JULY 2018 NUMBER 6

Upper Llano River Watershed Protection Plan

JANUARY – JULY 2018

Welcome to the sixth Upper Llano River Watershed Protection Plan (WPP) newsletter and thank you for your continued interest in preserving our valuable natural resource.

Accepted by the Environmental Protection Agency (EPA) in late 2016, the Upper Llano River WPP is a 10-year plan developed by stakeholders to proactively address threats to the Upper Llano. The Plan is based on a holistic set of strategies to restore and/or protect the quantity and quality of surface water and groundwater resources through voluntary, non-regulatory watershed management strategies.

This newsletter serves to inform readers on the upcoming changes in the administration of the Plan and provide updates on Technical Assistance and Plan Implementation.

Since 2012, funding for development and implementation of the Plan has come from the Texas State Soil and Water Conservation Board. Due to reductions in budget however, the Board is unable to continue to fund the project. Efforts are well underway to discover new ways to continue administration of the WPP efforts.

At the same time, new research associated with the WPP continues to make new discoveries and management measures identified in the Plan continue to move forward.

Come learn what's new…

Coordination Committee Members

Businesses – Charles Hagood

Cities – Mayor Russell Hammonds (Junction)

County Extension – James Crockett

Counties– Judge Delbert Roberts

Soil Districts – Bob Brockman / Marty Graham

Texas Parks Wildlife – Melissa Parker/Megan Bean

Groundwater Districts – Jerry Kirby/Joel Pigg/Jim Polonis

Texas Forest Service – Lori Hazel

Llano River Watershed Alliance – Znobia Wootan

South Llano River State Park – Scott Whitener

Prescribed Burn Association – Sam Jetton

NRCS – Dandy Kothmann

Landowners – Art Mudge/Tom Vandivier/Ruth Russell/Andrew Burnard/Roland Trees/Joe David Ross/Rex Webb

COORDINATION COMMITTEE CHARTS A PATH FORWARD

The Coordination Committee for the Upper Llano River Watershed Protection Plan gathered at the Llano River Field Station for their biannual meeting last Wednesday, July 25th.

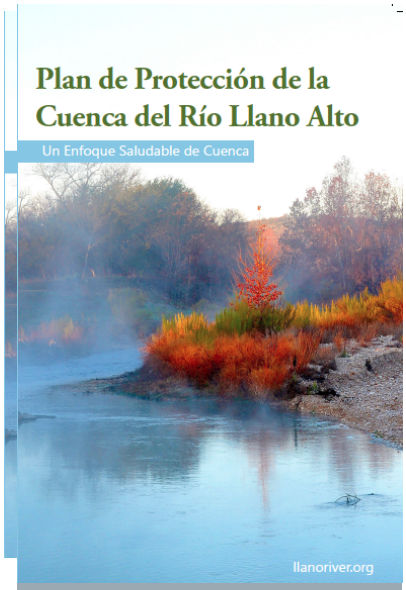
The main topic on the agenda was to discuss a path forward for implementing the Plan. Since the beginning of the Plan, grant funding from the EPA Clean Water Act and the Texas State Soil and Water Conservation Board has provided for a Watershed Coordinator to be housed at the Llano River Field Station.

Late last year, it became apparent that this funding source was no longer going to be available. With the approval of the Coordination Committee, the Field Station applied for funding from alternative sources. Unfortunately, these other sources failed to materialize.

Without future funding for a Watershed Coordinator for the Plan, the Committee explored alternative scenarios for implementing the Plan. At Wednesday's meeting, by consensus, the Committee accepted Dr. Tom Arsuffi's offer to temporarily be the Watershed Coordinator.

In the meantime, the Committee will continue to explore a partnership agreement with Texas Wildlife Association for this well-established organization to serve as the financial agent for the funding and administration of grants to implement the Watershed Protection Plan.

EL FOLLETO DEL PLAN TRADUCIDO AL ESPAÑOL



Colaboradores

Texas Tech University at Junction Llano River Field Station

Texas Water Resources Institute

Llano River Watershed Alliance

Texas Parks and Wildlife Department

Texas State Soil and Water Conservation Board

Financiamiento otorgado a través de fondos federales del Clean Water Act §319(h) sobre Fuentes de Contaminación Indefinida administrados por el Consejo de Suelo y Agua del Estado de Texas de la Agencia de Protección de Medio Ambiente de los Estados Unidos (EPA).

