Water Quality, Watershed Planning and Riparian Issues

Nikki Dictson
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Texas Water Resources Institute & Texas A&M Institute of Renewable Natural Resources
Managing for Water is Complicated!
Texas Water Picture

- Population increase from 26 million to 46 million by 2060
- Water Use about 18 MAF today
- Water use maybe be 22 MAF in 2060
- Cities need more water
- Total Capital Costs for all 2012 recommended strategies $53 Billion

Water Supplies

- **Surface Water:** Fully appropriated/big deals by public agencies
- **Groundwater:** Still available but new rules
Water Factoids

**Use and Source**
- About 17 MAF: 60% groundwater/40% surface
- Groundwater supports agriculture (80% for irrigation)
- Surface Water supports municipal and industrial uses

**Users of Texas Water**
- **Agriculture** 60% (10 maf) - 80% from groundwater
- **Municipal** 30% (5 maf) - 65% surface water
- **Industrial/Other** 10% (2 maf) - 65% surface water
Water Use Factoids

- **MUNICIPAL USES (5.0 maf- 30%)**
  - Dallas/Houston/ San Antonio Regions
    - 70% of all Municipal Use in these 3 regions
    - 60% of Industrial Use in these 3 regions

- **IRRIGATION USE (10 maf-60%)**
  - High Plains/ Lower Rio Grande Valley/Winter Gardens
    - 75% of all Irrigation Use
Water Demand Projections (acre-ft per year)
Lower Colorado: Region K
Lower Colorado: Region K

- Nearly 6% of Texas population projected to increase by 100%
- 77% of supply from groundwater
- Irrigation is the main water user but will be surpassed by municipal by 2060.
- Additional supply needed in 2060—367,671 acre-feet per year
- All 6 water users need additional water by 2060
- Total capital cost—$907 million
- Conservation accounts for 37 percent of 2060 strategy volumes
- One new major reservoir (Lower Colorado River Authority/San Antonio Water System Project Off-Channel)
- Reuse accounts for 21 percent of 2060 strategy volumes
Reflections for Central & South Texas

- AGRICULTURAL IRRIGATION USE TO DECLINE
  - Conservation measures
  - Declining aquifer levels
  - Increased Urbanization

- CITIES TO ACCESS MORE GROUNDWATER

- REUSING TREATED EFFLUENT TO INCREASE

- DESALINATION EXPENSIVE FOR CITIES

- SMALLER COMMUNITIES AT GREATER RISK

- NEW RESERVOIRS FOR SOUTH TEXAS

- CONFLICTS TO INCREASE AS DROUGHT CONTINUES
What is a WATERSHED?
A Watershed can be characterized as consisting of:

- Upland
- Riparian zone and
- stream system

Each watershed functions as an ecosystem, i.e., each component affects the rest of the system including the benefits or negative impacts. As water flows through the system the impacts are cumulative.
Watersheds are Complex Systems

Chemical variables:
- Solubilities
- Alkalinity
- Temperature
- D.O.
- pH
- Turbidity
- Hardness

Flow Regime:
- Velocity
- Land use
- High/low extremes
- Ground water
- Precipitation & runoff

Biotic factors:
- Disease
- Parasitism
- Reproduction
- Feeding
- Competition
- Predation

Energy source:
- Sunlight
- Organic matter inputs
- 1° and 2° Production

Water resource integrity:
- Riparian vegetation
- Width/depth
- Bank stability
- Channel morphology
- Gradient
- Current
- Substrate
- Canopy
- Instream cover

Habitat structure:
- Siltation
- Sinuosity

Characteristics of a Healthy Upland Watershed

A Healthy Watershed is a catchment, i.e., rainfall is captured on-site. It acts as a sponge storing water to later release.

“High” infiltration rates due to good vegetation cover and soil organic matter/structure and depth.

Water flowing from the uplands as runoff & subsurface flow to springs and aquifers is “clean” and is slowly released down slope.
Unhealthy Watersheds?

Most streams and rivers in Texas have been adversely affected by past natural and human activities resulting in:

- Increasingly damaging floods
- Lower base flows
- High sediment loads
- Reduced reservoir storage capacity
- Invasion of exotic species
- Loss of natural riparian habitats
- Degraded water quality
Functions of a Stream

- Transport water
- Transport and deposit sediment
- Transport and replenish nutrients
- Biological functions (food, shelter, shading, movement, etc.)
Why should we be concerned about the health of the stream and riparian areas?

