Brush Control for Water Supply Enhancement

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Texas State Soil and Water Conservation Board

Texas Invasive Species Coordinating Committee
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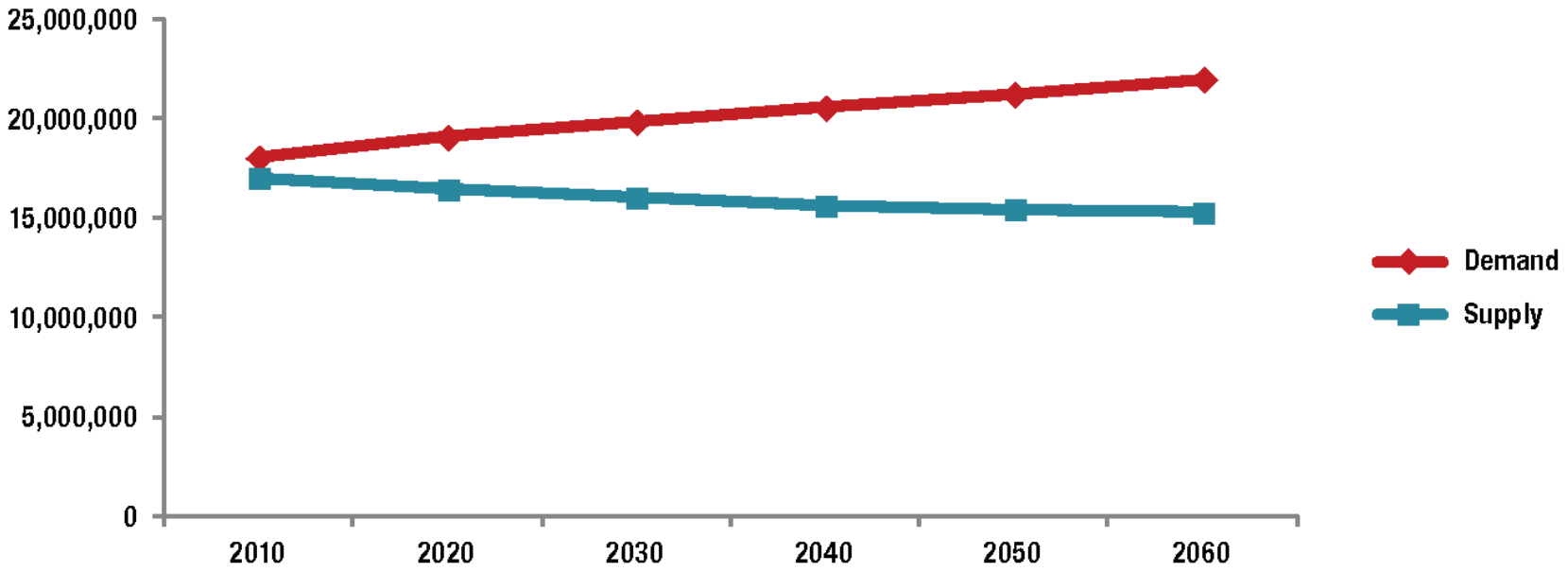
Austin, TX

Scarcity and competition for water have made sound water planning and management increasingly important. With Texas' population expected to grow by 82% in the next 50 years, the availability of water supplies is essential for not only the Texans of today but also for those of tomorrow (2012 State Water Plan, TWDB).

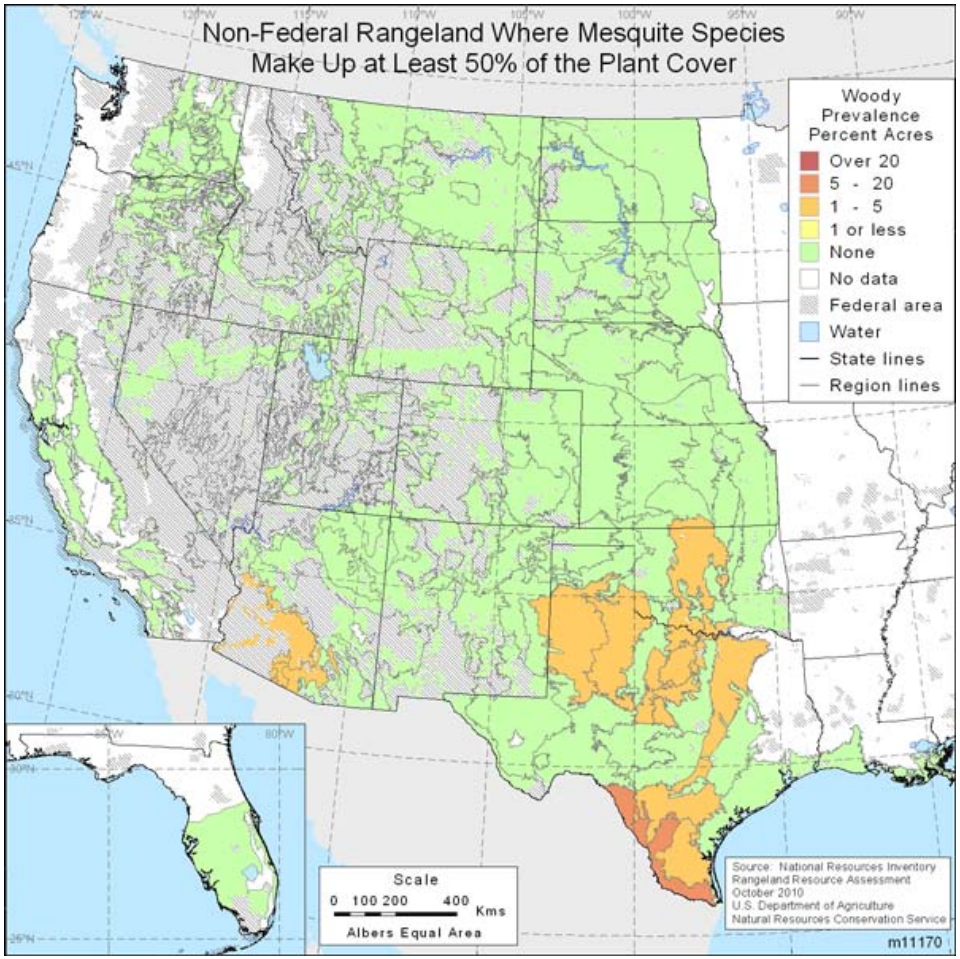
Projected Water Demand & Existing Supplies (ac-ft/yr)



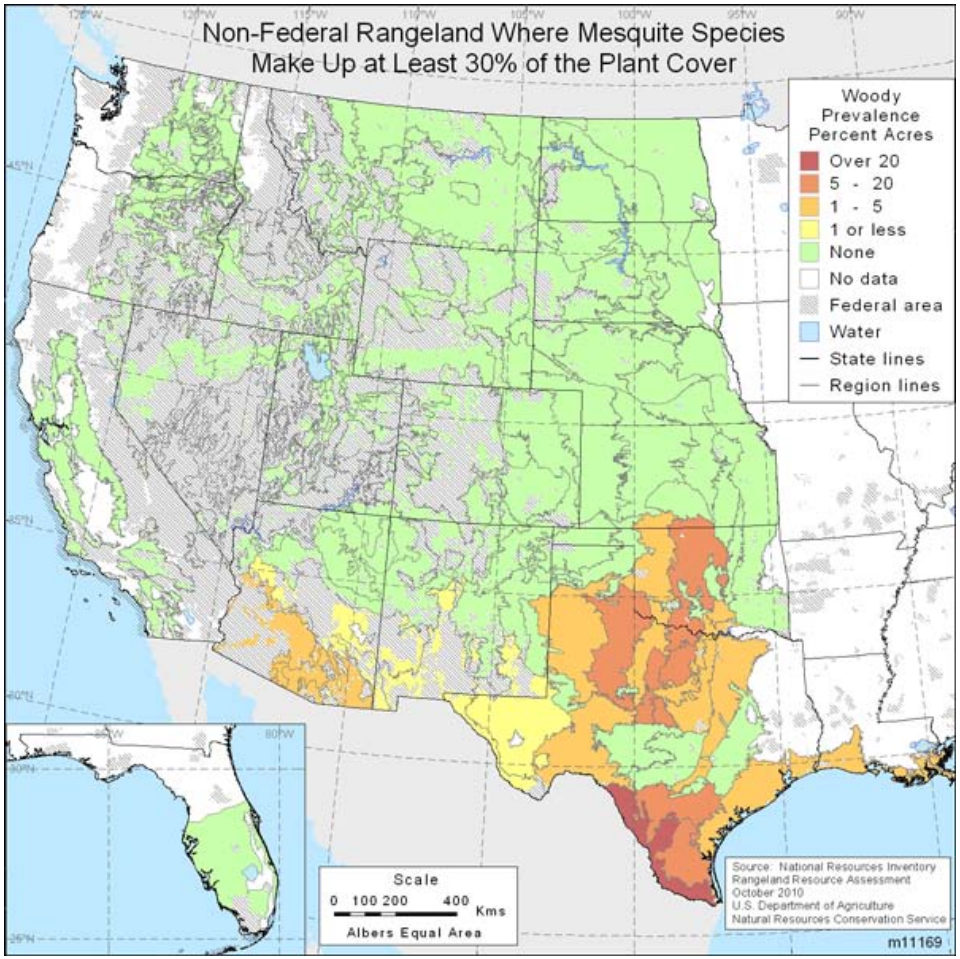
Texas Water Development Board

Noxious brush, detrimental to water conservation, has invaded millions of acres of rangeland and riparian areas in Texas, reducing or eliminating stream flow and aquifer recharge through interception of rainfall and increased evapotranspiration.

