

The background of the slide features a light beige, textured surface with faint, organic patterns. On the left side, a dark brown stem extends vertically, with a single, elongated, dried leaf attached near the top. On the right side, another dark brown stem extends horizontally, with a single, elongated, dried leaf attached near the end. The overall aesthetic is natural and scientific.

# Communicating Science: Multiple approaches at TTU Llano River Field Station

TOM ARSUFFI –

TTU LLANO RIVER FIELD STATION



# *“Trailblazing”*

- setting out in a promising new direction; pioneering or innovative:
- "Do not follow where to path may lead. Go instead where there is no path and leave a trail." ~Ralph Waldo Emerson.







*"I understand they're going to connect them. The Provost ordered it."*

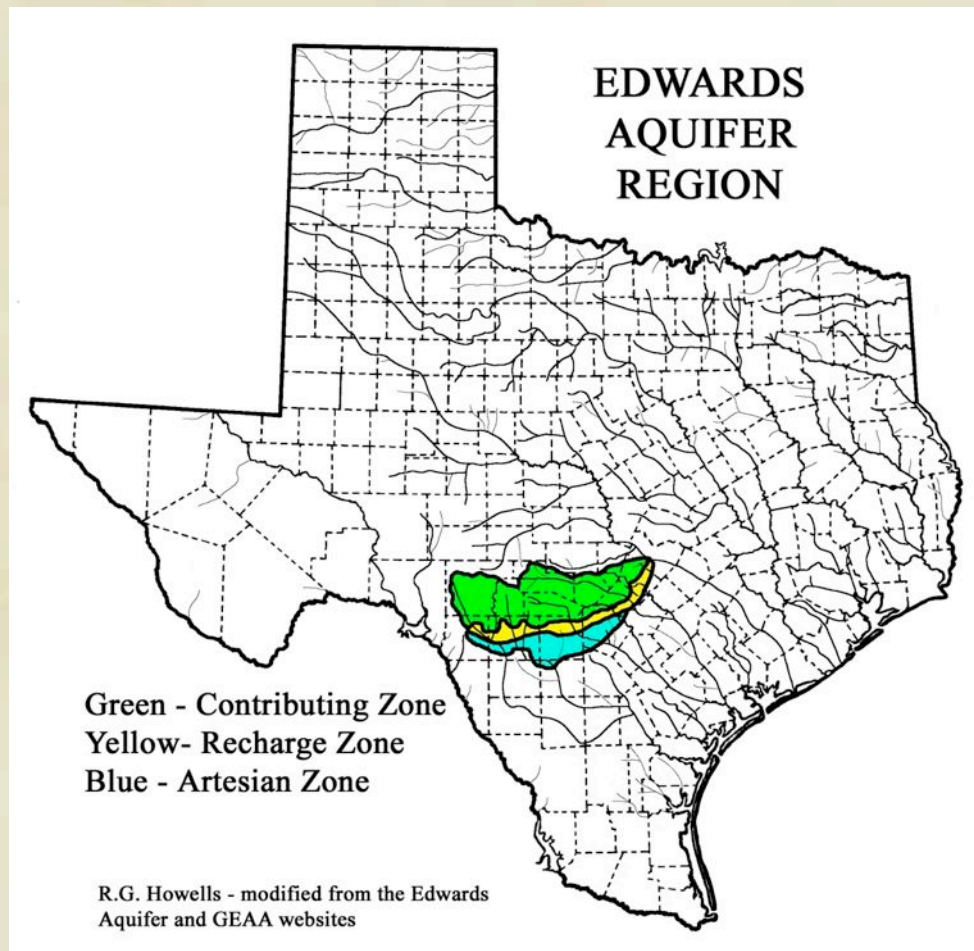




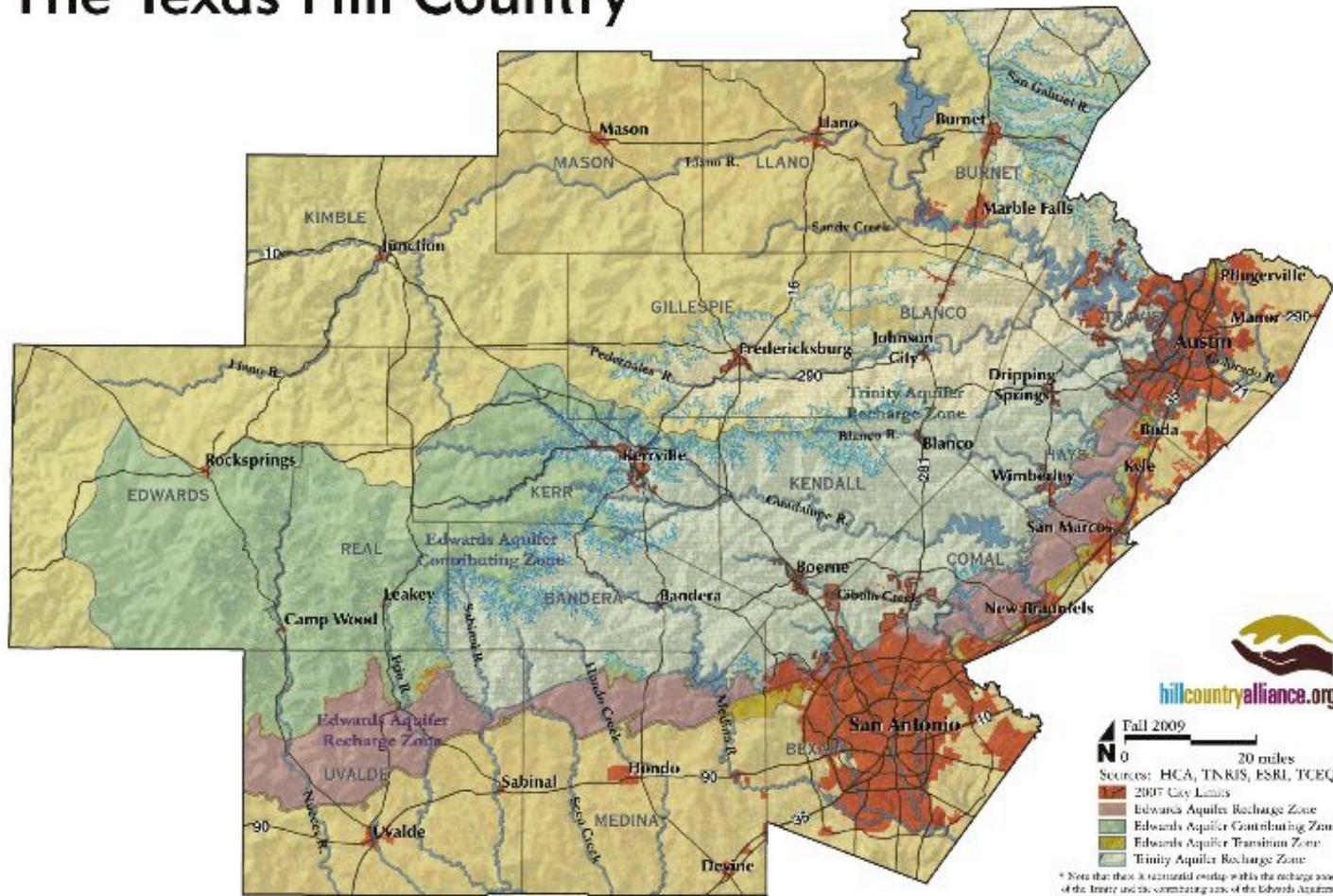
# *Vision and Change*

*“We can't see where the barriers are by only talking to ourselves”*

# EDWARDS AQUIFER REGION

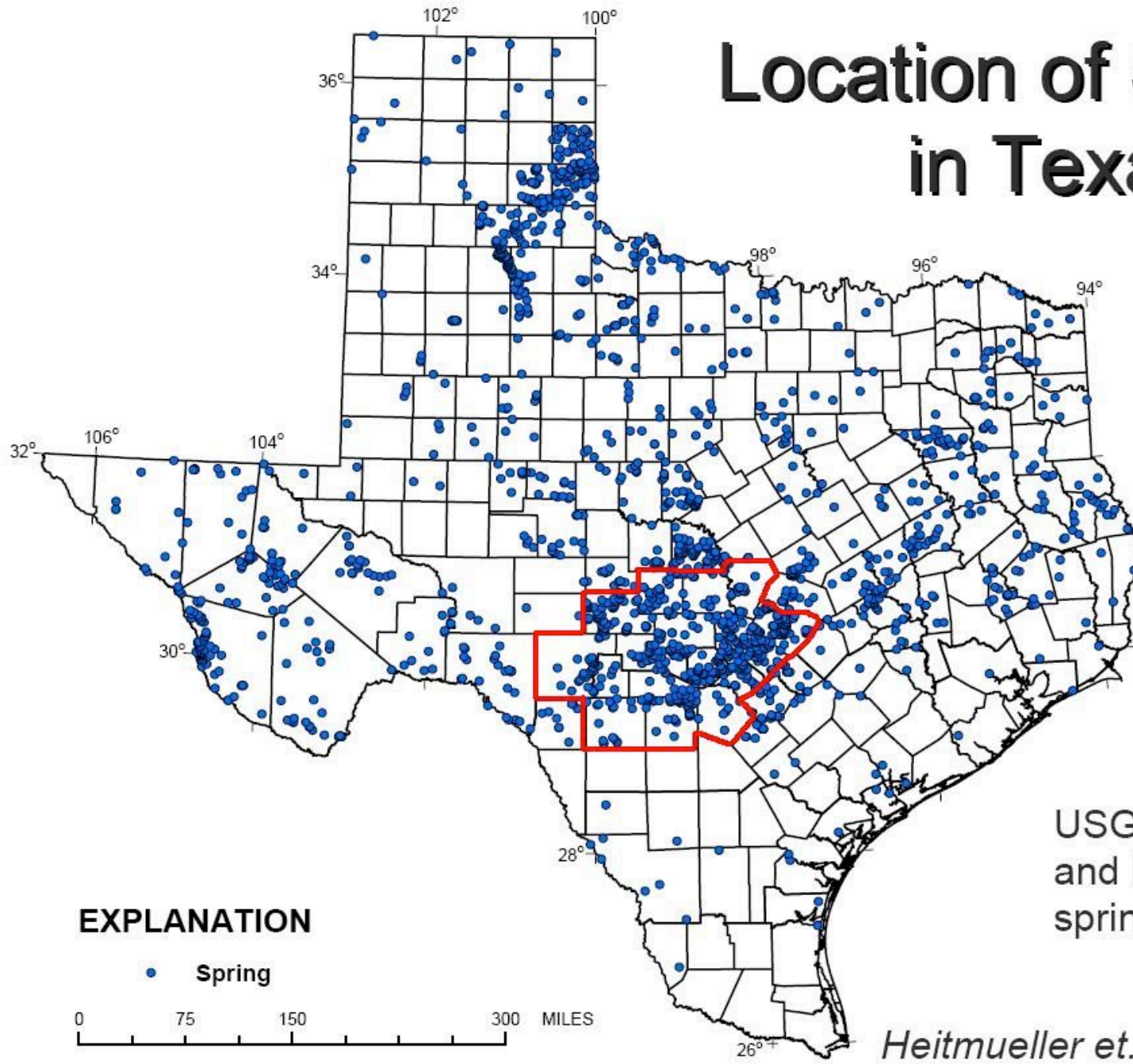


# The Texas Hill Country





# Location of Springs in Texas



## EXPLANATION

• Spring

USGS verified existence and location of 1,891 springs in Texas

*Heitmueller et. al (2003)*

# Hill Country/Upper Llano Natural Resource Issues

- Water Management
- Water Resources
- Natural Threats
  - Floods
  - Droughts
- Water Resource Impairments due to Development
  - Groundwater Quantity
  - Groundwater Quality
  - Surface Water Quality
- Invasive Species
- Wildlife Management
- Range Management



