the trail tread in this spot. Additionally, there will be a step by step description and examples of how to properly restore a trail that has been abandoned from either lack of use or because of a better solution elsewhere.

The Relations between size and growth parameters in *Arundo doanx* and infestation by the wasp *Tetremesa romana*

Megan E Brown[1] and Beth Crouchet, (830) 305-5698, Megan.Brown@ctx.edu

Restoration Giant reed (*Arundo donax*) is a large, non-native grass growing 3-9 m tall that often invades riparian habitat and damp soil. Giant reed was brought to North America almost two centuries ago as a material resource. It displaces native plants and associated wildlife species and forms large stands. In the Rio Grande valley thousands of acres of native vegetation have been displaced by near monocultures of giant reed. The arundo wasp (*Tetramesa romana*) has been approved as a biological control agent. We examined six sites in and around Austin, Texas, during two sampling periods approximately one month apart in October and November. At the beginning of the study four sites were known to be infected with the arundo wasp and two were thought to be uninfected. Plants at each site were measured for diameter and height. Other parameters such as the presence of an inflorescence, lateral shoots, nodes, and the presence of arundo wasp exit holes were examined. Overall, uninfected plants exhibited greater height and had more nodes with side shoots than infected plants. Average diameter was greater in infected plants for 0-1, 1-2, and 3-4 m size classes, but among plants greater than 4 m tall uninfected plants exhibited greater diameter. For most size classes there were more wasp exit holes in November than in October. Infected plants had significantly fewer inflorescences than uninfected plants. These data indicate wasp infection was related to decreasing plant height and that the wasp infection rate increased during the study period.

Remnant prairies: evaluation, conservation and management challenges

Leslie Cook, *Native Prairie Association of Texas, 512.913.2486, leslie_cook@texasprairie.org*

Remnant prairies are dwindling at an alarming rate and the preservation of these systems relies on aggressive intervention. Often found in forests or wooded regions, these remnant prairies, also known as pocket prairies, are in the greatest danger of being lost and possibly the most difficult to protect. These small patches of native prairie play vital ecological roles in controlling erosion, cycling nutrients, maintaining water quality and quantity, and providing habitat for wildlife. Whether a remnant, a restoration, or a reconstructed prairie, the challenges are all variations of consistent themes: invasive species, limited gene exchange, urban sprawl and lack of fire. Conserving, protecting, and managing these jewels of native prairie are essential to the ecological and cultural preservation of our country.

Mercury in the Caddo Lake avian ecosystem

Sarah Schulwitz, *University of North Texas, Department of Biological Sciences, 919.605.0974, Sarah.Schulwitz@gmail.com*

Ecotoxicologic studies are relevant to ecological restoration; current management and restoration goals should consider these studies where appropriate. The presence of contaminants may alter organisms' physiological functioning, and thus their ecological interactions. In the case of ecosystems where alarming concentrations of some contaminant exists, we should consider the effects of the contaminant on the organisms of the ecosystem and we should also study methods to reduce the contamination (and thus restore the ecosystem). Caddo Lake, located in northeast Texas, is positioned downwind from a large number of coal-burning power plants found throughout southeast Texas. It has been shown that many organisms in Caddo Lake possess high concentrations of methylmercury, which tends to increase with higher trophic levels (Chumchal et al. 2008). Methylmercury contamination has been found in fish, mammals and invertebrates at Caddo Lake; however, there has been little work on avian species (Chumchal et al. 2008). Here we quantified the levels of mercury in avian species of various tropic levels in the Caddo Lake and Lake Lewisville (reference site) ecosystems, including Wood Duck (*Aix sponsa*), Eastern Bluebird (*Sialia sialis*), Carolina Wren (*Thryothorus ludovicianus*), Great Blue Heron (*Ardea herodias*) and Great Egret (*Ardea alba*). For some of the species we found that the Caddo Lake birds had significantly higher levels of mercury than the Lake Lewisville birds. All of the Great Blue Heron feathers analyzed were well above the level of 5 ppm dry weight known to cause reproductive effects in seabirds (Burger and Gochfeld 1997). In addition, two dead Wood Ducks were found with very high mercury levels. Mercury in birds at Caddo Lake is cause for concern and we plan to investigate the sub-letahal effects of mercury in Wood Ducks at Caddo Lake in future studies.