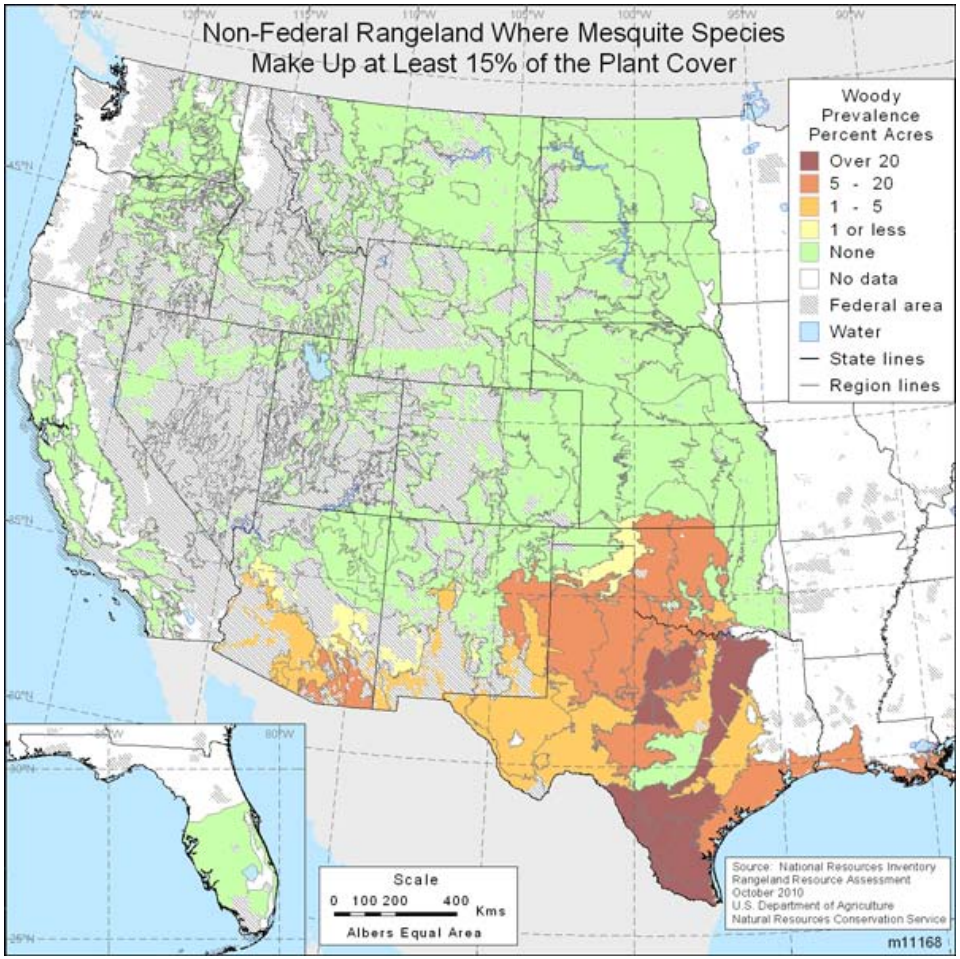
USDA NRCS NRI Rangeland Mesquite 50%



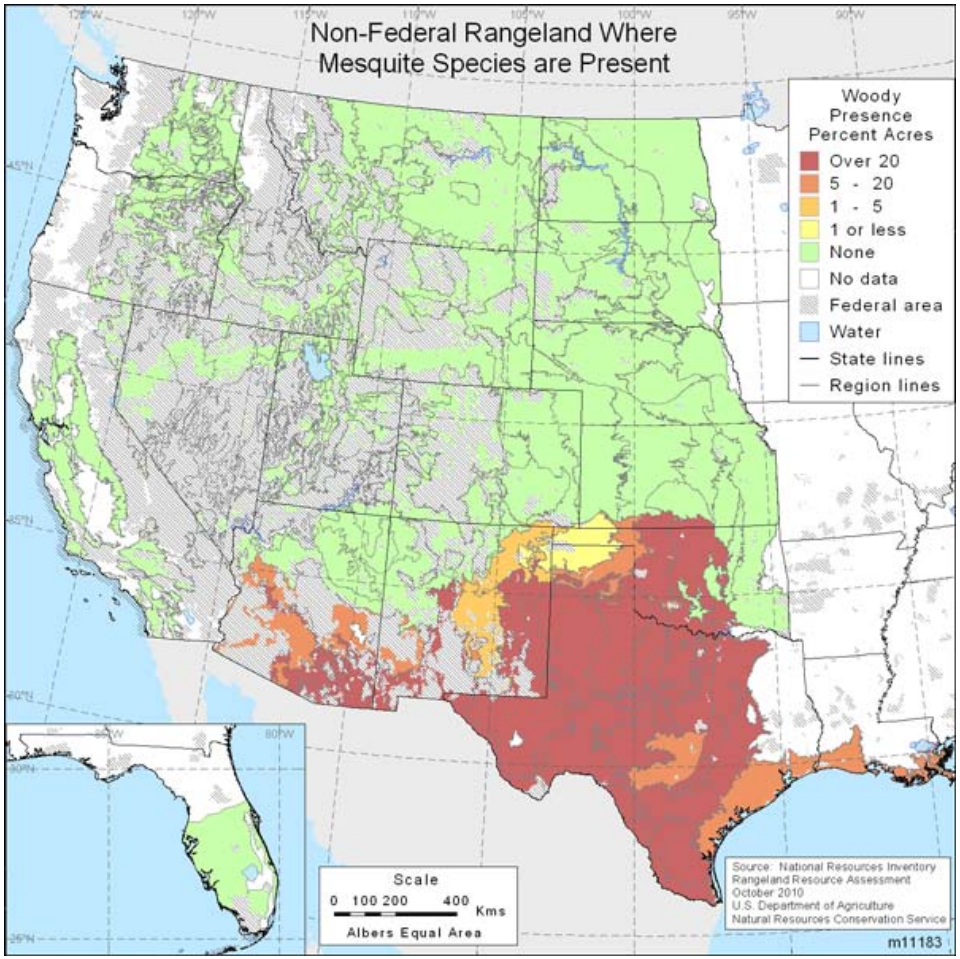
USDA NRCS NRI Rangeland Mesquite 30%



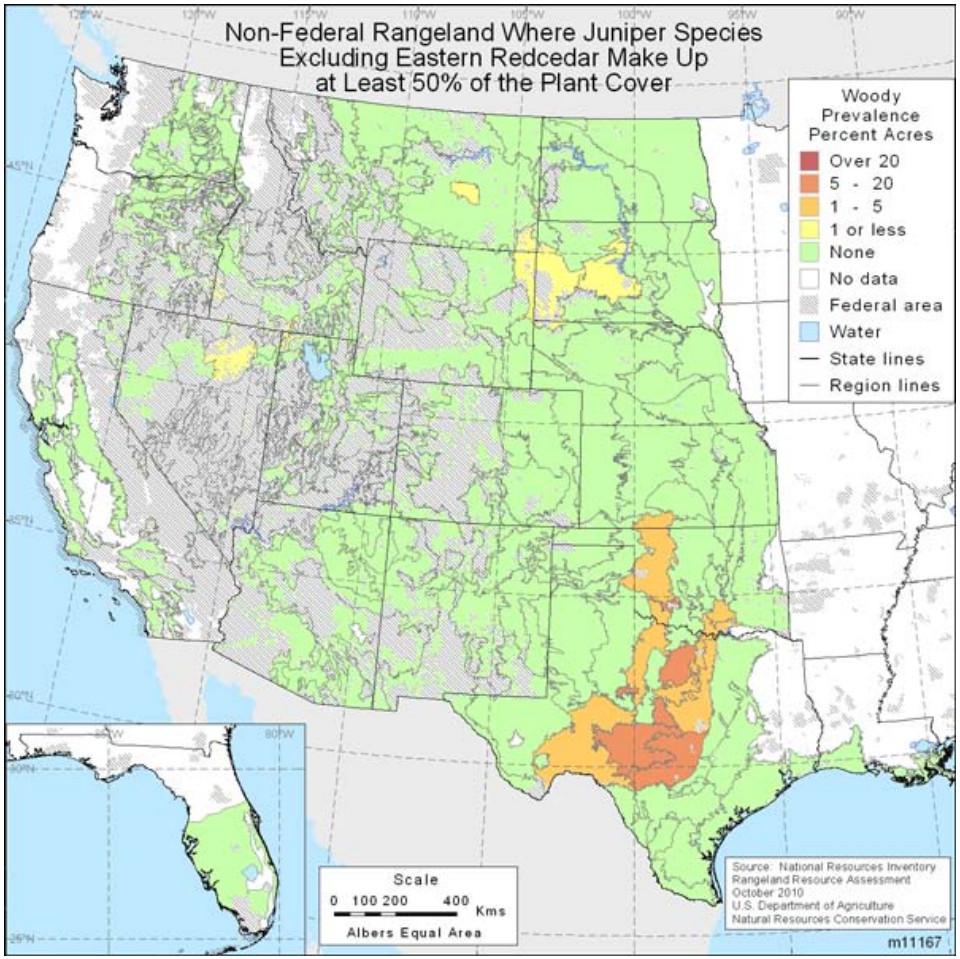
USDA NRCS NRI Rangeland Mesquite 15%



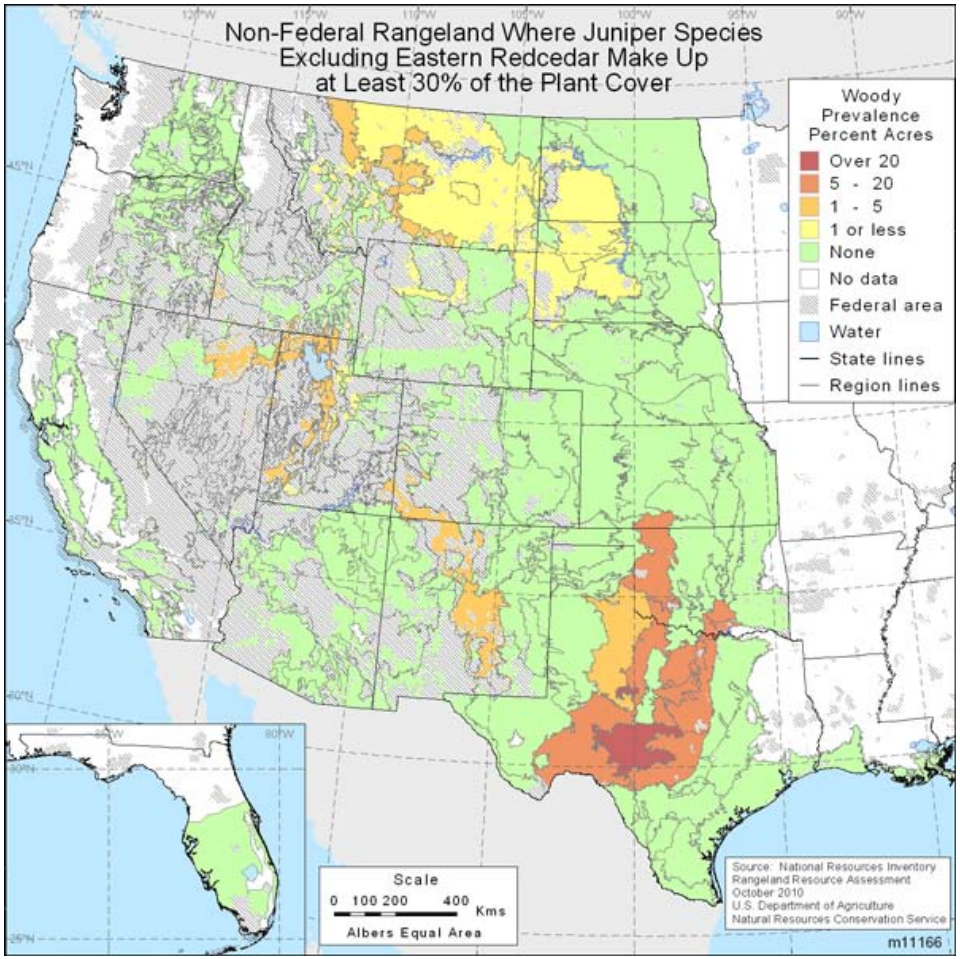
USDA NRCS NRI Rangeland Mesquite present