- Cumulative impacts of natural and man induced disturbances in the drainage area.
- Management not only affects the individual landowner but everyone else downstream.
- Stream and riparian systems are the water pipelines in Texas.
- They are one of the most important resources found on private and public lands in Texas.
The Water Cycle

Evaporation → Condensation → Evapotranspiration → Precipitation
Rain is Precious: Factors Affecting the Fate of Rainfall

Many factors determine what happens to the rainfall received. Some of the primary factors include:

- type, quantity, and density of vegetative cover;
- storm intensity and duration;
- soil moisture prior to the storm event;
- soil water holding capacity;
- and slope.

These factors affect how much evaporates, infiltrates, moves through vegetation, and the amount and velocity of overland flow which may erode the soil surface and enter the stream.
Long-Term Average Annual Rainfall Across Texas from 1961-1990
Average Annual Runoff and Evaporation Rates 1961-1997 (TWDB 1997)
The Drought

- County Burn Bans
- 902 Public Water Supply Systems imposed voluntary or mandatory restrictions
- TCEQ suspended the use of certain water rights in several river basins
Drought Impact on Texas Surface Water

Based on USGS map issued October 6, 2015

Drought Severity Index
- Nothing
- D0 - Abnormally Dry
- D1 - Drought - Moderate
- D2 - Drought - Severe
- D3 - Drought - Extreme
- D4 - Drought - Exceptional

Sources
- NDMC
- USDA
- NOAA
- TCEQ Office of Water

Drought Monitor Dataset developed by the National Drought Mitigation Center (NDMC) U.S. Department of Agriculture (USDA) and National Oceanic & Atmospheric Administration (NOAA)
DROUGHT 2015
Public Water Supply Systems Affected
as of September 30, 2015

Total number of Community water systems affected: 1,117
Total number of active Community water systems in Texas: 4,631

Resolved. A public water supply that has corrected production capacity deficiencies, or drought conditions for mandatory water use restrictions have alleviated.

Watch - Voluntary. A public water supply that has reported problems with high water usage and production, but has not suffered a loss of distribution system pressure. Voluntary water use restrictions have been implemented.

Watch - Mandatory. A public water supply that has reported problems with high water usage and production, but has not suffered a loss of distribution system pressure. Mandatory water use restrictions have been implemented.
Recent droughts are infants!

C. Great Plains PDSI

YIKES!
Mega-droughts dot our past

A 2129-Year Reconstruction of Precipitation for Northwest New Mexico

from Grissino-Mayer 1996
Floods
Drought Impact on Texas Surface Water

Based on USGS map issued January 19, 2016

Drought Severity Index
- No Drought
- D0 - Abnormally Dry
- D1 - Drought - Moderate
- D2 - Drought - Severe
- D3 - Drought - Extreme
- D4 - Drought - Exceptional

Sources
- NDMC
- USDA
- NOAA
- TCEQ Office of Water

Drought Monitor Dataset developed by the National Drought Mitigation Center (NDMC) U.S. Department of Agriculture (USDA) and National Oceanic & Atmospheric Administration (NOAA)
DROUGHT 2015
Public Water Supply Systems Affected
as of January 20, 2016

- RESOLVED (0)
- WATCH - Voluntary (410) (groundwater 295, surface water 150)
- WATCH - Mandatory (685) (groundwater 464, surface water 283)

Total number of Community water systems affected: 1,095
Total number of active Community water systems in Texas: 4,628

Resolved: A public water supply that has corrected production capacity deficiencies, or drought conditions for mandatory water use restrictions have alleviated.

Watch - Voluntary: A public water supply that has reported problems with high water usage and production, but has not suffered a loss of distribution system pressure. Voluntary water use restrictions have been implemented.

Watch - Mandatory: A public water supply that has reported problems with high water usage and production, but has not suffered a loss of distribution system pressure. Mandatory water use restrictions have been implemented.

