



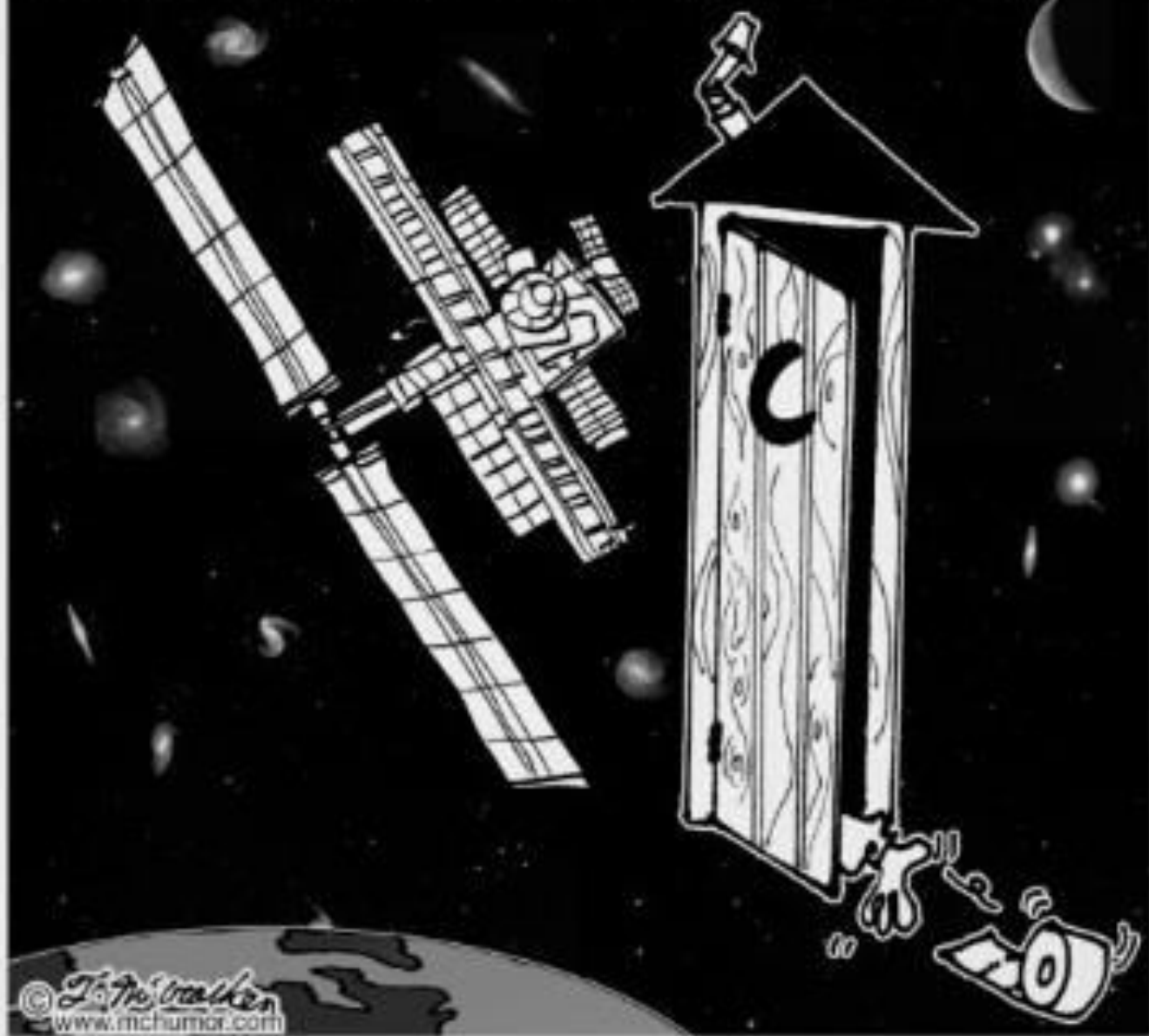
***Field Stations as Ambassadors and Agents in
Bridging Silos: Engagement in Watershed
Protection, Research & Natural Resource Literacy***



Llano River Field Station
Texas Tech University



HOUSTON, WE HAVE A PROBLEM.