# Texas Situation



- 95% Privately Owned
- 85% Urban
- Pop. Expected to double in 50 years



# Our Mission

To encourage, educate, engage, conduct and coordinate basic and applied research projects dealing with:

- Water /watersheds
- Exotic species
- Range management
- Natural resources
- Ecological restoration
- Environmental education





# Llano River Field Station Development Strategies

- Professional scientific/educational conferences
- Organizing national research/educational symposia to provide exposure to LRFS programs
- Developing innovative partnerships, community engagement workshops, water/watershed educational & research efforts
- Serving on scientific, educational, NGO professional organizations scientific & advisory committees
- Increased funding, visibility & stature of LRFS Outdoor School
- Local, state and national grants

# R&D is increasingly performed in “Pasteur’s Quadrant”

Research is inspired by:  
Consideration of use?

No

Yes

Quest for  
Fundamental  
Understanding?


Yes

No

Pure Basic Research (Bohr)	<b>Use-inspired Basic Research (Pasteur)</b>
<b>Former University Presidents (Vest)</b>	Pure Applied Research (Edison)

Adapted from *Pasteur’s Quadrant: Basic Science and Technological Innovation*, Donald E. Stokes 1997





## Hosting and networking through professional scientific/educational conferences

- Organization of Biological Field Stations
  - Texas Academy of Science (2007, 2016)
  - Texas Association of Environmental Educators
  - Southwestern Association of Naturalists
  - Texas Society for Ecological Restoration
- + others to showcase the station, educational programs, facilities and natural resource research and opportunities of the region.

## *TTU Llano River Field Station Organizations/Meetings/ Workshops*

Texas Academy of Science  
**Southwest Association of Naturalists**  
Organization of Biological Field Stations  
Texas Society of Mammalogists  
Texas State Comptroller Mussel  
Identification Workshop  
Society of Ecological Restoration  
Texas Riparian Association  
Texas Ornithology Society





*TTU Llano River Field Station Organizations/Meetings/  
Workshops*

A&M Range Youth Workshop  
**Rainwater Harvesting Workshops**  
Annual Kite Retreat  
Presidio ISD River Rangers  
Boy Scouts  
Junction ISD Cross Country Track Meets  
Earth Day  
Farm Safety Day  
Emmaus Retreats







# Upper Llano River Watershed Healthy & Notable

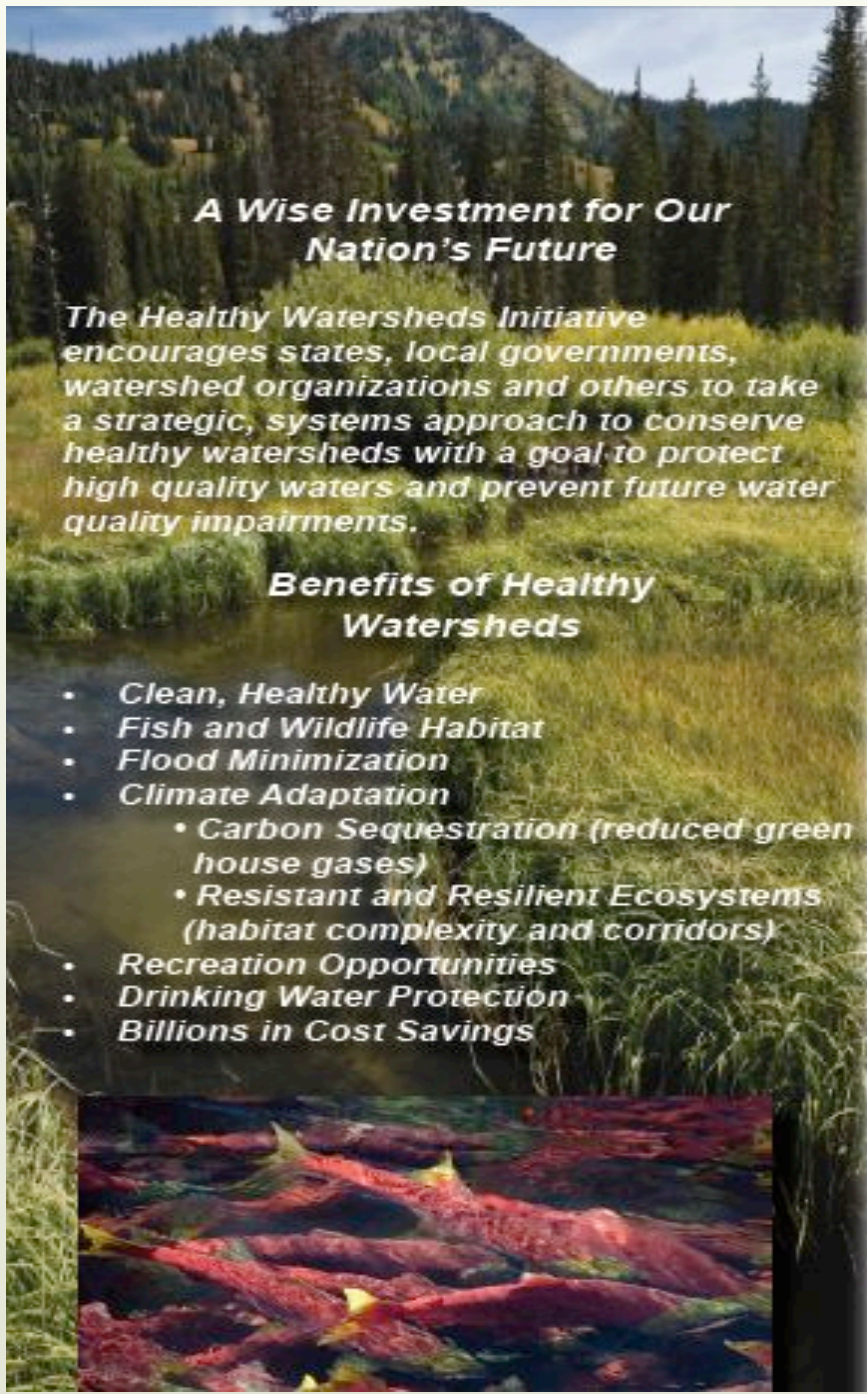
- 1) Hill Country - last great ecosystems,
- 2) 10 Waters to Watch,
- 3) Ecologically Significant Stream, TPWD
- 4) Important, here & downstream



# Local, state and national grants

- Junction Economic Development Council
  - Communities Foundation of Texas
  - U.S. Department of Education
  - National Science Foundation
  - Texas Parks and Wildlife Department, Environmental Protection Agency
  - State Energy Conservation Office (Texas Comptroller)
  - Texas State Soil and Water Conservation Board
- and others – with over **\$7M** in funding, not including the South Central Climate Science Center





## ***A Wise Investment for Our Nation's Future***

*The Healthy Watersheds Initiative encourages states, local governments, watershed organizations and others to take a strategic, systems approach to conserve healthy watersheds with a goal to protect high quality waters and prevent future water quality impairments.*

### ***Benefits of Healthy Watersheds***

- ***Clean, Healthy Water***
- ***Fish and Wildlife Habitat***
- ***Flood Minimization***
- ***Climate Adaptation***
  - ***Carbon Sequestration (reduced green house gases)***
  - ***Resistant and Resilient Ecosystems (habitat complexity and corridors)***
- ***Recreation Opportunities***
- ***Drinking Water Protection***
- ***Billions in Cost Savings***



# **EPA's Healthy Watersheds Initiative**



**D**espite billions of dollars spent in the last three decades to address impairments to water resources, aquatic ecosystems are still in decline. A recent EPA survey of the nation's wadeable streams found 42 percent in poor biological condition and 25 percent in fair condition. Nearly 40 percent of North America's freshwater fish, 700 species in total, are imperiled. We face a serious conservation crisis.

The solution demands a more integrated approach that looks broadly to maintain water quality and ecological integrity on a geographic – or watershed basis. Thanks to today's highly advanced assessment, planning and data analysis tools, we now can achieve the vision for holistic water resource management embraced by EPA and others in the early 1990's. Under the new *Healthy Watersheds Initiative*, EPA is proposing:

- ***A Strategic Framework*** that outlines a systems-based approach to integrated watershed assessment, protection and conservation programs.
- ***A New Policy Direction*** that focuses on maintaining healthy waters and meeting Clean Water Act (CWA) goals of fishable and swimmable.
- ***A Collaborative Approach*** that integrates CWA programs and other aquatic resource programs across agencies and the private sector.
- ***Technical Assistance and Funding*** to states and watershed organizations to support healthy watershed assessment and conservation.



