



Water Supply Enhancement Program

Meeting Critical Water Conservation Needs and Enhancing Public Water Supplies Through Brush Control

Aaron Wendt
Texas State Soil and Water Conservation Board

Texas Groundwater Protection Committee

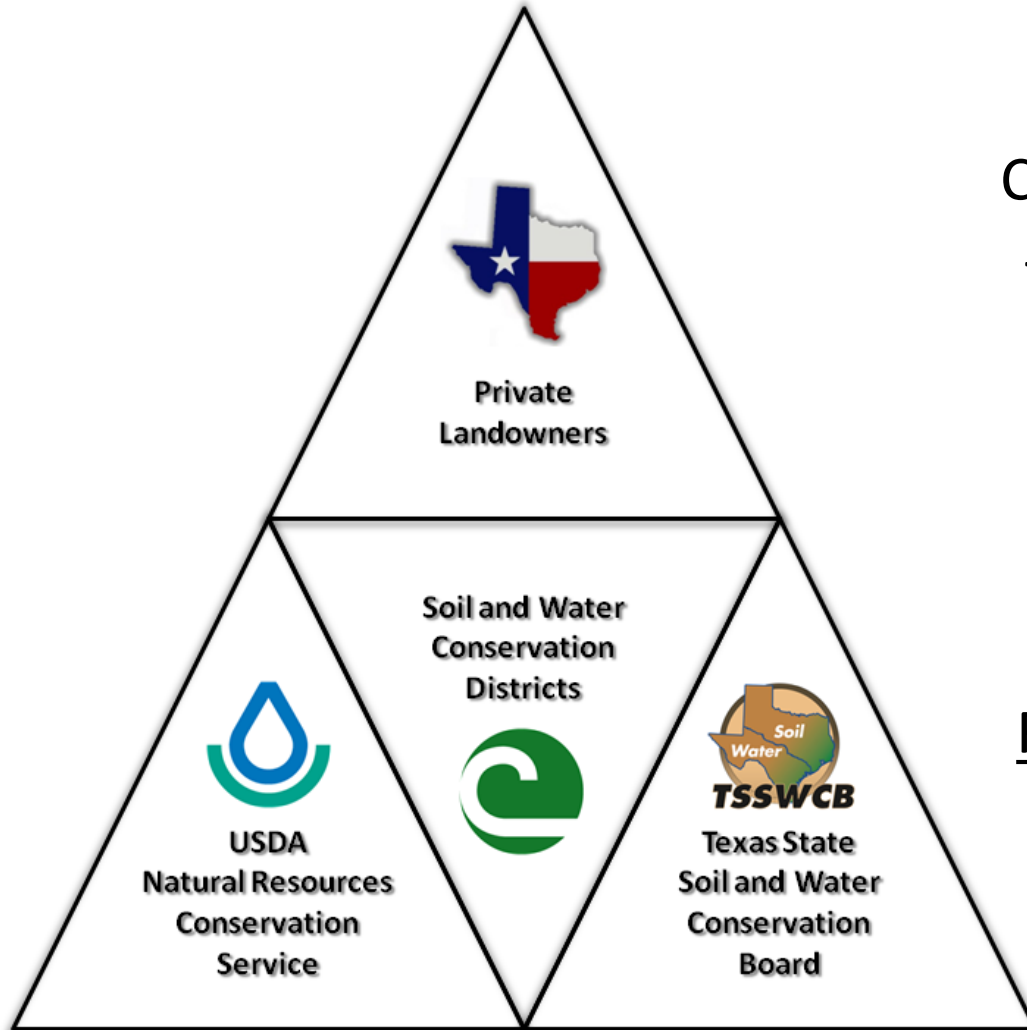
January 13, 2016
Austin, TX



Protecting and Enhancing Natural Resources for Tomorrow

AGENCY OVERVIEW

Texas Conservation Partnership



Providing
Conservation Assistance
to Private Landowners
for over 76 Years

LOCAL = 216 SWCDs

STATE = TSSWCB

FEDERAL = USDA-NRCS



TSSWCB

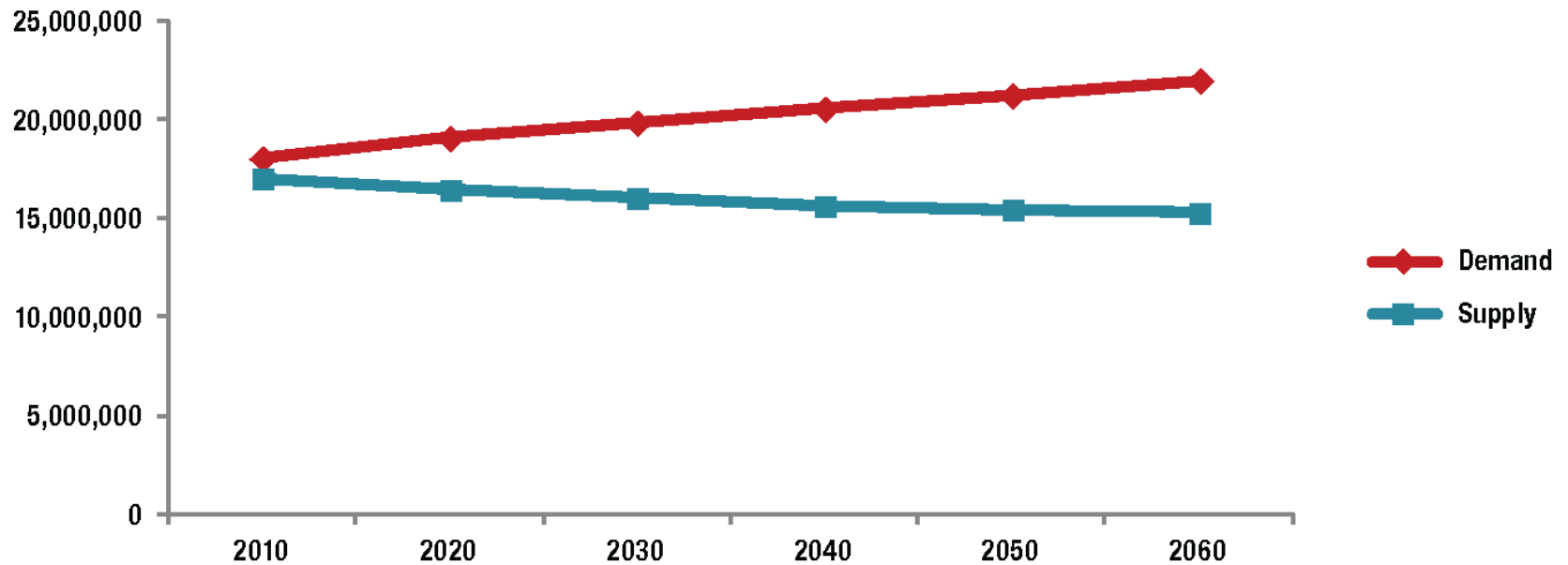
- established in 1939 in response to the ecological and agricultural devastation of the Dust Bowl
- administers Texas' soil and water conservation law
- delivers coordinated natural resources conservation programs to agricultural producers through State's 216 local SWCDs
- lead agency for implementing programs for preventing and abating agricultural and silvicultural nonpoint sources of water pollution
- administers water supply enhancement program to increase available surface and ground water through targeted control of water-depleting brush
- works to ensure State's network of 2,000 flood control dams is protecting lives and property
- facilitates Texas Invasive Species Coordinating Committee
- improves border security along Rio Grande through carrizo cane control



Meeting Critical Water Conservation Needs and Enhancing Public Water Supplies Through Brush Control