Perception

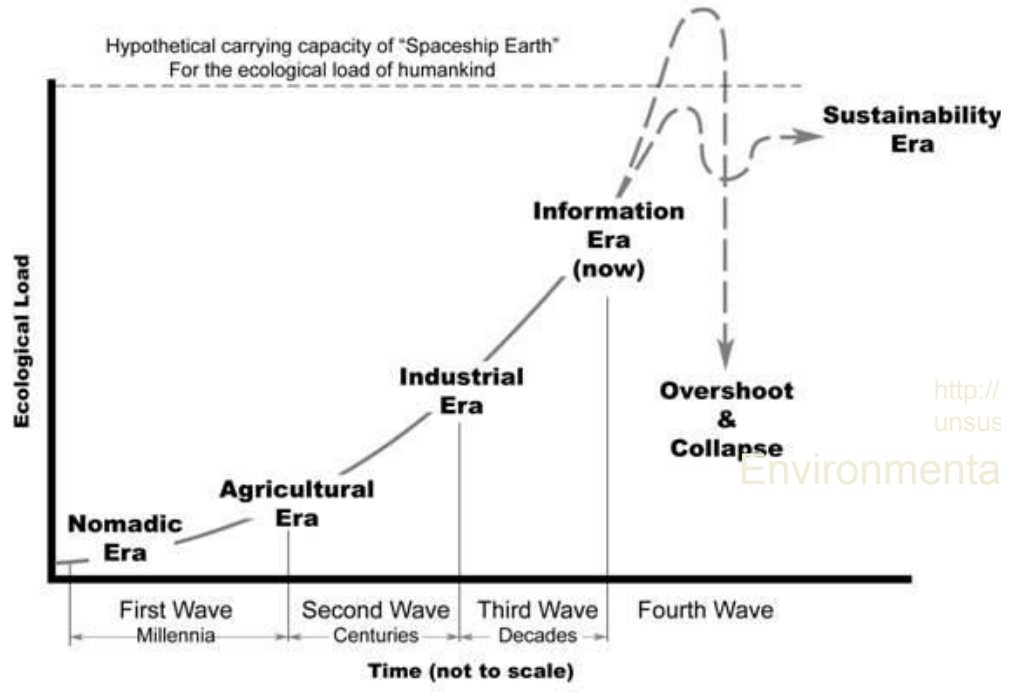


Reality



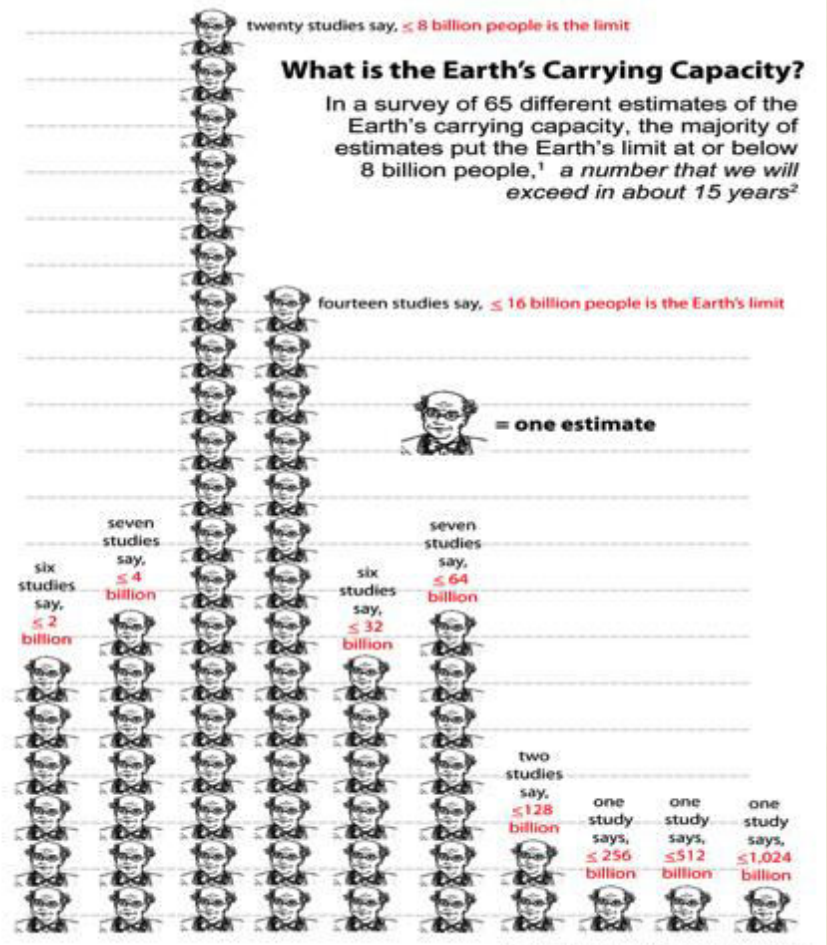


< 8B




<http://unsus>

Environmenta



¹ Cohen, J. (1995) ² U.S. Census Bureau (2012)



Challenges for the South Central Region

- Ecosystem restoration under increased climate variability.
- Fish and wildlife response to climate change?
- Invasive species and fires
- Protection of trust species
- Wildlife diseases
- Climate impacts on agriculture
- Renewable resources - water