Para más información: llanoriver.org

El Río Llano Alto, que incluye los Ríos Norte y Sur, es una joya verdadera de la provincial montañosa de Texas. Dado su naturaleza prístina y el constant flujo de sus manantiales, el Río Llano Alto es actualmente un ecosistema sano que apoya una variedad de comunidades acuáticas y terrestres y fomenta numerosas oportunidades de recreación.

Implementación del Plan del Río Llano Alta se llevará a cabo en un period de 10 años, enfocado en ocho medidas de administración. Cada medida contará con un period de implementación de año para su cumplimiento, así como de los fondos requeridos y organizaciones responsables de la implementación de las medidas recomendadas.

Acciones Volontarias

- **Sistema de tanques sépticos:** Reparar y renovar 100 sistemas
- **Cerdos salvajes** : Bajar la población de cerdos salvajes a un 66% (26,000 animales)
- **Animales silvestres y exóticos** : Incrementar por lo menos dos ranchos que cuenten con planes de administración de vida silvestre al ano,

particularmente en las áreas riberenas

- **Ganado** : Incorporar a más de > 250,000 acres de tierra para la ganadería en un plan de conservación.
- **Control de maleza** : Dar tratamiento a más de 144,000 acres de tierra de maleza para mejorar sus condiciones y su capacidad de retención del agua.
- **Restoración de los bancos de sedimento**: Comenzar la restauración de 14 millas donde escasea protección la ribereña e inicial el mejoramiento de la vegetación del 10% de la zona ribereña..
- **Escurrimientos urbanos** : Identificar e implementar mejores prácticas del manejo de los escurrimientos urbanos.
- **Conservación del agua**: Mejorar la eficiencia del consume en un 10%

Technical Assistance

EDUCATION & OUTREACH

Technical Assistance via Education and Outreach is an important component of the WPP. During the first part of this year, the WPP hosted Texas A&M AgriLife Rainwater Harvesting Workshop, gave tours of the LRFS wildlife exclosures, and demonstrated the Stream Trailer to local school districts.

Clockwise from above: Flyer for Rainwater Harvesting Workshop; attendees at the Workshop; Science in the Sun students learn the importance of healthy riparian areas with the Stream Trailer; Llano River Watershed Alliance tours Llano River Field Station Wildlife Exclosures.

Technical Assistance

RESEARCH

Research is a vital component of the WPP and the Field Station. Doctoral Candidate Matt Buchholtz, from Texas Tech Department of Natural Resources Management (NRM) continues research on axis deer while Graduate Research Assistant Heather Williams, also from NRM will soon complete her research on Guadalupe Bass.

2018 Texas Tech University Axis Deer Project Update

By Matt Buchholtz, Warren Conway, Blake Grisham and Thomas Arsuffi
Reprinted with Permission

Following the completion of the Upper Llano River Watershed Protection Plan in 2016, Texas Tech University's Department of Natural Resources Management and Llano River Field Station developed a research project to better understand the ecology of free-ranging axis deer along the South Llano River. The goals of this project are to assess the effects that axis deer have on native riparian habitats and vegetation, assess current and possible future population status and growth, investigate possible issues with the spread of disease between axis and white-tailed deer, and assess habitat selection by free-ranging axis deer. We are finishing the first year of the 3 ½ year field data collection portion of the research and are providing a project update to current and potential landowners and collaborators.

Effects of axis deer on native riparian habitats and vegetation Last summer we constructed 33 (33 ft. x 33 ft.) exclosures along the riparian corridor on the South Llano River. We have been collecting data to estimate biomass and percent ground cover of grasses, forbs (flowering plants), and woody plants from the exclosures every 3 months. Vegetation data collection will continue through January 2020.

Young-of-year Guadalupe Bass in the Upper Llano River

By Heather Williams
heather.m.williams@ttu.edu.

Hybridization with nonnative Smallmouth Bass was once the greatest threat to Guadalupe Bass populations in the South Llano River. To combat this issue, the Llano River Watershed Alliance, Texas Parks and Wildlife, and other project partners joined forces in 2010 to establish an action plan to restore genetically-pure Guadalupe Bass in this region. The resulting stocking program was a resounding success! Now, with the greatest threat to Guadalupe Bass populations largely alleviated, conservation managers can now focus on more diffuse threats such as habitat degradation caused by altered flow regimes.