Number of systems on map may not represent total number of affected systems due to common water source or scale of map.
Surface Water Quality

- The 2012 303d List has 568 impaired water bodies on it.
- Many WPP and TMDL Implementation projects are ongoing across the state to improve WQ in watersheds.
- Bacteria is the cause for over 50% and low dissolved oxygen (nutrients) and organics in fish tissue at 15% each.
Surface Water Quality in Texas

Impaired Water Bodies

![Graph showing the number of impaired water bodies in Texas from 1996 to 2010. The number of impaired water bodies increases over time, with a significant increase between 2004 and 2006.]
Upcoming Watershed Trainings in 2016

- Roundtable
- Getting in Step
- Stakeholder Facilitation
- Developing Water Quality Monitoring Plan
Texas - >100 Species under Status Review

- 12 mussels
- 11 amphibians
- 20 fish
- 6 snail
- 1 Mammal

- 14 Insect
- 7 Arachnids
- 4 crustacean
- 11 bird
- 21 plants

**IF** all were listed, it would **DOUBLE** Endangered Species listed for Texas.
Texas Population

- 1997 – 19 Million
- 2012 – 26 Million
- 36% increase
- 500,000/year
- 65% of increase occurred within Top Ten Highest Populated Counties
Loss of Working Lands

- 1997 – 143.4 Million acres
- 2012 – 142.3 Million acres
- Loss 1.1 Million acres
Texas Land Trust Council Conservation Lands Inventory

Total Area Conserved: 1,603,927 acres
Conservation Easements: 930,311 acres
Fee Simple: 671,198 acres
Other Conservation Properties: 2,418 acres

ACRES PROTECTED BY ECO-REGION

- Blackland Prairie, 14,988
- Rolling Plains, 30,088
- High Plains, 105,142
- Pineywoods, 121,018
- Gulf Coast, 268,863
- Trans Pecos, 484,495
- South Texas, 139,545
- Edwards Plateau, 419,803
- Post Oak Savannah, 7,982

Prepared by Sigs Group
Night Time Illumination

Increase 1992-2012
Increase in Impervious Surface

Fig. 3.21 — Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface runoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.

Land Uses: We Live and Work in a Watershed
Watershed vs. Catchment
Catching the water

Storing the water in the land

An Overlooked Opportunity
Basic Types of Surface & Groundwater Interactions

A. Gaining Stream
   - Flow direction
   - Unsaturated zone
   - Water table
   - Saturated zone

B. Losing Stream
   - Flow direction
   - Water table
   - Unsaturated zone

C. Losing Stream That Is Disconnected From The Water Table
   - Flow direction
   - Unsaturated zone
   - Water table
Texas Riparian and Stream Ecosystem Education Program

Nikki Dictson
Texas Water Resources Institute


Funding is provided by the U.S. Environmental Protection Agency through the Texas State Soil and Water Conservation Board.
Creeks / Riparian Areas are special places that need preferential treatment.

To implement better management strategies we need to better understand these areas, the benefits, and what may be hindering their own natural restoration processes.
History of Riparian Workshops

- Workshops have been offered in the past by Texas A&M AgriLife Extension Service and Research, Texas Riparian Association, Universities, Stream Teams in North Central and Central Texas, Nueces River Authority, NRCS and Texas Parks and Wildlife Dept.

- These workshops have been very successful in the Nueces River Basin, Plum Creek and Lampasas River Watersheds attracting 30-120 participants.

- Unfortunately funding for many of these programs had ended except for TPWD and NRCS.
Texas Riparian & Stream Ecosystem Education

- Promote healthy watersheds and improve water quality through riparian and stream ecosystem education
- Increase citizen awareness and understanding of the nature and function of riparian zones, their benefits and management practices to protect them and minimize NPS pollution
- Enhance interactive learning opportunities for riparian education across the state and establish a larger, more informed citizen base working to improve and protect local riparian and stream ecosystems through online tools
- Connect landowners with local technical and financial resources to improve management and promote healthy watersheds and riparian areas
Education

- Deliver 24 riparian education programs to participants in prioritized watersheds, typically watersheds with watershed planning or total maximum daily load efforts due to impaired water quality.

Major Collaborators

- Texas Water Resources Institute
- United States Department of Agriculture, Natural Resources Conservation Service
- Texas Parks & Wildlife
- Texas A&M AgriLife Research & Extension
- Texas A&M Forest Service
- Nueces River Authority
- United States Environmental Protection Agency
- Nueces River Field Station
- Dixon Water Foundation
Texas Riparian & Stream Ecosystem Workshop –
Upcoming Training Locations

- Big Cypress Basin / Lake O’ the Pines – April 26, 27, or 28,
- Village Creek/Lake Arlington – May 24, 2016
- Gilleland Creek – May 5, 2016
- Cost: Free for training but cost for catered lunch
Theme: Advancing Stream Restoration in the Southwest

2016 CALL FOR ABSTRACTS

Submit abstracts by January 30, 2016 to southweststream@gmail.com
Completed Workshops

