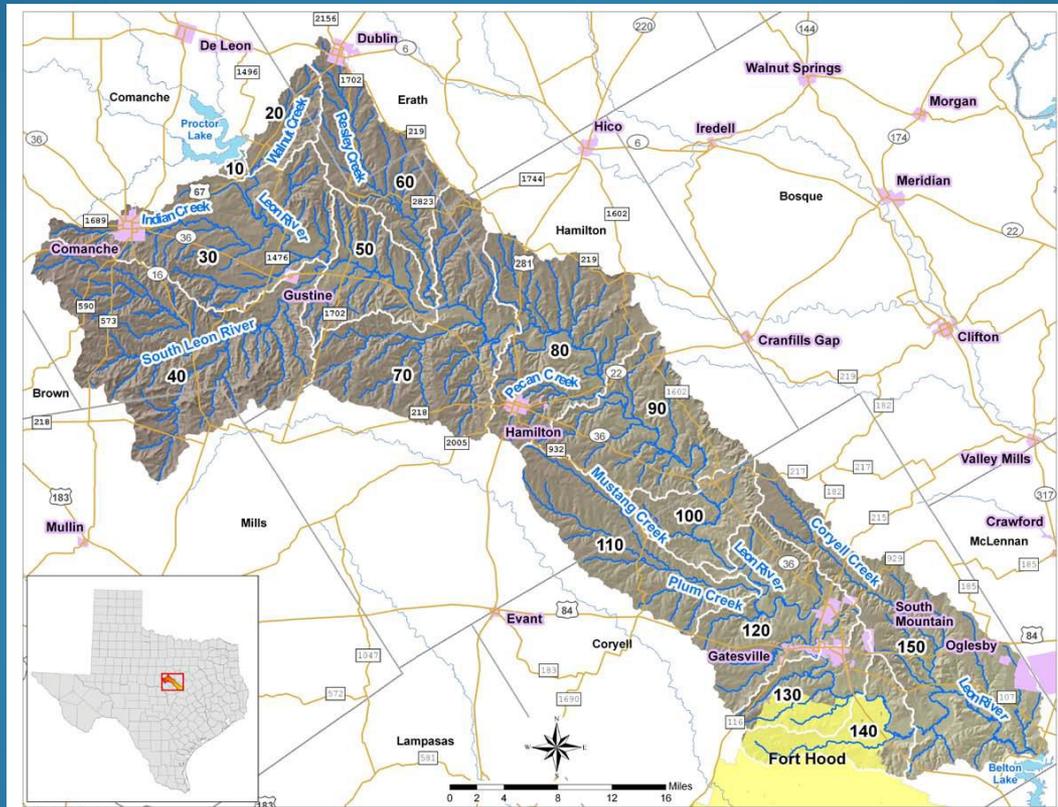




# The Leon River Watershed

# Leon Watershed

- Counties: Coryell, Hamilton, Comanche, and small portions of Mills and Erath
- 190 miles long, covering 1,375 square miles





- The Leon River Watershed is a rural watershed
- Rural watersheds have different characteristics compared to urban watersheds
  - Feral hogs and wildlife vs pets
  - Dairy and beef cattle operations
  - Septic systems

# Leon Watershed Protection Plan

- 303d list in 1996
- TMDL prepared in 2008
  - 21% reduction in bacteria
  - Final adoption delayed in August
- Town hall meeting (2008)
- WPP submitted 2012
- WC hired June 2013
- EPA comments
- Response to comments



# Potential Sources of Impairment

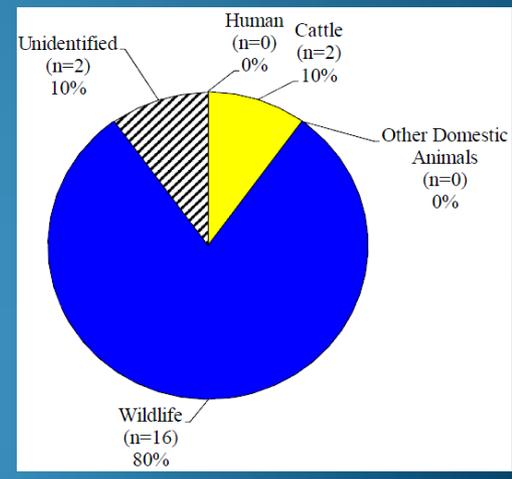
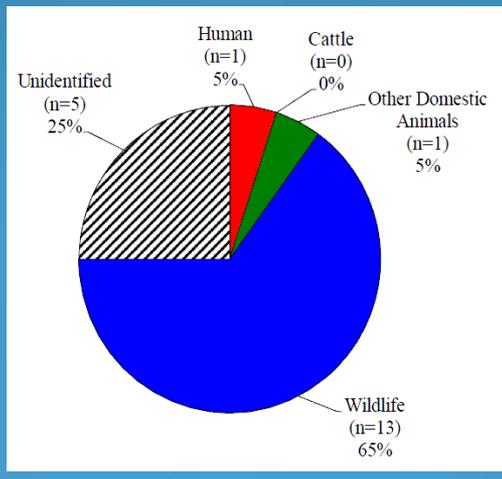
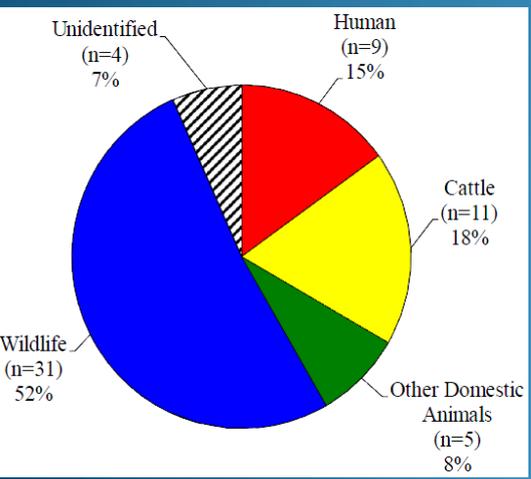
- Direct
  - Wastewater Treatment and Collection
  - Septic Systems
  - Wildlife, Feral Hogs, Livestock, and Carcass Disposal
- Indirect- “runoff”
  - Forestland- wildlife and feral hogs
  - Cropland- application of manure and fertilizers
  - Rangeland- wildlife, hogs, and livestock
  - Urban- bacterial runoff from many sources