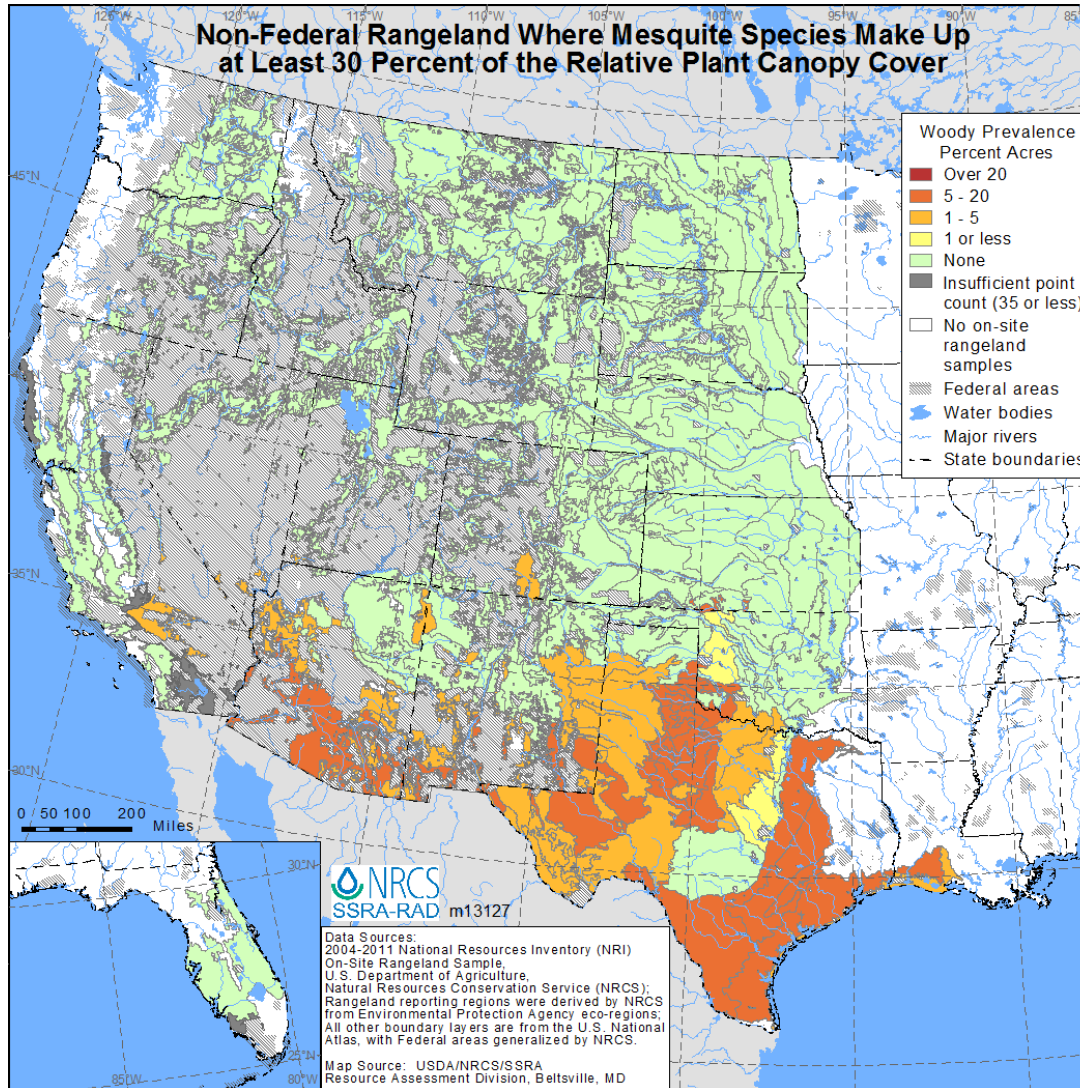
WATER SUPPLY ENHANCEMENT PROGRAM

Projected Water Demand & Existing Supplies (ac-ft/yr)