Axis Deer -Buchholtz

Four of the exclosures had visible differences compared to surrounding outside areas as early as 3 months post-construction, and by April 2018,~20 of the exclosures had visible differences compared to surrounding areas. In many cases vegetation inside was taller whereas the control plots had little vegetative structure, and were grazed to the bare-ground. For example, the exclosure shown here (Figure 1) has wintergrass and buffalograss that is 6-8 inches tall and seeding out, while the outside area is dominated by frost weed. Many exclosures also have small seedlings of cedar elm, pecan, and live oak while none have been recorded outside exclosures. These preliminary data suggest that the combined effect of both species of deer on plant biomass is substantial. While identifying the effect of each deer species is difficult, differences in grass biomass may be attributed to axis deer foraging given that their diet consists of substantially more grass than white-tailed deer diets.

Figure 1: Example of a deer exclosure depicting abundant grasses inside and near bare ground out- side the exclosure. Photo by Ivy Whitener.

This summer we will continue monitoring the exclosures and conduct vegetation transects to record plant species presence and composition. We will also be estimating soil erosion associated with axis deer trails compared to random sites along the South Llano River to assess what effect they may have on erosion into the river.

Population Surveys

Starting summer 2018, we will be conducting spotlight surveys to estimate axis deer density in the study area, within Kimble County. We have identified several routes along county and FM roads, along with routes on accessible properties that will be surveyed monthly (excluding September, December, and February). We will use distance sampling for these surveys, where we will measure how far away axis deer are from the route, which can be used to estimate axis deer density (# herds/ mi^2). Herd composition (number of bucks, does, and fawns) will also be recorded to help characterize population growth and breeding chronology. We anticipate observing mixed groups of axis and white-tailed deer to assess possible interactions between the two species.

Disease and Genetics

So far we have collected approximately 50 tissue samples and 10 blood samples to test for genetic diversity and disease, respectfully. This summer and fall, sample kits will be made available and distributed to landowners to help in tissue and blood collection from any axis deer harvested. We are waiting to collect more samples before submitting any for analysis to the Texas Veterinary Medical Diagnostic Laboratory in College Station.

In March, we were made aware of a sick axis deer that was put down by a collaborator. While test results have yet to come back, we suspect that the deer may have died from a viral disease called Malignant Catarrhal Fever (MCF). The symptoms that were described to us match with previously observed symptoms of MCF in axis deer. MCF is transmitted through contact with infected individuals and via aerosolized droplets. This is the only suspected case of disease-related mortality in axis deer we have witnessed to-date, but we have observed a white-tailed deer last summer that we suspect died from a rattlesnake bite.

As a result of the suspected case of MCF, we are adding MCF to the list of diseases in our study. The list of tests also includes Epizootic Hemorrhagic Disease, Bluetongue Disease, and a white blood cell count to assess if their immune system is responding to another potential disease.

Axis Deer -Buchholtz

Habitat Selection

Capturing of axis deer to affix GPS collars has been difficult and has gone very slowly. As a result of difficulties in netting axis we have shifted our focus to attempt to capture them with chemical immobilization. Our goal is to start darting axis deer in late May or early June 2018.

Preliminary observations from the individuals that have been GPS-tagged suggest home ranges are small and they remain near the river with occasional trips into the uplands by travel- ling via ravines. We plan to use locations of axis herds on the spotlighting routes to assess what characteristics are important for habitat selection via occupancy analysis techniques.

Figure 2: An axis doe with a GPS tracking collar and identifying ear tags attached. Photo by Robert Stubblefield.

Tooth Replacement and Wear Guide

As part of our assessment of axis deer population structure and disease models, we needed an accurate method to estimate axis deer age. Currently, most people age axis deer using the tooth replacement and wear model available for white-tailed deer. However, given the variation between axis and white-tailed deer diets (grazers vs. browsers) we hypothesized that the tooth wear pattern in axis may be substantially different than what is seen in white-tailed deer.

We recently sent teeth from 51 axis deer collected from hunts on the South Llano River State Park, roadkill, from processors, or harvested by landowners to a lab for cementum annuli analysis to develop an accurate aging guide. Once we receive those results we will compare jaws within and between age groups and look for any consistent wear patterns to develop an aging guide. We are also asking professionals to assist with aging the actual jaws in a similar manner as they would a white-tailed deer to assess possible differences in the replacement and wear patterns between axis and white-tailed deer.