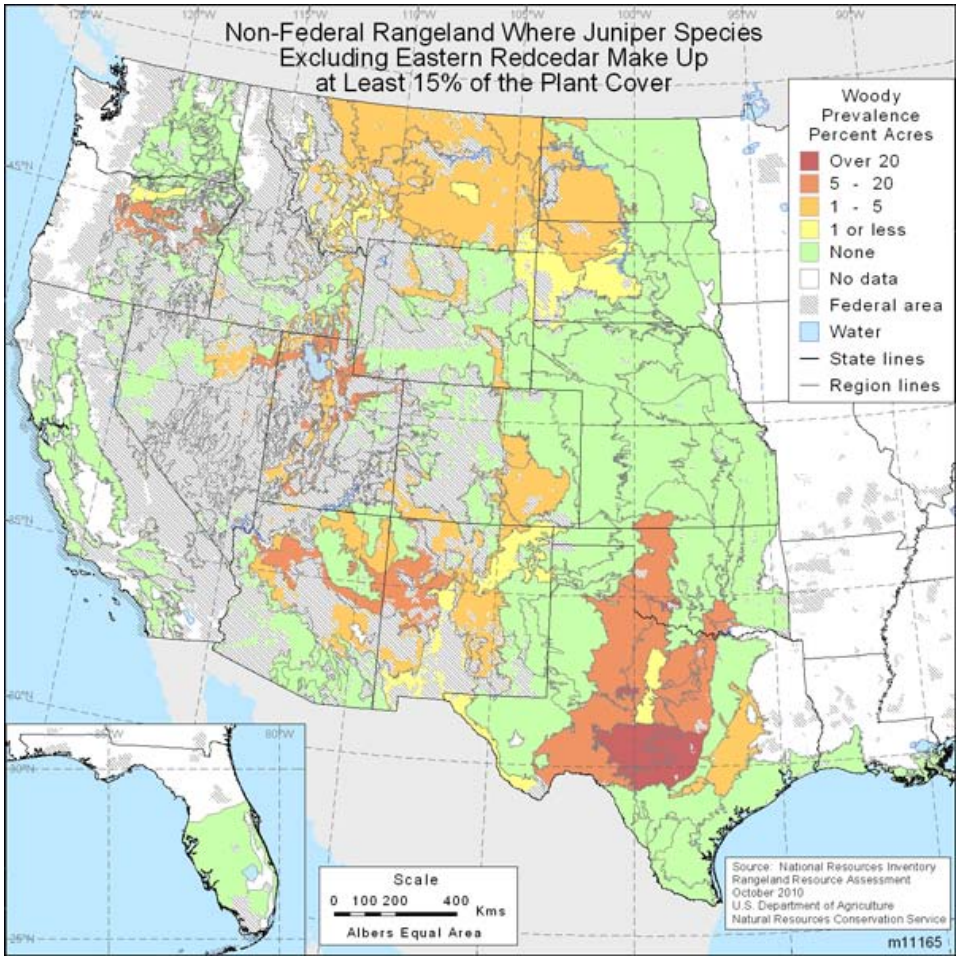
USDA NRCS NRI Rangeland Juniper 50%



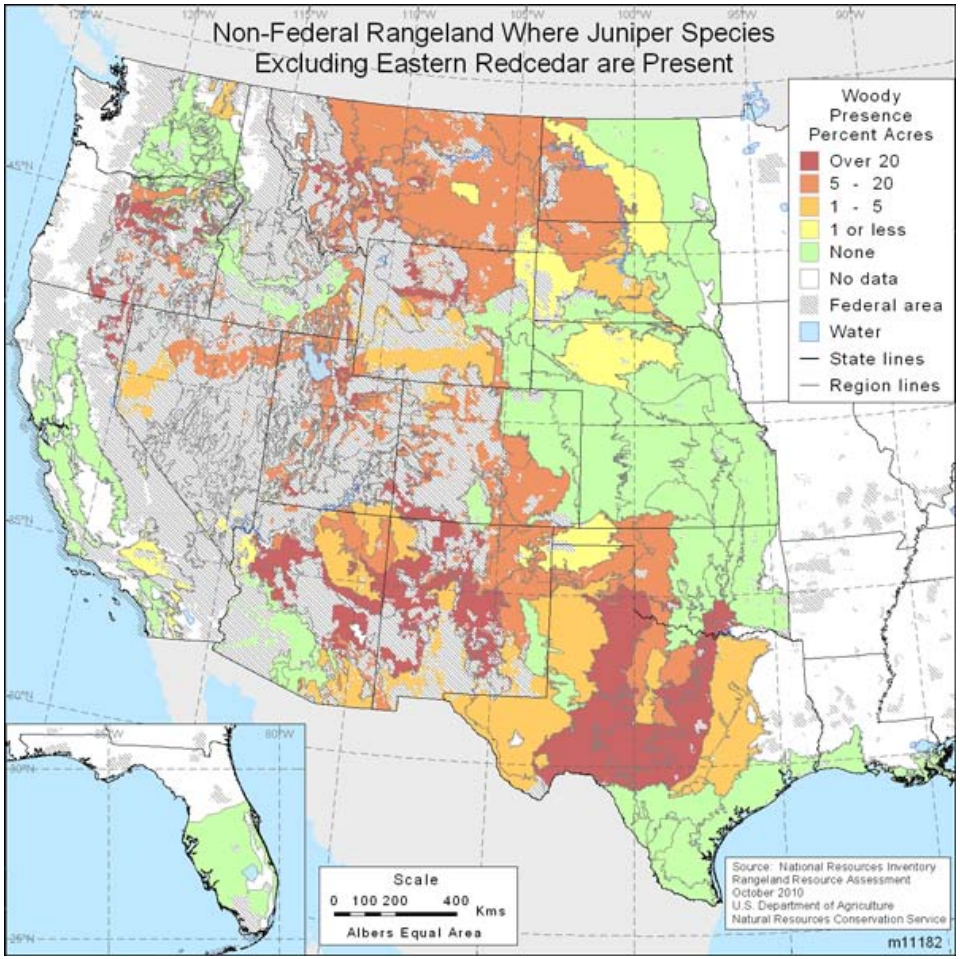
USDA NRCS NRI Rangeland Juniper 30%



USDA NRCS NRI Rangeland Juniper 15%



USDA NRCS NRI Rangeland Juniper present



In order to help meet the State's critical water conservation needs and ensure availability of water supplies, the Texas Legislature established the Water Supply Enhancement Program (WSEP).

Program Background

- 69th Legislature created the Texas Brush Control Program in 1985
  - Since then, TSSWCB has been collaborating with SWCDs to implement the program
- TSSWCB went through the Legislative Sunset review process in 2010-2011
- Sunset Advisory Commission adopted recommendations to address several issues identified with agency programs
  - Concluded that the framework of the Texas Brush Control Program was ineffective for meeting the State's critical water conservation needs
- 82nd Legislature, as a result of the Sunset Commission's recommendations, passed House Bill 1808 in 2011 which delineated major changes to TSSWCB's programs

HB1808
Statutory Changes

- Amended Texas Agriculture Code Chapter 203
- Eliminated what was known as the Texas Brush Control Program
- Established new program for agency, the Water Supply Enhancement Program
- Effective September 2011

HB1808
Goals for Grant Programs

- Sunset focus was on accountability for state-funded programs
- Require agency to develop goals for each competitive grant program, including WSEP
- Along with goals, also develop program results, beneficiaries, and evaluation criteria
- Report on extent to which programs achieve goals by measuring evaluation criteria

HB1808
Criteria for Prioritizing Projects

- Adopt a system to prioritize projects for funding, giving priority to projects that balance the most critical water conservation need with the highest projected water yield
- Criteria must include a requirement that each proposal state the projected water yield, as modeled by a person with expertise in hydrology, water resources, or another technical area pertinent to the evaluation of water supply
- Develop standard methods of reporting the projected water yield of each project

Policy

- On July 18, 2013, TSSWCB approved a revised *Policy on Allocation of Grant Funds for the WSEP*. This policy was originally approved on March 6, 2013.
- Policy describes
  - WSEP purpose and goals
  - competitive grant process
  - proposal ranking criteria
  - factors that must be considered in a feasibility study
  - geospatial analysis methodology for prioritizing acreage for brush control
  - how the agency will allocate funding

Policy

- On July 18, 2013, TSSWCB approved a new *Policy on Brush Control Feasibility Studies for the WSEP*.
- Policy describes
  - requirements for computer modeling for water yield predictions in feasibility studies
  - process to review applications for funding to conduct new feasibility studies
- Policy will allow TSSWCB to provide grant funds to entities for conducting new watershed assessments of the feasibility of conducting brush control for water supply enhancement.

The TSSWCB administers this program to increase the availability of surface and ground water supplies through the targeted control of brush species that are detrimental to water conservation (e.g., juniper, mesquite, saltcedar). Brush control has the potential to enhance water yield, improve soil conservation, protect water quality, and manage invasive species.

HB1808
Purpose of WSEP

- to increase available surface and ground water supplies through the selective removal of brush species that are detrimental to water conservation

Policy Goals

- As recommended by the Stakeholder Committee, goals describe the 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.

The TSSWCB collaborates with local, regional, state, and federal agencies to identify watersheds across the state where it is feasible to implement brush control to enhance water supplies.