National Research Council – National Academy of
Sciences

Field Stations and Marine Laboratories
in the 21st Century

Public Report Briefing

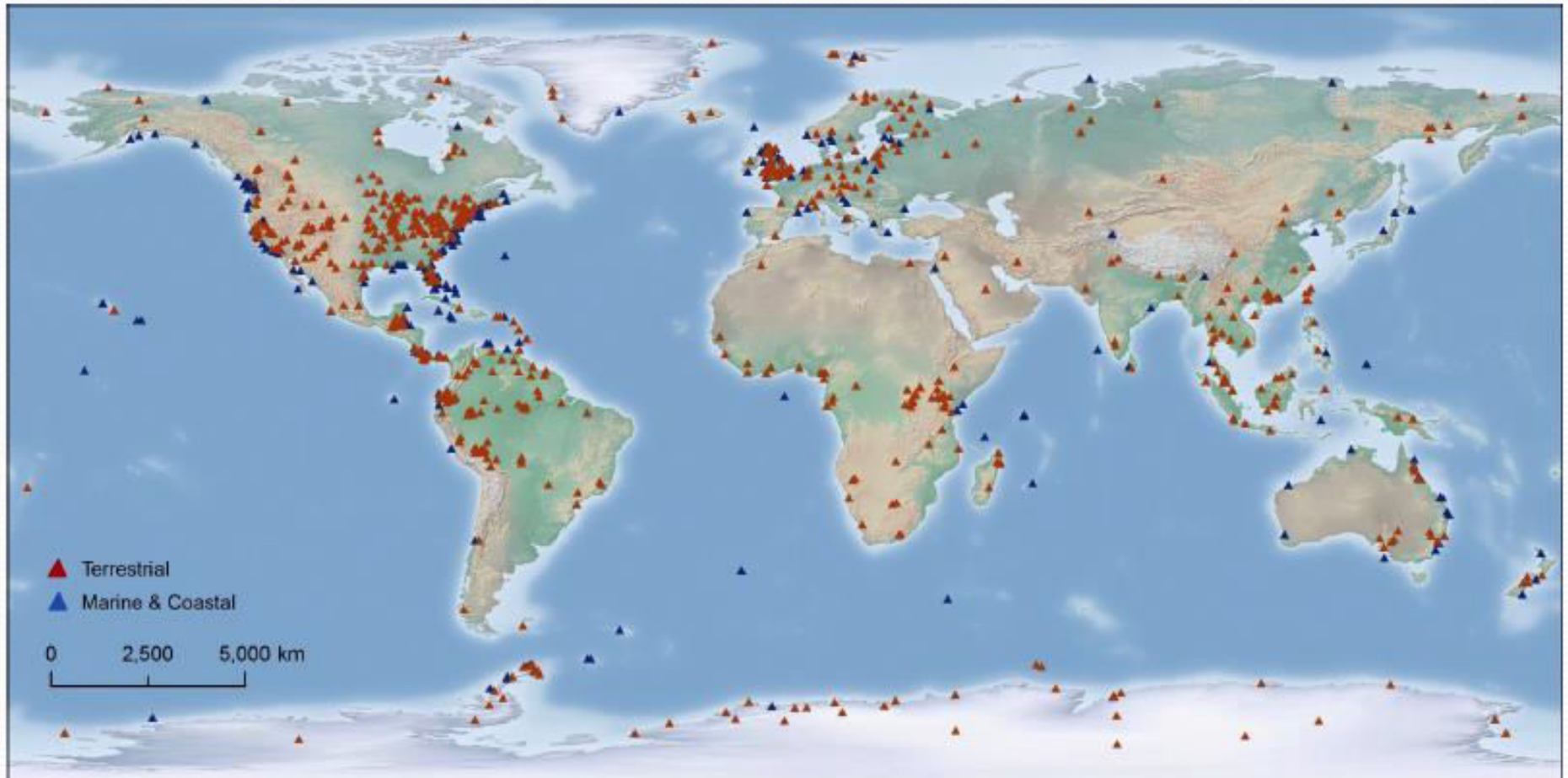
July 23, 2014

Jerry Schubel, Committee Chair

Twitter: #fieldstations



Field Stations: A Critical Asset



Our Mission

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

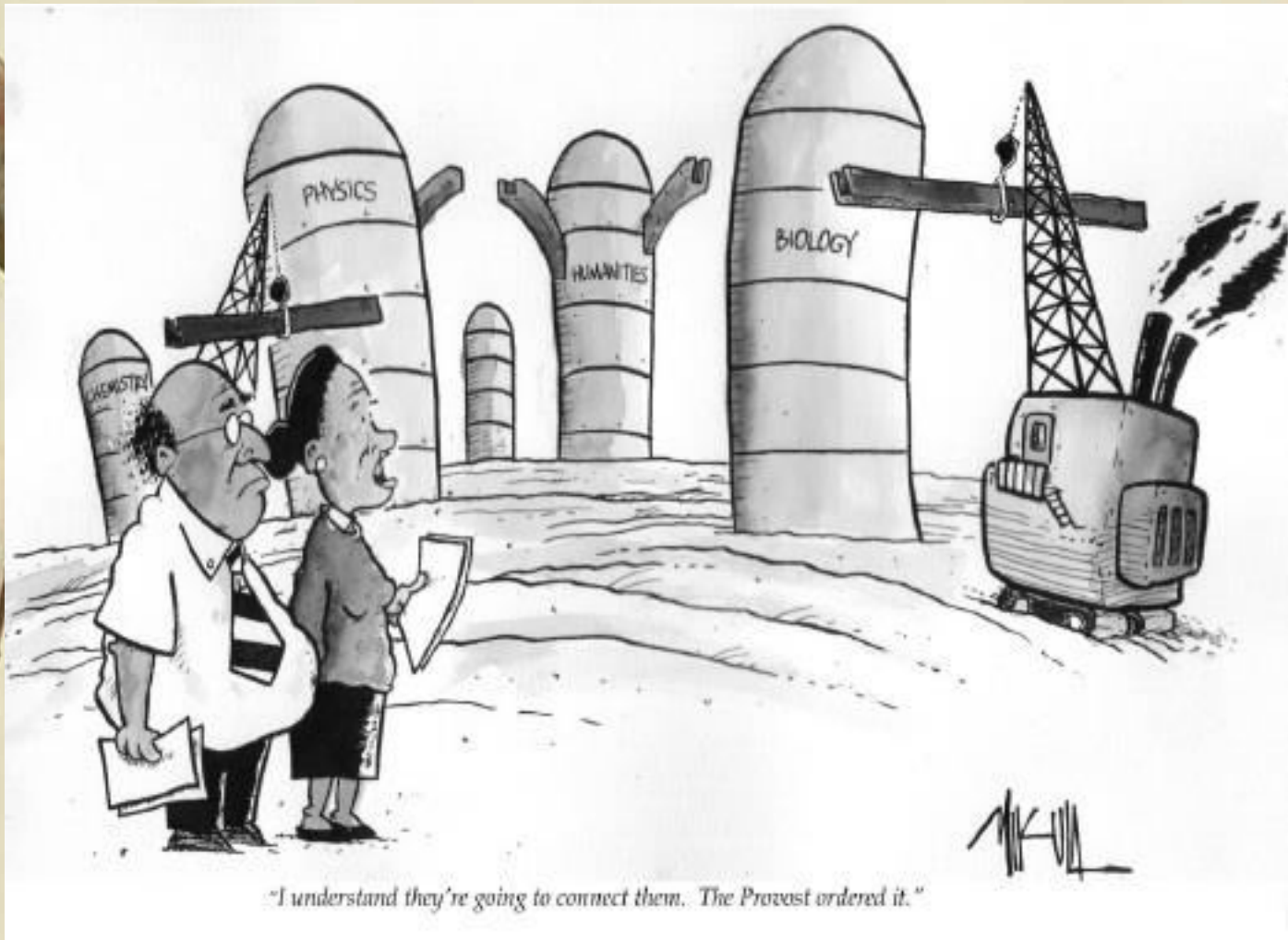
- Water /watersheds
- Exotic species
- Range management
- Natural resources
- Ecological restoration
- Environmental education



Vision and Change

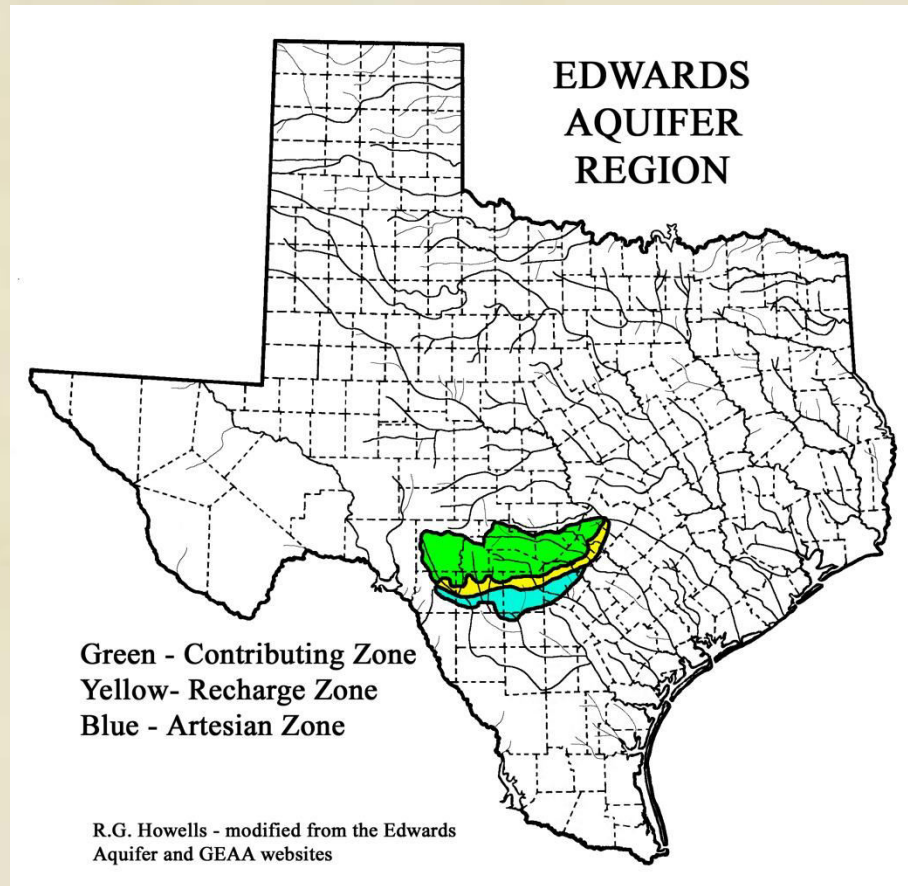
“We can't see where the barriers are by only talking to ourselves”