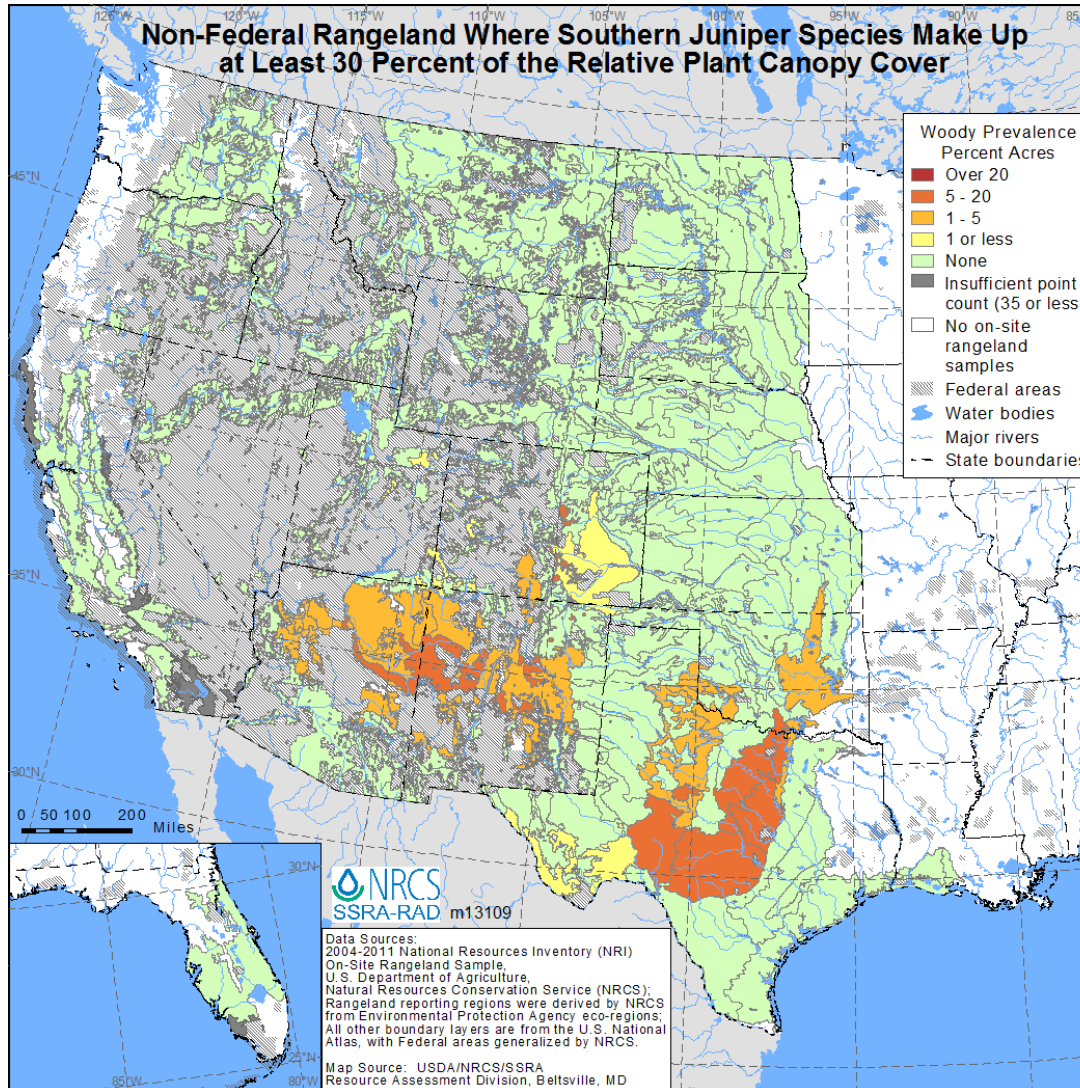
NRCS National Resources Inventory

Rangeland Mesquite 30%

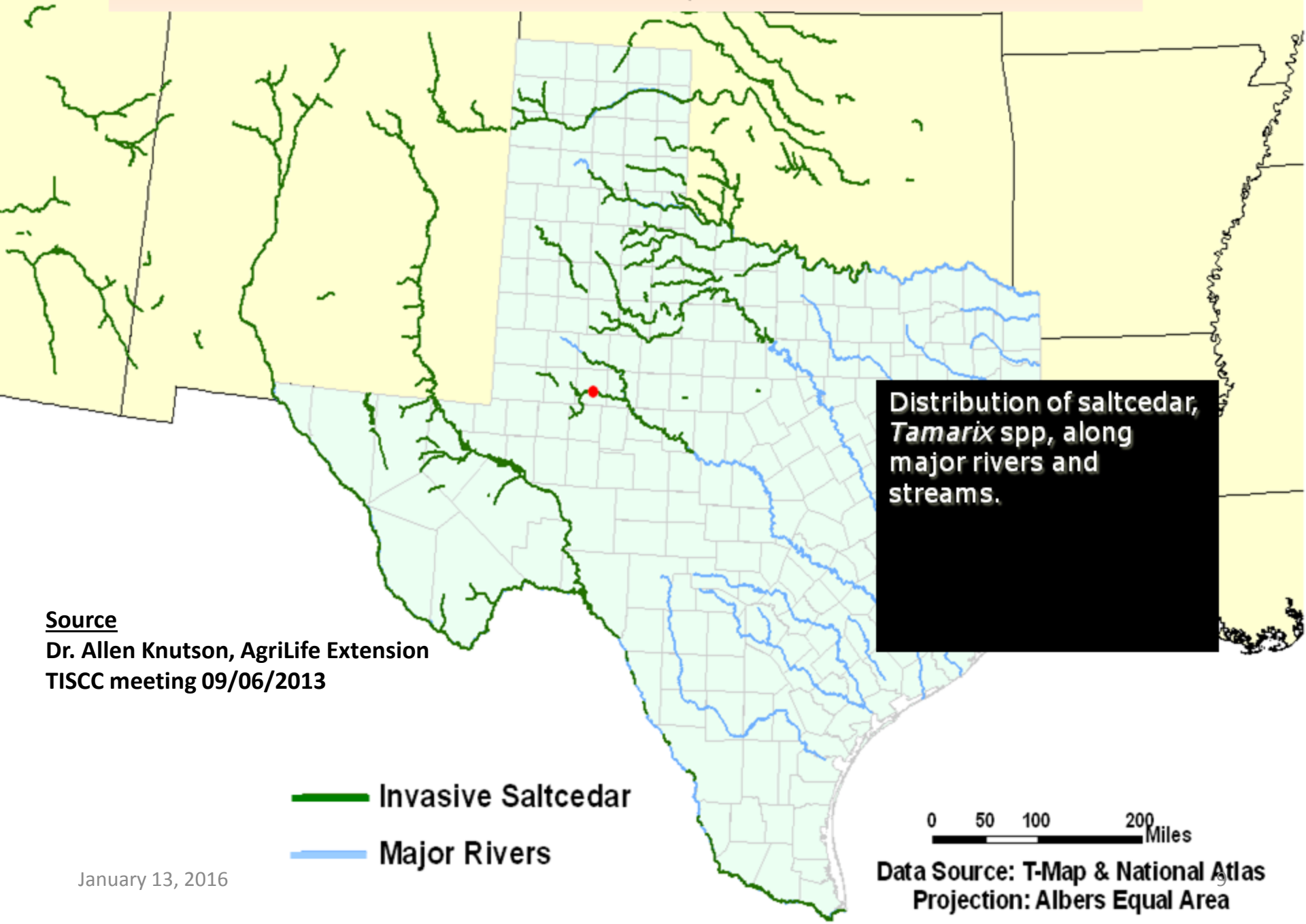


NRCS National Resources Inventory

Rangeland Juniper 30%



Saltcedar Infests about 450,000 acres in Texas.



Source

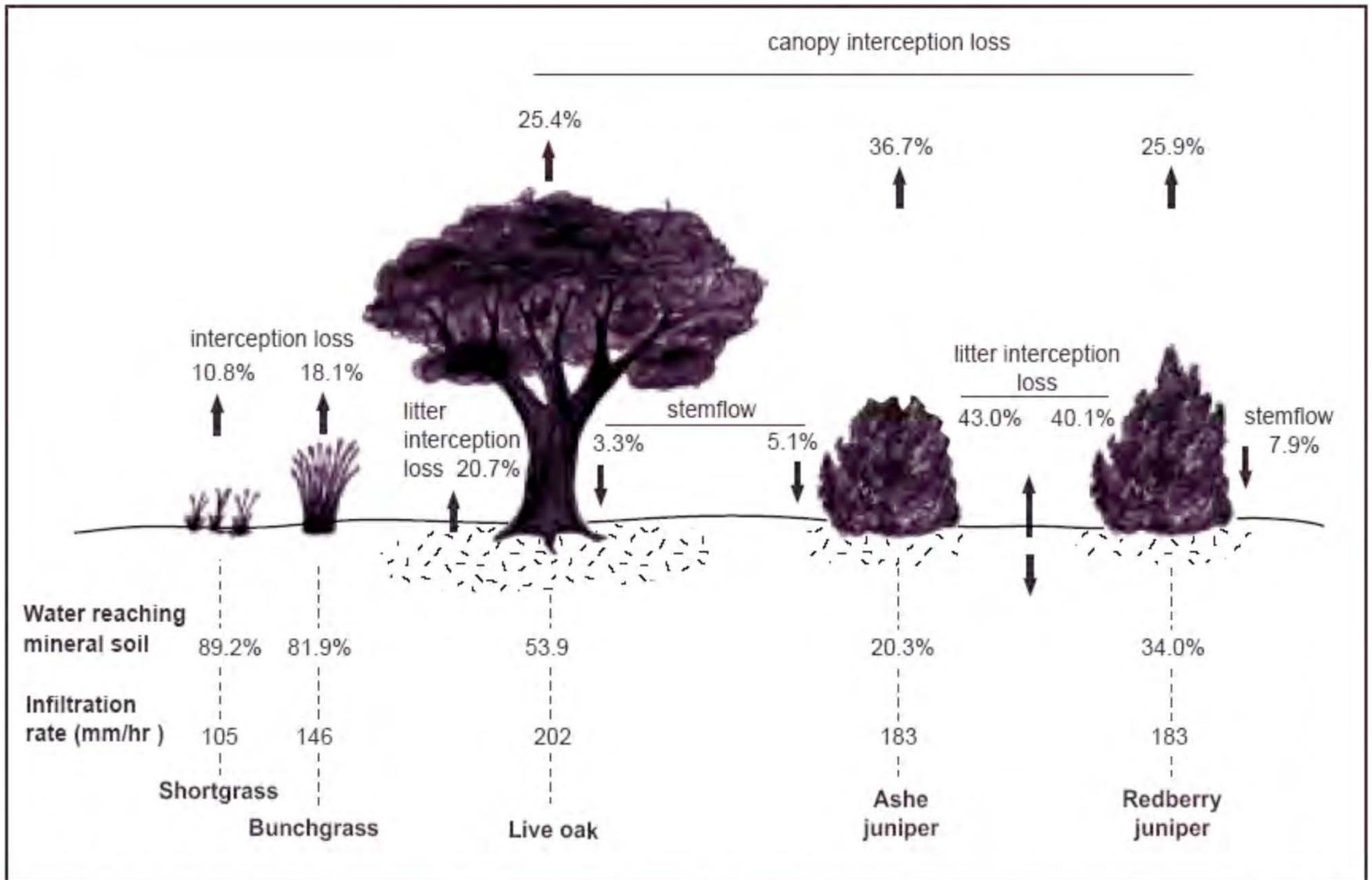
Dr. Allen Knutson, AgriLife Extension
TISCC meeting 09/06/2013

January 13, 2016



Statutory Purpose of WSEP

- to increase available surface and ground water supplies through
 - targeted control of noxious brush species that are detrimental to water conservation, and
 - revegetation of land on which brush has been controlled





Ecosystem Services of Brush Control

- conserving water lost to evapotranspiration
- recharging groundwater
- enhancing spring and stream flows

- improve soil health
- restore native wildlife habitat by improving rangeland
- improve livestock grazing distribution
- aid in wildfire suppression through reduction of hazardous fuels
- protect water quality and reduce soil erosion
- manage invasive species