# Sources of Impairment

Load Contribution of Pollutant Source (10<sup>6</sup> org/day)

Pollutant Source	Subwatershed														
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
<b>Direct Discharges of Pollutants to Waterbody</b>															
WWTF	-	-	4	-	9	37	-	9	-	-	-	40	22	-	-
Wastewater Collection System	-	-	1,154	-	101	463	-	1,698	-	-	-	5,920	2,299	-	-
OSSF	12	1	305	137	9	73	52	286	25	61	57	107	423	44	109
Direct Deposition	21,672	5,101	45,552	25,131	32,463	12,282	33,089	47,570	14,544	25,742	12,637	80,495	68,250	21,887	21,012
<b>Polluted Storm Water Wash Off</b>															
Forest	13	6	85	56	64	17	123	122	84	76	92	236	150	256	356
Cropland	71	33	619	157	342	65	247	146	109	128	134	186	33	28	464
Rangeland	398	317	4,098	3,958	4,239	901	7,821	4,613	2,697	1,916	3,056	6,198	2,493	2,340	5,873
Waste Application Field	-	193	586	64	606	333	299	196	-	-	-	-	-	-	184
Residential/Commercial/Industrial	4,992	1,072	21,465	3,906	5,513	4,756	9,090	25,658	5,450	4,877	371	39,303	31,245	7,906	13,061
<b>Total Source Loads</b>	<b>27,157</b>	<b>6,723</b>	<b>73,868</b>	<b>33,410</b>	<b>43,348</b>	<b>18,925</b>	<b>50,720</b>	<b>80,299</b>	<b>22,909</b>	<b>32,800</b>	<b>16,346</b>	<b>132,485</b>	<b>104,914</b>	<b>32,461</b>	<b>41,059</b>



# Bacterial Source Tracking

## Leon River WPP

- TWRI
- Agrilife Research
- UT El Paso

TEXAS A&M  
AGRI LIFE  
RESEARCH EXTENSION



Texas Water Resources Institute TR 441  
April 2013



### **Bacterial Source Tracking to Support the Development and Implementation of Watershed Protection Plans for the Lampasas and Leon Rivers**