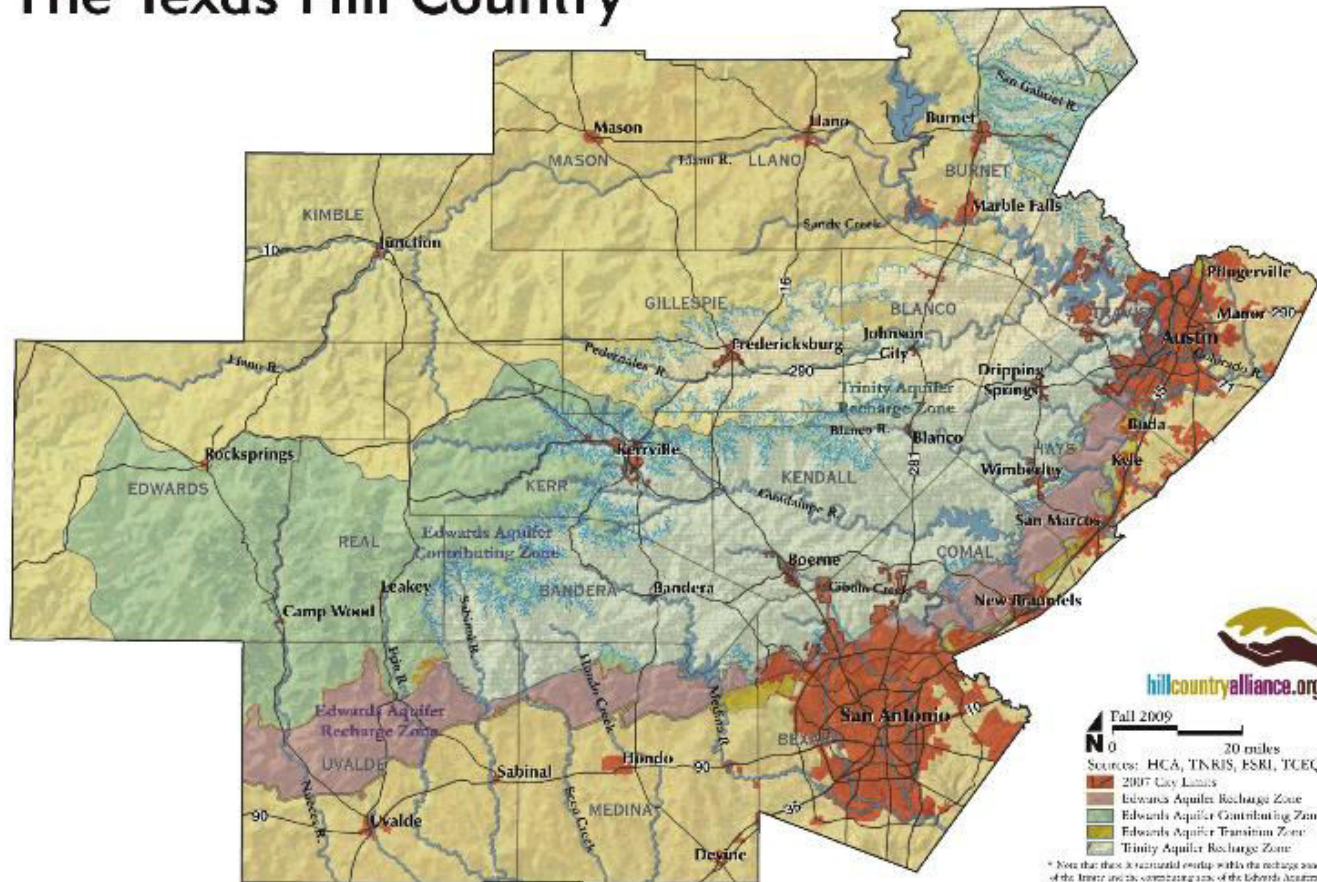


"I understand they're going to connect them. The Provost ordered it."