HB1808
Feasibility Studies

- establish a process for locating a person with expertise in hydrology, water resources, or another technical area pertinent to the evaluation of water supply to conduct a Feasibility Study using a water yield model
- To receive funding for a Feasibility Study, a proposal must include a statement of the anticipated impact on water resources

Policy
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
- For a watershed to be considered eligible for allocation of cost-share funds, the feasibility study must demonstrate increases in post-treatment water yield as compared to the pre-treatment conditions
- Feasibility studies must, at a minimum, have examined:
  - Watershed Delineation
  - Topography
  - Hydrology
  - Soil Types and Distribution
  - Vegetation and Land Use

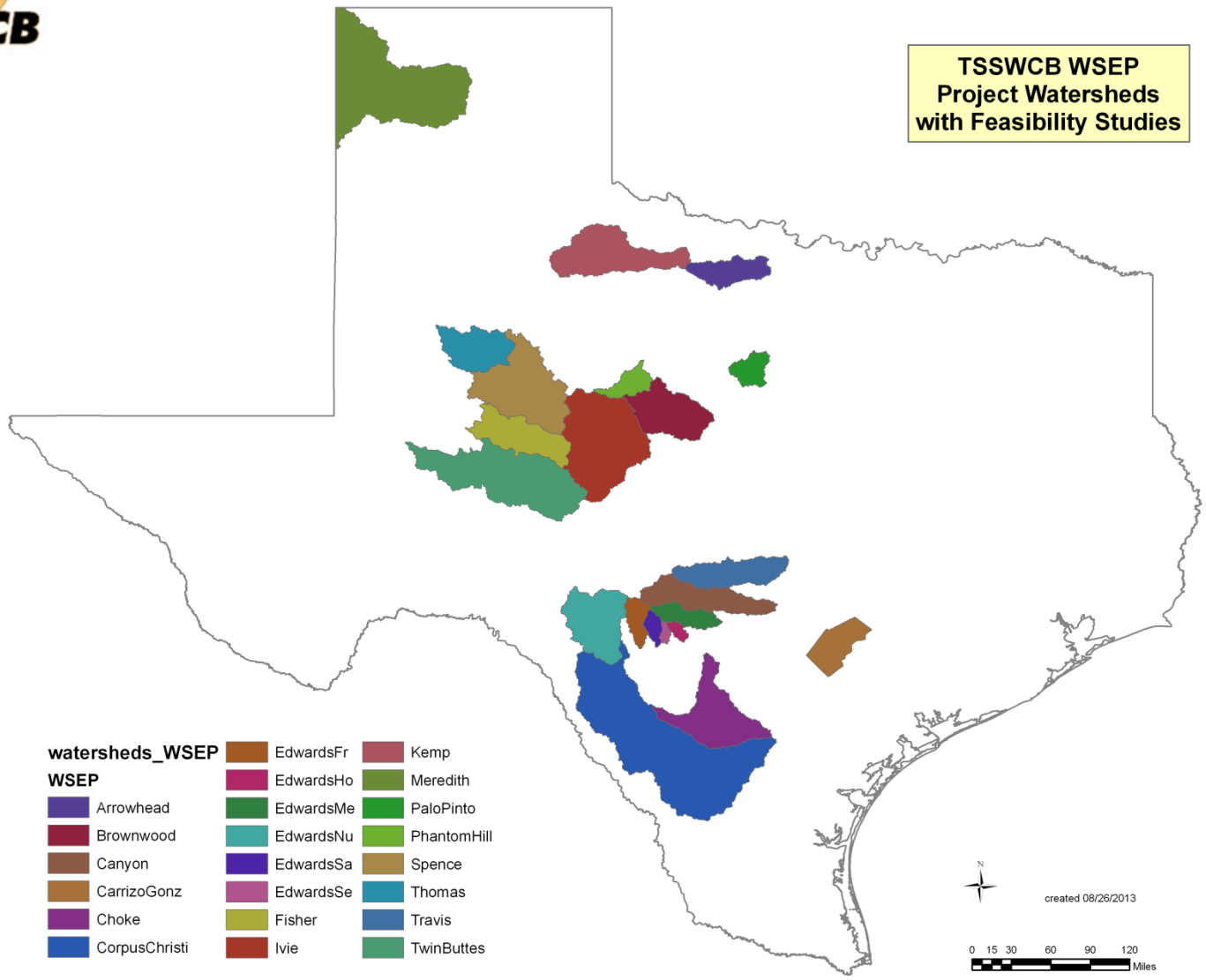
Policy
Feasibility Studies

- recommended that for all new feasibility studies the SWAT model be used, or alternatively the EDYS model.
- period for calibration for all new feasibility studies is defined as 1995-2010.
- If the watershed of interest contains USGS streamflow gages, those flow data must be used in model calibration. If the watershed of interest does not contain a USGS gage, data from either the nearest downstream gage or a gage in a neighboring watershed may be used to calibrate the model.
- Treatment scenarios for brush control to be simulated with the model must at least include the removal of 100% of treatable brush within the watershed of interest.
  - Treatable brush is unique to each watershed and varies based on factors such as slope, brush density, proximity to waterbodies, and endangered species habitat.
  - The 15-year simulation period corresponds to the defined calibration period

Policy
Feasibility Studies

- Applications for funding to complete a new FS will be referred to the Science Advisory Committee for review
- In considering the project's anticipated impact on water yield, the Science Advisory Committee will consider:
  - Recommendations in the State Water Plan or a Regional Water Plan to conduct a FS in the specific watershed.
  - Published science that suggests the proposed project may yield water in Texas.
  - Will the proposed study conform to the Requirements for Computer Modeling for Water Yield Predictions in Feasibility Studies? Can conformity be reasonably achieved?
    - sufficient streamflow and rainfall data to satisfy the defined period for model calibration
    - utilize either of the recommended models, or provide adequate justification for selecting a different model
- Once applications are considered, the Science Advisory Committee will direct applying entities to an appropriate modeler to conduct the FS

Feasibility Studies



A competitive grant process is used to rank projects and allocate WSEP grant funds, giving priority to projects that balance the most critical water conservation need of municipal user groups with the highest projected water yield from brush control.

Policy
Competitive Grant

- competitive grant process to select projects and allocate funds for the fiscal year
- Project proposals must relate to a water conservation need, based on information in the State Water Plan as adopted by TWDB
- A feasibility study must have been completed for the watershed in each project proposal
- Project proposals will be prioritized for each funding cycle, giving priority to projects that balance the most critical water conservation need with the highest potential water yield
- Agency staff will issue a request for proposals that includes an application and describes the process for entities to propose projects

Policy
Proposal Ranking

- Funding will be allocated through a competitive grant process that will rank applications based on projected water yield using evaluation criteria established by the Stakeholder Committee
- Evaluation criteria include:
  - 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
- A Ranking Index (RI) will be calculated that gives a measure of the water yield increased per capita user for each proposal:
  - RI = Reliance on source * (Yield Benefit ÷ Population)
  - Reliance on source = % ground or surface water by WUG
  - Yield benefit = gal per treated ac from FS

Approach (Mace, 2012)

- Step 1: Water supplies expected to benefit
- Step 2: Firm yield benefit to water supplies
- Step 3: WUGs relying on water supplies
- Step 4: Percent of augmented water supply used by WUGs
- Step 5: Population of WUG
- Step 6: Ranking Index (RI)

Ranking Index

- Ranking Index (RI) gives a measure of the yield benefit per capita
- RI basis:

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

  - Yield Benefit per population
    - Larger acre-ft/yr/capita increases index
  - Reliance of a population on a specific supply
    - Larger reliance increases index

Reliance on source = (% water being supplied from a specific source)
Higher priority is given to those populations who rely solely on the specified water supply source

Major Cities and Associated Municipal Water User Groups (WUGs)

- GIS analysis identified major cities and municipal WUGs for each reservoir
- River Authorities contacted for verification

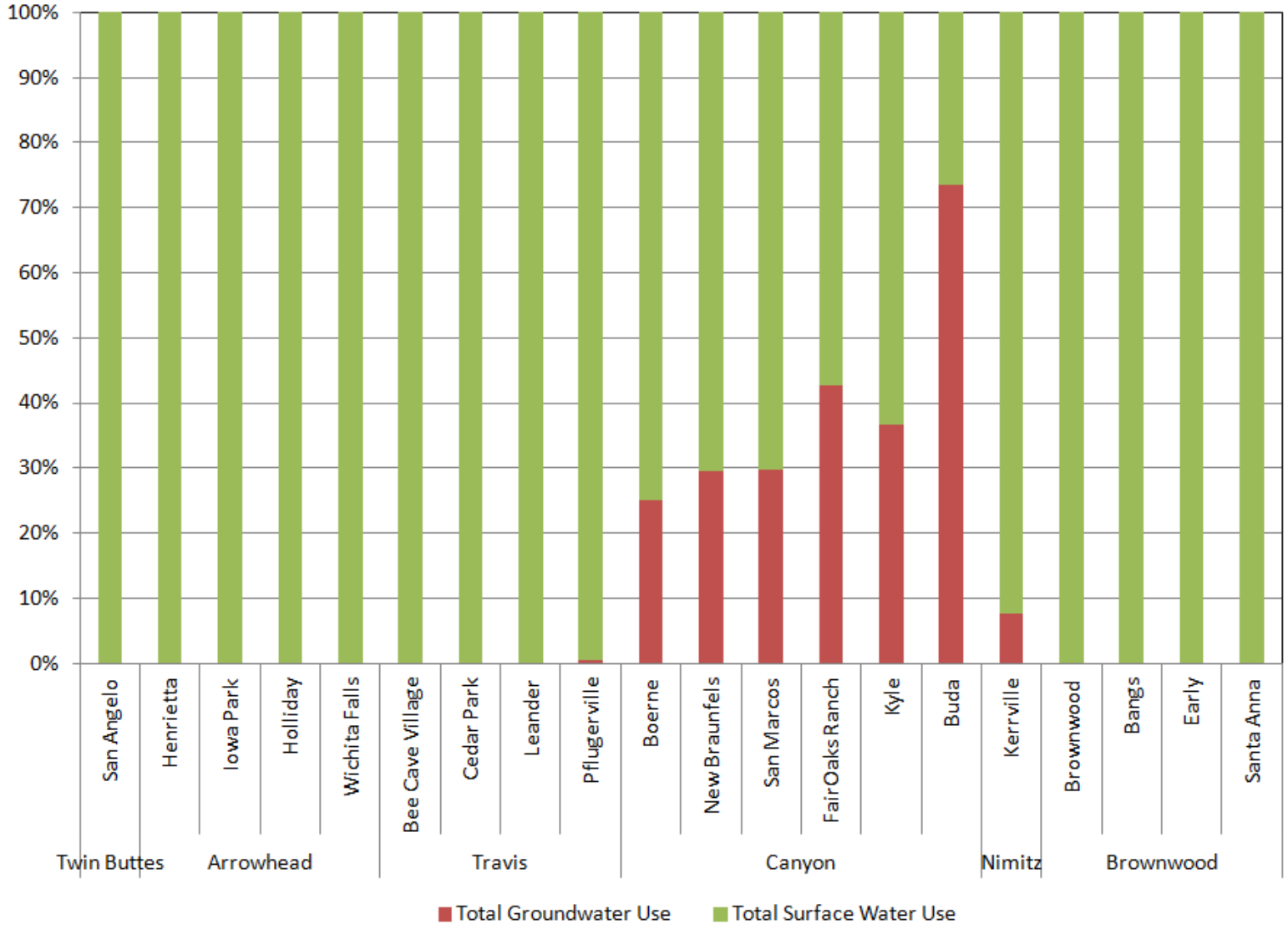
Arrowhead
Henrietta
Holliday
Iowa Park
Wichita Falls
Brownwood
Bangs
Brownwood
Early
Santa Anna
Canyon
Boerne
Buda
Fair Oaks Ranch
Kyle
New Braunfels
San Marcos
Nimitz
Kerrville
Travis
Bee Cave Village
Cedar Park
Leander
Pflugerville
Twin Buttes
San Angelo