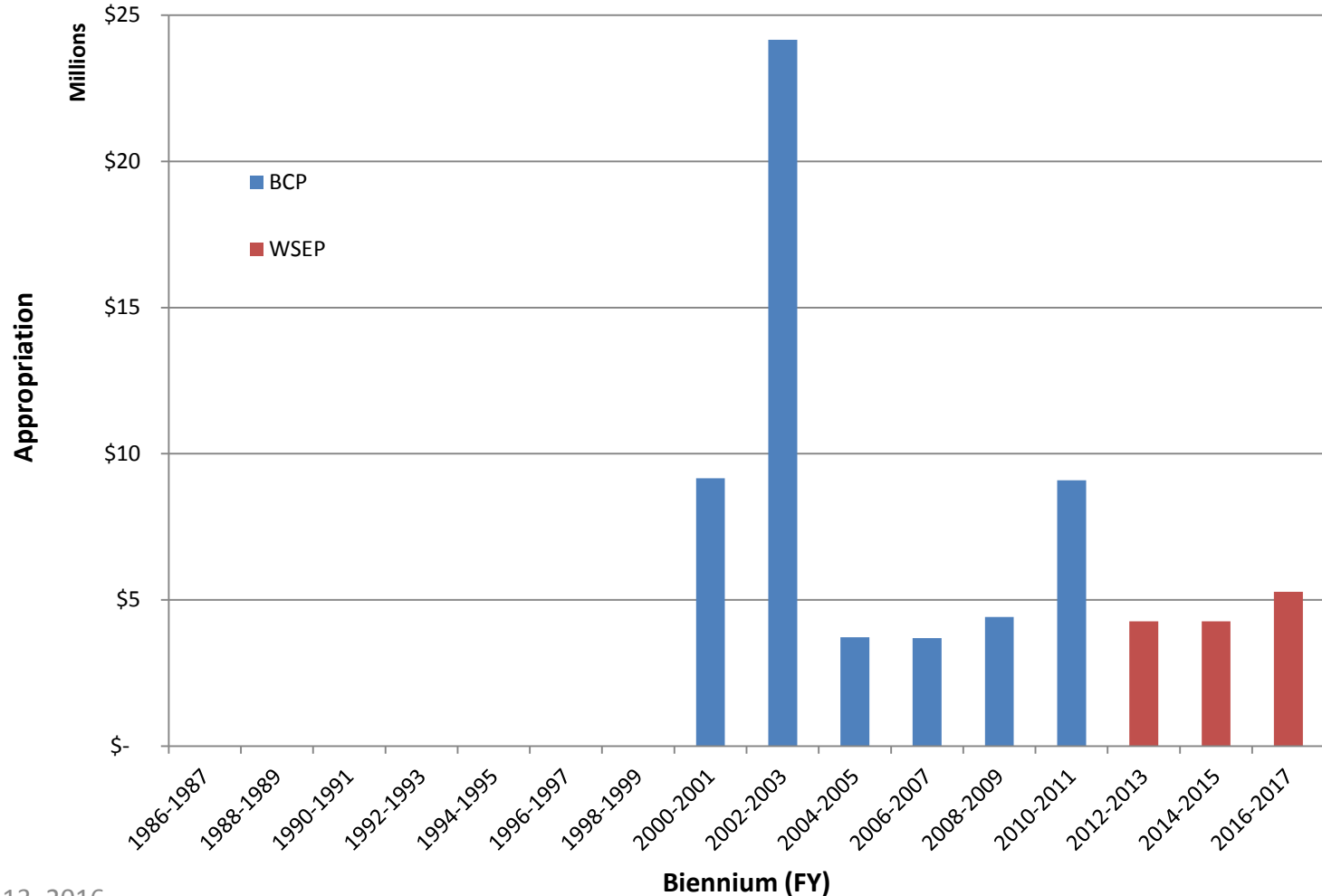
Program Background

- 69th Legislature (1985) created Texas Brush Control Program
 - Program unfunded until 1999
- 76th Legislature (1999) provided 1st appropriation to begin implementing Program in FY2000
- Sunset review process in 2010-2011 - Sunset Advisory Commission adopted recommendations to address several issues identified with agency programs
 - Concluded that framework of Texas Brush Control Program was ineffective for meeting State's critical water conservation needs
- 82nd Legislature (2011), as a result of the Sunset Commission's recommendations, passed HB 1808 which delineated changes to TSSWCB's programs
 - Established new program for agency, the Water Supply Enhancement Program (WSEP)



Appropriations

Texas State Soil and Water Conservation Board Brush Control Program / Water Supply Enhancement Program





Implementing Sunset Changes

- Competitive grant process to rank projects and allocate funds
- Detailed criteria for prioritizing projects
- Feasibility study that includes a computer model to estimate projected water yield
- Follow-up brush treatment monitored through status reviews
- Established a Stakeholder Committee of Program Beneficiaries
- Established a Science Advisory Committee
- Hired consulting hydrologist
- Adopted revised Rules (2012) & amendments to Rules (2014)
- Adopted three Policies
- Adopted State Water Supply Enhancement Plan (2014)
- Internal Audit (2014) – fully compliant with Legislative directives
- Sunset Compliance (2015) – all provisions of HB 1808 fully implemented



Role of Committees

Stakeholder Committee

- Program Beneficiaries
- WSEP goals
- Proposal ranking process
- Ranking Index

Science Advisory Committee

- Technical experts
- Requirements for feasibility studies
- Method for prioritizing acreage for brush control
- Evaluate new potential feasibility studies



Water Supply Enhancement Program Stakeholder Committee

- Association of Texas Soil and Water Conservation Districts
 - Jule Richmond
- Texas and Southwestern Cattle Raisers Association
 - Jason Skaggs
- Texas Commission on Environmental Quality
 - vacant
- Texas Water Development Board
 - Dr. Robert Mace
- Texas Tech University
 - Dr. Ken Rainwater





Water Supply Enhancement Program Science Advisory Committee

- Texas A&M AgriLife Extension Service
 - Dr. Alyson McDonald
- Texas Department of Agriculture
 - Dr. David Villarreal
- Texas Parks and Wildlife Department
 - Chad Norris; Anne Rogers (alt)
- Texas Tech University
 - Dr. Ken Rainwater; Dr. Tom Arsuffi (alt)
- Texas Water Development Board
 - Dr. Ruben Solis; Dr. Yujuin Yang (alt)
- Texas Institute for Applied Environmental Research at Tarleton State University
 - Dr. Larry Hauck
- USDA Agricultural Research Service
 - Dr. Daren Harmel
- USDA Natural Resources Conservation Service
 - Dr. Ken Spaeth; Jeff Goodwin (alt)
- U.S. Geological Survey
 - Dr. George Ozuna; Dr. Ryan Banta (alt)





Consultation

- Required by Texas Agriculture Code §203.016
- Texas Water Development Board
 - effects on water quantity
- Texas Parks and Wildlife Department
 - effects on fish and wildlife
- Texas Department of Agriculture
 - effects on agriculture





Goals

- recommended by Stakeholder Committee
- goals describe intended use of a water supply enhanced by the program and the populations that the program will benefit
- General Goals
 - Enhance domestic and municipal uses, including water for sustaining human life and the life of domestic animals, agricultural and industrial uses, commercial value, and environmental flows.
 - Enhance mining and recovery of minerals, power generation, navigation and recreation and pleasure, and other beneficial uses.
- Specific Goals
 - Implement project proposals that most enhance water quantity to the municipal water supplies most in need.
 - Direct program grant funds toward acreage within an established project that will yield the most water.



State Water Supply Enhancement Plan

- TSSWCB shall prepare and adopt the State Water Supply Enhancement Plan
 - State’s comprehensive strategy for managing brush in all areas of the state where brush is contributing to a substantial water conservation problem
 - programmatic guidance for the TSSWCB’s WSEP
- Adopted on July 28, 2014
 - updated and revised in order to continue implementing provisions of HB 1808
 - inclusive public comment process
- Must be updated at least every 2 years
 - public outreach meetings (3) – January and May 2015



State Water Supply Enhancement Plan

- goals describing intended use of water supply enhanced by program and populations that program will target
- factors that must be considered in a feasibility study
- priority watersheds across state for water supply enhancement and brush control
- eligible brush species detrimental to water conservation
- how WSEP interacts with State Water Plan and Regional Water Planning process
- competitive grant process
- proposal ranking criteria
- how agency will allocate funding
- geospatial analysis methodology for prioritizing acreage for brush control
- technical assistance and financial incentives for landowners for developing and implementing resource management plans on enrolled acreage
- how success for WSEP will be assessed and reported
- how overall water yield will be projected and tracked



Eligible Brush Species

- target species are those brush species that consume water to a degree that is detrimental to water conservation
- eligible species
 - mesquite (*Prosopis spp.*)
 - juniper (*Juniperus spp.*)
 - saltcedar (*Tamarix spp.*)
- other species of interest conditionally eligible
 - huisache (*Acacia smallii*)
 - carrizo cane (*Arundo donax*)

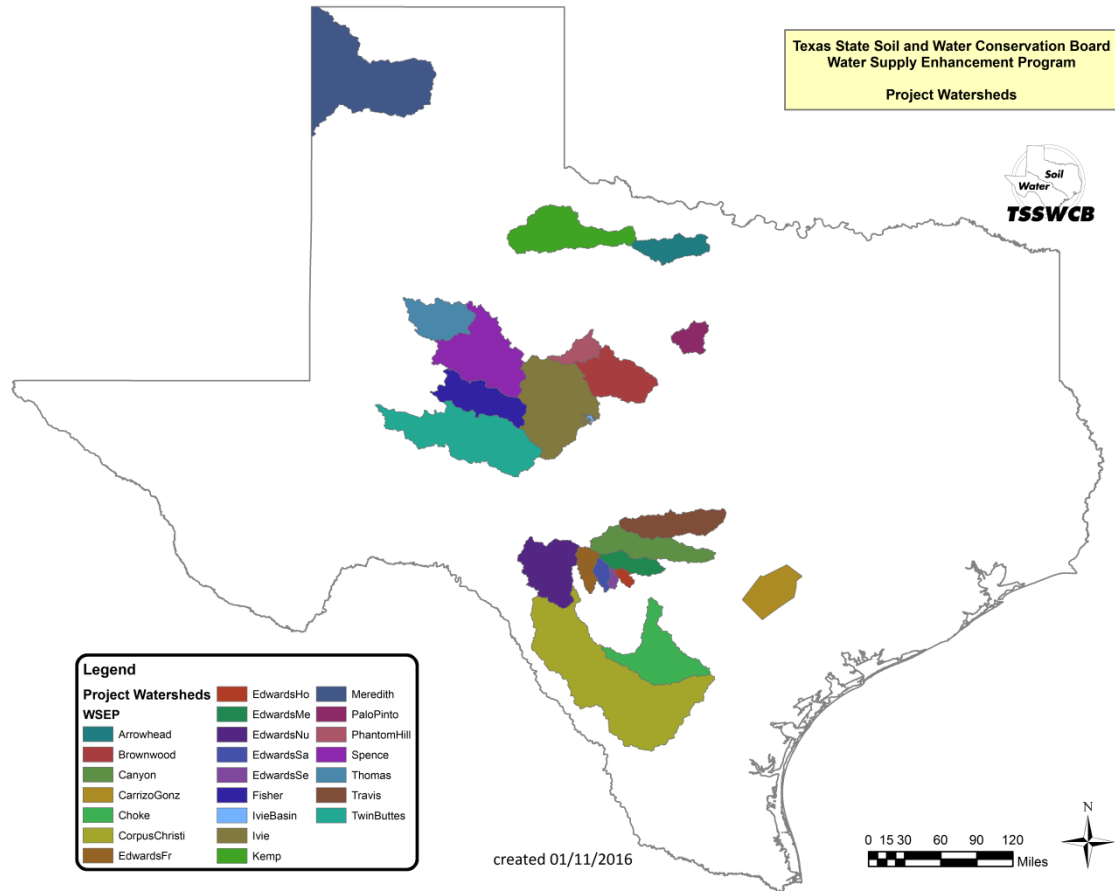


Feasibility Studies

- funds will only be allocated for brush control cost-share to projects that have a completed feasibility study that includes a site-specific computer-modeled water yield developed by a person with appropriate expertise
- to be eligible for cost-share funds, the feasibility study must demonstrate increases in post-treatment water yield as compared to the pre-treatment conditions
- detailed requirements for computer modeling for water yield projections developed by Science Advisory Committee
 - balance WSEP consistency and comparability between feasibility studies with the practical limitation on how strictly prescriptive requirements should be