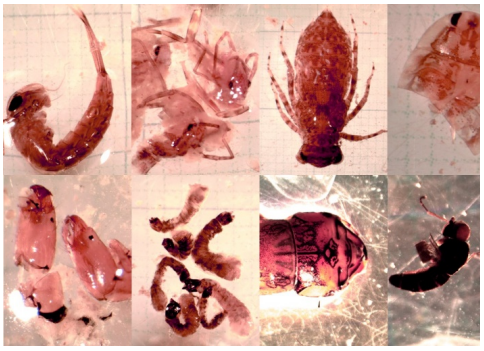
Figure 3: Axis deer jaws. The top jaw is estimated to be from a ~3 year old while the bottom jaw is estimated to be from a ~ 7 year old. Photo by Matthew Buchholz.

Diet Analysis

Last summer, the Llano River Field Station conducted diet analysis of axis deer on the TTU Junction campus and the South Llano River State Park. Using a technique called metabarcoding that looks for plant DNA, along with traditional microhistological techniques, they looked for the presence of plant species in feces and rumen contents. While many different plant species were found, including several different grasses as expected, it was interesting just how much browse they were consuming. Mesquite and pecan were near the top in both fecal and rumen analysis.

For more information, please contact Matthew Buchholz at matthew.buchholz@ttu.edu or 806-392-3699.

Guadalupe Bass -Williams



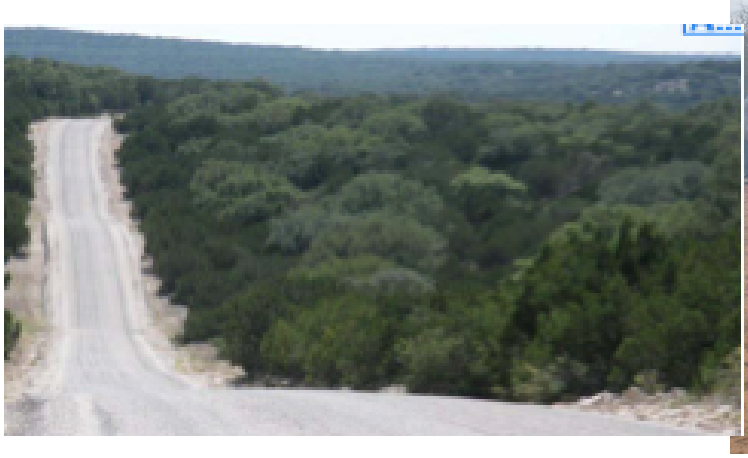
Guadalupe Bass demonstrate a preference for higher-current velocity habitats, such as riffles and runs. As such, any flow alterations that reduce availability of this flowing water habitat are thought to negatively impact Guadalupe Bass vitality. Successful recruitment can be affected by river flow, water temperature, and food availability. To better understand the mechanisms and impacts of a changing flow regime, a chapter of my Master's thesis was focused on assessing the influence of river flow on young-of-year (YOY) Guadalupe Bass growth, recruitment, and diet during their first summer of growth. YOY are age-0 fish, hatched during spring of that given year. Environmental conditions during this early life-stage are important for successful recruitment of juvenile individuals into the adult population.

This research was conducted on eight river segments on the North and South Llano River during 2015-2017 summer months. The Upper Llano provides an excellent study region because though these two watersheds are similar in size and representative of other tributary systems in the Edwards Plateau, the North Llano River undergoes higher rates of hydrologic disturbance resulting in a dramatic decrease in streamflow during the summer months. Otoliths were used to assess weekly YOY Guadalupe Bass growth. Otoliths are calcium-carbonate "ear bones" that accrete layers throughout the fish's life. Under magnification, otoliths of YOY fish can be used to enumerate daily growth rings and estimate age of the fish in days. We used daily otolith rings to back-calculate 7-day growth for collected Guadalupe Bass. We also conducted a stomach content analysis to examine diet composition in relation to streamflow between the two rivers.