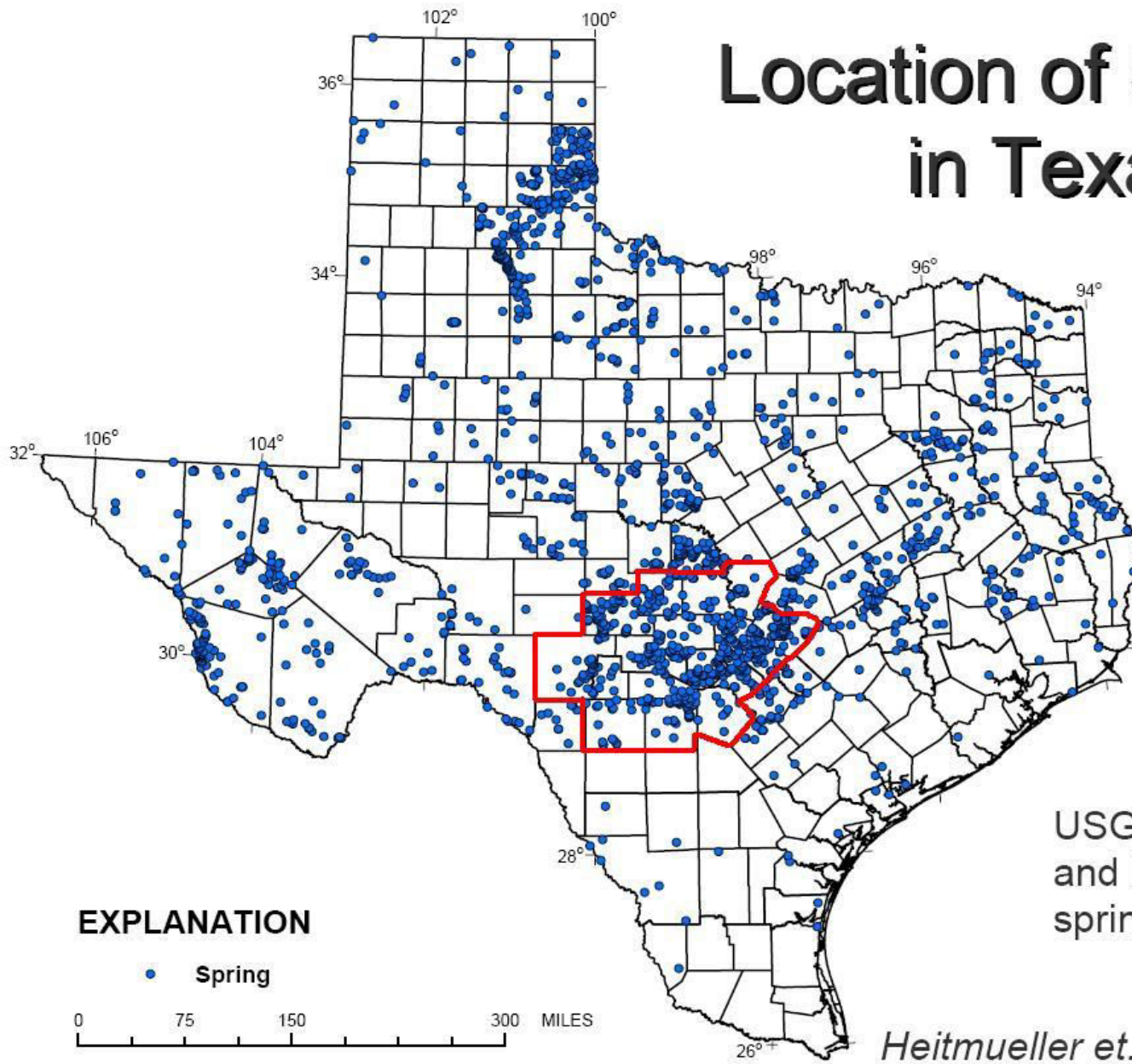
EDWARDS AQUIFER REGION



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)



Community-Engaged Teaching, Research, & Service: What Does It Mean/Does It Matter?

- Federal Agencies
- State Agencies
- Municipal
- Professional
- NGOs
- University/Community Colleges
- Landowners

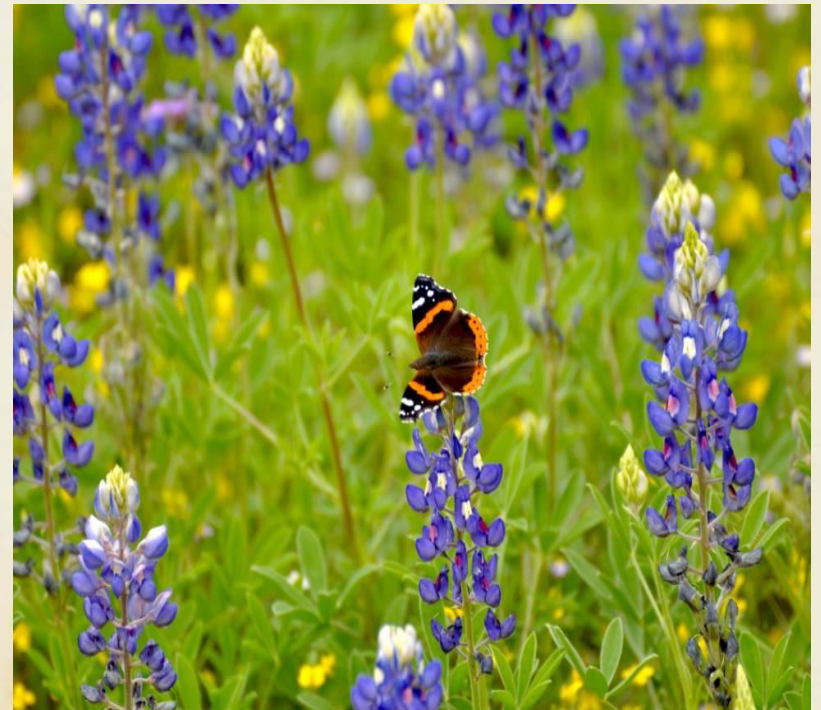
Llano River Field Station Development Strategies

- 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

TTU Llano River Field Station

Organizations/Meetings/Workshops

- **Texas Parks and Wildlife Department**
- Texas Parks and Wildlife Foundation Board
- **National Park Service**
- South Llano River Watershed Alliance
- Watershed Protection Plan Meetings
- **Texas Forest Service**
- Natural Resources Conservation Service
- **National Science Foundation**
- Angelo State University
- CISER – Center for the Integration of STEM Education and Research



Over 5000 visitors in FY2014

*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



Texas Situation



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



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

EPA's Healthy Watersheds Initiative



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*

Despite 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.



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
- Znobias 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



Benefits of a Healthy Watersheds Approach

- Reduces costs to communities by minimizing vulnerability to floods, fires, and other natural disasters
- Reduces or eliminates costs of water treatment for drinking water by protecting aquifer recharge zones and surface water
- Ecosystems store carbon which can help offset carbon emissions
- Minimizes ecological impacts of future land use
- Facilitates ecological restoration downstream
- Helps target and prioritize ecological restoration opportunities
- Reduces vulnerability to invasive species
- Sustains future generations

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.”

Alan I. Leshner,

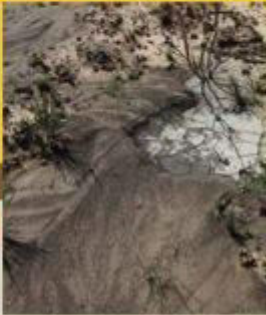
American Association for the Advancement

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



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.



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://tws.tamu.edu/workshops/online-registration>
or call 979.862.8070

Upper Llano River



**South Llano
Watershed Alliance**





LANDOWNER WORKSHOPS: Llano River Field Station.

- Riparian Essentials in Practice Workshop. March 12 – 14, 2010. Texas Riparian Association. 45 registrants.
- Edwards Plateau Ecoregion Workshop. April 19-20, 2010. Multiagency Stakeholder Meeting to develop Texas Conservation Action Plan. 35 registrants.
- Texas Watershed Steward Workshop. 2010. 40 registrants.
- Riparian Workshop. May 3, 2010. Sponsored by South Llano Watershed Alliance, Nueces River Authority and Llano River Field Station. 35 registrants.
- Hill Country Land Stewardship Workshop: Plans and Practices for Maximizing the Value and Resources of Your Land. 2009. Organized by WEPTMN, TTU Llano River Field Station, and Texas AgriLife Extension Service. 95 registrants.
- Conservation Across Boundaries Texas Workshop, Teacher Natural Resource Education Workshop. 22 teachers.
- Rainwater Harvesting Workshop, August 16-20 Texas AgriLife Extension Education.