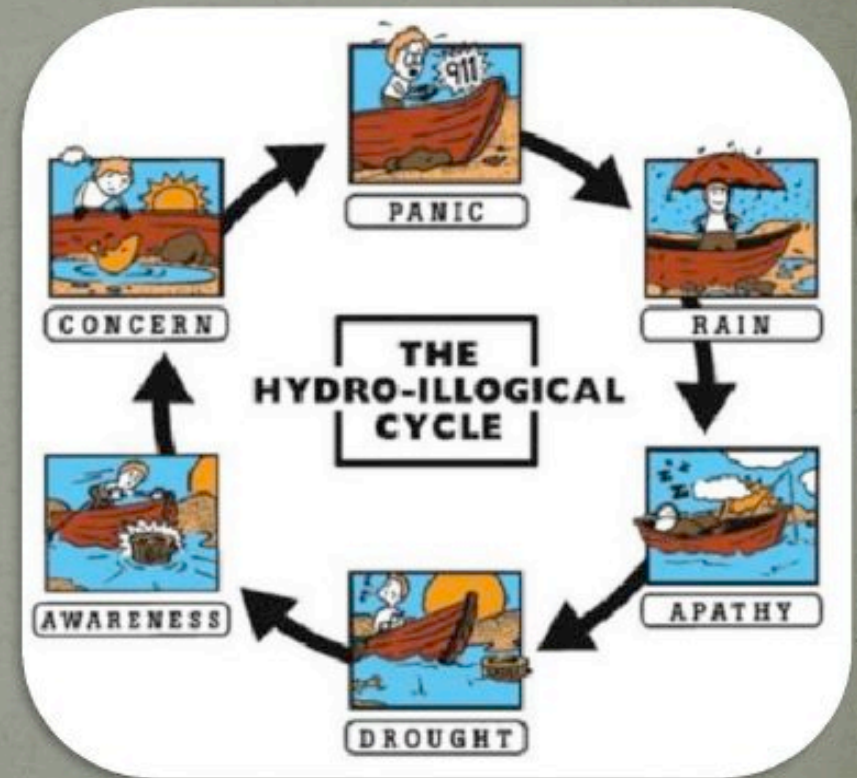


# Development of the Upper Llano River Watershed Protection Plan

- ☉ 1) empowering local stakeholders,
- 2) characterizing current water quantity & quality conditions
- ☉ 3) analyzing watershed data using models, and
- ☉ 4) increasing education among the targeted audience

# Landowner Trends

- New Landowners
- Generational Turnover
- Shrinking Property Sizes
- Absentee Landowners
- Increased Interest in Wildlife Integration & Ecotourism



# Empowering stakeholders

- Landowners benefit because they are part of the process and their desires are incorporated into the WPP
- Partnerships
  - South Llano Watershed Alliance, TTU, and TWRI
- Voluntary community stakeholder meetings





# Working Group Membership

## Invasive species

- Fred Gregg
- Andrew Murr/Billy Braswell)
- Brady Richardson/Daryl Stanley

## Riparian protection and management

- Melissa Parker/Gary Garrett
- Znobla Wootan
- Art Mudge

## Water quality and conservation

- Marty Graham
- Jerry Kirby
- Marvin Ivy/Raymond McDonald

## Water supply enhancement

- Marty Graham
- Tom Vandivier
- Souli Shanklin
- Brady Richardson/Daryl Stanley
- Ward Whitworth

## Upland management

- Dandy Kothmann
- Souli Shanklin
- Sam Silvers/Marvin Ensor

# Example Workgroup: Aquatic Invasives

## 1. Identify concern

- Invasive, non-native elephant ear located within Upper Llano watershed

## 2. Identify region(s) of concern

- Elephant ear has been documented along South and North Llano rivers
  - Found mostly on the SLR above 1<sup>st</sup> crossing to CR150
  - Patches found along NLR near Roosevelt

## 3. Methods of management

- Manual removal; herbicide (glyphosate); mechanical cutting; combination

## 4. Informed decision making

- Through experiences and previous studies: hand-painting herbicide with multiple treatments best

## 5. Implementation

- Technical and financial assistance through TPWD
- Education and outreach through SLWA

## 6. Make set of recommendations to Coordination Committee

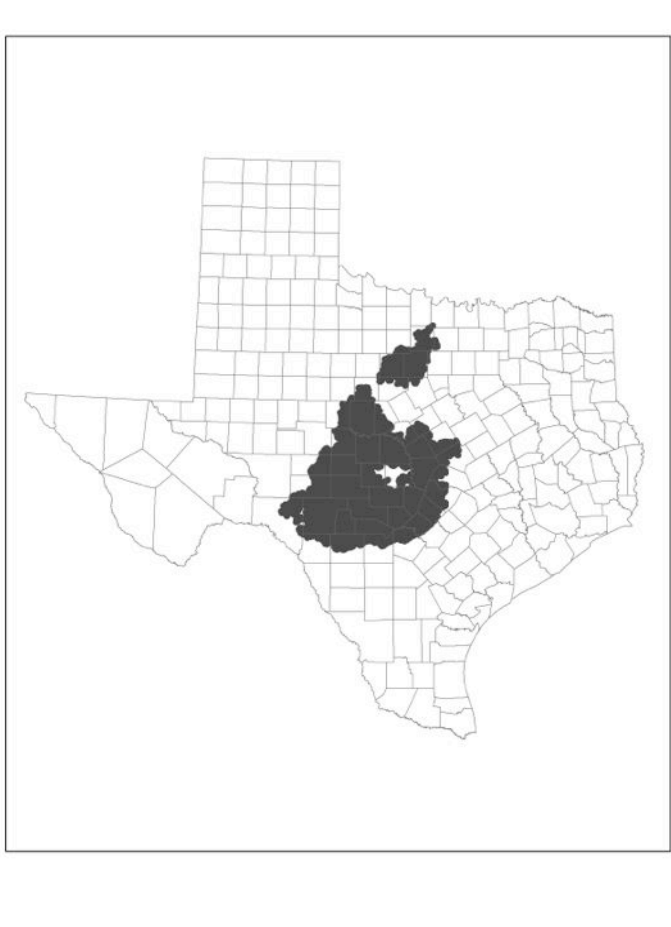


# A TEXAS SIZE PROBLEM: “Evapotranspiration”





# Ashe juniper (*Juniperus ashei*)





# Advantages of Watershed Restoration and Brush Control

- Conserves water lost to evapotranspiration
- Recharges and slows groundwater depletion
- Enhances spring and/or stream flows
- Enhances and restores native habitat; rangeland improved with native grasses and other beneficial land cover
- Positive environmental and ecosystem benefits
- Landowner approved brush sculpting improves grazing, wildlife, hunting and recreation income
- Increased land value



# **RESEARCH UNIVERSITIES AND THE FUTURE OF AMERICA**

Ten Breakthrough Actions Vital to  
Our Nation's Prosperity and Security

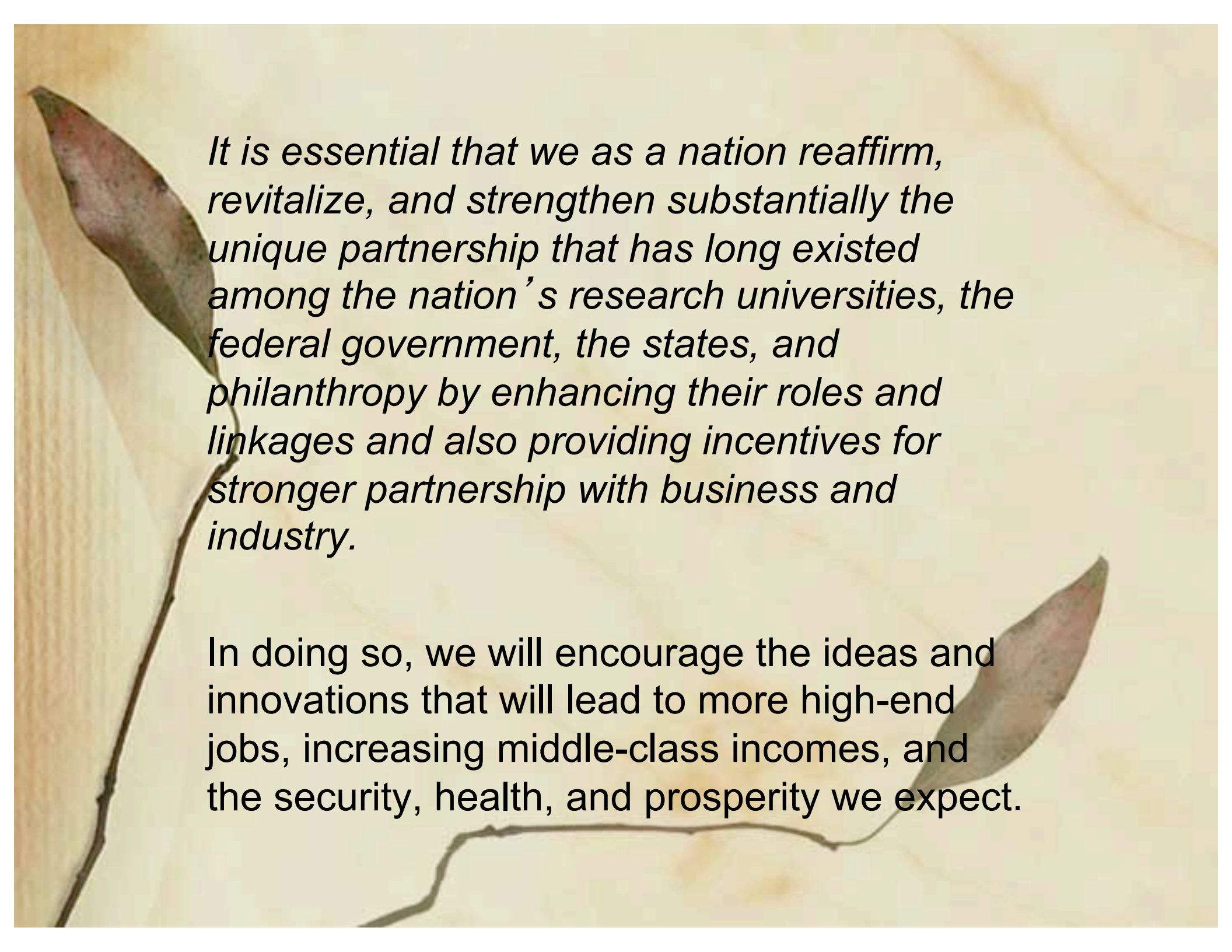
Committee on Research Universities  
Board on Higher Education and Workforce  
Policy and Global Affairs

NATIONAL RESEARCH COUNCIL  
*OF THE NATIONAL ACADEMIES*

THE NATIONAL ACADEMIES PRESS







*It is essential that we as a nation reaffirm, revitalize, and strengthen substantially the unique partnership that has long existed among the nation's research universities, the federal government, the states, and philanthropy by enhancing their roles and linkages and also providing incentives for stronger partnership with business and industry.*

In doing so, we will encourage the ideas and innovations that will lead to more high-end jobs, increasing middle-class incomes, and the security, health, and prosperity we expect.