Final results of this study and their resulting management implications will be completed by the end of this year. Overall, YOY Guadalupe Bass growth was influenced by duration and magnitude of low-flow periods throughout all study sites. Individuals collected from the lower North Llano River at its confluence in Junction City Park experienced the most variable growth rates. Diet composition of fishes collected in the North Llano River also shifted to higher volume and frequency of fish prey consumed compared to South Llano River fishes, which consumed a diet dominated by aquatic insect larvae throughout the summer months. This diet difference is likely due to a decrease in insect drift in the North Llano following a dramatic decrease in streamflow during late summer. Despite a loss of ideal habitat and increased YOY mortality on the lower North Llano River, Guadalupe Bass maintained a reproducing population in this area throughout the three-year study period. The restoration efforts implemented by the Guadalupe Bass Restoration Initiative and the Upper Llano Watershed Protection Plan will aide in the continued enhancement and protection of Guadalupe Bass habitat in this region. This project was funded by the Gulf Coast Prairie Landscape Conservation Cooperative through Texas Tech University Department of Natural Resources Management. For questions about this research, please contact Heather Williams at heather.m.williams@ttu.edu.

Implementation

Implementation of Management Measures defined in the Upper Llano River Watershed Protection Plan continues on pace. Thanks to partnerships with Natural Resources Conservation Service, local Soil and Water Conservation Districts, and local Prescribed Burn Associations, both the annual goal for brush control and prescribed burning were reached. And thanks to a partnership with Texas Parks and Wildlife Department and volunteer efforts from Hill Country Alliance, Texas Master Naturalist, and Llano River Watershed Alliance, significant strides in Riparian Restoration were made in the Watershed.



In the first 18 months, over 23,000 acres of brush were treated in the Watershed. The annual goal in the WPP is 9,000 acres.

Over 9,100 acres in the Watershed were treated with Prescribed Burning in the first year. The annual goal is between 5,400 and 7,700 acres.

Elephant Ear were treated on 46 miles of riparian habitat along the Llano. The WPP goal is to improve vegetation conditions along 10% of the riparian zone lacking riparian buffer.

Seven wildlife exclosures were constructed at the Llano River Field Station to evaluate changes in vegetation, biomass and bank stability under different wildlife management scenarios.

Implementation

RIPARIAN RESTORATION

Lack of recruitment of native woody species due to wildlife overbrowsing is an identified concern in the WPP. Learn how the activities of two groups are addressing this concern.

Llano River Field Station Native Plant Propagation

The Llano River Field Station recently constructed seven wildlife exclosures to assist riparian restoration efforts in the Watershed. The large 500x500' exclosure is primarily designed to decrease bank erosion by increasing native vegetation, especially wood plants, along the banks.

To hasten the healing process, Station Foreman Mike Bailey is propagating a variety of natives for replanting across the campus. These natives include Burkett Pecans, Chinquapin Oaks, and Spanish Oaks.

At times, Mike had to outsmart squirrels for nuts and acorns. Only three Chinquapins exist on campus and the squirrels often seemed to beat Mike to the punch; however, they overlooked the acorns that fell on the amphitheater roof.

TTU-Junction Foreman Mike Bailey tends to natives nursery at Maintenance Yard. They will soon be transferred to a protected exclosure near the Yard.

Landowner Axis Trapping

One of the unique features of the WPP is that many of the management measures identified in the Plan to maintain and improve water quality are measures landowners are already doing to improve their lands, e.g. brush control, prescribed burning, and control of exotics.

Control of exotic wildlife is identified in the WPP as a management measure to improve and restore riparian habitat. Native to India, axis deer were introduced to Texas about 1932, and today are the most abundant exotic ungulate in Texas. Damage from axis deer includes competition with white-tailed deer as well as significant erosion from axis trailing behavior, especially in riparian areas.

For the last three to four years, landowners along the Llano have been trapping axis to sell to hunting ranches across Texas. Using circular traps (similar to round hog pens) or funnel traps (axis are driven into a series of smaller pens with a loading chute at the end), these landowners have captured and removed several thousand axis from the Upper Llano.

Funnel pen with loading chute at end.