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



July 10, 2009

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Alan I. Leshner,

American Association for the Advancement



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

NEWS

MUSIC

PROGRAMS

SUPPORT

ABOUT

PUBLIC
RADIO

hear yourself think

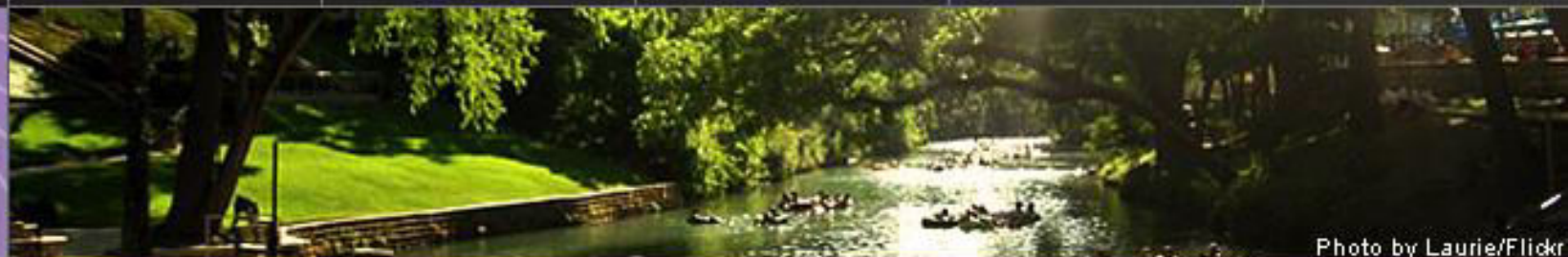


Photo by Laurie/Flickr

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.

**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*

July 10, 2009

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Alan I. Leshner,

American Association for the Advancement

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.



Rivers, Trails, and Conservation Assistance Program
Intermountain Region

National Park Service
U.S. Department of the Interior



Texas News



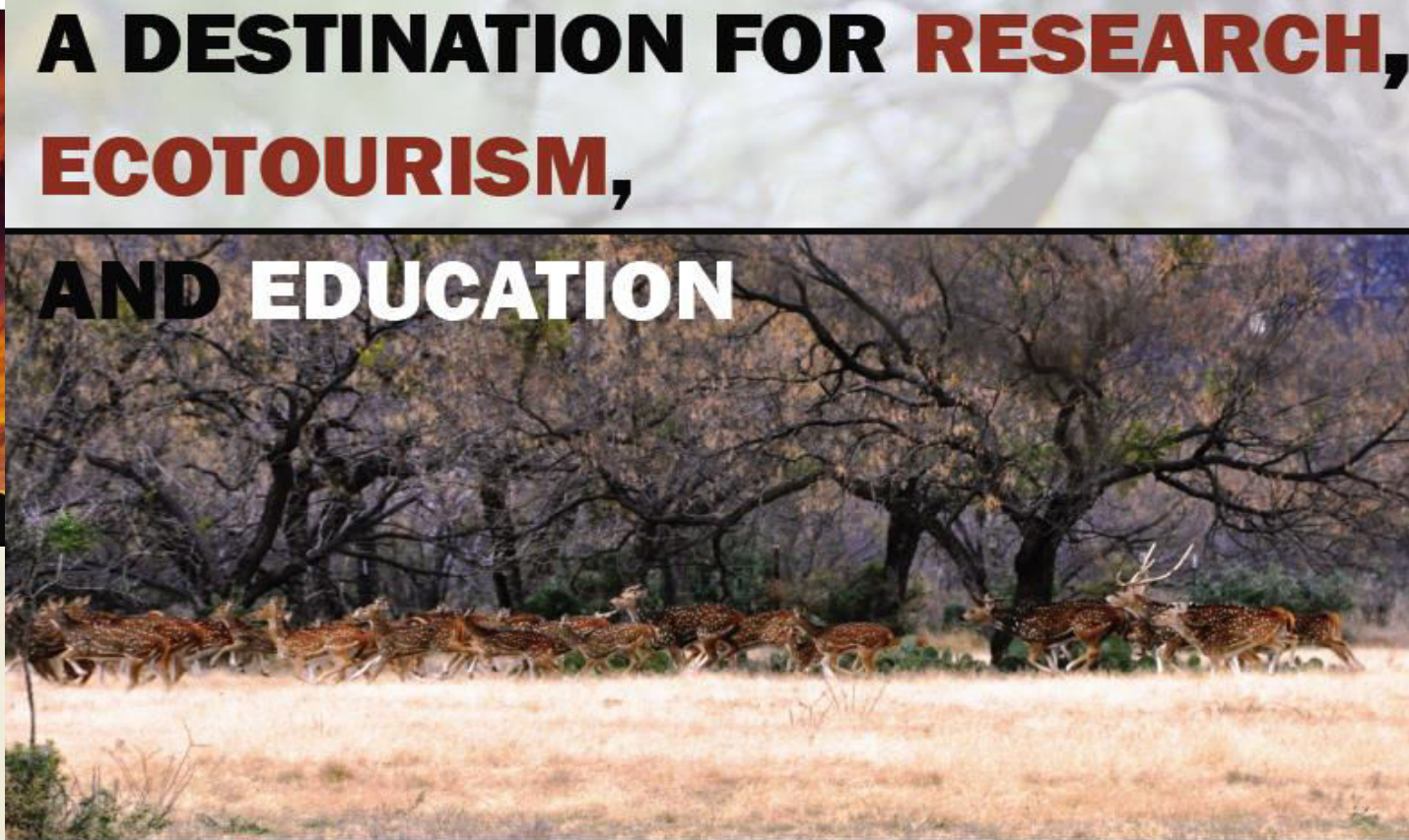
Members of the Bike Share Expansion Project Team with B-Cycles at San Antonio Missions National Historical Park. Photo: NPS