- Lockhart – Plum Creek Watershed, June 2013
- Temple/Moody – Leon River Watershed, September 2013
- Seguin – Geronimo and Alligator Creek, September 2013
- Junction – Upper Llano River Watershed, October 2013
- College Station – Graduate Course, October 2013
- Junction Pre-conference Workshop – November 2013
- College Station – Carters Creek Watershed – Nov. 21, 2013
- Hallettsville – Lavaca River Basin – February 25, 2014
- Wharton – San Bernard River – March 18, 2014
- Weslaco – Arroyo Colorado River – April 24, 2014
- Mont Belvieu – Cedar Bayou Watershed – May 8, 2014
- Kerrville – Upper Guadalupe River Basin – May 13, 2014
- Hankamer – Double Bayou Watershed – September 24, 2014
- Corpus Christi – Lower Nueces, Petronila Creek, & Oso Creek – Oct. 8, 2014
- Azle – Eagle Mountain Lake Watershed – October 14, 2014
Texas Riparian & Stream Ecosystem Workshop  
Upper Llano River Watershed

October 16, 2013  
8:00 a.m. - 4:00 p.m.  
Texas Tech Univ. Junction Llano River Field Station  
254 Red Raider Ln.  
Junction, Texas 76849

Online RSVP and Agenda: naturalresourcestraining.tamu.edu/schedule

For more information and to register please contact Nikki Dicson at 979-458-5915 or n-dicson@tamu.edu.

Continuing Education Units available: Texas Department of Agriculture Pesticide Applicators License – 3 CEUs; Texas Water Resources Institute – 1 CEU; Texas Forestry Association – 4 hours; Society of American Foresters – 4.5 hours; Texas Nutrient Management Planning Specialists – 4 hours; Texas Board of Architectural Examiners "Acceptable for HSW credit"; and may also be used for CEUs for Professional Engineers.

The workshop will include both indoor classroom presentations and an outdoor field portion at the river to discover how they function and the role of riparian vegetation in properly functioning stream systems by viewing the river in action. RSVPs will be required by October 11, 2013 and please remember to select if you would like the catered lunch (cost of $10 cash at the door) or if you will bring your own lunch and drink. To RSVP by mail, please complete the form below and send to 1500 Research Pkwy, Ste 110, College Station, TX 77843-2260.

First name: ___________________________ Last name: ___________________________

Email address: ___________________________ Phone: ___________________________

Org./Employee: ___________________________ Lunch Options:  ____ I would like the catered lunch  ____ I would like to bring my own

News Releases through AgriLife Today  
Listserv -  
TEXASRIPARIAN@LISTSERV.TAMU.EDU

Website -  
http://texasriparian.org

Facebook -  
http://www.facebook.com/TexasRiparianAssociation

Online Registration –  
http://naturalresourcestraining.tamu.edu/schedule/
Attoyac Bayou Watershed – Agenda
December 3, 2015

8:00  Meeting Registration
8:15  Welcome & Introductions
      - Ricky Thompson, Texas AgriLife Extension Service, Nacogdoches County
8:30  Program Overview, Watershed & Riparian Management & Water Quality
      - Nikki Dictson, Texas Water Resources Institute
9:15  How Creeks Function & Bear Creek Example
      - Melissa Parker, Texas Parks and Wildlife Department
10:00 Break
10:15 Riparian Vegetation
      - James Rogers, USDA Natural Resources Conservation Service (NRCS)
11:00 Management Practices, Local Resources and Photo Monitoring of Streams
      - Nikki Dictson, Texas Water Resources Institute
11:45 Lunch
12:00 Attoyac Bayou Watershed Protection Plan
      - Lucas Gregory, Texas Water Resources Institute
      - Anthony Castilaw, Castilaw Environmental Services, LLC
12:15 The Role of Forests and Trees in Watershed Protection
      - Todd Thomas, Texas A&M Forest Service
1:00  Lanes Balance Presentation
1:30  Trip to the Bayou (Split into 3 groups for 40-45 min stations)
      - Bayou Walk
      - Assistance for Improving the Health of Creeks – Kyle Wright, NRCS
      - Feral Hogs – Mark Tyson, AgriLife Extension Service
4:00  Wrap Up Evaluation and Head for Home!

Online Resources and Tools

- Website: Texas Riparian Association
  [http://texasriparian.org/](http://texasriparian.org/) has had 31,229 views since it was moved and re-established in January 2013.