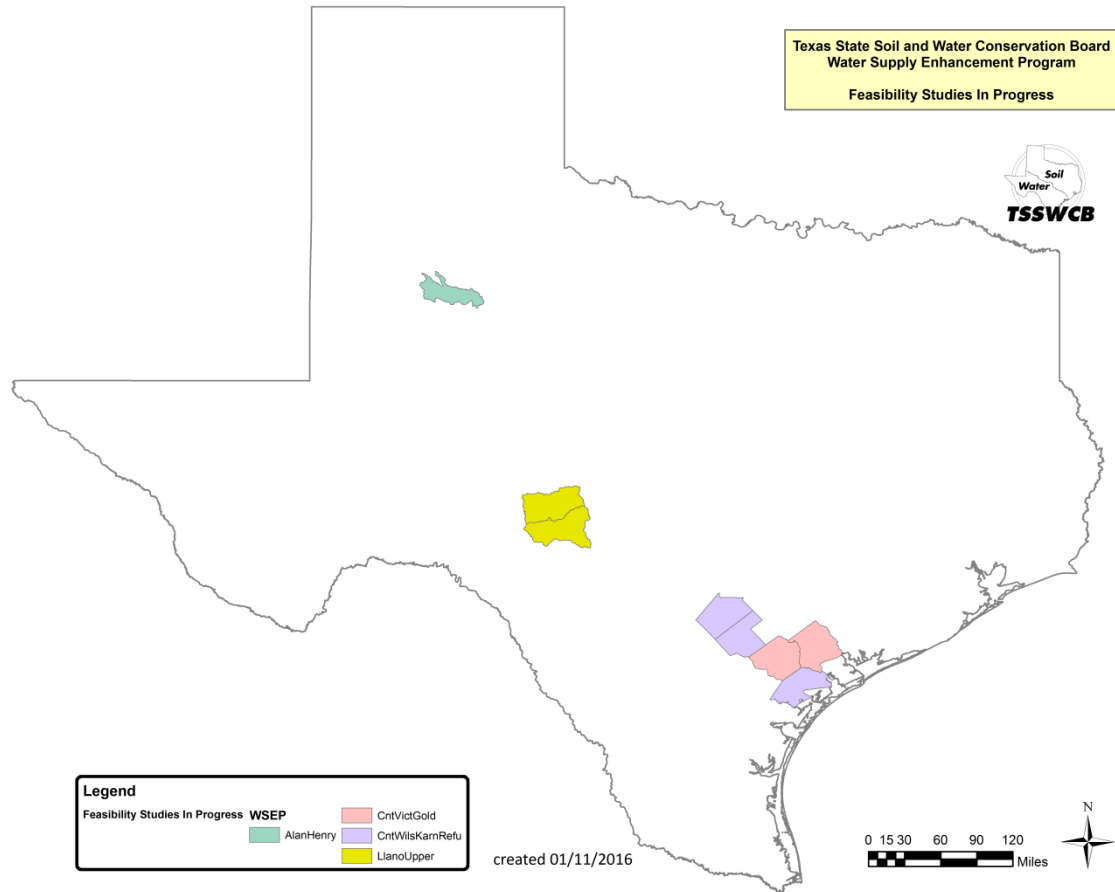


Completed Feasibility Studies



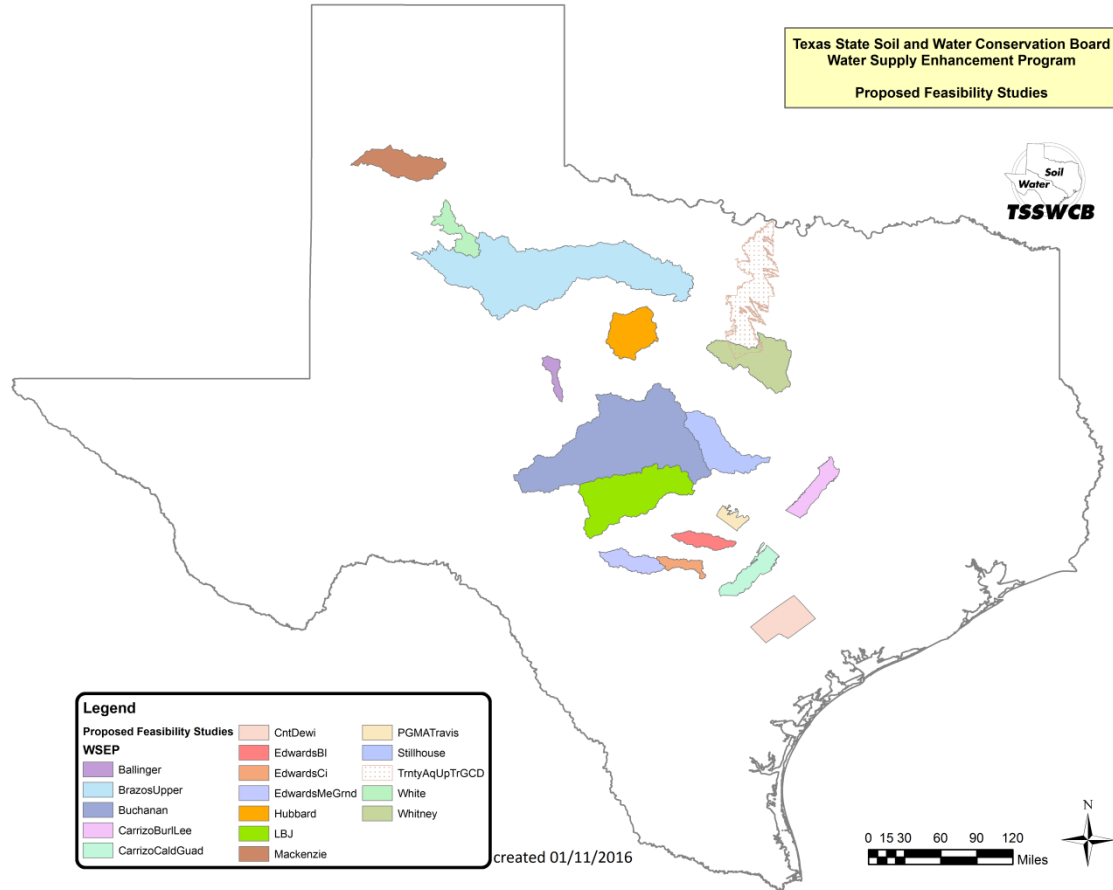


Feasibility Studies In Progress





Proposed Feasibility Studies





Competitive Grant and Ranking Index

- competitive grant process to rank project proposals and allocate funds
- proposals must relate to a water conservation need, based on information in the State Water Plan as adopted by TWDB
- Feasibility Study must have been completed for the watershed
- proposals are prioritized for each funding cycle, giving priority to projects that balance most critical water conservation need of municipal WUGs with highest projected water yield from brush control
- evaluation criteria established by Stakeholder Committee (Mace, 2012)
 - public water supplies expected to be benefited by the project
 - firm yield enhancement to municipal water supplies
 - Water User Groups relying on the water supplies
 - percent of enhanced water supply used by Water User Groups
 - population of Water User Group
- Ranking Index is calculated that gives a measure of water yield increased per capita user for each proposal

$$RI = \textit{Reliance on source} \times \frac{\textit{Yield Benefit}}{\textit{Population}}$$



Criteria for Prioritizing Projects

- need for conservation of water resources within the watershed, based on the State Water Plan as adopted by TWDB
- projected water yield of project, based on soil; slope; land use; types and distribution of brush; and proximity of brush to rivers, streams, and channels (and aquifer recharge features)
- method the project may use to control brush
- cost-sharing rates within the project
- location and size of the project
- budget of the project
- implementation schedule of the project
- administrative capacities of TSSWCB and SWCD that will manage the project
- scientific research on the effects of brush removal on water supply
- any other criteria relevant to assure the WSEP can be most effectively, efficiently, and economically implemented