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

SECO Renewable Energy Grant

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



Llano River Field Station Texas Tech University Center at Junction



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

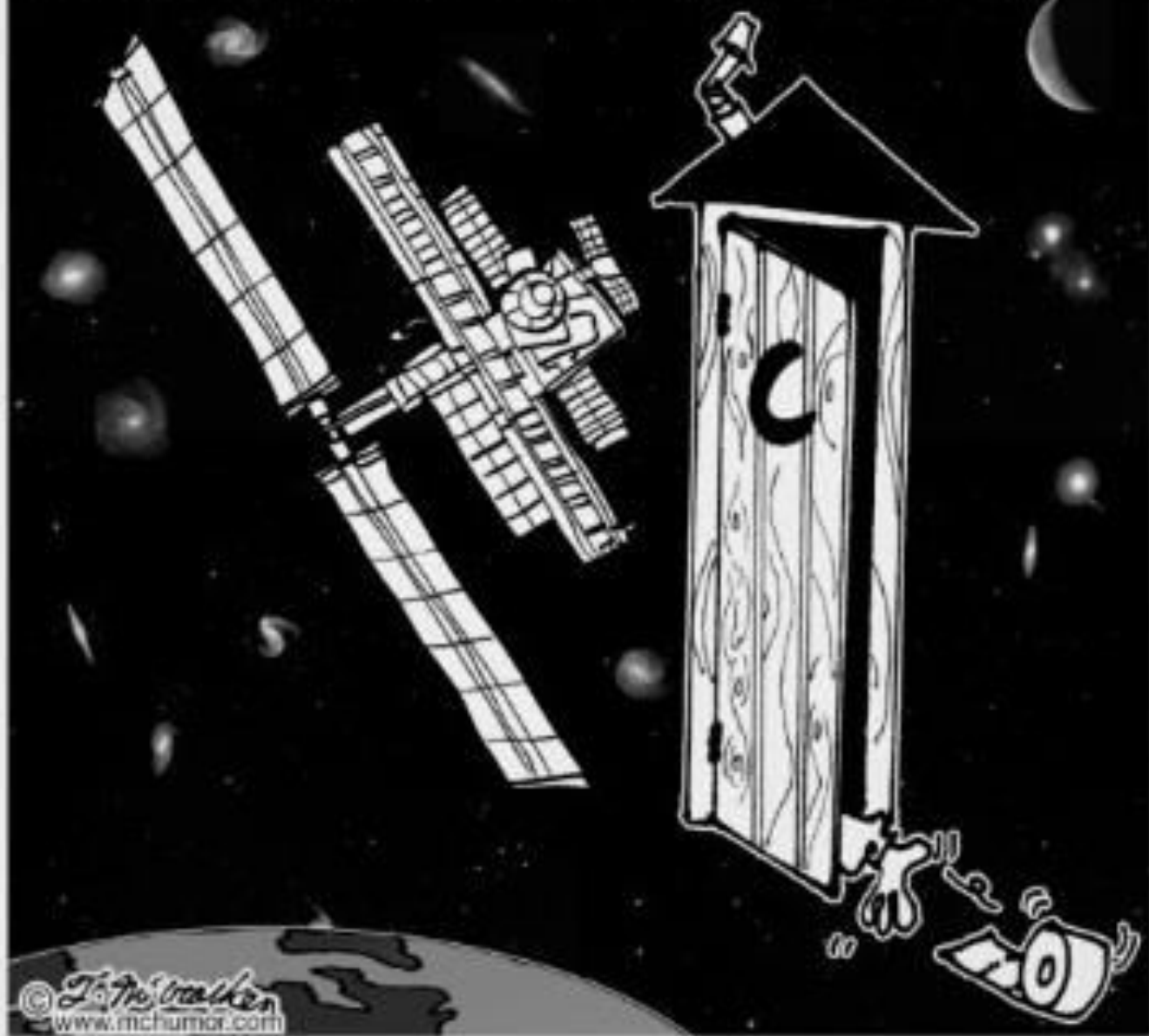


Guadalupe Bass \$\$\$ Impacts

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




HOUSTON, WE HAVE A PROBLEM.



WHAT DO WE KNOW ABOUT EE IN TEXAS?

VERY LITTLE

- ❑ National studies assessed comprehensive state-level environmental education (EE) programs. Sixteen criteria: program, structure, and funding components.
 - 1995 – Texas met 7 out of 16 criteria (Kirk & Wilke 1997)
 - 1998 – Texas met 6 out of 16 criteria (Ruskey et al. 2001)
 - Today – Texas meets 9 out of 16 criteria
- ❑ **Very little is known about EE in Texas!**
 - Based on these studies, Texas has only developed about half of the criteria needed for a well established state-level EE program. Due to a lack of infrastructure, relatively little is known about EE programs across the state.
- ❑ This study aimed to identify basic descriptive themes & characteristics of EE programs in Texas.



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.

45 Million Americans think the Ocean is a Source of Freshwater





How Widespread Is Belief in Pseudoscience??

- 41% of the public believe astrology is scientific
- >50% public believes in haunted houses and ghosts, faith healing, communication with the dead and lucky numbers

Nature Deficit Disorder

- ☉ “Describes an environmental dissatisfaction or dejection flowing from children's fixation on artificial entertainments rather than the natural wonders.”
- ☉ “Miss the restorative effects that come with the nimbler bodies, broader minds and sharper senses that are developed during random running-around at the relative edges of civilization.”



What is Environmental Education (EE)?

☉ “teaches children and adults how to learn about and investigate their environment and to make intelligent, informed decisions about how they can take care of it.”

☉ (EETAP, 2010; NAAEE, 2013)

☉ After 40 years of



“Houston, We Have Solutions”



From Here, it is Possible...



Why does the Outdoor School Work?

- TEKS based STEM Career/ Curriculum

- Team Building

- Instruction/learning focuses on multiple intelligences



- Scientific Method based learning units



From Here, it is Possible...

14 Curricular units at the Elementary Level



Composting & Recycling
Geology
Hiking
Lepidoptering



Aquatic Biology
Astronomy
Biodiversity
Circuits



Night Predation
Orienteering
Pedology
Quail CSI
Streamflow
Understanding Watersheds

From Here, it is Possible...

To inspire a new
generation of Scientists

7 Curricular units at the Secondary Level, with more to come...



Advanced Pedology
Aquatic Biology-River Study
Earthcaching
Field Ornithology
Photovoltaic Cells
Quail Necropsy
Wind Energy



From Here, it is Possible...

To develop deep
Scientific understanding

Data Supports Our Success

- Over 65 ISDs, 25,000 students & teachers since we began
- 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.
- Female & economically disadvantaged students had the highest improvements.





Llano River Field Station Outdoor School

- Texas High School Project twice recognized Exemplar Program
- Organization of Biological Field Stations Human Diversity Award
- GLOBE Partner
- Communities Foundation of Texas, Globe, NASA AQ grants
- House Bill 1700 legislation
- Teacher professional development workshops

From Here, it is Possible...

To impact the way Texas
teaches

Texas Environmental Literacy Plan



The
Environmental
Literacy
Summit

January 2013
San Antonio,
TX



Every Student Succeeds Act Includes Historic Gains for Environmental Education



For Immediate Release

Contact: Sarah Bodor, Director of Policy, 410-991-3340

Every Student Succeeds Act Includes Historic Gains for Environmental Education

The North American Association for Environmental Education (NAAEE) applauds the Senate passage of the bipartisan Every Student Succeeds Act, which replaces No Child Left Behind. The much-anticipated bill includes language that, for the first time, supports opportunities to provide students with environmental education and hands-on, field-based learning experiences. A companion bill overwhelmingly passed the House last week.

Website:

[NAAEE Policy Initiatives](#)

Download:

 [December 9, 2015 Press Release](#)



BY **SARAH BODOR** | DECEMBER 9, 2015

Biodiversity

- The variety of life on earth in all its forms and the ecological and evolutionary processes that sustain it



In recognition of contributions to increasing
human diversity in field science

Outdoor School
TTU Llano River Field Station

was awarded the 2007 Organization of
Biological Field Stations Human Diversity Award





Strategies for Ecology Education, Diversity and Sustainability



ESA SEEDS/SPUR Interns



The screenshot shows the top portion of the SEEDS website. It features a teal header bar with the text "eStore" on the right. Below this is a search bar with the word "Search" and a magnifying glass icon. The main header area contains the SEEDS logo, which is an oval with the text "Diverse People for a Diverse Science" at the top, "Seeds" in a large, stylized font in the center, and "esa" in a smaller, teal font below it. Underneath the logo is the text "A Program of the Ecological Society of America". To the right of the logo is the ESA logo, which includes the text "ECOLOGICAL SOCIETY OF AMERICA" and "esa" in a large, teal font. Below the ESA logo is the text "The largest organization of professional ecologists". At the bottom of the header is a black navigation bar with white text for the following links: "Home", "Chapters", "Field Trips", "SPUR Fellowship", "ESA Annual Meeting", "Leadership Meetings", "Opportunities", and "About SEEDS".