- Website has 4,956 subscribers to blog posts.

- Facebook page has 680 friends.

- Listserv has 308 subscribers since May 2014.
Riparian Online Modules

The Riparian and Stream Ecosystem Education Workshop will include the following presentations for the indoor portion of the training:

You Tube Videos – Voice over PowerPoint Presentations
1. Riparian and Watershed Management: Steve Neile, Retired USDA Natural Resources Conservation Service
3. Riparian Vegetation and hindrances to Healthy Riparian Areas: Steve Neile, USDA NRCS
5. Riparian Considerations for Land Operators: Loni Haze, Texas A&M Forest Service

Riparian Mini-Modules

- Lesson 1: Debunking the Myths
  Nueces River Authority
- Lesson 2: Defining Riparian
  Nueces River Authority
- Lesson 3: Function Produces Values
  Nueces River Authority
- Lesson 4: How A River Works
  Nueces River Authority
- Lesson 5: The Impacts of Channel Degradation
  Nueces River Authority
- Lesson 6: The Importance of Riparian Vegetation
  Nueces River Authority
- Lesson 7: What Hinders Function and Recovery
  Nueces River Authority
- Lesson 8: Riparian Degradation and Recovery
  Nueces River Authority

Understanding Lane’s Balance for streams – A YouTube video with Steve Neile explaining Lane’s Balance.
Understanding Your Remarkable Riparian Area – A webinar on YouTube featuring Sky Jones-Levey of the Nueces River Authority that was sponsored by Texas Wildlife Association and AgLife Extension Service in 2012.

PowerPoint Presentations

Understanding Creek and Riparian Areas (PowerPoint presentation)
Local Contacts: Technical and Financial Resources

- County Extension Agent/County
- Watershed Coordinator
- Soil and Water Conservation District
- NRCS
- TPWD
- Wildlife Management Association
- CEU Partners
- Web links to resources and BMP guides
Continuing Education Units

- Texas Department of Agriculture Pesticide Applicators License - 3 CEUs
- Texas Water Resources Institute - 1 CEU
- Texas Nutrient Management Planning Specialists - 6 hours
- Texas Forestry Association - 6 hours
- Society of American Foresters - 5.5 hours
- Texas Board of Architectural Examiners “Acceptable for HSW credit”
- The program may also be used for CEUs for Professional Engineers.
- Advanced Hours for Texas Master Naturalist and Master Gardeners (Chapter Approval)
River, Floodplain and Riparian Areas are One

- Erosion Control
- Water Quality Improvement
- Wildlife Habitat
- Aquatic Habitat
- Recreation
- Water Storage
- Flood Protection
The patterns of rivers are naturally developed to dissipate the energy of the moving water and to transport sediment. The meander geometry and associated riffles and pools adjust to keep the system operating efficiently.
Lane's Relationship (1955)

\[(\text{Sediment LOAD} \times \text{Sediment SIZE}) \propto (\text{Stream SLOPE} \times \text{Stream DISCHARGE})\]
Properly Functioning Riparian Area

Adequate vegetation, landform or large woody material to:

- Dissipate stream energy
- Stabilize banks
- Reduce erosion
- Trap sediment
- Build / enlarge floodplain
- Store water
- Floodwater retention
- Groundwater recharge
- Sustain baseflow

Physical Function

- Water quality
- Water quantity
- Forage
- Aquatic habitat
- Wildlife habitat
- Recreational value
- Aesthetic beauty

Values
The Role of Riparian Vegetation
Riparian Chain Reaction

Adequate Vegetation:

- Protects banks from excess erosion
- Dissipates energy and slows the velocity of floodwater
- Sediment dropped
- Sediment trapped and stabilized
- Floodplain / riparian sponge is enlarged
- Increased groundwater recharge
- Base-flow is sustained over time
Stability Ratings of Riparian Plants
Scale of 1 - 10

1 = Bare ground
10 = Anchored rock or large anchored logs
6/7 = Acceptable riparian stability *
Interpreting Riparian Vegetation

- **Switchgrass** = 9
- **Emory sedge** = 9
- **Black willow** = 7
- **Water cress** = 3

**FACW**

**FAC**

**OBL**
Root Length; Miles per Cubic Foot

- **Curlymesquite**: 0.5 miles
- **Sideoats grama**: 0.8 miles
- **Deergrass**: 7.2 miles
- **Baltic rush**: 8.7 miles
- **Knotgrass**: 18.8 miles
- **Spikerush**: 22 miles