Implementation

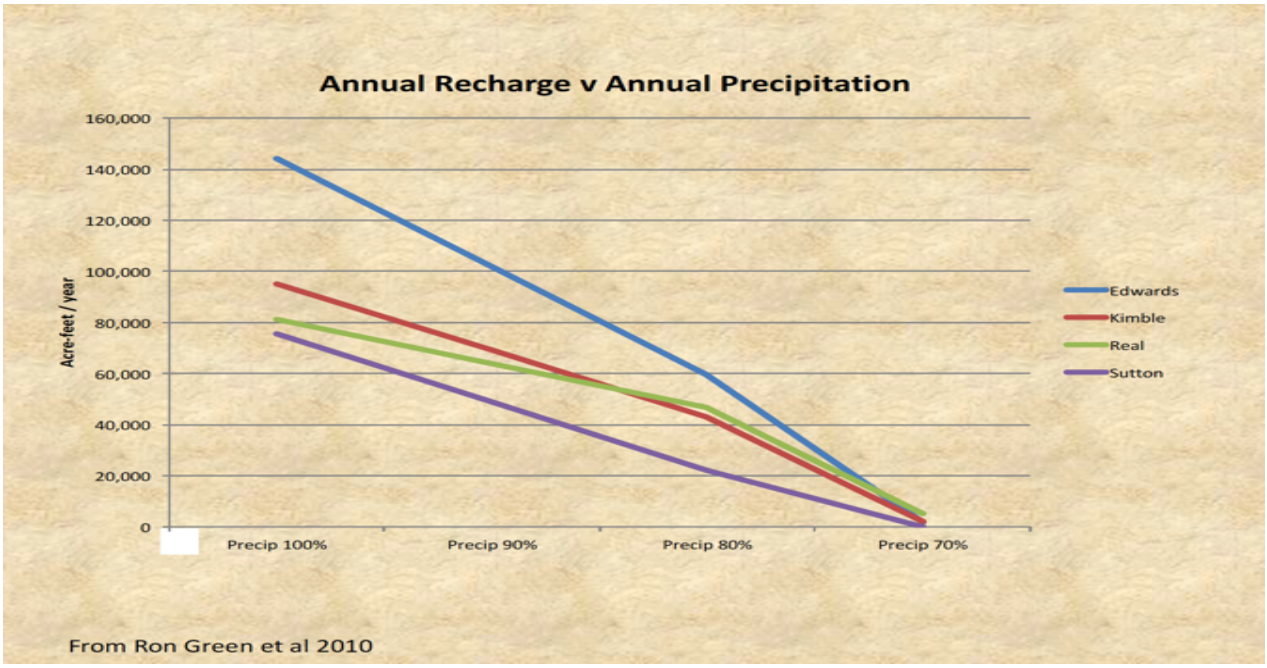
WATER SUPPLY ENHANCEMENT THROUGH BRUSH CONTROL

NOTE: Excerpted from Mitchell Foundation Blog Post by Tyson Broad.

To many Texans, the vast limestone savannah of the Edwards Plateau is an area that one must cross while traveling to Big Bend, Marfa, and other points west. Yet hidden beneath this sea of grasses and trees is the key to one of Texas's most precious resources, the origin of the state's iconic Central Texas rivers.

The San Saba, Llano, Guadalupe, Medina, Sabinal, Frio, Nueces, and Devils rivers all originate from springs flowing from canyon walls cut into the sides of the Edwards Plateau. Some of the precipitation falling on the Plateau finds its way into cracks, crevices, and conduits in the limestone, emerging much later and many miles away as springflow that maintains the flow of these rivers in which we love and depend on.