**Leon River Watershed Final Report**

L. Gregory, E. Casarez, J. Truesdale,  
G. Di Giovanni, R. Owen, J. Wolfe

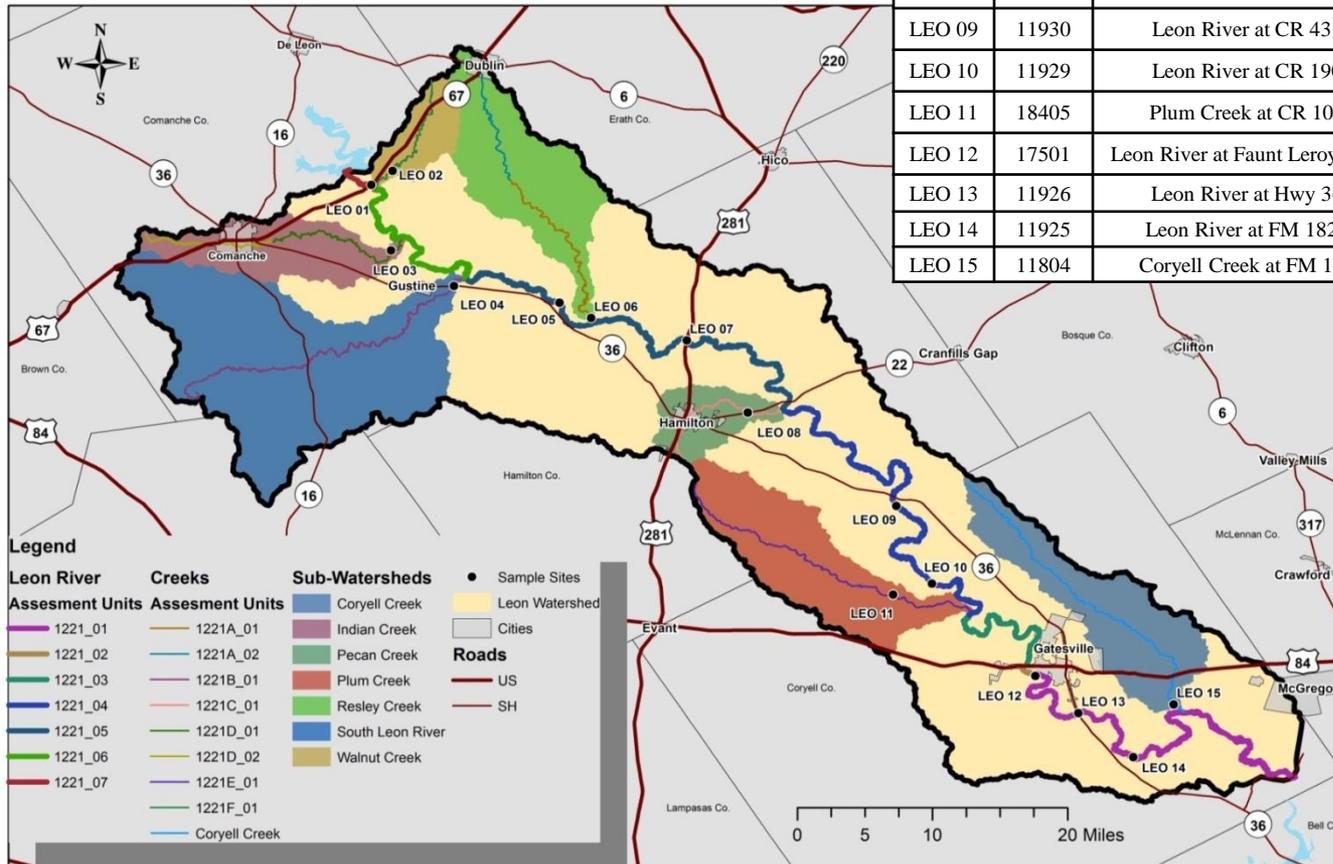
# Project Goals

---

- **Monitor water quality and streamflow at 15 sites for 1 year**
- **Evaluate *E. coli* levels in water samples**
- **Collect known source fecal samples for inclusion in the Texas *E. coli* BST Library**
- **Conduct BST analysis to assess different sources of bacterial loading to the Leon River**

# Monitoring Stations

Site	TCEQ ID	Location	County	Latitude	Longitude	USGS Gage
LEO 01	11934	Leon River at Hwy 67/377	Comanche	31.95778	-98.4593	Yes
LEO 02	17379	Walnut Creek at FM 1476	Comanche	31.97312	-98.4367	No
LEO 03	11818	Indian Creek at CR 304	Comanche	31.88658	-98.4381	No
LEO 04	11817	South Leon River at Hwy 36	Comanche	31.84813	-98.3708	No
LEO 05	11933	Leon River at CR 382	Comanche	31.82971	-98.2575	No
LEO 06	11808	Resely Creek at CR 394	Comanche	31.81303	-98.2240	No
LEO 07	11932	Leon River at Hwy 281	Hamilton	31.78746	-98.1211	Yes
LEO 08	17547	Pecan Creek at Hwy 22	Hamilton	31.71031	-98.0563	No
LEO 09	11930	Leon River at CR 431	Hamilton	31.60882	-97.8968	No
LEO 10	11929	Leon River at CR 190	Coryell	31.52514	-97.8601	No
LEO 11	18405	Plum Creek at CR 106	Coryell	31.5126	-97.9001	No
LEO 12	17501	Leon River at Faunt Leroy Park	Coryell	31.46250	-97.7492	No
LEO 13	11926	Leon River at Hwy 36	Coryell	31.38369	-97.7017	No
LEO 14	11925	Leon River at FM 1829	Coryell	31.33584	-97.6425	No
LEO 15	11804	Coryell Creek at FM 107	Coryell	31.39278	-97.5994	No



# Where did the Bacteria (*E. coli*) Come From?

---

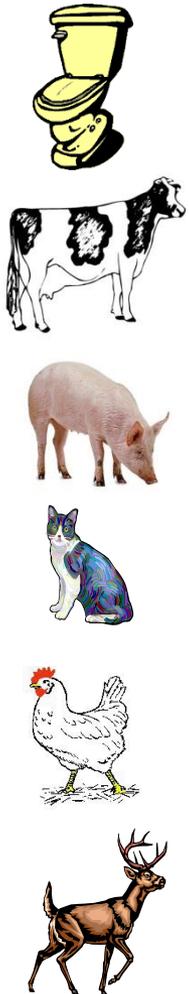
- **Potential sources**
  - **Humans**
  - **Domesticated animals**
  - **Wildlife**
- **Methods for determining sources**
  - **Source survey**
  - **Modeling**
  - **Bacterial source tracking**