Total Municipal Water Use by WUG

Lake	City	Total Use	Total Groundwater Use	Total Surface Water Use
		(acre-ft/year)		
Twin Buttes	San Angelo	14792	0	14792
Arrowhead	Henrietta	448	0	448
	Iowa Park	797	0	797
	Holliday	168	0	168
	Wichita Falls	12584	0	12584
Travis	Bee Cave Village	976	0	976
	Cedar Park	10512	0	10512
	Leander	3223	0	3223
	Pflugerville	3322	13	3309
Canyon	Boerne	1827	456	1371
	New Braunfels	13286	3907	9379
	San Marcos	7349	2182	5167
	Fair Oaks Ranch	1385	592	793
	Kyle	2222	816	1406
	Buda	1205	887	318
Nimitz	Kerrville	4963	378	4585
Brownwood	Brownwood	3149	0	3149
	Bangs	193	0	193
	Early	293	0	293
	Santa Anna	149	0	149

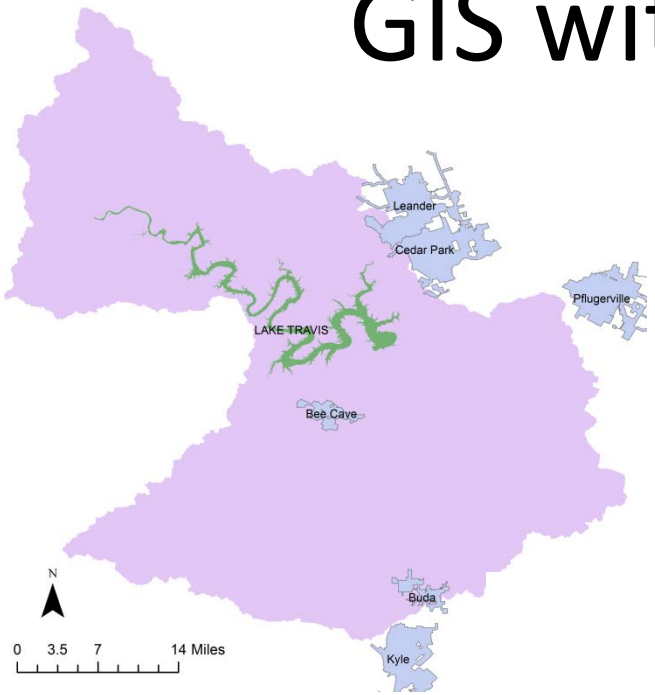
Data from TWDB 2010 water use surveys

Fraction of Surface Water Use



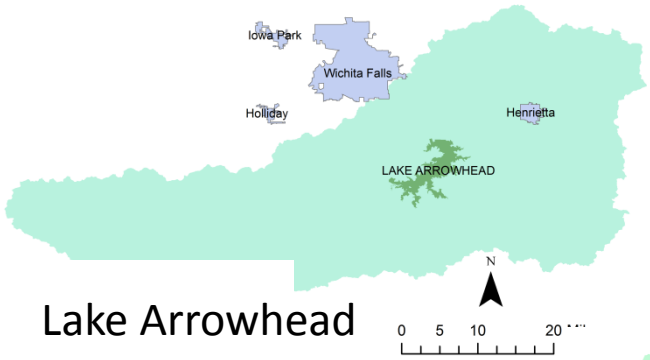
Data from TWDB 2010 water use surveys

GIS with Urban Centers

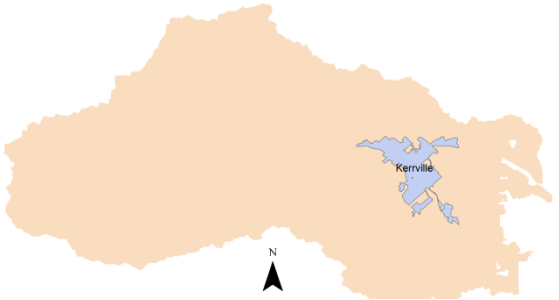


Lake Travis

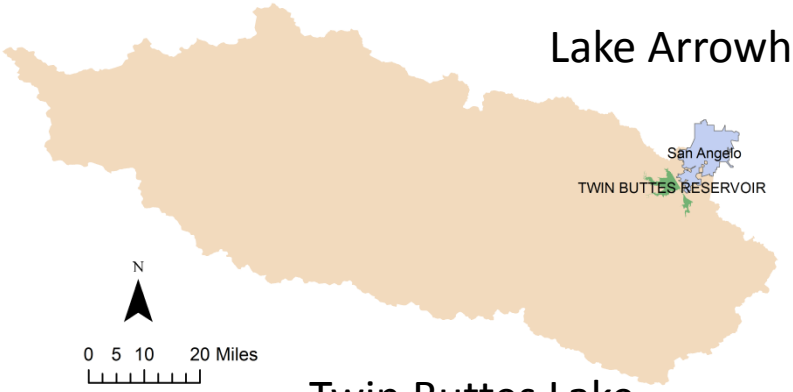
Lake Brownwood



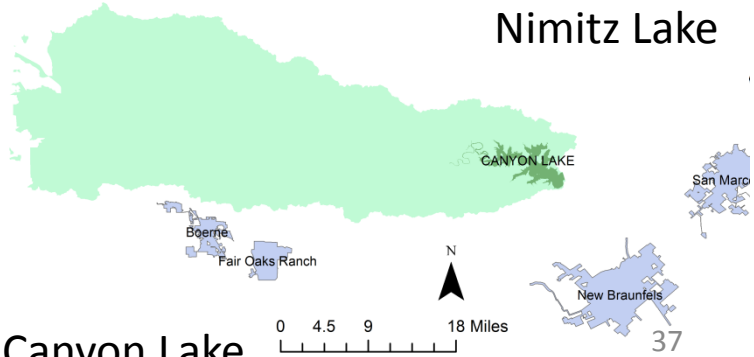
Lake Arrowhead



Nimitz Lake



Twin Buttes Lake



Canyon Lake

Population Estimates

Lake	Watershed Population	WUG Population
Arrowhead	14246	115807
Brownwood	57335	24752
Canyon	45504	154402
Nimitz	48980	22347
Travis	974700	126319
Twin Buttes	56952	93200

**The contributing areas of Arrowhead, Canyon, and Twin Buttes are more rural with population centers crossing watershed boundaries

**Austin will only use a fraction of water from Lake Travis during dry years; otherwise, Austin pulls no water from Lake Travis

Lake	City	Population
Twin Buttes	San Angelo	93200
Arrowhead	Henrietta	3141
	Iowa Park	6355
	Holliday	1758
	Wichita Falls	104553
Travis	Bee Cave Village	3925
	Cedar Park	48937
	Leander	26521
	Pflugerville	46936
Canyon	Boerne	10471
	New Braunfels	57740
	San Marcos	44894
	Fair Oaks Ranch	5986
	Kyle	28016
	Buda	7295
Nimitz	Kerrville	22347
Brownwood	Brownwood	19288
	Bangs	1603
	Early	2762
	Santa Anna	1099

*Data from U.S. Census, 2010

Reliance per Capita

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

Lake	Reliance/Capita
Arrowhead	2.64E-02
Brownwood	4.87E-02
Canyon	4.23E-03
Nimitz	4.13E-03
Travis	8.35E-03
Twin Buttes	1.07E-03

- Ranking Index cannot be calculated without water yield benefits
- Lakes having largest reliance per capita will have higher rankings if all other factors are held constant

Ranking
(partial FY2013)

Lake / Project Area	Gallons/Treated Acre	Sub-basin #'s	Ranking Index	Relative Rank
Lake Brownwood	118,778	28	5784	1
Arrowhead/Archer County	202,270	11	5340	2
Arrowhead/Clay County	199,036	24	5255	3
Lake Travis/Pedernales River	212,420	5	1774	4
Lake Canyon	73,275	19	310	5
Lake Nimitz/Upper Guadalupe	29,189	2	121	6
Twin Buttes/Eldorado Divide	61,184	SD 4	65	7
Twin Buttes/Tom Green County	51,328	SC 11	55	8
Twin Buttes/Middle Concho	41,189	SD 6	44	9

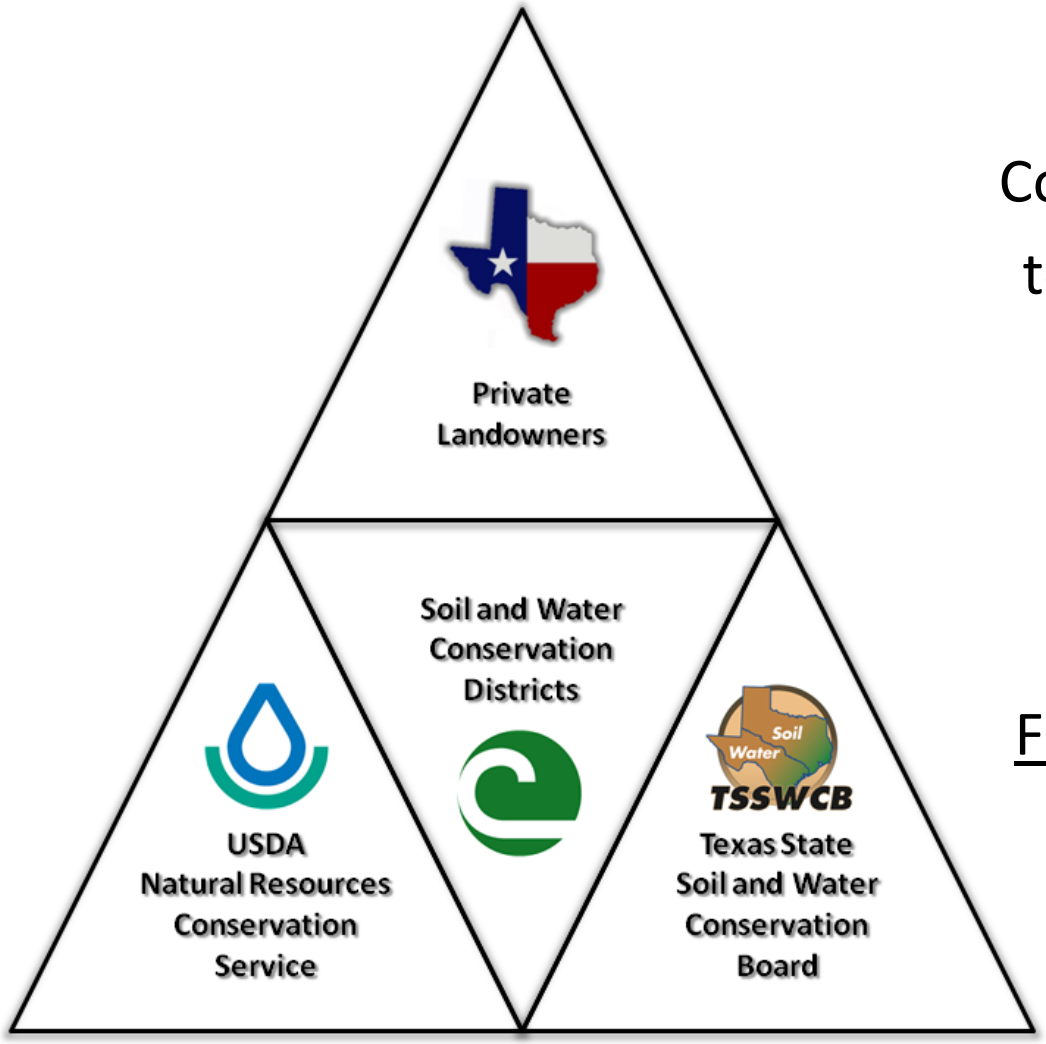
**Ranks increase with higher gallons/treated area and higher reliance/capita