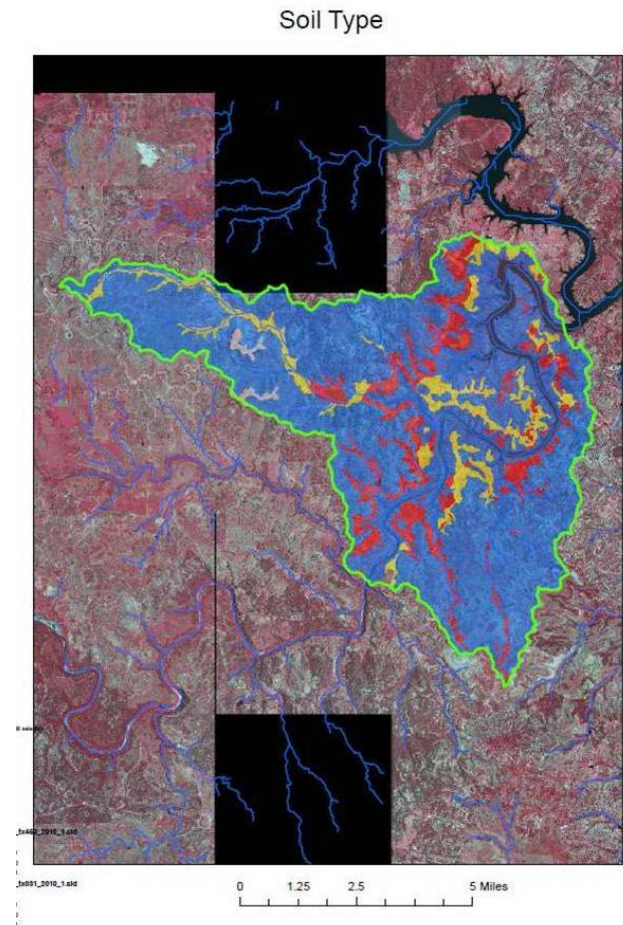
Cost-Share Allocations

| Target Public Water Supply | Sub | Yield | Ranking Index | Requested Funds | FY2016 Allocation |
|----------------------------|---------|---------|---------------|---------------------|---------------------|
| Edwards Aq - Sabinal Rvr | 16 | 118,045 | 6,073 | \$ 120,000 | \$ 120,000 |
| Edwards Aq - Frio Rvr | 12 | 54,697 | 3,938 | \$ 100,000 | \$ 100,000 |
| Medina Lk | 10 | 169,544 | 3,814 | \$ 110,000 | \$ 110,000 |
| Brownwood, Lk | 25 | 150,100 | 607 | \$ 300,000 | \$ 300,000 |
| Edwards Aq - Nueces Rvr | 101-04 | 64,123 | 384 | \$ 150,000 | \$ 150,000 |
| Palo Pinto Rsrvr | 2010902 | 212,200 | 240 | \$ 162,000 | \$ 162,000 |
| Travis, Lk | 5 | 212,420 | 168 | \$ 100,000 | \$ 100,000 |
| Arrowhead, Lk | 13 | 196,202 | 130 | \$ 200,000 | \$ 200,000 |
| Travis, Lk | 4 | 164,352 | 130 | \$ 75,000 | \$ 75,000 |
| Nimitz Lk | 7 | 22,800 | 97 | \$ 160,000 | \$ 160,000 |
| Kemp, Lk | 48 | 85,776 | 57 | \$ 300,000 | \$ 300,000 |
| Twin Buttes Rsrvr | SC-03 | 50,043 | 56 | \$ 200,000 | \$ - |
| Twin Buttes Rsrvr | SC-13 | 36,569 | 41 | \$ 300,000 | \$ - |
| Kemp, Lk | 30 | 49,096 | 33 | \$ 300,000 | \$ - |
| Canyon Lk | 20 | 58,500 | 26 | \$ 50,000 | \$ - |
| Canyon Lk | 18 | 56,000 | 25 | \$ 50,000 | \$ - |
| Twin Buttes Rsrvr | MC-27 | 10,047 | 12 | \$ 100,000 | \$ - |
| Choke Canyon Rsrvr | 109-04 | 87,633 | 10 | \$ 14,175 | \$ - |
| Corpus Christi, Lk | 105-03 | 84,134 | 10 | \$ 75,600 | \$ - |
| Corpus Christi, Lk | 105-13 | 72,098 | 8 | \$ 37,800 | \$ - |
| Choke Canyon Rsrvr | 108-17 | 68,413 | 8 | \$ 24,570 | \$ - |
| Choke Canyon Rsrvr | 108-17 | 68,413 | 8 | \$ 69,300 | \$ - |
| Ivie Rsrvr, O.H. | CNC-32 | 55,358 | 8 | \$ 300,000 | \$ - |
| Corpus Christi, Lk | 105-42 | 56,299 | 7 | \$ 37,800 | \$ - |
| Ivie Rsrvr, O.H. | CNC-33 | 45,337 | 7 | \$ 300,000 | \$ - |
| Ivie Rsrvr, O.H. | 1 | 29,465 | 6 | \$ 450,000 | \$ - |
| Fort Phantom Hill Rsrvr | 15 | 119,368 | 5 | \$ 210,000 | \$ - |
| Fort Phantom Hill Rsrvr | 16 | 104,404 | 5 | \$ 210,000 | \$ - |
| Travis, Lk | 26 | 739 | 1 | \$ 200,000 | \$ - |
| Oak Creek Rsrvr | CLD-62 | 47,225 | NR | \$ 300,000 | \$ - |
| Fisher Rsrvr, O.C. | 7 | 12,774 | NR | \$ 300,000 | \$ - |
| | | | | \$ 5,306,245 | \$ 1,777,000 |



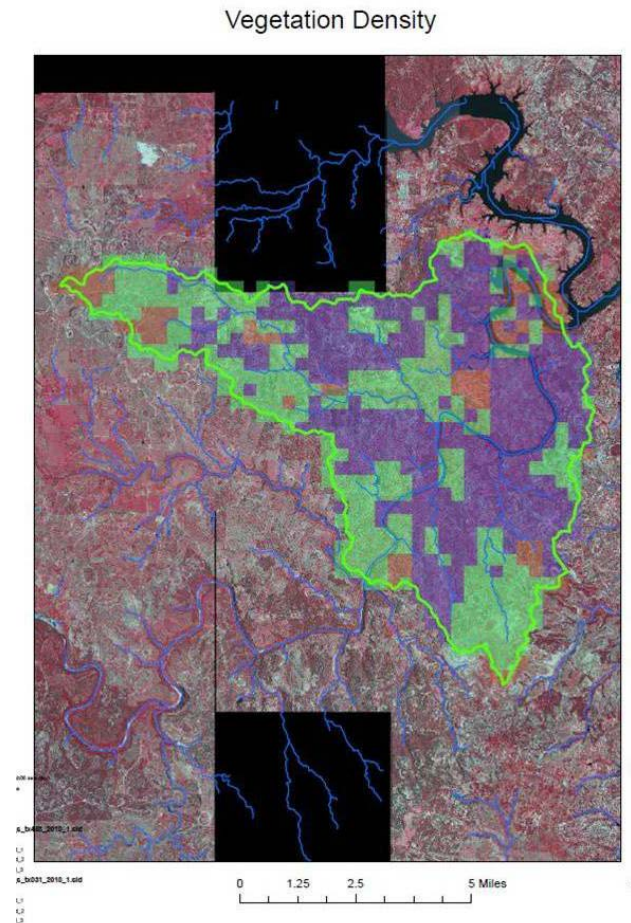
Prioritizing Acreage

- maximize positive impacts of brush control on water supply enhancement
- maximize effective and efficient use of allocated funds
- perform geospatial analysis
- delineate and prioritize eligible acres that have highest potential to yield water within project watershed