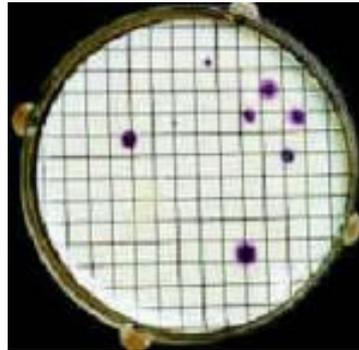
# Development of Texas *E. coli* BST Library

---

## Sources



**Isolate**  
→  
*E. coli*

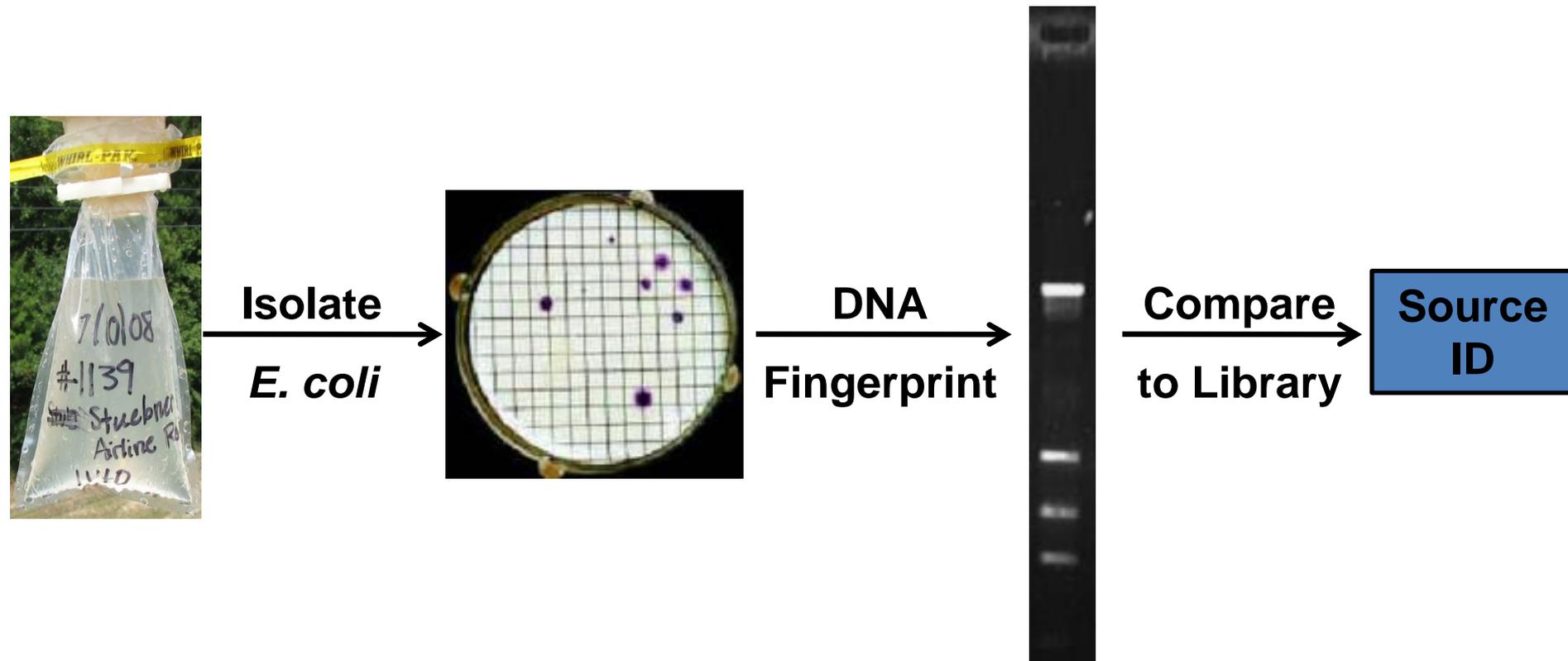


**DNA**  
→  
**Fingerprint**



**Add to**  
→  
**Library**

# Use of Texas *E. coli* BST Library for Identifying Water Isolates



# Water Quality Results

---

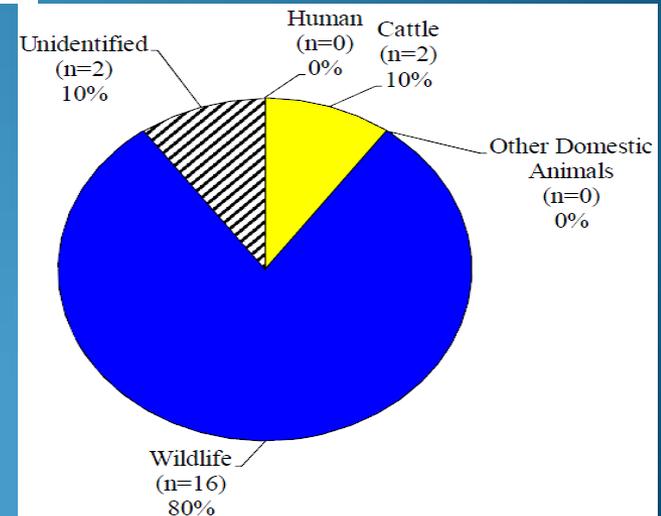
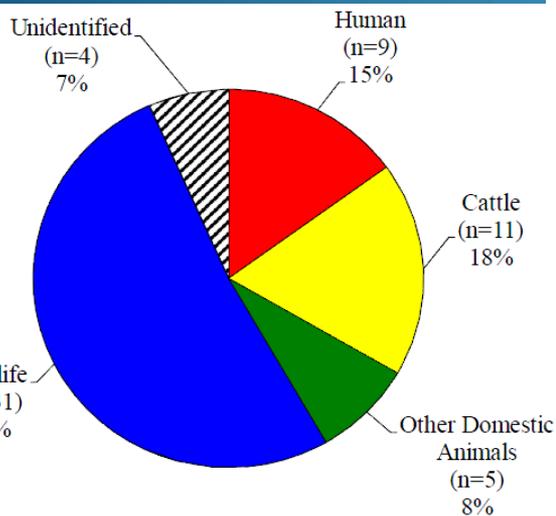
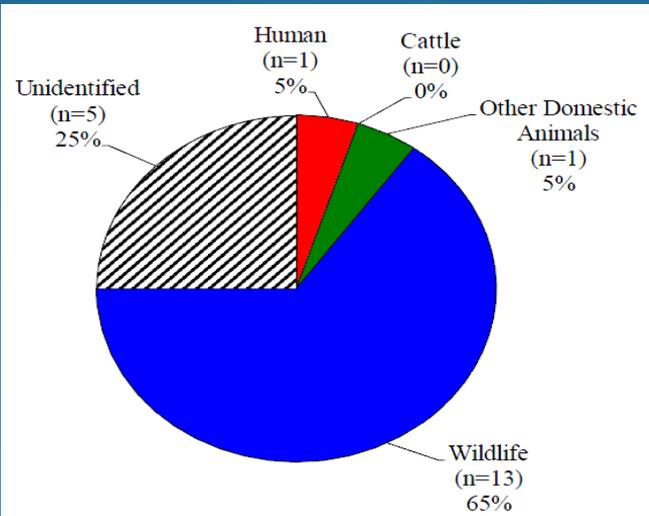
Table 5. Summary of *E. coli* enumerations, expressed as colony forming units (CFU) per 100 mL, sampled from flowing water in the Leon River watershed

Station	TCEQ Station ID	# of Samples	Geometric Mean (CFU/100 mL)
LEO 1	11934	12	40
LEO 2	17379	8	163
LEO 3	11818	4	225
LEO 4	11817	4	32
LEO 5	11933	10	118
LEO 6	11808	5	71
LEO 7	11932	7	54
LEO 8	17547	6	16
LEO 9	11930	7	36
LEO 10	11929	12	76
LEO 11	18405	3	20
LEO 12	17501	12	75
LEO 13	11926	12	54
LEO 14	11925	12	66
LEO 15	11804	4	42

\* Geometric means reported in this column were calculated using data collected for flowing water at each respective sampling site.

\* **BOLD** geometric means exceed the state's contact recreation standard of 126 CFU/100 mL

# Sources of impairment from three sampling locations



# Project Results

---

- **Geometric means of *E. coli* collected at 13 of 15 sites was in compliance with the state's primary contact recreation standard of 126 cfu/100 mL**
- **Primary *E. coli* sources in watershed appear to be wildlife (coyotes, deer, feral hogs, avian wildlife)**
- **BST results must be assessed keeping drought conditions in mind**
- **BST results at individual sites were similar to the results for all sites in the watershed combined**
- **Although non-avian wildlife vs avian-wildlife was parsed out, specific wildlife groups could not be based on the analysis**

# Evidence for contribution by feral hogs

- In 2011 there were an estimated 1.9-3.4 million hogs across 134 million acres of Texas
- Population growth (18-20% annually)
- Hogs “hang out” in riparian areas
- Wallowing and defecation



# Feral Hogs: impact to water quality



# Leon Watershed Hog Abatement



- œ Education and Outreach in all 3 counties
- œ CHAMP; Hog-Out; Coryell Abatement Program
- œ Traps, cameras, and spotlights given away
- œ Over 2,000 tails collected from bounty programs
- œ Helicopter hunting
- œ Wounded Warriors project