FY2014 WSEP Request For Project Proposals

- for water supply enhancement projects seeking funding to conduct brush control under the WSEP
- focus on watersheds with demonstrated water conservation need where brush control has been shown, using computer model, to be feasible strategy to enhance surface/ground water supplies
- Deadline October 13, 2013 (RFP released August 29, 2013)
- Application
  - Feasibility Study
  - State Water Plan water conservation need
  - Projected Water Yield
  - Budget, cost-share rate, acres to be treated
  - Impact on wildlife
  - Estimated landowner participation
- instructions for the application that provide explanations of questions on the form and resources for answering those questions
- guidelines that detail project eligibility requirements, identifies watersheds with published feasibility studies, and provides additional information critical for successful applications

In watersheds where WSEP grant funds have been allocated, TSSWCB works with SWCDs to deliver technical assistance to landowners to implement brush control activities.

Texas Conservation Partnership



Providing
Conservation Assistance
to Private Landowners
for 70+ Years

LOCAL = 216 SWCDs

STATE = TSSWCB

FEDERAL = USDA-NRCS

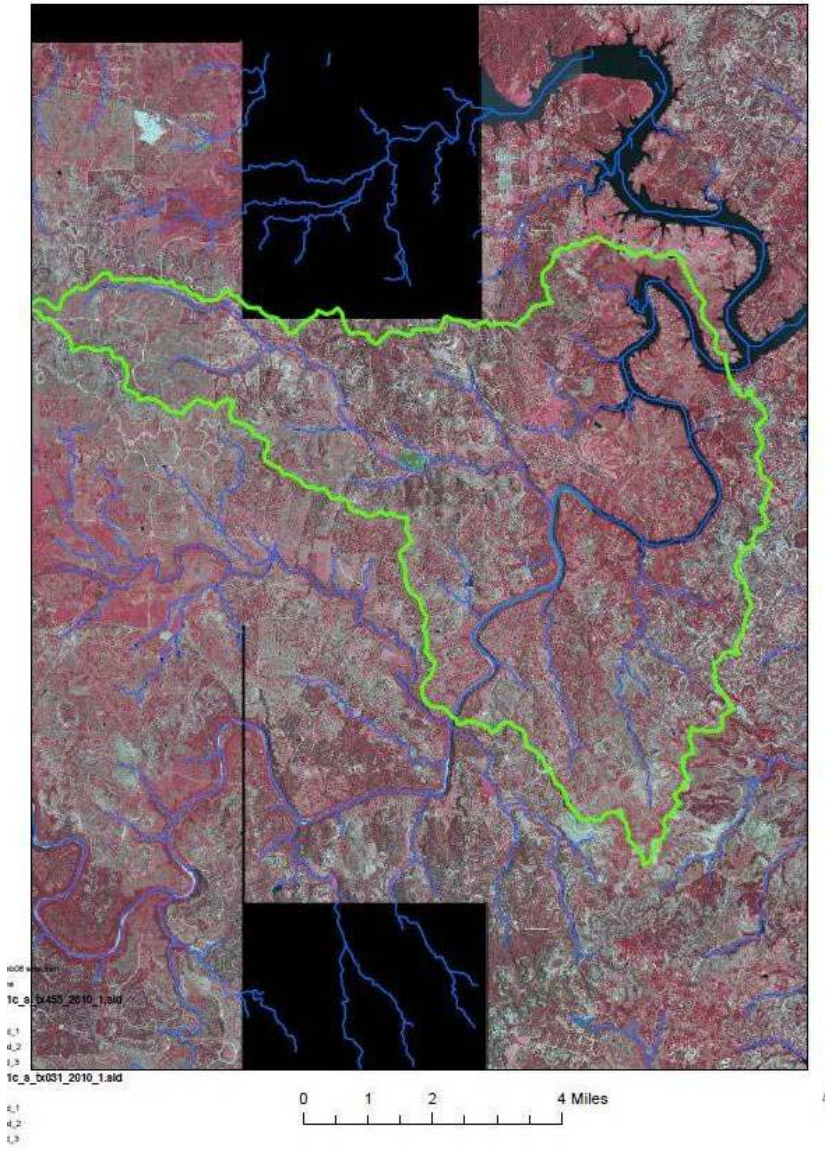
Cost-share assistance is provided through the WSEP to landowners implementing brush control on eligible acres.

Policy
Prioritizing Acreage

- to maximize the positive impacts of brush control on water supply enhancement and the effective and efficient use of allocated funds
- a geospatial analysis will be performed to delineate the eligible acres that have the highest potential to yield water within the project watershed and thereby increase water supplies
- Factors that will be assessed in the geospatial analysis include:
  - Soils – relative to runoff potential or recharge
  - Slope – sufficiently steep to carry runoff to streambed but not impair method of brush control
  - Brush Density – fraction of the area with treatable brush
  - Proximity to Waterbodies – riparian areas and other hydrologically sensitive areas critical to streamflow and aquifer recharge
- Science Advisory Committee will be consulted on the unique variables for each criterion for each watershed
- The compiled geospatial analysis will result in three brush control priority zones for each watershed: high, medium, and low-to-none

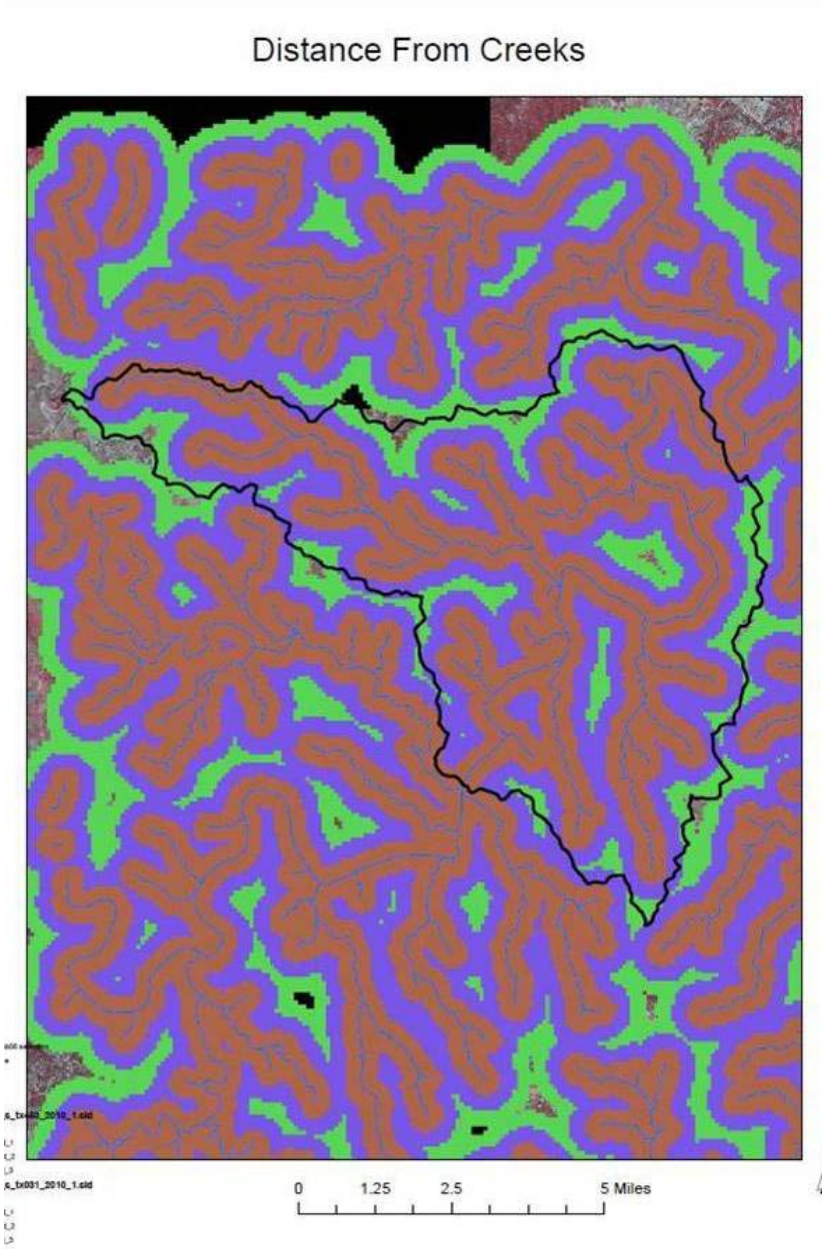
Watershed A

Ten meter resolution digital elevation model (DEM) were used with ArcHydro to determine stream and watershed delineation