# Aquifer Group, LLC

*Capitalizing on Intersecting  
Water-Energy-Biomass Markets*

**Goal:**

*Global Sustainable W-E-B Nexus  
Remediation, Mitigation and  
Production Leadership*





# SYNERGIES + CLUSTERS = SOLUTIONS

**WEN Alliance:** In today's environment, inventive entrepreneurs cannot obtain the capital needed to perfect their ideas, universities spend their time pursuing grants to support their research, large commercial firms seek new ideas to develop to stay competitive in the world, and venture capital groups are searching for new investments with promising returns. *What is missing is an alliance for sustainable solutions that serves to coordinate and interface with investors, government, industry, universities, environmental interest groups and other interested stakeholders to accelerate the development of viable water and energy innovations.*

**Texas Tech University Water, Energy, and Natural Resources Innovation and Research Cluster:** “the present state of having uncoordinated and mission-driven water resources agendas within and between agencies, within and between research components of universities, and within and between companies and industries in the private sector will have to change” “through strategic, integrated university components working alongside the private sector and state agencies”

# A Discussion of AG's Proposed Dedicated Field Research Facilities

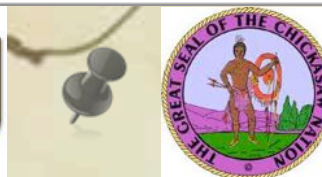
- ***Pyote, Texas - Trans Pecos Field Station*** (Texas Permanent University Fund, Texas General Land Office, University of Texas, Private Partners, O&G Industry)
- ***Uvalde, Texas – Biomass Field Station***
- ***Junction, Texas – Watershed Field Station*** (Texas Tech University, LCRA, Texas Department of Agriculture, Texas Parks and Wildlife)
- ***Fredericksburg, Texas – Wildfire and Watershed Interaction Field Station***  
(Texas Forestry Service, Texas Parks and Wildlife, Texas State Soil and Water Conservation Board, Texas Department of Agriculture)





# The WEN Alliance Solution







# What does Climate Variability Look Like?





# Droughts







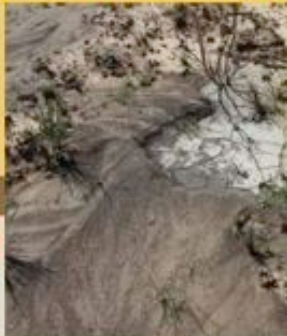


# Drought and Oasis Fire Landowner Workshop

## OASIS PIPELINE WILDFIRE RECOVERY & RECLAMATION WORKSHOP



WILDFIRE OVERVIEW



EROSION PROTECTION



Where do we go from here?

SLOPE SEEDING DEMOS

REDUCE EROSION  
JUMPSTART THE HEALING OF YOUR LAND

NOV. 12, 2011  
TTU JUNCTION CAMPUS

Landowners affected by recent wildfires will gain knowledge and resources towards reducing the devastating long-term impacts to their land.











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About the Watershed

# Home

The South Llano Watershed Alliance is an organization of landowners and interested stakeholders whose mission is to preserve and enhance the South Llano River and adjoining watersheds by encouraging land and water stewardship through collaboration, education, and community participation



### Quick Links

- Join the Alliance's [email list](#)
- [Contact us](#)

#### WEATHER AND CLIMATE

- [Junction Weather forecast](#)
- [LCRA Hydromet: Temperature, Rainfall, Streamflow](#)
- [How Dry is It?...latest drought map](#)
- [Central Texas 180 - Day Rainfall Deficit](#)

#### HYDROLOGICAL INFORMATION

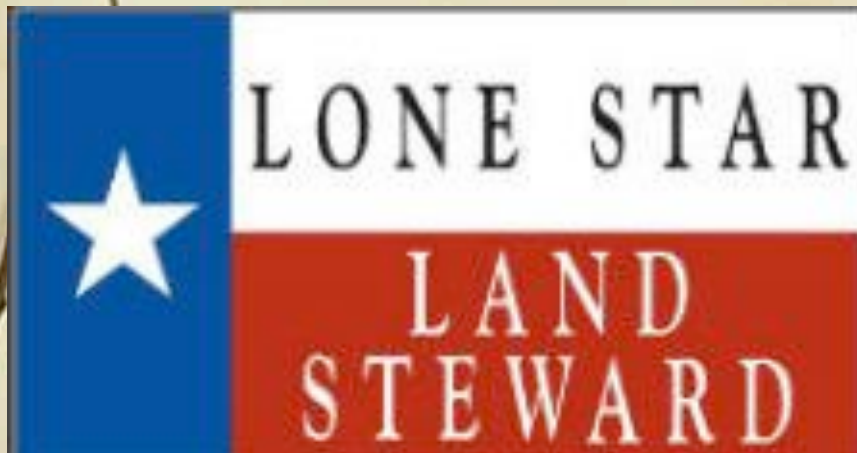
- [Llano River at Junction](#)
- [Llano River at Llano](#)



# Lone Star Land Steward Awards

- **South Llano River Watershed Alliance**

Formed in 2009, the South Llano River Watershed Alliance is an organization of landowners and interested stakeholders whose mission is to preserve and enhance the South Llano River and adjoining watersheds. Current president is Znobias Wooten; Dr. Tom Arsuffi serves as vice president.



# Partners for Wildlife Brush & Riparian Demonstration










# Riparian Management



*Funding (\$20,000): Hal & Charlie Peterson Foundation, Partner's for Fish & Wildlife*  
*Additional Partners: NRCS, Schreiner University Internship Program*





NY Times, p. A17.

July 10, 2009

## Survey Shows Gap Between Scientists and the Public

“Scientists must find new ways to engage with the public. One cannot just exhort ‘we all agree you should agree with us.’ It’s **a much more interactive process** that’s involved. It’s time consuming and can be tedious. But it’s very important.”



# Hill Country Land Stewardship Workshop

{ Plans and Practices for Maximizing  
the Value and Resources of Your Land }

**When:** **Date:** April 19th  
**Sign In & Late Registration:** 8:30 a.m. – 9:00 a.m.  
**Program:** 9:00 a.m. – 4:00 p.m.

**Where:** **Texas Tech University, Junction Campus, Junction, Texas** (Dining Hall)

**Sessions:** **Morning Session: Speakers and Topics**

- Bill Armstrong, former director of Kerr Wildlife Management Area, "Historical Perspective of the Hill Country and How It's Changed"
- Dr. Tom Arsuffi, TTU at Junction, Director, Field Research Station, "Water: Where Does It Come From and Where Does It Go?"
- Billy Kniffen, Menard Co. TAES agent, "Be the Change You Wish to See on Your Land"
- Russell Kott, Kimble Co. TAES agent, "Agencies' and Organizations' Resources"
- Paul Bierschwale, Appraiser, "Property Taxes and Exemptions"

**Afternoon Session: Landowners' Tour Led by Billy Kniffen**

- Caravan to local ranch for tour of old home site in natural setting on Gentry Creek with native landscaping and beautiful tall grass pastures, a result of prescribed burns.
- Tour of small landowner's property to observe management practices including; cedar removal; water catchment by cedar slash terracing, and the preservation and encouragement of native species and diversity.

**Details:** **Cost:** \$15 registration fee (After April 10th \$20 for late reg.)  
Registration limited to 120 people  
Registration fee required for all attendees, including WEPTMN members  
Fee includes resource packet, lunch, and drinking cup

**Contact:** Scott or Martha Richardson, 325-475-2271,  
scottr@ctesc.net or marthar@ctesc.net

**Sponsors:** WEPTMN, TTU at Junction, Texas AgriLife Extension Service.



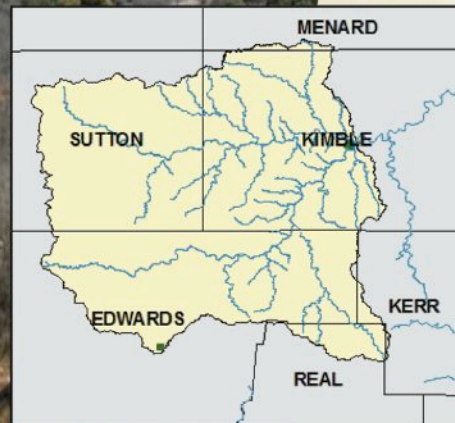
# TEXAS Watershed Steward



The Texas Watershed Steward program is a free, one-day educational workshop designed to help watershed residents improve and protect their water resources by getting involved in local watershed protection and management activities.

**August 30, 2012:  
8:00 am - 4 pm**

Llano River Field Station  
Texas Tech Center at Junction  
254 Red Raider Lane  
Junction, TX 76849



The workshop will provide an overview of water quality and watershed management in Texas. It will primarily focus on water quality issues in the Llano River as well as efforts by the South Llano Watershed Alliance, Texas Water Resources Institute, Texas Tech University, Texas Parks and Wildlife Department, Texas State Soil and Water Conservation Board, and area residents to help improve water resources and the health of the surrounding watersheds in the area. For information visit: <http://southllano.org/>

Pre-register for the workshop by going to:  
<http://tw.s.tamu.edu/workshops/online-registration>  
or call 979.862.8070

## Upper Llano River





**We think environmental education is important!**

**95% of Americans and 96% of parents think environmental education should be taught in schools.....**

Coyle, K. 2005. Environmental Literacy in America: What ten years of NEETF? Roper Research and Related Studies Say About Environmental Literacy in the U.S. <http://www.neefusa.org/pdf/ELR2005.pdf>