# Feral Hog Workshops



# Feral Hog Booth at CCYF



# Trap Demos and Prizes



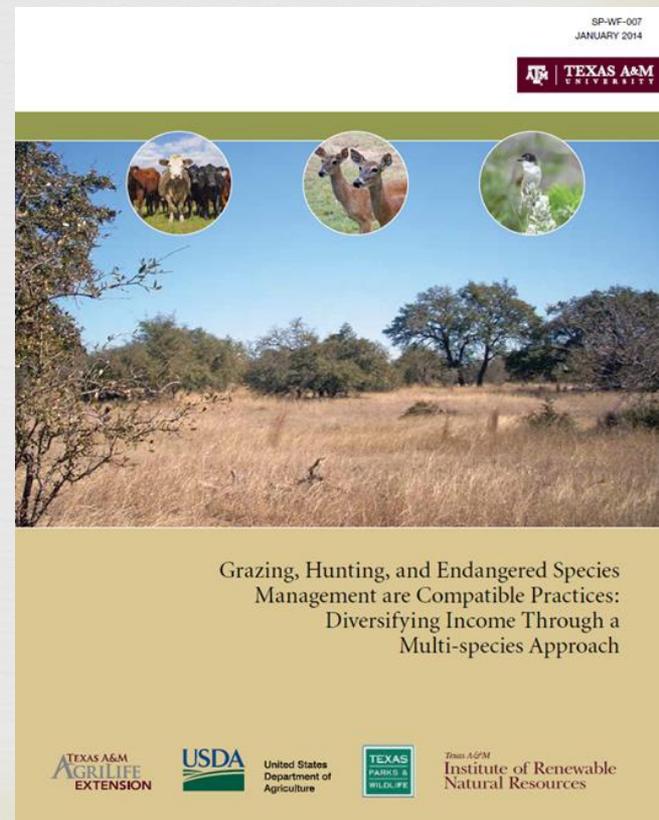
# Other Wildlife Concerns



# Wildlife Efforts



- ❧ Newsletter article highlighting wildlife management
- ❧ Out On The Land
- ❧ Extension publication
- ❧ 319 grant for workshops
- ❧ Wildlife Field Day



# Livestock Strategy

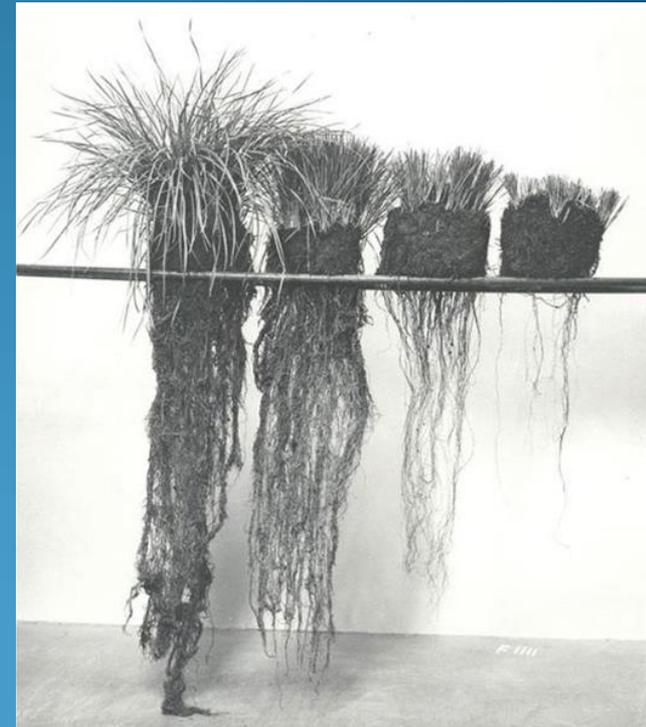


Which side of the fence  
would you like to be on?



It takes grass to grow grass

Take half leave half



# Workshops



## ☞ Lonestar Healthy Streams

☞ Dairy

☞ Beef Cattle

☞ Horses

## ☞ Watershed Stewards

## ☞ Riparian Workshop



# Urban Strategies

- Rainwater Harvesting
- Native Landscaping
- Minimize pollutant run-off
- Wastewater Treatment Facilities
- Septic System Maintenance



# Homeowner Water Day in Comanche: Feb 26th



# Hamilton County Septic Program



# Coryell County Septic Program



- ❧ \$100,000 funded by TCEQ
- ❧ WC and County Attorney's office
- ❧ Identify and prioritize
- ❧ Fix a few key systems
- ❧ Future 319 funding for implementation
- ❧ Expand model to Comanche

# Grant Proposals: progress



- ❧ TCEQ- OSSF program for Coryell County--accepted
- ❧ TSSWCB- extension of Hamilton's OSSF program--  
pending
- ❧ TSSWCB- district water technician--pending
- ❧ TSSWCB- extension of Leon WC project--accepted
- ❧ TSSWCB- wildlife/riparian workshop--pending
- ❧ TDA CHAMP Grant--accepted