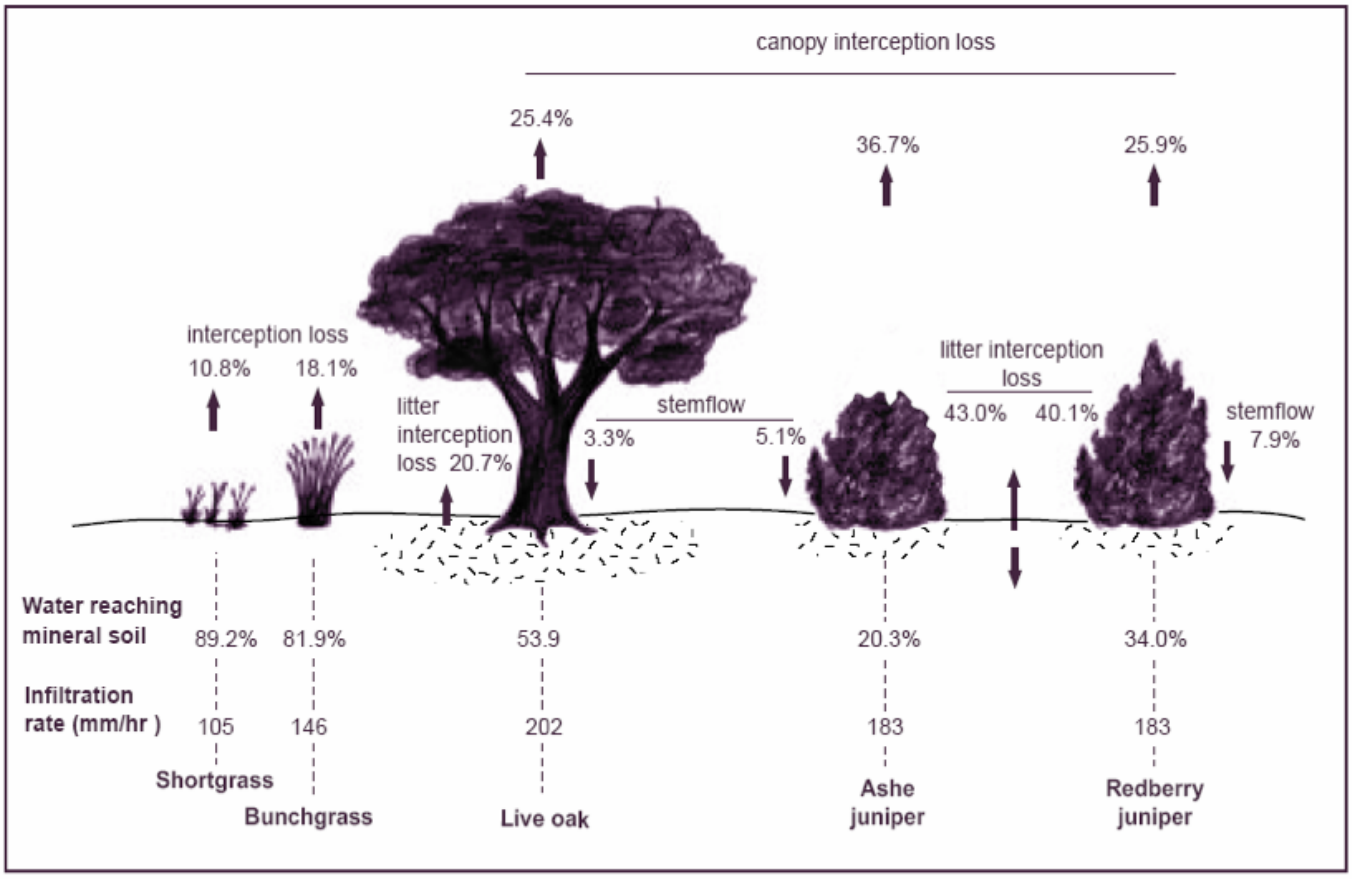
Through analysis of the volume of water into and out of the Edwards Plateau system, researchers have learned that during periods that receive 70 percent or less of annual average precipitation (e.g., 14 inches versus 20 inches), the amount of recharge—water that finds its way into cracks and crevices—approaches zero. During those dry years, there is more water evaporating into the atmosphere and little left to soak into the ground and, eventually, replenish these springs that are so critical to life.



Brush Control -continued

In creating the Upper Llano River WPP, stakeholders used an ecological model developed at Texas Tech to simulate changes in water quality and availability resulting from the implementation of management recommendations in the WPP. Of particular interest to this discussion are the results from simulating the removal of Ashe-juniper or cedar from selected locations in the Upper Llano.

Due to its dense canopy, only about 20 percent of precipitation that falls over Ashe-juniper infiltrates into the ground, whereas infiltration rates associated with native grasses are greater than 80 percent. WPP model results suggest that over the course of 25 years, removing 9,000 acres of brush annually, coupled with follow up prescribed burning, decreases evapotranspiration by 63,000 to 75,000 acre feet annually during normal years and about 46,000 acre feet annually during drier periods. However, the positive hydrologic response—increased water availability resulting from decreased evapotranspiration—has a lag time of approximately 11 years following brush control.



Influence of vegetation type on water yield. (From Thurow and Hester, 1997).

Brush Control -continued

How much water is 75,000 acre-feet annually? That volume equates to just over 100 cubic feet per second (cfs). For comparison, the mean flow of the Llano River at Junction is about 190 cfs.

While it is unlikely that there is a 1:1 relationship between decreases in evapotranspiration and corresponding increases in recharge and baseflow, the potential hydrologic benefits associated with improved brush control and other upriver land stewardship practices in contributing watersheds from the Edwards Plateau (or any contributing watershed for that matter) certainly should be a part of any future water management discussions.

STAY IN TOUCH

For weekly updates on happenings in the Llano Watershed, go to **llanoriver.org** and sign up for the weekly newsletter. The newsletter is a publication of the Llano River Field Station and Llano River Watershed Alliance. It's Free!

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