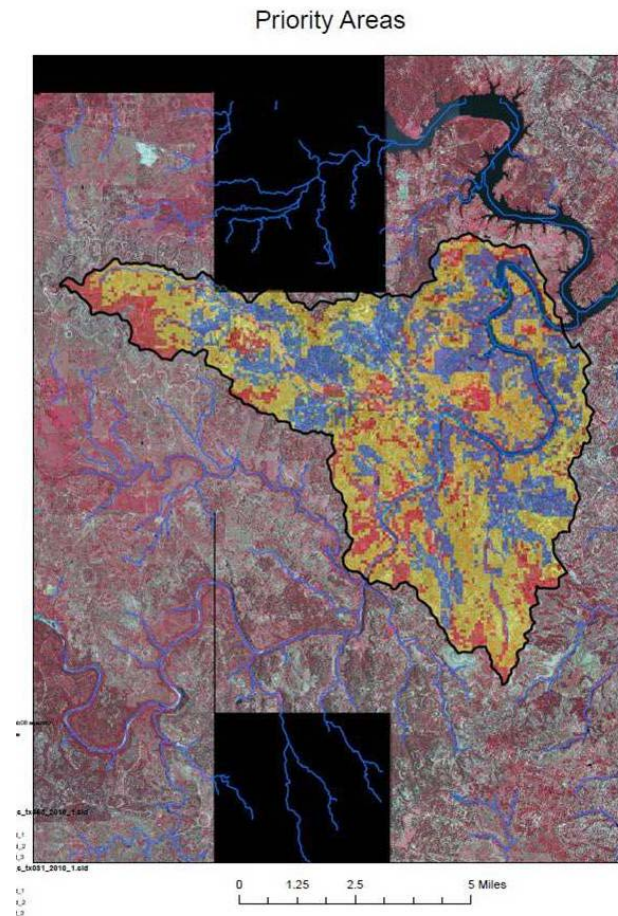
Prioritizing Acreage

- factors that will be assessed
 - Soil Type – relative to runoff potential or recharge
 - Slope – sufficiently steep to affect runoff potential or recharge but not impair method of brush control
 - Vegetation Density – type and density of treatable brush in area
 - Proximity to Waterbodies – riparian areas and other hydrologically sensitive areas critical to streamflow and aquifer recharge
 - Proximity to Watershed Outlet
- automatically excluded areas
 - areas that are designated as project habitat or endangered species habitat
 - slopes greater than 16%



Prioritizing Acreage

- two ranking systems based on site characteristics and their impacts on goal of project
 - manage brush for aquifer infiltration enhancement
 - manage brush for surface water enhancement
- compiled analysis results in four brush control priority zones for each watershed
 - highest yielding areas (blue)
 - medium yielding areas (yellow)
 - lowest yielding areas (red)
 - areas not eligible





Example: Aquifer Infiltration Enhancement

Manage Brush for Infiltration Enhancement

| Characteristic | Criteria | Ranking |
|-----------------------------|---|---------|
| Brush density | > 30% canopy coverage | 1 |
| | > 10% and < 30% canopy coverage | 2 |
| | < 10% canopy coverage | 3 |
| Hydrologic Soil Type | HSG A | 1 |
| | HSG B | 2 |
| | HSG C | 3 |
| | HSG D | 4 |
| Slope of Area | 0 to 7.4% | 1 |
| | 7.5 to 16% | 2 |
| | 16 to 24% | 3 |
| | >24% | 4 |
| Proximity to Stream Channel | .25 to .50 miles from channel | 1 |
| | .51 to .75 miles from channel | 2 |
| | >.75 miles from channel | 3 |
| Proximity to Outlet | 1 st 3 rd of the subbasin | 1 |
| | 2 nd 3 rd of the subbasin | 2 |
| | Last 3 rd of the subbasin | 3 |



Landowner Plans

- site-specific 10-year resource management plan for implementation of brush control and sound range management practices
- plan must include
 - brush control activities
 - follow-up brush control requirements
 - requirement to limit average brush coverage to not more than 5% (target species)
 - periodic dates throughout course of plan when TSSWCB will inspect status of brush control
- SWCDs responsible for developing and approving plans
- designed to achieve a level of brush control necessary to
 - increase watershed yield
 - meet landowner goals
 - address wildlife considerations
- best available management and technology as described in USDA NRCS Field Office Technical Guide
- essential practices utilized in all resource management plans
 - brush management
 - erosion control measures
 - prescribed grazing
 - upland wildlife management



Status Reviews and Follow-up Treatment

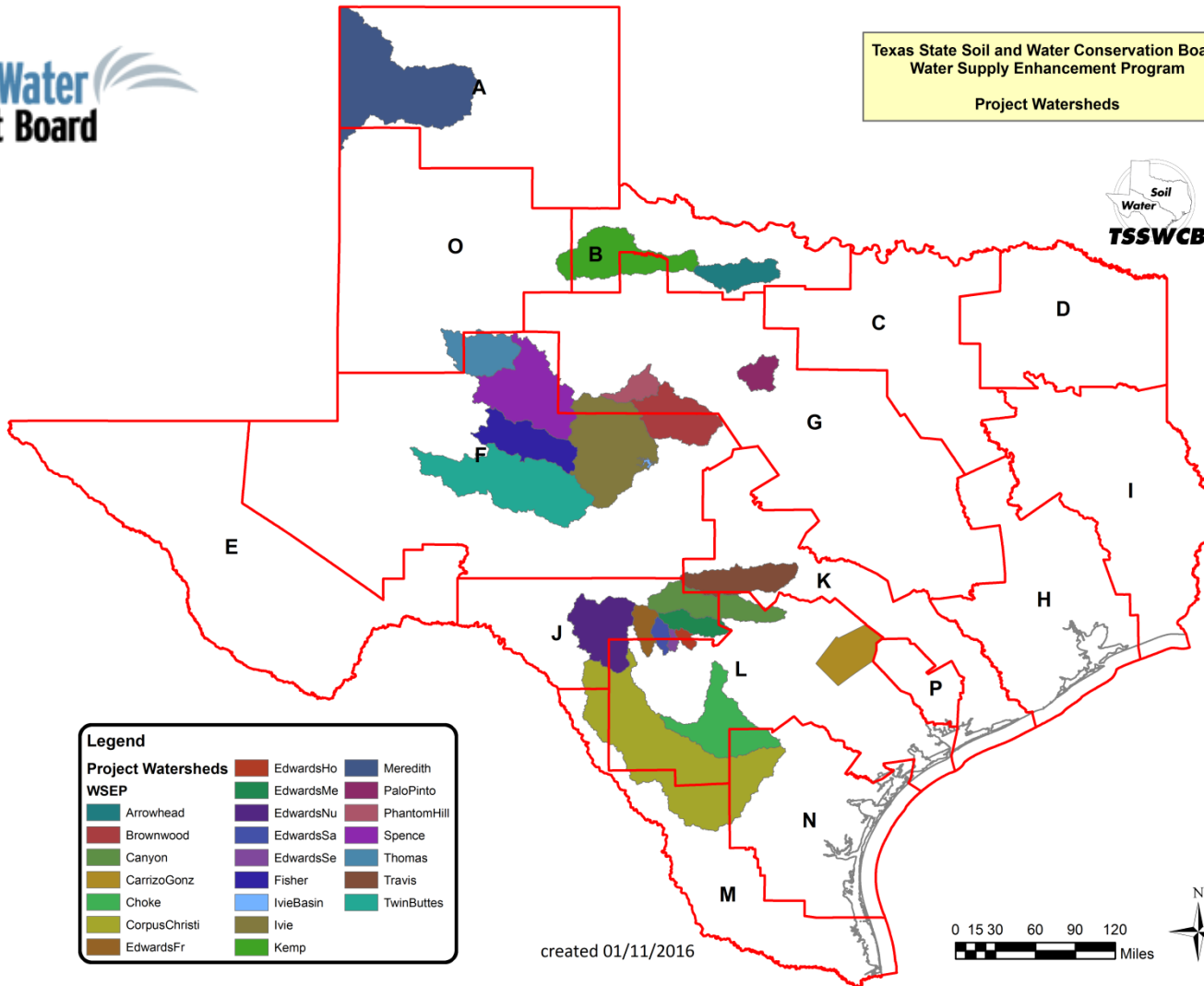
- Status Reviews
 - to determine if canopy is >5% (target species only)
 - 1st within 3-5 years after initial treatment
 - 2nd performed 8-9 years after initial treatment
- Follow-up Treatment
 - mesquite, saltcedar, mixed
 - 3 years after initial treatment, if canopy >5%
 - juniper
 - 8 years after initial treatment, if canopy >5%



Regional Water Planning

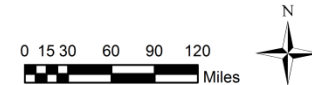


Texas State Soil and Water Conservation Board
Water Supply Enhancement Program
Project Watersheds



| Legend | |
|---------------------------|--|
| Project Watersheds | <ul style="list-style-type: none"> EdwardsHo EdwardsMe EdwardsNu EdwardsSa EdwardsSe Fisher IvieBasin CorpusChristi EdwardsFr Meredith PaloPinto PhantomHill Spence Thomas Travis TwinButtes |
| WSEP | <ul style="list-style-type: none"> Arrowhead Brownwood Canyon CarrizoGonz Choke CorpusChristi EdwardsFr Kemp |

created 01/11/2016



2012 State Water Plan

- Discussed in 13 RWPs, Recommended in some form in 9 RWPs
- Fully evaluated, recommended WMS for brush control (2)
 - Region F
 - City of San Angelo
 - projected to yield 8,362 ac-ft/yr (20% of yield from ac treated)
 - total capital cost of \$23M
 - Region J (Plateau)
 - Kerr County
 - projected to yield 10,500 ac-ft/yr (15,000 ac to be treated)
 - total capital cost of \$3.9M
- By the 2060 planning horizon
 - 2 brush control WMS evaluated and recommended
 - only contribute 0.2% (18,862 ac-ft/yr) to total supply volume of WMS (9.0M ac-ft/yr)
 - only constitute 0.05% (\$26.9M) of total capital costs of implementing State Water Plan (\$53B)