# Newsletter



- Wastewater Treatment
- Rainwater Harvesting
- Urban BMPs
- Triennial Revisions
- Workshops highlighted

TEXAS A&M IRNR-T&M & TEXAS STATE  
SOIL AND WATER CONSERVATION BOARD

March 2014

Volume 1, Issue 4

## Leon River Watershed Project

### Wastewater Treatment in the Leon River Watershed

**Inside this issue:**

Rainwater Harvesting	2
Improving water quality through water conservation at home	3
Workshops in the Leon River Watershed	4
SCBO's triennial revisions	8

**Did you know that**

Municipalities in the watershed that operate a wastewater treatment facility (WWTF) discharge their treated effluent to creeks. When operated and maintained properly, WWTFs discharge effluent with bacteria concentrations much lower than the water quality standards. For example, in 2008 the City of Comanche voluntarily sampled its effluent for *E. coli* and recorded concentrations typically below 10 cfu/100 ml. However, when a collection system receives excessive infiltration inflow, the WWTF may be overwhelmed and not have the capacity to properly treat the wastewater. No matter the reason, the release of improperly treated wastewater from a WWTF is a permit violation. The consequence is that it is

sheds.

The Leon Watershed has taken great efforts to maintain compliance and improve potential issues relating to WWTF discharges. The Cities of Hamilton and Oterville and the Upper Leon River Municipal Water District have spent millions of dollars on facility improvements that increase treatment capacity and improve the treatment processes of their WWTF. The City of Oterville has taken over the treatment of Ft. Hood's wastewater. This will improve the quality of the treated wastewater discharged to sub-watershed 120. The City of Dublin has finalized the conversion of its WWTF to a no discharge facility and acquired property to land-apply its treated effluent. Efficiencies of the

than 1 percent of the reduction by all strategies. However, these improvements also increase the capacity of the WWTF to handle peak flows more effectively and contribute to the reduction of sanitary sewer overflows (SSOs).

There are miles of pipelines in a municipal system. For example, the City of Dublin has approximately 7 miles, the City of Comanche has approximately 150 miles, the City of Hamilton has 28 miles, and the City of Oterville has 70 miles. The municipal focus group identified strategies that will reduce the potential for SSOs. The goal for all the municipalities is to decrease SSOs from occurring to the greatest extent possible. Three strategies were recommended: increase treatment

# Project Website

<http://leonriver.tamu.edu/>



## LEON RIVER

Watershed Protection Program

HOME OUR WATERSHED BMPS PUBLICATIONS MEETINGS NEWS EVENTS



### TCEQ Revisions

The TCEQ has adopted amendments to the Texas Surface Water Quality Standards, with several impacting the Leon River Watershed. See the Publications tab for the full report and news release.

### Our Mission

Our mission is to restore and maintain water quality of the Leon River to the maximum extent possible in order to meet state water quality standards so that citizens may enjoy the water resources with little risk to their health.

The vision of the coordinated effort for the Leon River Watershed Protection Plan is to have local Stakeholders developing and implementing management strategies to reduce bacteria loadings in the watershed resulting in an ecologically sound Leon River.

### Upcoming Events

APR 23 [Bennett Trust](#)

### News

MAR 24 [Lone Star Healthy Streams Workshop](#)

FEB 01 [Before the Tap Runs Dry](#)

### Leon River on Facebook

 **Leon River Watershed**  
Like You like this.

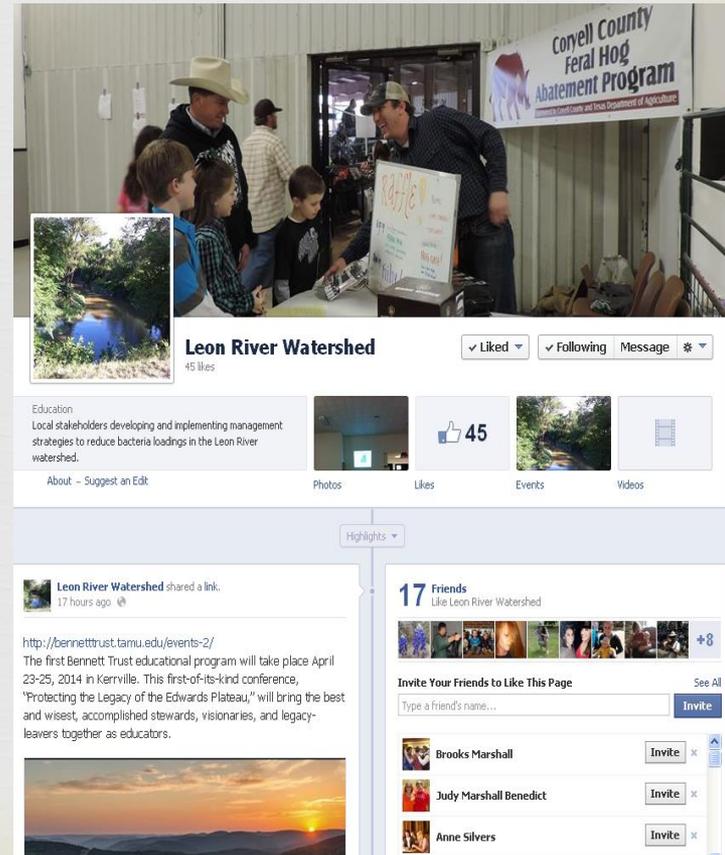
 **Leon River Watershed**  
<http://bennetttrust.tamu.edu/events-2/>  
The first Bennett Trust educational program will take place April 23-25, 2014 in Kerrville. This first-of-its-kind conference, "Protecting the Legacy of the Edwards Plateau," will bring the best and wisest, accomplished stewards, visionaries, and legacy-