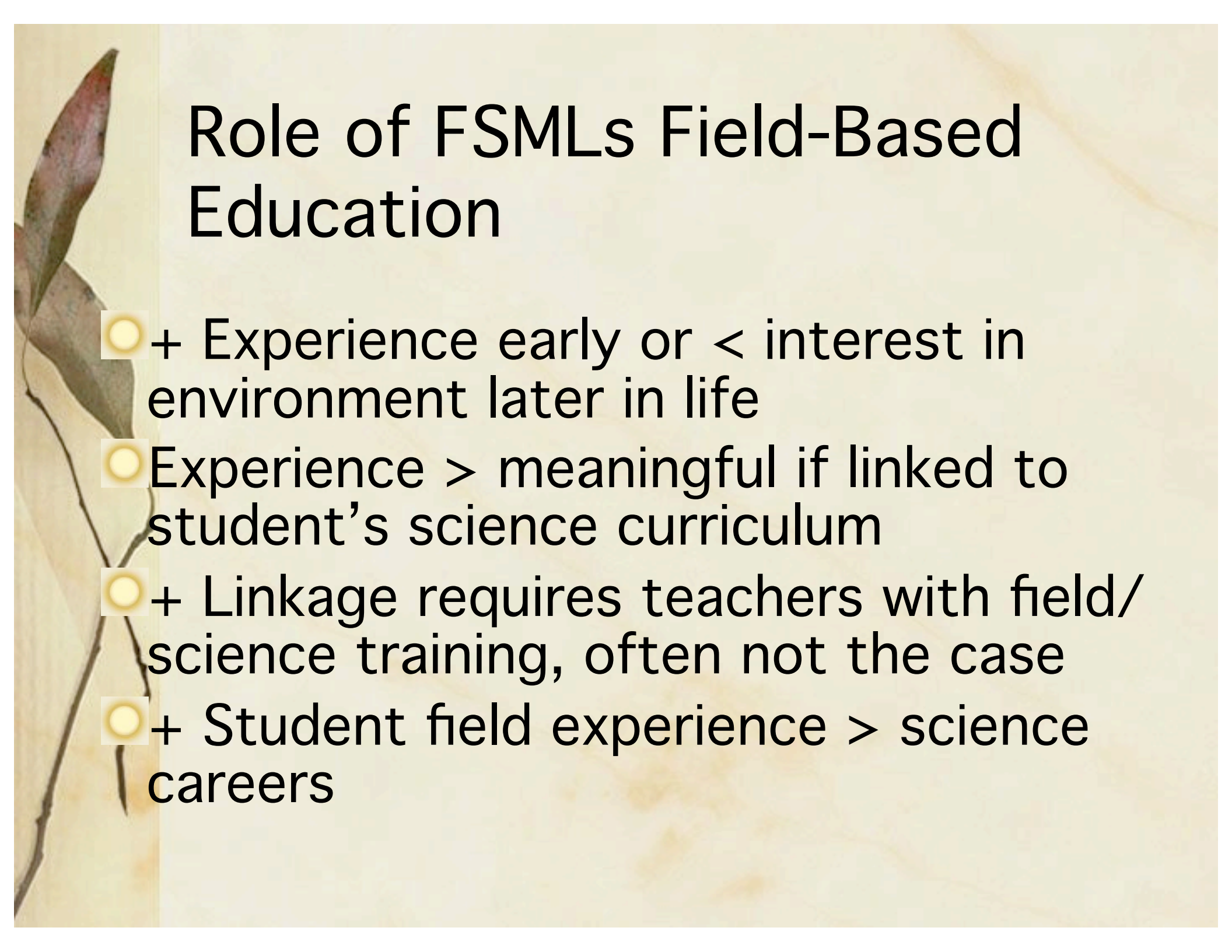




**We think we know a lot, but.....**

**70% of Americans rate themselves as fairly knowledgeable about environmental issues, but only ~10% receive a passing grade on a multiple choice quiz of basic knowledge.**

Coyle, K. 2005. Environmental Literacy in America: What ten years of NEETF? Roper Research and Related Studies Say About Environmental Literacy in the U.S. <http://www.neefusa.org/pdf/ELR2005.pdf>



# Role of FSMLs Field-Based Education

- ⦿ + Experience early or  $<$  interest in environment later in life
- ⦿ Experience  $>$  meaningful if linked to student's science curriculum
- ⦿ + Linkage requires teachers with field/science training, often not the case
- ⦿ + Student field experience  $>$  science careers



# LRFS Outdoor School: STEM Learning in Nature



# Llano River Field Station

## OUTDOOR SCHOOL

- THSP EXEMPLAR 2007-2010
- HB 1700. 1 OS X 130+ TPW X 1000+ ISDs = + STEM Reform
- OBFS HUMAN DIVERSITY AWARD
- International/National Symposia

- Ecology education and outreach programs at North American Field Stations: Natural resource islands to improve ecological literacy and outdoor learning experiences for a K-Gray urbanized society. Symposium organized by the TTU Llano River Field Station was competitively selected by the Program Committee for inclusion at the international 2008 annual meeting of the Ecological Society of America.

- Environmental Education and Outreach programs at Texas Field Stations, Informal Science Centers, State Agencies and Conservation Organizations: Science Islands to Improve Natural Resource Literacy and Outdoor Learning Experiences for a K-20+ Urbanized Society. Symposium organized by the TTU Llano River Field Station for the 2009 annual meeting of the Texas Academy of Science in Junction.

The screenshot shows the Texas High School Project website. The header includes the logo and navigation links: Home, Initiatives, Grantees, Voices, News, Partners, About Us, THSP Webinar Series. The main content area features a blue banner with the text "Exemplar: Texas Tech University Outdoor School" and a navigation menu with tabs for Mission & Philosophy, Challenge & History, Strategy, Outcomes, and Lessons Learned. Below the banner, there are several sections: "Initiative: Exemplar Grant Program" with a description of the program's goals, "Demographics" showing student statistics, and "Resources" with a link to the TTU OS Program Website. There are also images of students in a field setting and a smartphone displaying a website.

**OUR INITIATIVES**

- Early College
- High School Redesign
- Education Leadership
- New / Charter Schools
- T-STEM

Home Initiatives Grantees Voices News Partners About Us THSP Webinar Series

THSP • Initiatives • T-STEM • T-STEM Network • Texas Tech University Outdoor School

Exemplar: Texas Tech University Outdoor School

Mission & Philosophy Challenge & History Strategy Outcomes Lessons Learned

**Mission:** The mission of the Texas Tech University Outdoor School is to inspire students and teachers to develop passion and a sense of ownership and identity towards nature and the watershed in which they live, while building better classroom environments and generating higher TAMS scores. The Outdoor School program was designed to provide unique opportunities to use the environment as an integrating context for interdisciplinary, collaborative, student-centered, hands-on and engaged learning, with a focus on the sciences and mathematics.

The TTU OS program is consistent with and a component of the goals of the Texas Tech University strategic plan to: provide programs and services that disseminate knowledge and skill and that build strategic partnerships and alliances with external entities; create high-quality field based science education programs for regional school districts; sponsor professional development training for K-12 teachers from the region and increase the enrollment and diversity of students entering college in STEM content areas.

**Philosophy on teaching and learning:** Several studies indicate that if a child has not had a positive experience in nature and the outdoors by age 8 or 9, they will have little interest in the environment in later life. Early experiences are often through family or school activities. In the case of school activities, field experiences are most meaningful if they are part of, or linked to, a student's science curriculum rather than an isolated "field trip". In this manner the field experience can be integrated with classroom activities. Successful linkage, however, often requires that teachers also have had previous exposure to field experiences, which often is not the case.

Students receive a backpack loaded with learning instruments -

Field experiences can also have a positive influence on heightening students' interest in science and serve as an entry point to considering a career in science. Many researchers in the field biological sciences point to early field exposure as being the life changing experience, which led to their continued interest in science. The TTU Outdoor School motto is, "Inspiring students to develop passion and a sense of ownership and identity towards nature and the watershed in which they live, while building better classroom environments and generating higher TAMS scores". Very little time is occupied in a lecture mode of instruction. Instead, the program immerses learners in authentic real world, hands-on activities that stimulate imagination, develop a curiosity about life and create an environment to share discoveries.

**Demographics:**

- Grades Served: K - 12
- Total Students: 6,146 from 2004 to spring 2007
- Caucasian: 51%
- African American: 5%
- Hispanic: 43%
- Other: 1%
- Qualifying for federal free/reduced lunch: 50%

**Resources**

TTU OS Program Website





# Service on scientific & advisory committees

- Board of Directors-Texas Academy of Science
- Executive Committee-Organization of Biological Field Stations
- Advisory Board-Hill Country Alliance
- Advisory Committee-Multiagency Texas Invasive Species Coordination Committee
- TTU Water Leadership Council
- Appointed-Senate Bill 3 Nueces River/Corpus Christi Bay Expert Science Team
- Chair-Executive Committee, Society for Freshwater Science
- Appointed-Science Committee, Edwards Aquifer Habitat Conservation Plan
- Elected – Chair: Task Force for Implementation Texas Natural Resource/Environmental Literacy Plan

*Nueces River and Corpus Christi and Baffin Bays  
Basin and Bay Expert Science Team (Nueces  
BBEST)*


# Environmental Flows Recommendations Report





# Basin & Bay Expert Science Team (BBEST)


Member	Hydrology	Instream	Estuary
Sam Vaughn, Chair	★		
Rocky Freund, Vice Chair	✓	✓	
Dave Buzan		★	✓
Greg Stunz			★
Tom Arsuffi		✓	
Ken Dunton			✓
Ben Hodges	✓		✓
David Hoeinghaus	✓	✓	
Ryan Smith	✓	✓	
Lonnie Stewart	✓	✓	
Jace Tunnell			✓
Lance Williams		✓	



## Our Tactics - serving on agency & NGO scientific & advisory committees


- LCRA/SAWS Science Review Panel
- Texas Academy of Science Board of Directors
- TTU Water Leadership Council
- Hill Country Alliance Advisory Board
- Hill Country Alliance Technical Advisory Board
- Texas Invasive Species Committee Advisory Board
- GBRA Canyon Lake Gorge Scientific Committee
- South Llano River Watershed Alliance
- Senate Bill 3 Nueces BBEST
- Texas Riparian Association
- Texas Natural Resource/Environmental Literacy Task Force





Developing innovative partnerships,  
community engagement workshops,  
water/watershed educational and  
research efforts

- Texas Water Symposium with Texas Public Radio
- Regional land and watershed stewardship
- National Park Service
- Texas Parks & Wildlife Department
- South Llano River Watershed Alliance
- Industry: Aquifer Group/WEN Alliance



Educating the public on complex  
water issues to improve water  
literacy using expert panels, rotating  
venues, diverse partnerships and  
Texas Public Radio

Tom Arsuff -TTU-Llano River Field Station  
Christy Muse -Hill Country Alliance  
Ernie Villareal -Texas Public Radio  
Chris Distel -Schreiner University



TEXAS

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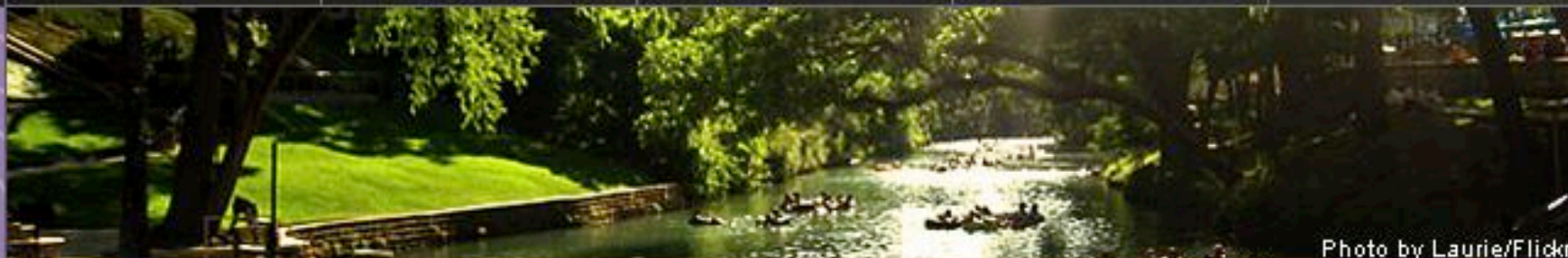
PUBLIC  
RADIO

Photo by Laurie/Flickr

hear yourself think

**The Newsmaker Hour**

Wednesday, March 25, 2009

listen now

on the air

Fresh Air  
11 a.m. to 12 p.m.