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Comparing mulching and juniper clearing in black-capped vireo habitat restoration

Charlotte Reemts[1], Carla Picinich[2], David Cimprich[3]

1 Fort Hood Project, The Nature Conservancy, 254.286-6745, creemts@tnc.org
2 Fort Hood Project, The Nature Conservancy
3 Natural Resources Management Branch, Fort Hood

Black-capped vireos (BCVI) nest in early successional shrublands. Historically, BCVI habitat was likely maintained by wildfire; it must now be maintained with prescribed fire or mechanical treatments. We tested whether mulching (chipping or mechanical mastication) could restore BCVI habitat. All vegetation in three study sites was mulched in the winter of 2005-2006; each mulched site was paired with a nearby untreated site. Ashe juniper (*Juniperus ashei*) was cleared from parts of two control areas in 2007 as part of other management activities. Before mulching, vegetation height in control and treatment areas was similar (2.6±0.2 vs. 2.9±0.2 m). Following mulching, height was reduced to 0.5±0.1 m. Four growing seasons later, height had increased to 1.1±0.2 m. Juniper, dominant in control areas, was almost completely absent from mulched areas; scaly-bark oak (*Quercus sinuata* var. *breviloba*) was dominant in mulched sites. Black-capped vireos were observed in the treatment areas in 2008, three years after treatment. In juniper-cleared areas, vegetation height was reduced to 2.0±0.2 m, lower than control areas, but taller than mulched sites. Total height-density (number of contacts with a pole within a height class) of mulched sites had increased to roughly control levels by 2009, but the majority of contacts were below 2 m. Total height-density in cleared sites was similar to mulched sites, but contacts were evenly distributed among height classes. Juniper was still present in cleared sites, and contacts with scaly-bark oak were not increased compared to control sites. Mulching appears to be an effective, if expensive, restoration technique.

From farmers to conservationists, natural resource managers to citizen scientists: working with all stakeholders on the invasive species problem in Oklahoma.

Priscilla H. C. Crawford, *Oklahoma Natural Areas Registry, Oklahoma Biological Survey, Oklahoma Invasive Plant Council, 405.325.7658, prill@ou.edu*

The Oklahoma Invasive Plant Council (OkIPC) was established in 2008 in response to a growing concern regarding the impact invasive species are having on Oklahoma's natural diversity and natural resources. A group of stakeholders from a variety of organizations and industries formed the OkIPC to facilitate efficient and effective management of invasive plants for the protection of the economic and natural resources and restoration of natural systems. For the past two years members of the council have been working to establish our role in the fight against invasive species. Our strategies include: increasing awareness through education, encouraging legislative and regulatory improvements to increase invasives control effectiveness; promoting coordination between all stakeholders; serving as a clearinghouse for invasive management and subsequent restoration strategies; identifying and encouraging sources of funding for education and management; and identifying the invasive species of the state and assessing their potential threat for Oklahoma. This presentation will briefly cover the progress we have made to establish OkIPC as a leader in invasive species information for Oklahoma and a force within the state to enact change regarding the knowledge about and attitude toward invasive plants among the diverse population affected by these species.

Diatom succession in the Greens Bayou Wetland Mitigation Bank: an indicator of rate and extent of success

Dr. Brad Hoge, *University of Houston – Downtown, 713.221.8289, hogeb@uhd.edu*

Diatoms are found in all types of aquatic environments, including lacustrine, fluvial, riparian and wetland ecosystems. Wetland assemblages within a watershed form from each of these diverse sources but eventually reach unique stable climax communities as the soil and water chemistry of the wetland matures. Even though climax community plants are used to create mitigated wetlands, diatom assemblages from established wetlands could theoretically be used to compare the rate and extent of succession in mitigated wetlands within the same watershed. In this study, diatom assemblages from the Greens Bayou Wetlands Mitigation Bank (GBWMB) were compared to a similar wetland in the Anahuac National Wildlife Refuge (ANWR). The ANWR was established in 1963, and the diatom death assemblage is fairly stable. The GBWMB was built in 1999. Samples of the diatom death assemblage in the GBWMB taken between 2004 and 2008 showed no correlation to the ANWR assemblage, nor between years at the GBWMB. The GBWMB diatom assemblage does show a positive correlation to the ANWR from 2008 through 2010, however. There is also a decrease in genera richness during this period in addition to the stabilization of diversity. These trends indicate that succession in the GBWMB may be occurring, but that the stabilization of the assemblage is measurable only once some biogeochemical boundary condition is met. This study suggests that these conditions may have been reached approximately ten years after the GBWMB was established.