# Social Media

# Scoop. *it!*



The screenshot shows the Twitter profile for Leon Watershed (@LeonWatershed). The profile picture is a map of the watershed area. The bio states: "Our mission is to test and maintain water quality to the maximum extent possible in order to meet state water quality standards for the Leon River, Gatesville, TX." The profile shows 6 tweets, 32 following, and 5 followers. A recent tweet from 15 hours ago reads: "pictures up from today's workshop and field trip to the oldest state park in Texas, Mother Neff on our Facebook page! pic.twitter.com/hok22Rkqjh". Below the tweet, it says "Retweeted by Leon Watershed". The left sidebar includes navigation links for Tweets, Following, Followers, Favorites, Lists, Photos and Videos, and Who to follow (listing Purdue Extension, Penn State Ag Sci, and USDA ARS Information).



The screenshot shows the Facebook page for Leon River Watershed. The cover photo features a group of people at a workshop, with a sign in the background that reads "Coryell County Feral Hog Abatement Program". The profile picture is a scenic view of a river. The page has 45 likes and is followed by the user. The "About" section describes the page as "Education" and mentions "Local stakeholders developing and implementing management strategies to reduce bacteria loadings in the Leon River watershed." A recent post from 17 hours ago shares a link to a conference: "http://bennetttrust.tamu.edu/events-2/ The first Bennett Trust educational program will take place April 23-25, 2014 in Kerrville. This first-of-its-kind conference, 'Protecting the Legacy of the Edwards Plateau,' will bring the best and wisest, accomplished stewards, visionaries, and legacy-leavers together as educators." The right sidebar shows 17 friends and an "Invite Your Friends to Like This Page" section with names like Brooks Marshall, Judy Marshall Benedict, and Anne Silvers.

# Implementation Updates

# TCEQ Triennial Revisions

- Adopted revisions pertinent to the Leon
  - Primary contact recreation 2
  - Splitting the Leon Watershed into 2 watersheds
  - Revisions to uses and criteria for:
    - Resley Creek- SCR<sub>2</sub> (1030 cfu/100 ml)
    - Indian Creek- SCR<sub>2</sub> (1030 cfu/100 ml)
    - Walnut Creek- SCR<sub>2</sub> (1030 cfu/100 ml)
    - South Leon River- SCR<sub>1</sub> (630 cfu/100 ml)

# Northern Portion

- Resley Creek- SCR<sub>2</sub> (1030 cfu/100 ml)
  - 209.23 and 380.57
- Indian Creek- SCR<sub>2</sub> (1030 cfu/100 ml)
  - 719.71 and 268.53
- Walnut Creek- SCR<sub>2</sub> (1030 cfu/100 ml)
  - 339.64
- South Leon River- SCR<sub>1</sub> (630 cfu/100 ml)
  - 256.75

# The rest of the watershed

- 1221\_01 (Coryell-Lake Belton)- 174.21
- 1221\_02 (Coryell-Stillhouse)- 125.03
- 1221\_03 (Stillhouse-Plum Creek)- 166.37
- 1221\_04 (Plum Creek-Pecan Creek)- 194.41
- 1221\_05 (Pecan Creek-South Leon)- 153.37
- 1221\_06 (South Leon-Walnut Creek)- 288.80
- 1221\_07 (Walnut Creek-Lake Proctor)- 121.84

# Summary of efforts

- Revisions to the WPP
- Septic Incentive Programs
- Over 40 WQMPs in the watershed
- TDA funding-over 2,000 feral hogs eradicated
- Pecan Creek removed from impaired list
- Hamilton WWTF conversion
- Several workshops
  - Riparian, Watershed Stewards, Well Owners, Septic, Dairy BMPs

# Spreading the Word

Local stakeholders know best how to take care of their own backyard.....

The only way to avoid regulation is to be involved!  
Please sign up on our mailing list as a good first step

Website- [Leonriver.tamu.edu](http://Leonriver.tamu.edu)

Mike Marshall

Leon River Watershed Coordinator  
office # 254-865-2061; cell # 512-461-6217  
email: [Leon.Watershed@gmail.com](mailto:Leon.Watershed@gmail.com)