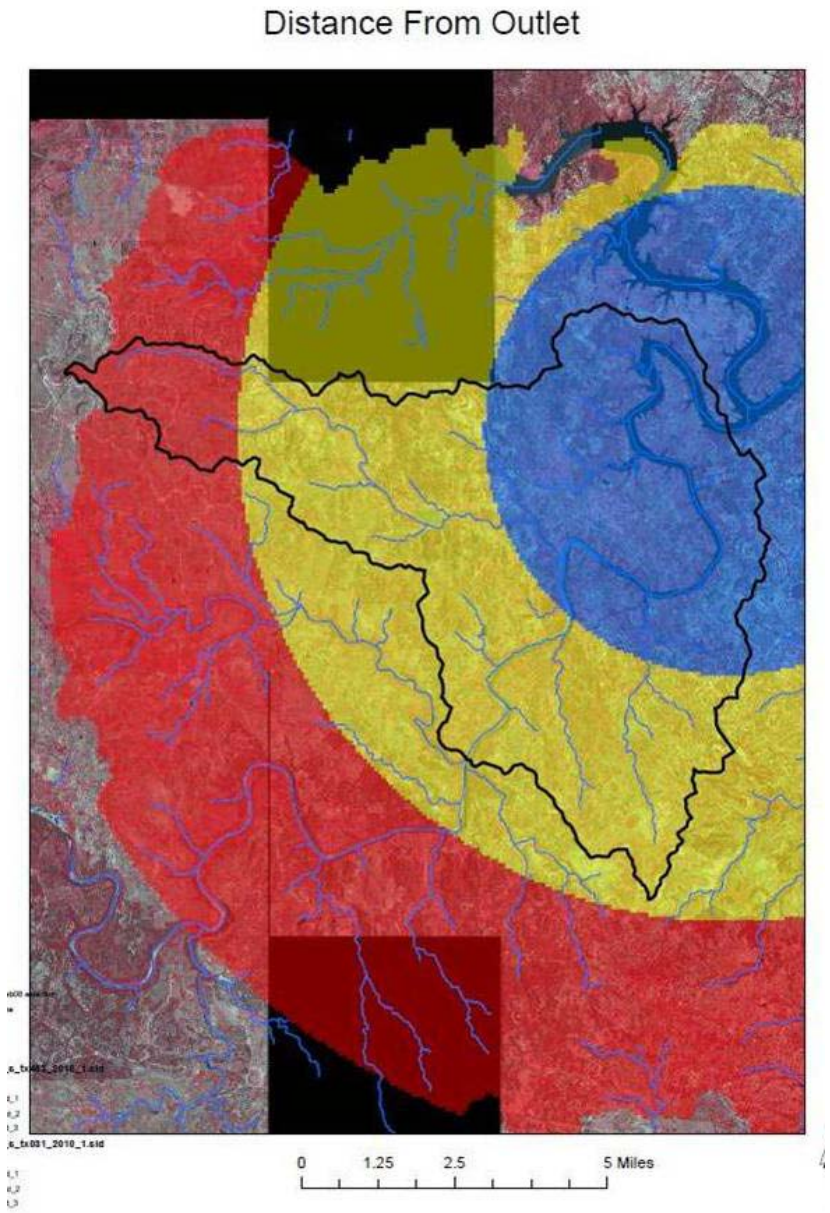
Distance from Creeks

Drainage lines were buffered using a pre-determined quarter (high priority), half (medium priority), three-quarter (low priority), and excess (low priority) to determine classification



Distance from Outlet

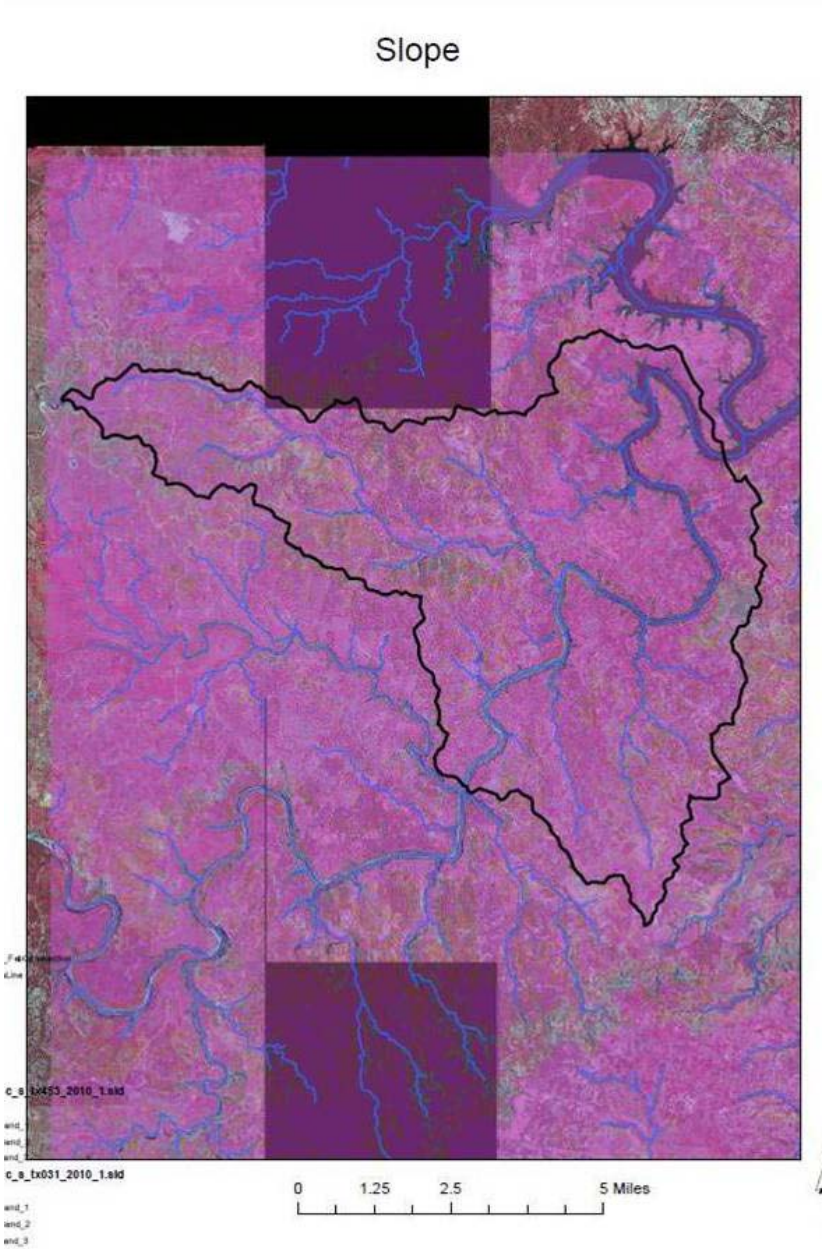
The outlet point was determined by the boundary of this sub-basin. The length of the sub-basin was then measured to determine the overall distance. The sub-basin was then cut into thirds, giving the high priority to the first third (blue area), medium priority to the second third (yellow area), and the low priority (red area).



Slope

Slope analysis were performed using the 10 m DEM and reclassified

Slope	Classification	Priority
0-7.4	1	High
7.4-16.7	2	Medium
16.7-24	3	Low

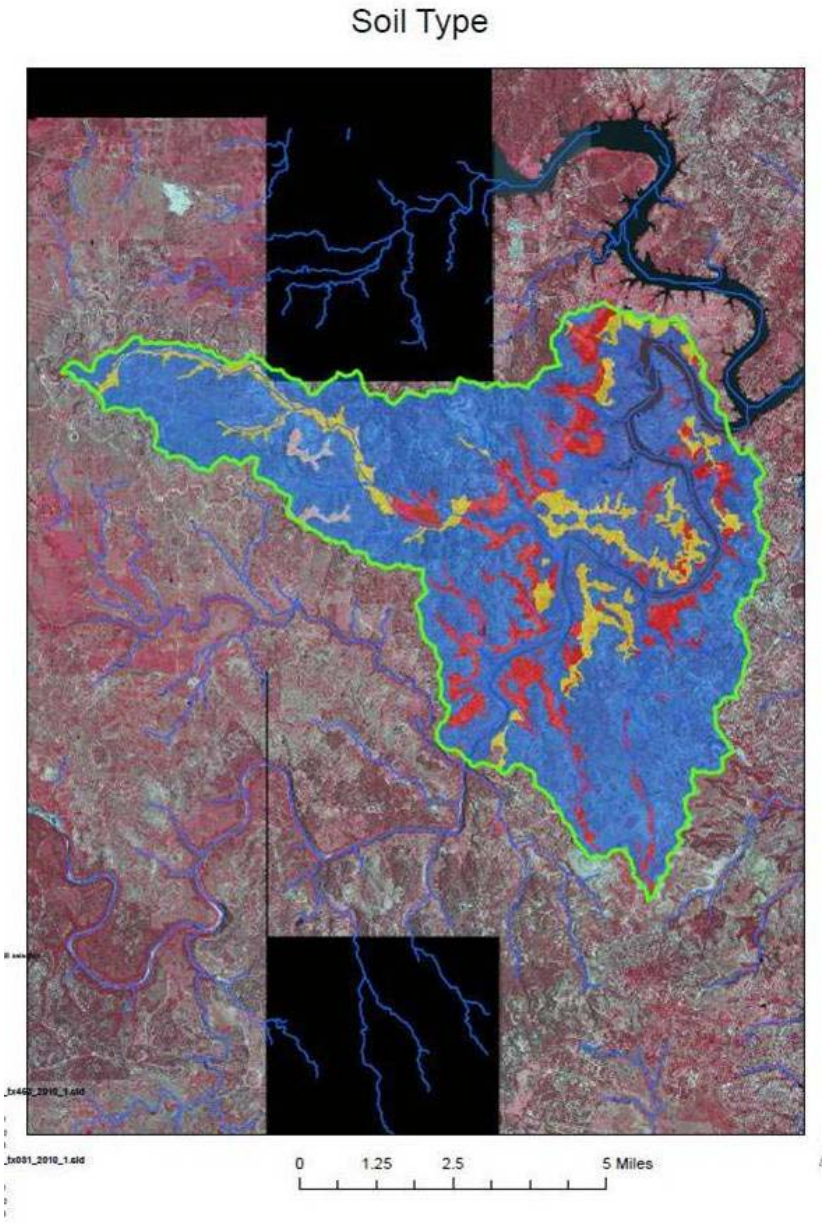


Soil Type

Soils were classified by Hydrologic Soil Grouping as defined in the USDA, NRCS, Urban Hydrology for Small Watersheds; technical release no.55, revised in June 1986. Section 19