SPUR Fellowship

SEEDS Partnerships For Undergraduate Research (SPUR) Fellowship

CARNEGIE MUSEUM OF
NATURAL HISTORY





Llano River Field Station Engagement



TEXAS TECH UNIVERSITY
College of Agricultural Sciences
& Natural Resources

Natural Resources Management

CASNR Water Center

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

Jeff Johnson

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



TEXAS TECH UNIVERSITY
College of Arts & Sciences

Biological Sciences

TIEHH

Robert Bradley
Lou Densmore
Dylan Schwilk
John Zak

Jon Maul
Chris Salice

USGS Fish and Wildlife Research Coop Unit

Reynaldo Patino
Tim Grabowski

STEM-CORE

Jerry Dwyer

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

Venkatesh Uddameri

Ken Rainwater

Water Resources Center

Civil Engineering

South-Central Climate Science Center

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

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

Gerald Skoog
Susan Talkmitt

Curriculum and Instruction

CISER

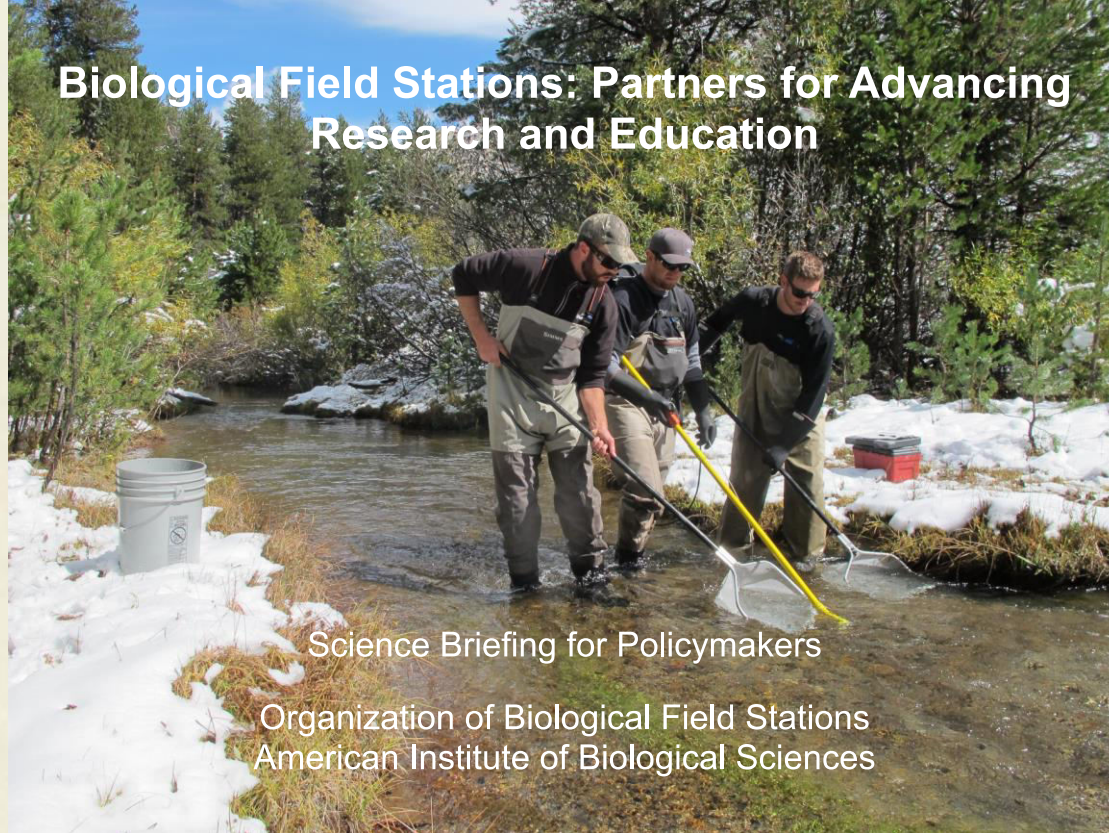


TEXAS TECH UNIVERSITY
Edward E. Whitacre Jr.
College of Engineering



TEXAS TECH UNIVERSITY
College of Education

Biological Field Stations: Partners for Advancing Research and Education



Science Briefing for Policymakers

Organization of Biological Field Stations
American Institute of Biological Sciences

Learn about how biological field stations are partnering with agencies, non-governmental organizations, and communities to advance research, science education, and public engagement on our natural resources.

Tuesday, July 14, 2015
2:30-4:00 PM
Capitol Visitor Center SVC-201

Speakers:

- Dr. Sarah Oktay, Nantucket Field Station
University of Massachusetts Boston
- Mr. Jeff Brown, Sagehen Creek Field Station
University of California, Berkeley
- Dr. Tom Arsuffi, Llano River Field Station
Texas Tech University

For more information and to RSVP, visit www.aibs.org/rsvp/obfs.html



LLANO RIVER FIELD STATION RECEIVES UCOWR EDUCATION AND PUBLIC SERVICE AWARD

June 18, 2015

Written By: [George Watson](#)



The station is a part of the Texas Tech University Center at Junction, a dedicated research and educational facility on the banks of the South Llano River.



Junction

The Universities Council on Water Resources (UCOWR) has given the Llano River Field Station the UCOWR Education and Public Service Award for 2015.

The [Llano River Field Station \(LRFS\)](#)

is the strategic arm of the [Texas Tech University Center at Junction](#), providing academic, research and service opportunities in the Texas Hill Country and Edwards Plateau. Researchers collaborate on studying and solving the issues of the region and beyond, including watershed, range science and environmental education and public engagement.

CASNR



The [College of Agricultural Sciences and Natural Resources](#) is made up of six departments:

- Agriculture and Applied Economics
- Agricultural Education and Communications
- Animal and Food Science
- Landscape Architecture
- Plant and Soil Science
- Natural Resources Management

Bridging the Gap



Environmental Education & Environmental

Literacy

Government

Economy

Public Health

Agriculture

Recreation

Natural Resource Careers

**Sustainable
Environment**

**Sustainable
Society**