Gonzales County Feasibility Study

- Published in 2012 by TTU
 - Carrizo-Wilcox Aquifer
 - Guadalupe River
 - Peach, Elm, & Sandies Creeks
 - San Marcos River
- EDYS, 44 subbasins
- Total annual water yield
 - 115,499 ac-ft
- Total cost for 10 year implementation
 - no economic analysis
- Brush treated 2000-2015
 - 464 ac





Gonzales County Feasibility Study

- Scenario 2 = upper limit to potential benefit of removal of target species
- Net water yield increased in all 44 subwatersheds
- Runoff, soil profile, deep storage, groundwater use
- <1 in/yr on 9 subs
>3 in/yr on 9 subs
county avg 1.9 in/yr
- Probable recharge into groundwater averaged 0.6 in/yr, or 2% of annual precip
- Vegetation used ~1.9 in/yr of groundwater as ET, or 2.5x average recharge

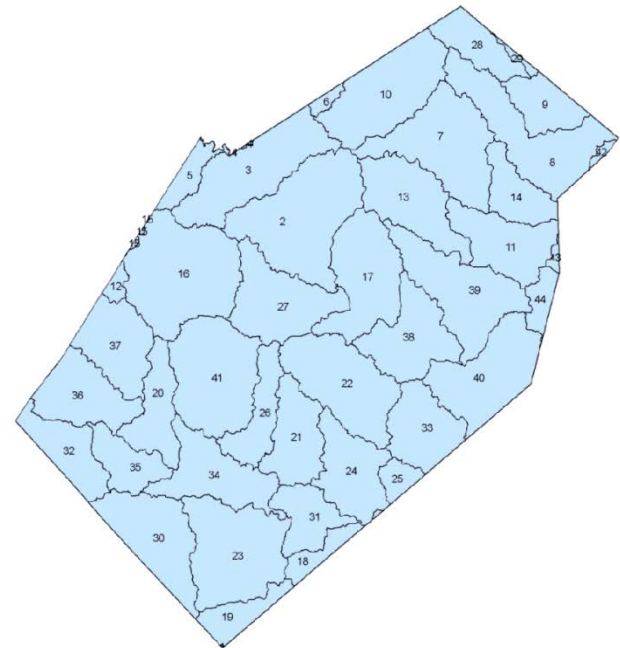


Figure 2.1 Spatial distribution of the 44 sub-watersheds used in the EDYS model application for Gonzales County, Texas.



Gonzales County

WMS Study (Carrizo-Wilcox GAM)

- Published in Aug 2015 by HDR, Inc.
- Using EDYS-based Feasibility Study for brush control in Gonzales County, extrapolate Carrizo-Wilcox recharge enhancement
- Run Carrizo-Wilcox Groundwater Availability Model with brush control enhanced recharge to calculate potential increase in Modeled Available Groundwater
- Brush control in Gonzales, Caldwell, and Guadalupe Counties
- MAG ↑ by 1,370-13,910 ac-ft/yr depending on landowner participation levels
 - 100% landowner = MAG ↑ 25%
 - 30% landowner = MAG ↑ 4,631 ac-ft/yr



Brush Management in Gonzales County as a Water Management Strategy

Final Report

HDR Project No. 229237

August 20, 2015





SWAT-WAM Results

- linkage between published Guadalupe River SWAT model created for brush control Feasibility Study and the TCEQ-authorized Guadalupe River Water Availability Model
- quantification of brush management water yields during periods lacking abundant rainfall, defined as when lake storage below 25th percentile
- brush control in the watershed increases lake levels during times of lowest quartile precipitation (i.e., drought-like conditions)
 - 110 ac-ft (20% brush)
 - 1,080 ac-ft (80% brush)

USGS
science for a changing world

Prepared in cooperation with the Texas State Soil and Water Conservation Board

Linkage of the Soil and Water Assessment Tool and the Texas Water Availability Model to Simulate the Effects of Brush Management on Monthly Storage of Canyon Lake, South-Central Texas, 1995–2010

Scientific Investigations Report 2013–5239

U.S. Department of the Interior
U.S. Geological Survey

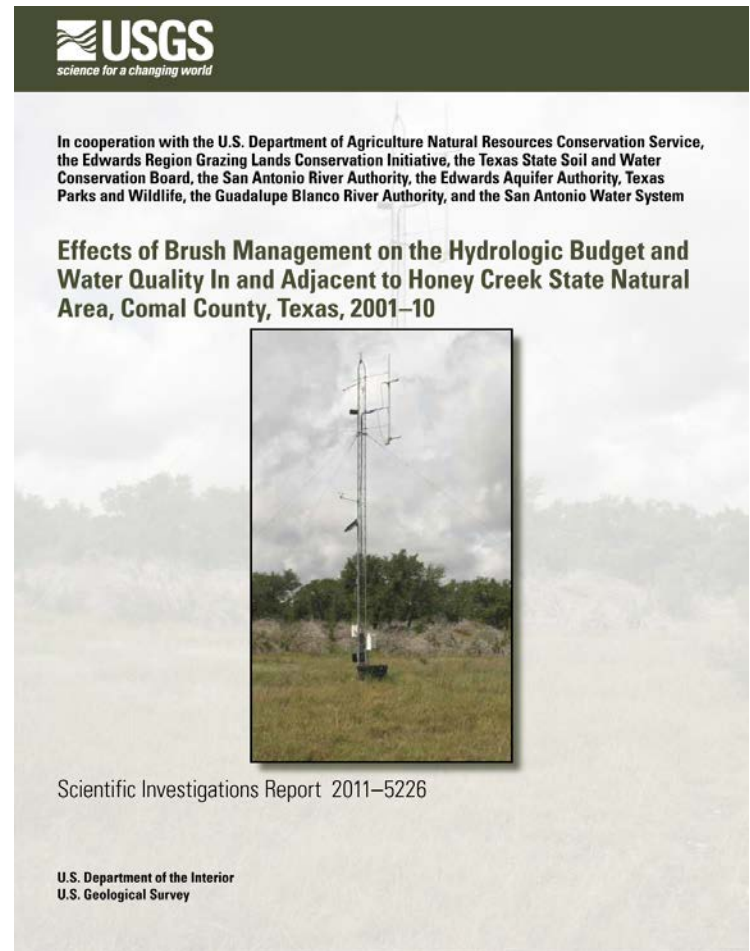
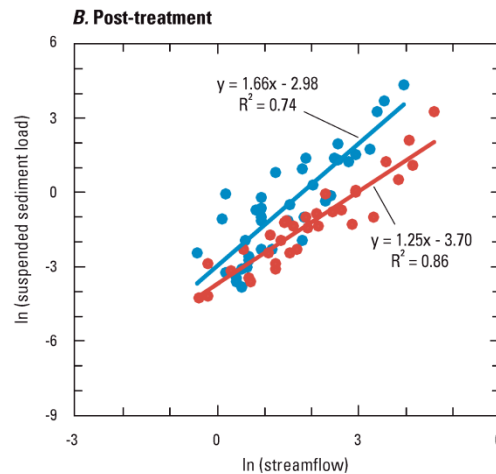


Soil Erosion Potential

- TSSWCB is the lead state agency responsible for preventing and abating agricultural and silvicultural nonpoint sources of water pollution and the agency's WSEP is designed to reinforce that mission
- Feasibility studies – modeled simulations of brush control by replacing target brush with native grass rangeland
- USDA NRCS Practice Standard – brush management restores desired vegetative cover to control erosion and reduce sediment – expect slight to moderate decrease in sheet and rill soil erosion
- USGS Honey Creek study – suspended sediment data

USGS Honey Creek Sediment

- during post-treatment period, relation between suspended-sediment loads and streamflow did exhibit statistically significant difference
- data indicate that for same streamflow, suspended-sediment loads from treatment watershed were generally less than suspended-sediment loads from reference watershed during post-treatment period





Sum of All Feasibility Studies

- 23 watersheds
 - 973 subwatersheds
- 15.75M ac to treat
 - 57% of watershed areas
- 2.4M ac-ft of water total projected annual yield
- \$1.173B total cost to treat
- 857k ac treated 2000-2015



WSEP Results

- FY2014
 - 6,215 ac of brush management in 9 project areas
 - landowners received \$844,666 in cost-share
 - based on feasibility studies, projected to increase water yield by 2,898 ac-ft/yr
- FY2015
 - 23,191 ac of brush management in 11 project areas
 - landowners received \$1,279,326 in cost-share
 - based on feasibility studies, projected to increase water yield by 5,929 ac-ft/yr



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