Effects of repeated crown fires in oak-juniper woodlands

Charlotte Reemts[1], Carla Picinich[2]

1 Fort Hood Project, The Nature Conservancy, 254.286-6745, creemts@tnc.org
2 Fort Hood Project, The Nature Conservancy

Oak-juniper woodlands are generally found in infrequently-burned areas, but adjacent to more frequently burned savannas and grasslands. Most woody species in these woodlands will resprout vigorously after fire. In contrast, the co-dominant Ashe juniper is fire sensitive and does not resprout. In 1996, a large crown fire burned more than 4000 ha of oak-juniper woodland on Fort Hood. Vegetation recovery was sampled in permanent transects in burned and unburned habitat. In 2009, 19 transects were burned in a second crown fire. Following the first fire, total woody stem density quickly returned to or even surpassed pre-burn levels, although basal area was still much lower even fifteen years later (~4 m^2/ha vs. ~18 m^2/ha). Ashe juniper recovery was much slower. In 2005, we found only 6 saplings (>1.8 m tall, <5 cm dbh); in 2010, we found 5 trees (>5 cm dbh) in once-burned areas. One year after the second fire, stem density in twice-burned transects was much higher than after the first fire (~100,000 stems/ha vs. ~50,000 stems/ha). Most woody species in our study area appear to be well-adapted to relatively frequent (~1/decade) crown fires. For Ashe juniper to co-dominate, high severity fire must occur much less often. Ashe juniper recovery after large crown fires may be limited by dispersal (there are few remnant trees within the burned area) or low survival of seedlings due to shading by resprouting species.

Relative differences in establishment and persistence of native grassland species restored from seeds and plugs

Kelly G. Lyons, Trinity University, San Antonio, TX, 210.999-8348, klyons@trinity.edu

Restoration of many Central Texas grassland communities is hindered by the presence of non-indigenous, invasive perennial grasses, such as KR Bluestem (*Bothriochloa ischaemum*, hereafter referred to as KR). Due to the long-term persistence of these species, soil nutrient dynamics and seed banks are highly altered. As a result, in many cases, effective management to remove the invasive and restore native species will involve active reseeding or plug planting. In this study, we conducted two field experiments to determine the feasibility of establishing Texas native grasses and forbs by seed and plug planting, following removal of the target invasive using prescribed burning (fall 2007 (seeding) and fall 2009 (plugs)). We also aimed to assess the native species' ability to deter reestablishment of KR. Following reintroduction of native grasses and a forb by broadcast seeding onto bare soil, we found large differences among the species in establishment and persistence over the three years of the study. The reestablishment of KR was not correlated with native species identity but was weakly correlated with successful establishment of the native, as determined by cover. We also found differences in the native grasses in successful establishment as plugs. Based on our first year of data for the plug study, trends suggest that, as in the seed addition study, species differ in their abilities to establish when planted as plugs. These results suggest that successful restoration of grassland natives will take into consideration differences among species in their establishment requirements.

Upland mixed pine-hardwood forest restoration on Tyler State Park, Smith County, Texas

Kay Jenkins[1], Jeff Sparks[2], and Eric Keith[3]

1. *1 Texas Parks and Wildlife Department, State Parks Division, Natural Resources Program, 903.566.0535x287, kay.jenkins@tpwd.state.tx.us*
2. *2 Texas Parks and Wildlife Department, State Parks Division, Statewide Fire Program Manager*
3. *3 Raven Environmental Services, Inc.; Project Manager*

Tyler State Park is a 983-acre park located approximately seven miles north of Tyler in Smith County, Texas. The park was acquired from private owners in 1934 and 1935, developed by the Civilian Conservation Corps (CCC) and opened to the public in 1939. Vegetation in the park consists primarily of mature pine-hardwood forests with dense canopies and sparse understory and herbaceous layers while woodland communities occur in scattered openings on sandy ridges. Shortleaf pine – hardwood forest restoration efforts were initiated in 2001 in Tyler State Park beginning with a selective thinning harvest operation in selected management units to open the overstory canopy allowing more sunlight to reach lower levels of the forest followed by applications of prescribed burns. Six permanent monitoring plots, located in the restoration areas, have been re-sampled annually since the initial thinning operation to assess changes in floristic composition and fire response over time. Results of a LSD comparison of the means by year for several parameters indicate that basal area of overstory trees, the number of overstory trees and the number of pole trees decreased ($\alpha<0.05$) after the selective thinning operation, while percent vegetative cover, number of species, number of herbaceous species and number of herbaceous stems increased ($\alpha<0.05$). The mean number of seedlings and the mean number of shrubs were generally not significantly different among the years sampled. The results of the sampling efforts indicate that a general pattern of species succession occurs in the plots in which woody species decrease and herbaceous species increase immediately after prescribed burns are conducted when more light reaches the ground layer and the reverse occurs in years following the burns as woody shrubs outcompete herbaceous species.