*The Newsmaker Hour* is a program featuring speakers addressing local and national organizations on a variety of topics and current events produced by Texas Public Radio's Ernie Villarreal. Local organizations regularly featured are the World Affairs Council of San Antonio, the Free Trade Alliance San Antonio and the Greater San Antonio Chamber of Commerce. Speakers invited to address the public and students at St. Mary's University, UTSA, San Antonio College and St. Philip's College are also featured. National organizations include the City Club of Cleveland and the National Press Club. Audio CDs of the locally produced programs are available for purchase by contacting producer Ernie Villarreal at [ernie@tpr.org](mailto:ernie@tpr.org).

**Program Archive:**

🔊 **"Forging Partnership: Addressing Complex Water Issues in Texas"** 📄 **Download MP3**

*March 20, 2009* · This program is the last in a series of panel discussions of the Texas Water Symposium; a joint project of Schreiner University, Texas Tech University, the Hill Country Alliance and Texas Public Radio. Moderating the discussion is Robert Potts, President of the Dixon Water Foundation. On the panel are: Bill Ross, Schreiner University Wilson Fellow; A. L. "Curg" Starkey III, rancher and the great-grandson of a founding father of Kerr County and David K. Langford, Vice-President emeritus of the Texas Wildlife Association.

🔊 **Q&A Session**

🔊 **John Quiñones, ABC News correspondent and San Antonio native**

*March 13, 2009* · Texas Public Radio's Ernie Villarreal spoke with ABC News correspondent and San Antonio native John Quiñones about his book titled **Heroes Among Us: Ordinary People, Extraordinary Choices** published by HarnerCollins. Their conversation was recorded on January 29, 2009.





Created through collaboration: [Schreiner University](#),  
[Texas Tech University](#), [Texas Public Radio](#) and [Hill Country Alliance](#)



## Texas Springs: Making Connections between Groundwater, Surface Water, Science and Stewardship

*Water, essential for life, is our most precious and valuable natural resource. But water supply is limited and under increasing pressure from a growing population. How will we protect this resource and plan for a sustainable future? There is a great need for a water-literate public; decisions being made today have far reaching and long lasting effects for our children and future generations.*

The Texas Water Symposium provides perspectives from landowners, policy makers, scientists, water resource experts and regional leaders.

Join us as we explore the complex issues and challenges in providing water for Texans in this century.

Each session is free and open to the public. The hour-long program begins at 7:00 pm, followed by discussion time with Q&A. The events are recorded and aired on Texas Public Radio one week later.

Stay informed about future programs by subscribing at [www.hillcountryalliance.org](http://www.hillcountryalliance.org)

More information at: [www.schreiner.edu/water](http://www.schreiner.edu/water)

Photo: Hamilton Pool  
Photographer: David Wilson

### Friday, March 8, 2013

Texas Tech University in Junction  
Doors open at 6:30  
Program 7:00 – 8:30 pm

**Moderator:** [Edwards County Judge Souli Shanklin](#)

**Rural Land Steward Panel:** [David Langford](#), [Tom Vandivier](#) and [Ruthie Russell](#)  
**Groundwater and Science:** [Dr. Robert Mace](#), [Deputy Executive Administrator Water Science and Conservation, Texas Water Development Board](#)  
**Springs, Surface Water and Science:** [Dr. Tom Arsuffi](#), [Director, Texas Tech University Llano River Field Station](#)

Sadly it has been documented that at least 63 historically significant Texas springs have stopped flowing. (Gunnar Brune's *Springs of Texas* 1973)

As Texans grapple with water shortages and the expensive challenges ahead to provide water supply for growing populations, it is important to understand the nature and value of spring flow.

Spring flow is a barometer of underground water supply. Springs provide what hydrologists call base flows, the water that feeds streams and rivers after runoff from rainfall ceases. In order to protect these springs, it is essential that we care for land on a large landscape scale.

Conserved rural lands ensure healthy springs, rivers and aquifer systems which provide long-term drinking water supply for cities and towns downstream. This is a unique opportunity to listen to Hill Country landowners' stories and understand the connection between their stewardship efforts and our water supply.


It is not a coincidence that this program is being held the day before Kimble County's annual public field trip to 700 Springs. Join us!





# TWS Structure and Function


- Rotating Venues: Austin, Junction, San Antonio, Kerrville, Boerne et al.
- HCA: Press, Marketing & Program
- Schreiner University: Website & Host
- TTU LRFS: Program, Host, Panelist
- Texas Public Radio: Taping, Broadcast, Marketing and Archive



"More precious than gold: The ethical, economic, legal and environmental implications of supplying 40 million people with water by 2050"

- **Joe Beal**, general manager of the Lower Colorado River Authority
- **Bill West**, general manager of the Guadalupe-Blanco River Authority
- **Robert Potts**, former general manager of the Edwards Aquifer Authority.






# “Kids, Water, and Science: Perspectives from Our Future”

The last of the 2009-10 Texas Water Symposium series will be at Schreiner University. Winners of the essay contest will be announced.

State representative Doug Miller (R) from District 73 will be master of ceremonies for the evening.

- **Cindy Loeffler**, water resources branch chief for the Texas Parks and Wildlife Department
- **Linda Ruiz McCall**, an education and outreach specialist in water science and conservation at the Texas Water Development Board
- **Irene Pickhardt**, assistant director of Science for the Texas Education Agency



# The Insidious and Stealthy Water Thieves of Texas:

Invasive species impacts on resources, economics and ecosystems

- Moderator: **Carter Smith**, Executive Director, Texas Parks and Wildlife Department.
- **Jim Bergan**, The Nature Conservancy
- **Earl Chilton**, Texas Parks & Wildlife
- **Tom Arsuffi**, Texas Tech University





# Assessment & Audience Feedback

- "this (symposium) is very valuable and Texas needs to be doing more of these kinds of education and outreach programs concerning water."

**BUT.....**

- "Global Warming is debatable and in question"



# 11. Llano River Biodiversity Trail

Project Partner: Texas Tech University's Llano River Field Station  
RTCA Contact: Marta Newkirk  
Location: Junction  
Congressional District: TX - 11

## Project Goal

Develop 3.2 miles of land trails which connect with a newly designated 4.4 mile paddle trail along the Llano River. Development of six demonstration areas of Best Management Practices for native plant gardens, rainwater harvesting systems, mesquite brush control, wildlife guzzlers with game cameras, invasive species management, and instream fish habitat improvement structures.



Rivers, Trails, and Conservation Assistance Program



- Who We Are
- Projects By State
- What We Do
- Contact Us
- Apply for Assistance
- News & Events
- Helpful Tools
- Search NPS
- Nationwide Rivers Inventory
- Rivers & Trails Home

Subscribe to our e-news

### WHAT IS THE RIVERS & TRAILS PROGRAM?

The Rivers, Trails, and Conservation Assistance Program is the community assistance arm of the National Park Service. RTCA supports community-led **natural resource conservation and outdoor recreation projects.**

RTCA staff provide **technical assistance** to communities so they can conserve rivers, preserve open space, and develop trails and greenways.



Members of the Bike Share Expansion Project Team with B-Cycles at San Antonio Missions National Historical Park. Photo: NPS

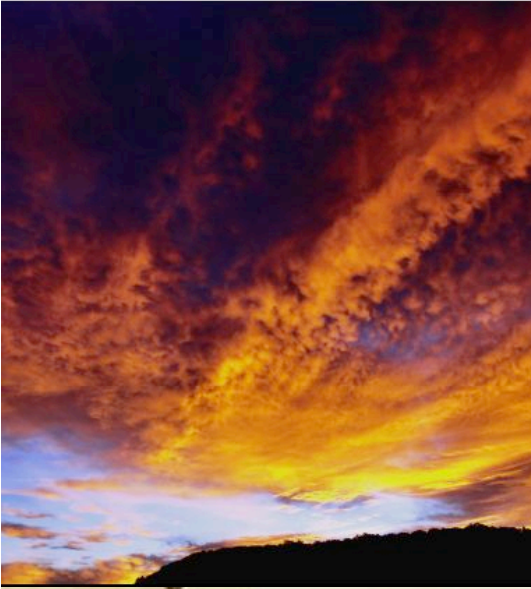
## Recent Successes



# DISCOVERY POINT

TRAILS AND OBSERVATION TOWER

Texas Tech University Llano River Field Station

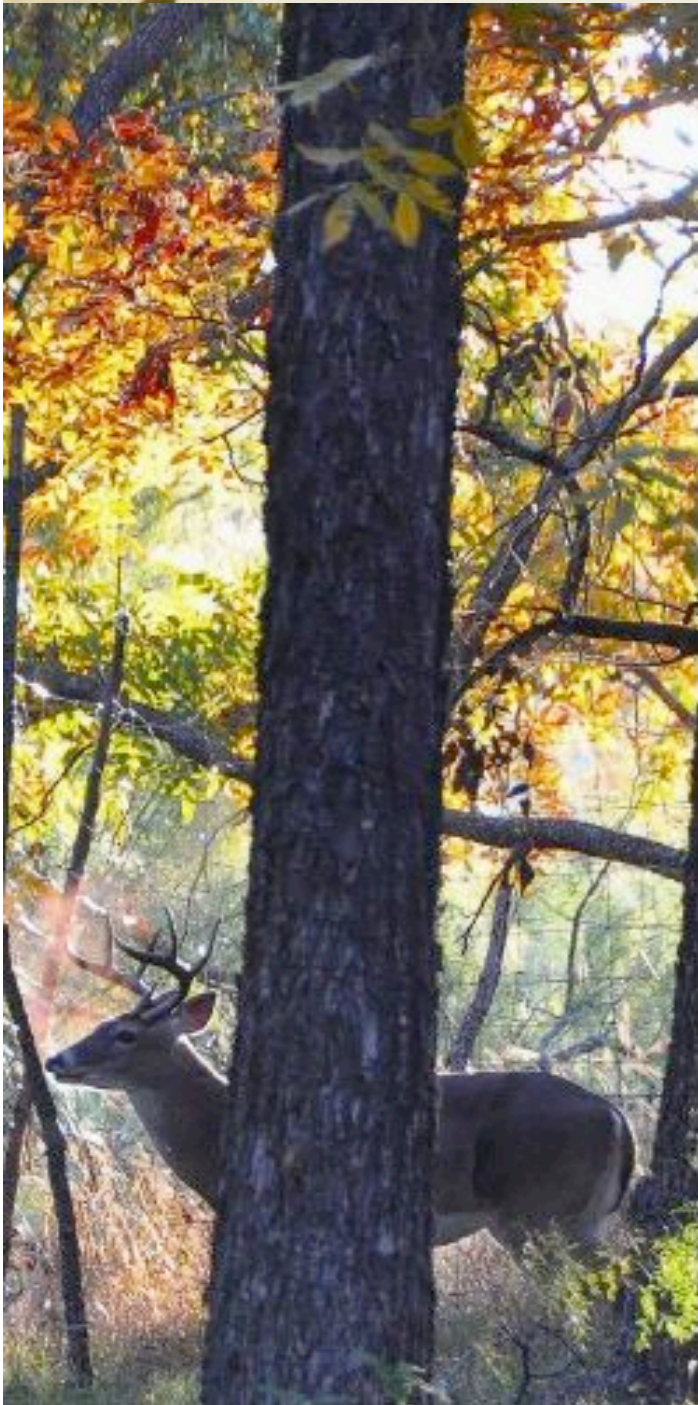


**A DESTINATION FOR RESEARCH,  
ECOTOURISM,  
AND EDUCATION**

**THE LLANO RIVER FIELD STATION IS ONE OF THE GREAT HIDDEN JEWELS IN THE STATE'S  
EDUCATION AND OUTREACH SYSTEM. THERE IS NO BETTER OR MORE PICTURESQUE SETTING  
...TO COME LEARN ABOUT THE HILL COUNTRY'S UNIQUE LANDS, WATERS, AND HERITAGE.**

- Carter Smith, Executive Director, Texas Parks and Wildlife Department





## Recognition of Participants

---

The following stakeholders are acknowledged with much appreciation for their contributions to this Vision Plan. These project supporters contributed their valuable ideas (and criticisms) by: attending planning workshops, participating in an online survey, initiating constructive conversations, and actively contributing to this effort over the past few years.