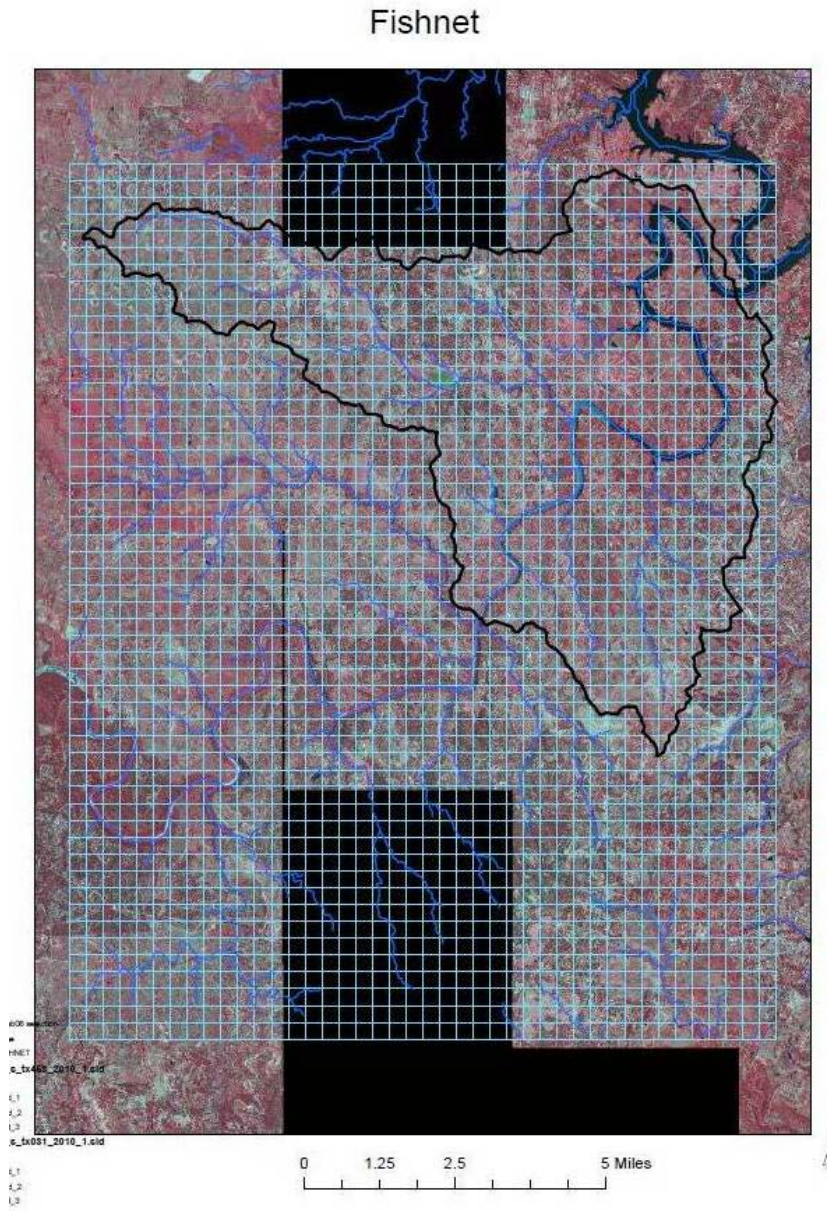
HSG Category	Runoff Potential	Infiltration Rate	Priority
A	Low	High	4
B	-	-	3
C	-	-	2
D	High	Low	1

In this particular example the focus was on high runoff which is represented by the blue area on the map, the yellow area represents priorities 2 and 3 , and the low priority area is represented by the red (4).



Fishnet

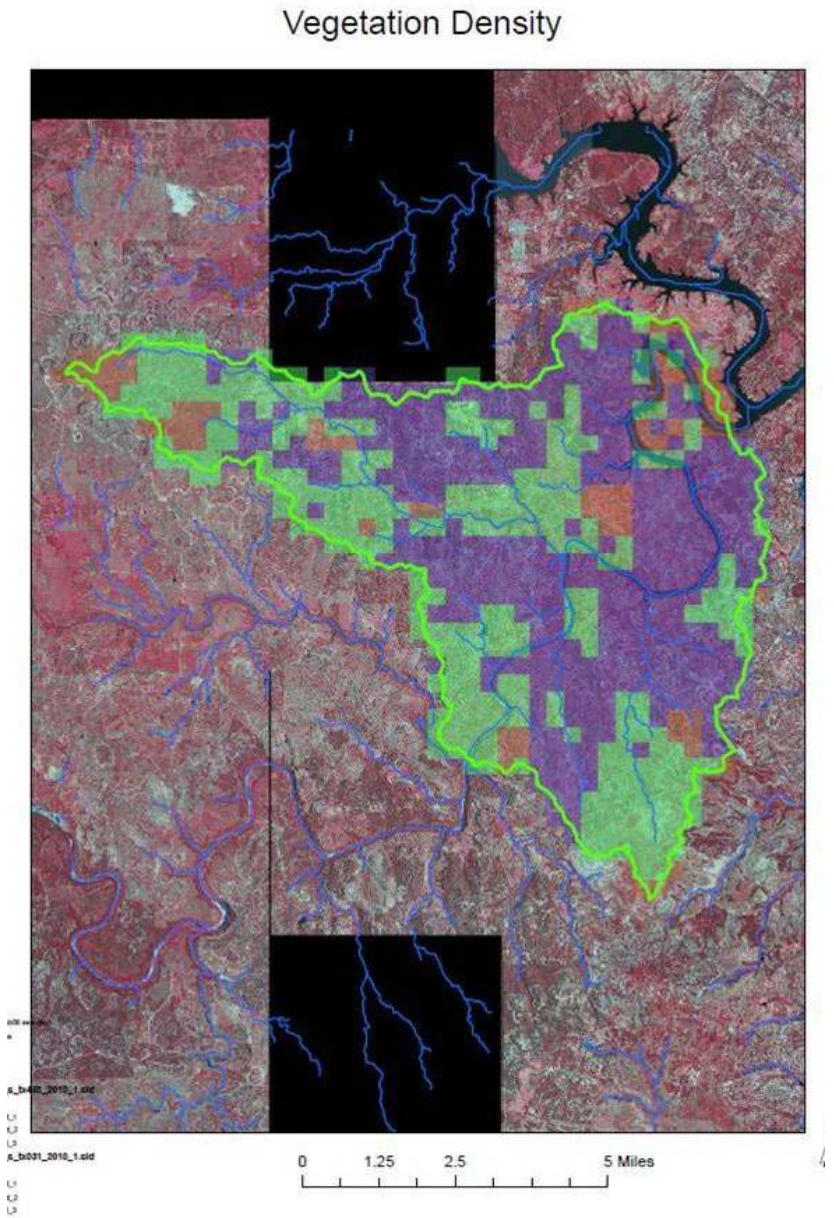
In order to consider vegetation density we applied a 50 ac fishnet. Each individual cell (50 ac) was looked at and given values based on the density.



Vegetation Density

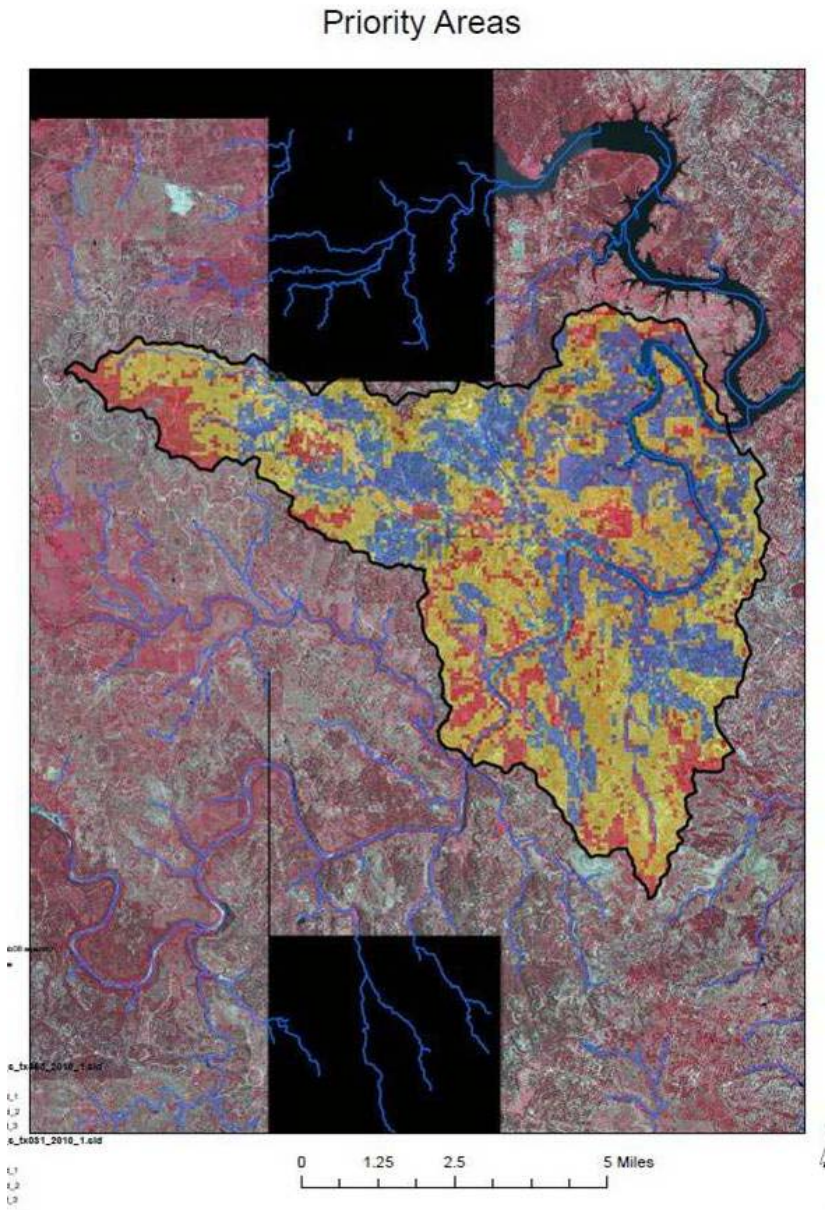
The density was determined using the 2010 NAIP image

Density Class	Percent Cover	Class Description
1	>60	Dense (Purple)
2	30-60	Moderate (Green)
3	10-30	Sparse (Brown)



Priority Areas

At this point five raster datasets were created which included distance from outlet, distance from drainage lines, slope, soils, and vegetation density. After combining the five datasets the end result is a raster map that represents the highest yielding areas (blue area), medium yielding (yellow area) and the lowest yielding areas (red area).



A 10-year resource management plan is developed for each property enrolled in the WSEP which describes the brush control activities to be implemented, follow-up treatment requirements, and brush density to be maintained after treatment.

HB1808
Landowner Plans

- Each applicant for cost-share will have a site-specific 10-year plan for the land that is subject to the contract
- Plan must include
  - brush control or other water supply enhancement activities
  - follow-up brush control
  - requirement to limit average brush coverage on the land that is subject to the contract to not more than 5% throughout course of the 10-year plan
  - periodic dates throughout course of the 10-year plan on which the TSSWCB will inspect the status of brush control that is subject to the contract

Status Reviews and Follow-up Treatment

- Status Reviews
  - 1st within 3-5 years after initial treatment to determine if canopy is >5%
  - 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%

State Water Supply Enhancement Plan

State WSE Plan

- TSSWCB shall prepare and adopt a State Water Supply Enhancement Plan
- comprehensive strategy for managing brush in all areas of the state where brush is contributing to a substantial water conservation problem
- Plan must list the goals established for the WSEP, including
  - a goal describing the intended use of a water supply enhanced or conserved by the program, such as agricultural purposes or drinking water purposes
  - a goal describing the populations that the WSEP will target
- Plan will discuss
  - competitive grant process
  - proposal ranking criteria
  - factors that must be considered in a FS
  - geospatial analysis methodology for prioritizing acreage for brush control
  - how the agency will allocate funding
  - Priority watersheds across the state for WSE and brush control
  - How success for WSEP will be assessed and overall water yield will be projected

Next Steps for State WSE Plan

- Draft to be reviewed by
  - Internal staff working group
  - Stakeholder Committee
  - Science Advisory Committee
- State Board will publish for public comment
- released to all SWCDs and the public for comment. Host a hearing to receive comment
- Present the plan to the State Board for adoption
- At least every two years the Plan will be reviewed and may be amended

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