- Upland plants
- Riparian plants

- 67 feet per cubic inch
**Rootmass; Pounds per Acre**

- **Curlymesquite**: 3,100
- **Sideoats grama**: 4,100
- **Big bluestem**: 11,000
- **Knotgrass**: 24,000
- **Spikerush**: 27,000
- **Baltic rush**: 47,000
- **Deergrass**: 65,000

**Upland plants**

**Riparian plants**
Plant Diversity

- Willow
- Bulrush
- Spikerush
- Sycamore
- Common reed
- Switchgrass
Plant Vigor-Leaves and Roots

Caring for the Green Zone, Riparian Areas and Grazing Management
Alberta Riparian Habitat Management Project, “Cows and Fish Project”
Vegetation Indicators:

- Multiple age classes?
- Plant diversity?
- Plants indicative of wet conditions?
- Stabilizing root mass?
- Plant vigor?
- Amount of plant cover?
- Source of large wood?
Hindrances to Healthy / Functional Riparian Areas:

- Farming too close to the bank
- Mowing, spraying close to the creek
- Manicured landscapes next to the creek
- Chronic grazing concentrations in creek areas
- Excessive deer, exotics, hogs in creek
- Burning in riparian area
- Removal of large dead wood
- Artificial manipulation of banks / sediment
- Excessive vehicle traffic in creek area
- Poorly designed road crossings / bridges
- Excessive recreational foot traffic
- Excessive alluvial pumping or other withdrawals

Channelization improves access but destroys the riparian/floodplain functions necessary to maintain healthy streams.

Channelization Within Urban Centers
Workshops typically have around 40+ attendees but have ranged from 30-93. Plum Creek Workshop had 120.
Value of the Program

- We developed evaluation tools with a pre/post-test component to try to evaluate knowledge gained during the program.

- The evaluation asks them demographic data on the pre-course evaluation.

- They are asked program satisfaction and willingness to adopt conservation practices on the post-course.
Riparian Evaluation of Program

1. Asked demographic data, program satisfaction, and willingness to adopt conservation practices.

2. We had a 73.2% response rate (754/1030).

3. The total combined acreage for all workshop participants is more than 184,949 acres.

4. 83% had a bachelor’s degree or higher

5. 19% increase between pre and post-test scores and knowledge gained overall (scores 77, 92)
-99.5% of respondents mostly or completely satisfied with the program

-99.3% were mostly or completely satisfied with the course materials

-99.2% were mostly or completely satisfied with the ease of understanding

Almost all respondents (99.7%) would recommend this course to others (1 no)

-43.1%, believed they would benefit economically from this course in the future
## Table showing Percent of Participants that plan to adopt each of the Conservation Practices

<table>
<thead>
<tr>
<th>Practice</th>
<th>% Plan to Adopt</th>
<th>% Undecided</th>
<th>% Will not Adopt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riparian Herbaceous Buffers</td>
<td>85%</td>
<td>14%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Riparian Forest Buffers</td>
<td>78%</td>
<td>19%</td>
<td>3%</td>
</tr>
<tr>
<td>Prescribed Grazing</td>
<td>72%</td>
<td>20%</td>
<td>8%</td>
</tr>
<tr>
<td>Rotational Grazing</td>
<td>76%</td>
<td>17%</td>
<td>7%</td>
</tr>
<tr>
<td>Manage Feral Hogs</td>
<td>82%</td>
<td>16%</td>
<td>3%</td>
</tr>
<tr>
<td>Rangeland Planting of Vegetative Cover</td>
<td>76%</td>
<td>21%</td>
<td>4%</td>
</tr>
<tr>
<td>Manage to Reduce Bare Ground</td>
<td>93%</td>
<td>7%</td>
<td>0.3%</td>
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<tr>
<td>Monitor Stream Sites through Photos</td>
<td>71%</td>
<td>24%</td>
<td>5%</td>
</tr>
</tbody>
</table>
Post workshop online evaluations

- 293 respondents out of the 938 or 31% rate of the total emails and 293 out of 395 that owned or managed land.

- 78% of respondents stated that they had adopted or planned still the BMPs discussed. 30% estimated they have benefited over $1,000-$10,000+ and 30% estimated between $100-$500 of economic benefits.

- An additional 29% of attendees or 72 individuals have participated in a conservation program since the riparian training.
Thanks!
TexasRiparian.org