David Akers, Akers Ranch  
Margaret Akers, Akers Ranch  
Tyson Broad, South Llano Watershed Alliance  
Todd Chambers, Texas Tech University  
Jerod Foster, Texas Tech University  
Tony Hall, Gentry Creek Ranch  
Melissa Hoggett, Junction ISD  
Curt Howell, Texas Tech University  
Bill Neiman, Native American Seed  
Emily Neiman, Native American Seed  
Robert Potts, Dixon Water Foundation  
Scott Richardson, South Llano Watershed Alliance  
Martha Richardson, Landowner  
Cappy Smith, Texas Parks and Wildlife Dept.  
Donna Oliver-Leep, Master Naturalists  
Clay Arnes, Texas Tech University @ Junction  
Salvador Martinez, Texas Tech University @ Junction

Mike Bailey, Texas Tech University @ Junction  
Derrick Ard, Texas Tech University @ Junction  
Zack Thomas, Texas Tech University Llano River Field Station  
Emily Seldomridge, Texas Tech University Llano River Field Station  
Donn Edwards, Texas Tech University Llano River Field Station  
Linda Edwards, Texas Tech University Llano River Field Station  
Greg Malstaff, South Llano River Watershed Alliance  
Trace Thomas, Texas Tech University  
Paul Vickery, West Cave Preserve  
Karen Lopez, Texas Tech University @ Junction  
Robert Stubblefield, Texas Tech University @ Junction

*"At Texas Tech, faculty and students are conducting research and creating solutions for issues that affect our state and nation. The Llano River Field Station provides novel educational experiences for our students that also compliment research projects which address water, the environment, and natural resources, all of which are critical issues for present and future generations of Texans."*

- Lawrence Schovanec, Interim President, Texas Tech University



# SECO Renewable Energy Grant



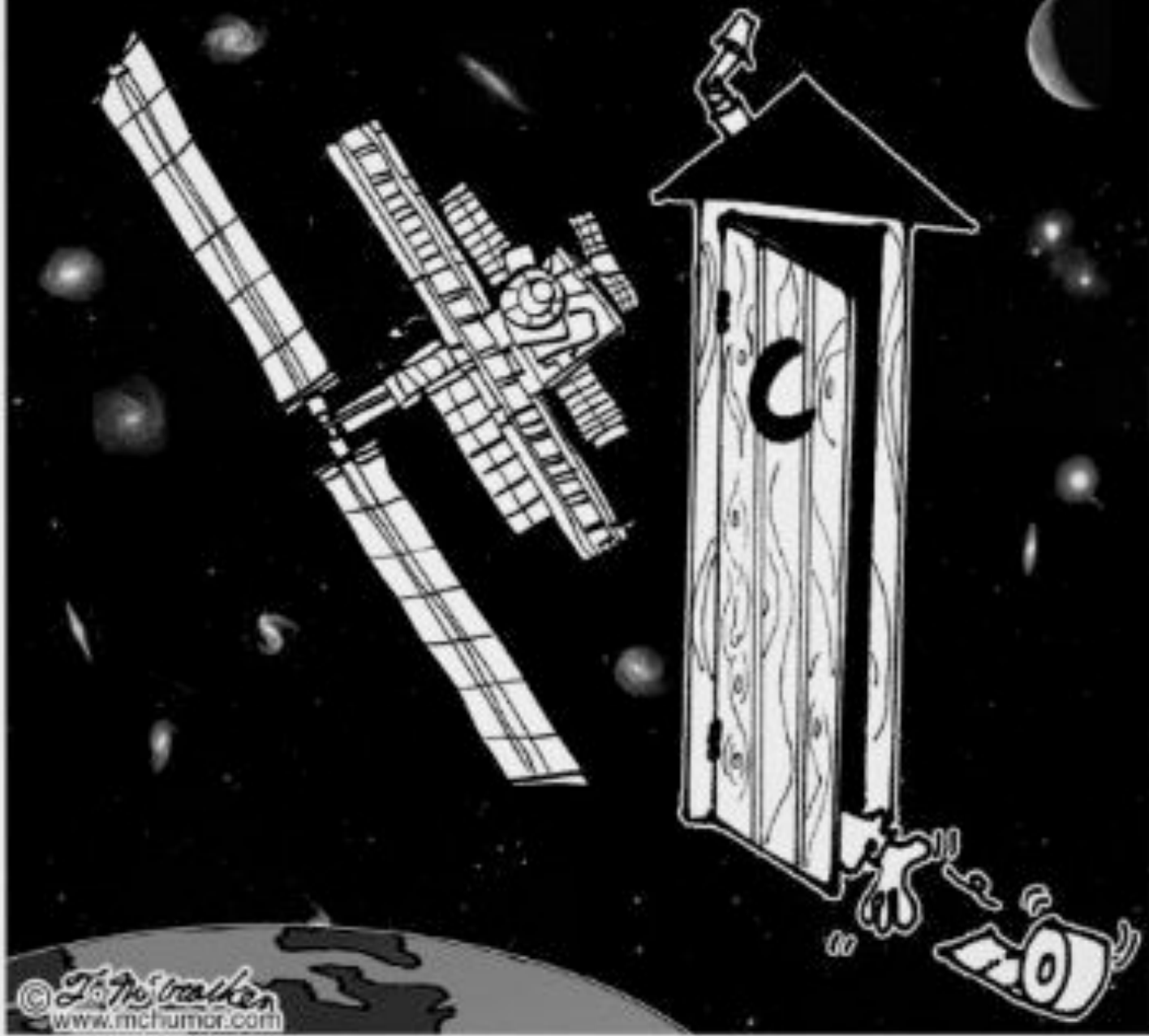
# SECO Renewable Energy Grant


- OS Renewable Energy Unit on Wind & Sun
- Energy/Water Nexus Demo
- Discovery Point Trail Experience





HOUSTON, WE HAVE A PROBLEM.





**We think environmental education is important,**

**95% of Americans and 96% of parents think environmental education should be taught in schools,**






**We think we know a lot but .....**

**70% of Americans rate themselves as fairly knowledgeable about environmental issues,**

**but only ~10% receive a passing grade on a multiple choice quiz of basic knowledge.**



Why is it important to have a population wise in the ways of science?

- need for a more sophisticated work force;
- a need for more scientifically literate consumers,
- equally as important, a scientifically literate electorate who can help shape public policy.



# LRFS Outdoor School: STEM Learning in Nature



# Llano River Field Station

## OUTDOOR SCHOOL

- THSP EXEMPLAR 2007-2010
- HB 1700. 1 OS X 130+ TPW X 1000+ ISDs = + STEM Reform
- OBFS HUMAN DIVERSITY AWARD
- International/National Symposia

- Ecology education and outreach programs at North American Field Stations: Natural resource islands to improve ecological literacy and outdoor learning experiences for a K-Gray urbanized society. Symposium organized by the TTU Llano River Field Station was competitively selected by the Program Committee for inclusion at the international 2008 annual meeting of the Ecological Society of America.

- Environmental Education and Outreach programs at Texas Field Stations, Informal Science Centers, State Agencies and Conservation Organizations: Science Islands to Improve Natural Resource Literacy and Outdoor Learning Experiences for a K-20+ Urbanized Society. Symposium organized by the TTU Llano River Field Station for the 2009 annual meeting of the Texas Academy of Science in Junction.

The screenshot shows the Texas High School Project website. The header includes the logo and navigation links: Home, Initiatives, Grantees, Voices, News, Partners, About Us, THSP Webinar Series. The main content area features a blue banner with the text 'Exemplar: Texas Tech University Outdoor School'. Below this, there are tabs for 'Mission & Philosophy', 'Challenge & History', 'Strategy', 'Outcomes', and 'Lessons Learned'. The 'Mission & Philosophy' tab is active, displaying a photograph of a student working in a field. The text describes the mission of the Texas Tech University Outdoor School, which is to inspire students and teachers to develop passion and a sense of ownership and identity towards nature and the watershed in which they live. It also mentions the program's focus on providing unique opportunities to use the environment as an integrating context for interdisciplinary, collaborative, student-centered, hands-on and engaged learning, with a focus on the sciences and mathematics. A 'Philosophy on teaching and learning' section follows, discussing the importance of field experiences. A 'Demographics' section lists the following data: Grades Served: K - 12, Total Students: 6,145 from 2004 to spring 2007, Caucasian: 51%, African American: 5%, Hispanic: 43%, Other: 1%, and Qualifying for federal free/reduced lunch: 50%. A 'Resources' section at the bottom lists 'TTU OS Program Website'.



# From Here, it is Possible...

To develop deep Scientific understanding

## Data Supports Our Success

- Over 60 ISDs and 15,000 students since we began in 2003
- Overall, TAKS Science pass rate was 5.6% higher on years of attendance .
- Average pass rate increased with multiple visits to the OS in consecutive years.
- A 16.3% decrease in pass rate was noted for 10 schools who did not return to the OS during the 2007/2008 school year as compared to 8 schools who returned to the OS.
- Female & economically disadvantaged students had the highest improvements.



# “Houston, We Have a Solution”





**From Here, it is Possible...** To impact the way Texas teaches

## **Texas Environmental Literacy Plan**

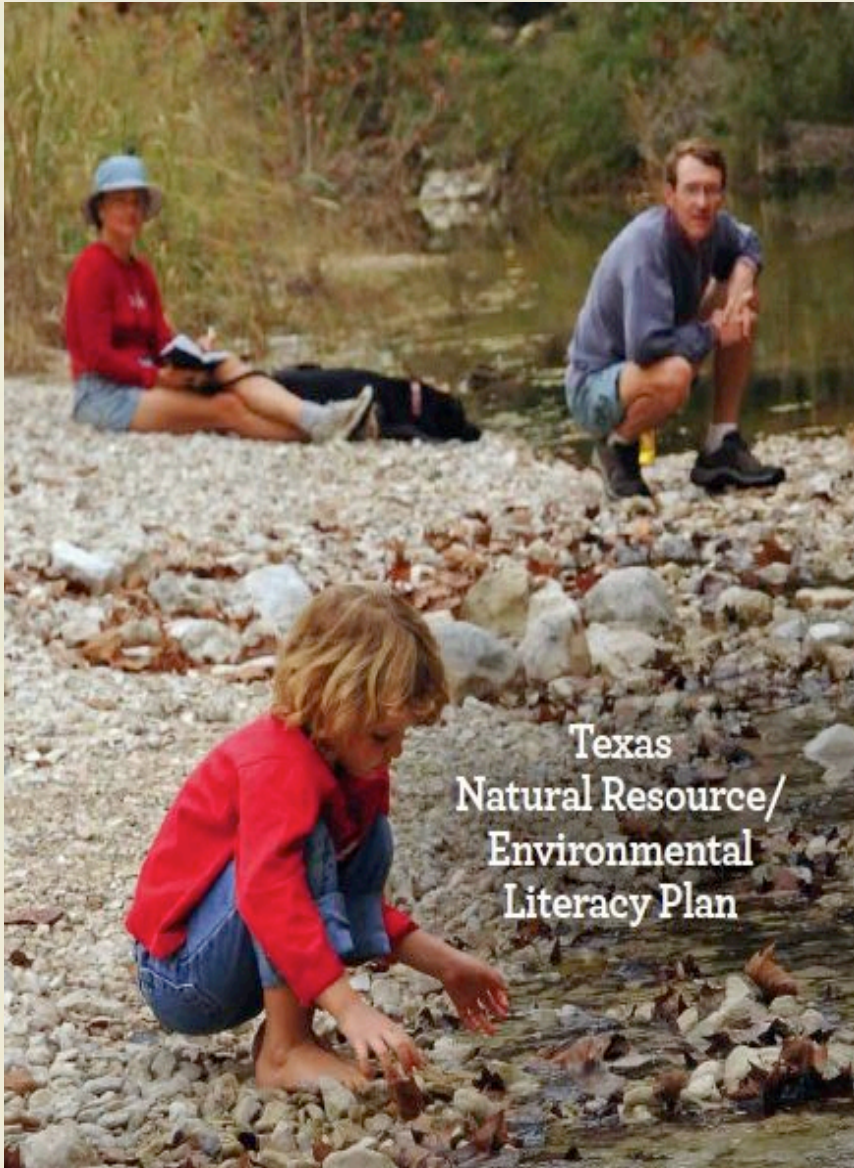


**The  
Environmental  
Literacy  
Summit**

**January 2013  
San Antonio,  
TX**



# New Texas Initiative



## Vision

All Texans value Texas' natural resources, know the principles of natural resources stewardship and live sustainably.

## Mission

To provide a framework for ongoing statewide efforts that foster natural resource/environmental literacy as a cornerstone of education, recreation and life-long learning.





# Texas Natural Resource/ Environmental Literacy Plan Summit for Leadership and Action

*Proudly sponsored by*



# Bridging the Gap

## Environmental Education & Environmental Literacy

**Sustainable  
Environment**



**Government**

**Economy**

**Public Health**

**Agriculture**

**Recreation**

**Natural Resource Careers**

**Sustainable  
Society**





# Bridging the Gap



**Sustainable  
Environment**



**Sustainable  
Society**



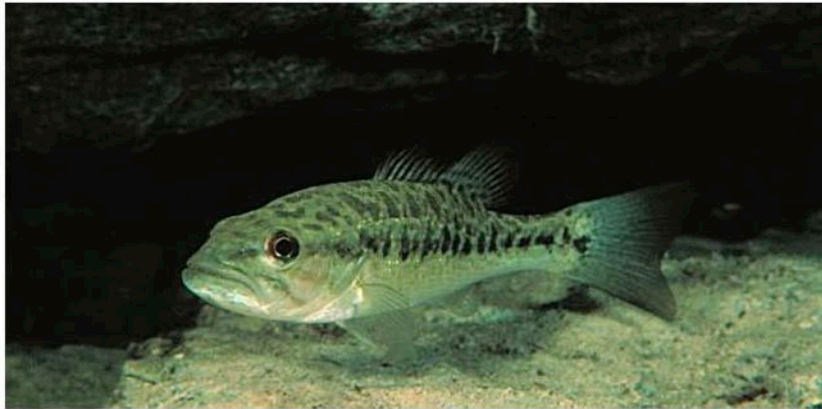
**Natural Resource Careers**





## **A Business Plan for the Conservation of Native Black Bass Species in the Southeastern US:**

A Ten Year Plan



February 2010













# Recreational Effort and Economic Impact of Angling for Guadalupe Bass in Central Texas Streams

Zack Thomas, Tom Arsuffi  
Texas Tech University  
Department of Biological Sciences  
Llano River Field Station

Stephan Magnelia

Texas Parks and Wildlife  
Department  
River Studies Program



# Guadalupe Bass \$\$\$ Impacts

- Direct Angler Expenditures
  - \$74.2M
- Indirect Angler Expenditures
  - \$71.6M
- JOBS
  - 776

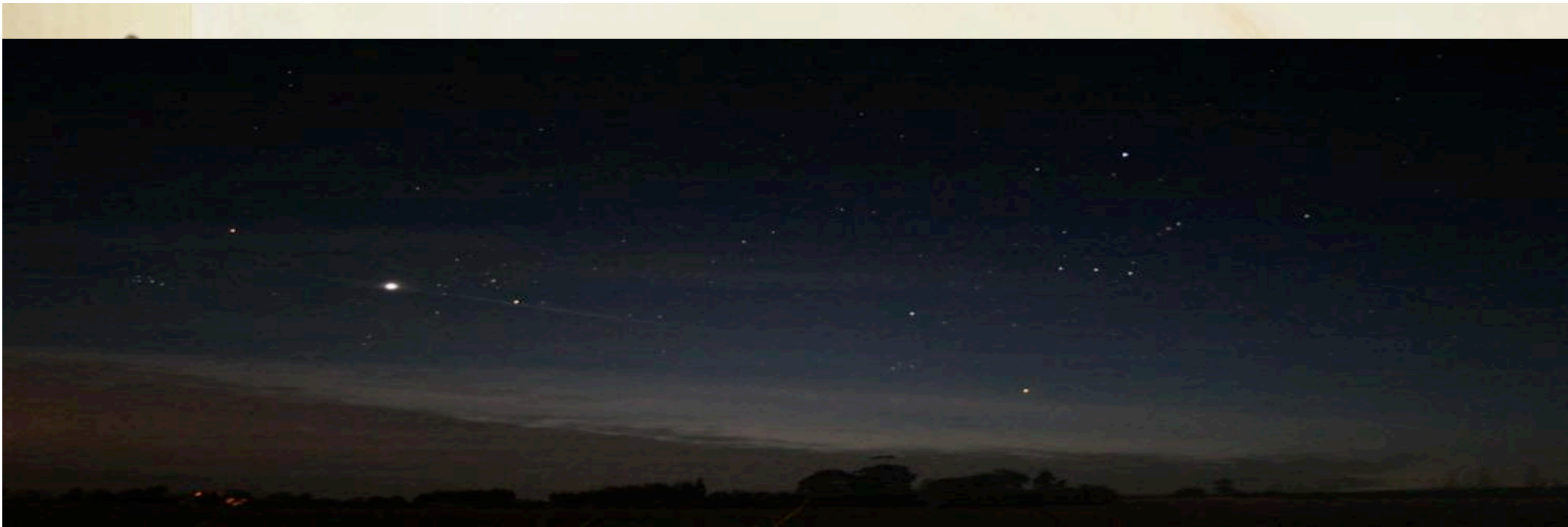




# What Can We Do!

- ☉ The lie that is promulgated is that small efforts do not have large consequences.
- ☉ The watershed protection efforts initiated and developed at Junction TTU Llano River Field Station will help provide critical information to the state and the nation on what it will take to keep our watersheds productive, while training the next generation of managers, conservation biologists and landowners.





The Hill Country we love is changing. More people, more roads, more development, can also mean fewer stars. Unlike other types of pollution problems like spilled oil, contaminated water, or poor air quality, light pollution has a pretty simple solution; switch off, shield or use lower wattage lights and the stars reappear. We'll save money too!

Taking care of the Hill Country is our responsibility



# Llano River Field Station Engagement



TEXAS TECH UNIVERSITY

College of Agricultural Sciences  
& Natural Resources

Natural Resources Management

Kerry Griffis-Kyle  
Terry McLendon  
Allison Pease  
Robin Verble  
Mark Wallace

CASNR Water Center

Jeff Johnson

USGS Fish and Wildlife Research Coop Unit

Reynaldo Patino  
Tim Grabowski

Venkatesh Uddameri

Water Resources Center

Ken Rainwater

Civil Engineering



TEXAS TECH UNIVERSITY

Edward E. Whitacre Jr.  
College of Engineering

Environmental Protection Agency  
National Park Service  
Texas Parks & Wildlife Dept.  
South Llano Watershed Alliance  
City of Junction  
Texas A&M University  
Texas Soil/Water Conservation Board  
60 ISDs  
GLOBE  
NASA



Tom Arsuffi, Director  
Linda Edwards, Outdoor School  
Robert Stubblefield, Director of Operations

South-Central Climate Science Center

Michael Farmer  
Blake Grisham  
Katherine Hayhoe  
Reynaldo Patino  
Ken Rainwater  
Mark Wallace  
John Zak



TEXAS TECH UNIVERSITY

College of Arts & Sciences

Biological Sciences

Robert Bradley  
Lou Densmore  
Dylan Schwilk  
John Zak

TIEHH

Jon Maul  
Chris Salice

STEM-CORE

Jerry Dwyer

Zenaida Aguirre-Muñoz  
Walter Smith  
New faculty hire – Curriculum and Instruction

Curriculum and Instruction

Gerald Skoog  
Susan Talkmitt

CISER



TEXAS TECH UNIVERSITY

College of Education