TSSWCB WSEP: Enhancing Surface and Ground Water Supplies Through Brush Control in Region L

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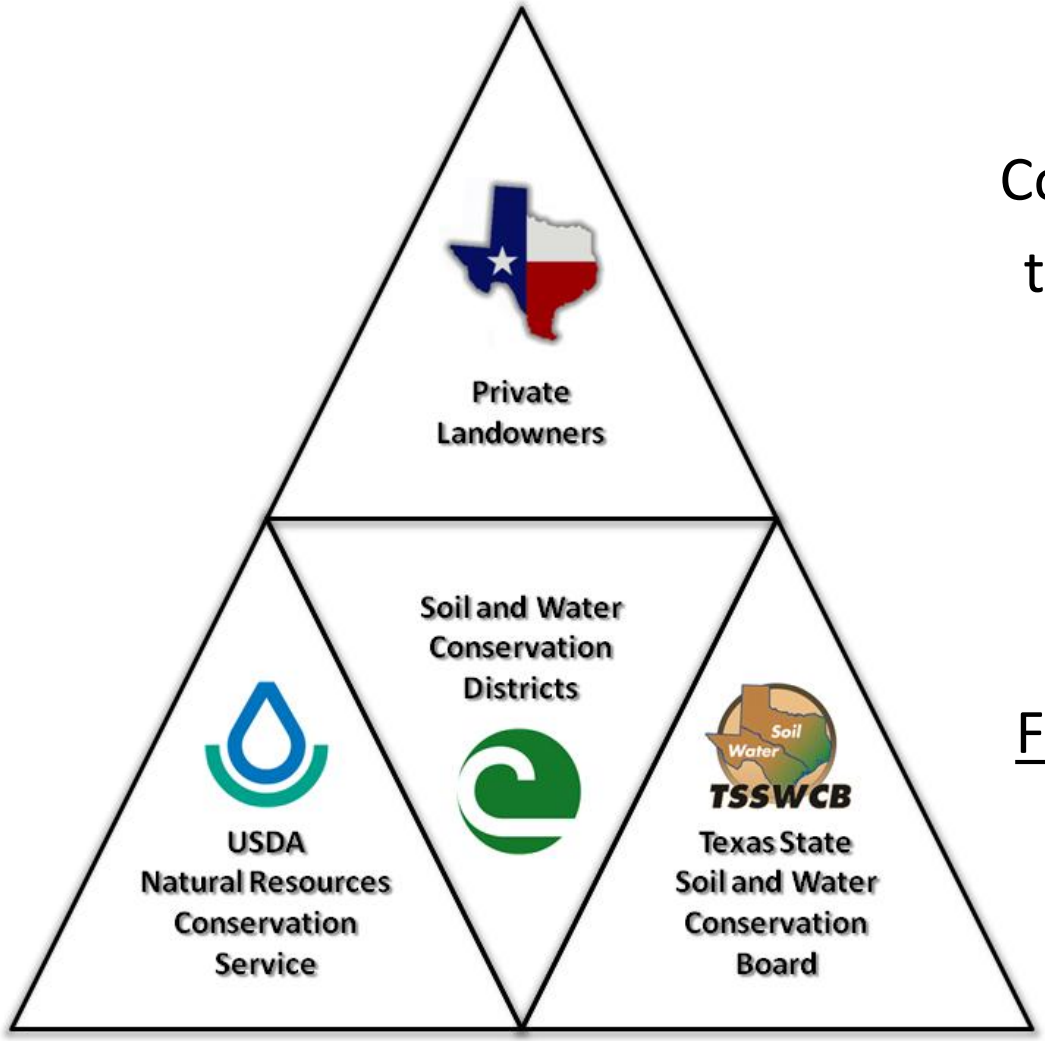
Texas State Soil and Water Conservation Board

South Central Texas Regional Water Planning Group
November 7, 2013
San Antonio, TX

Texas Conservation Partnership



Providing
Conservation Assistance
to Private Landowners
for 70+ Years

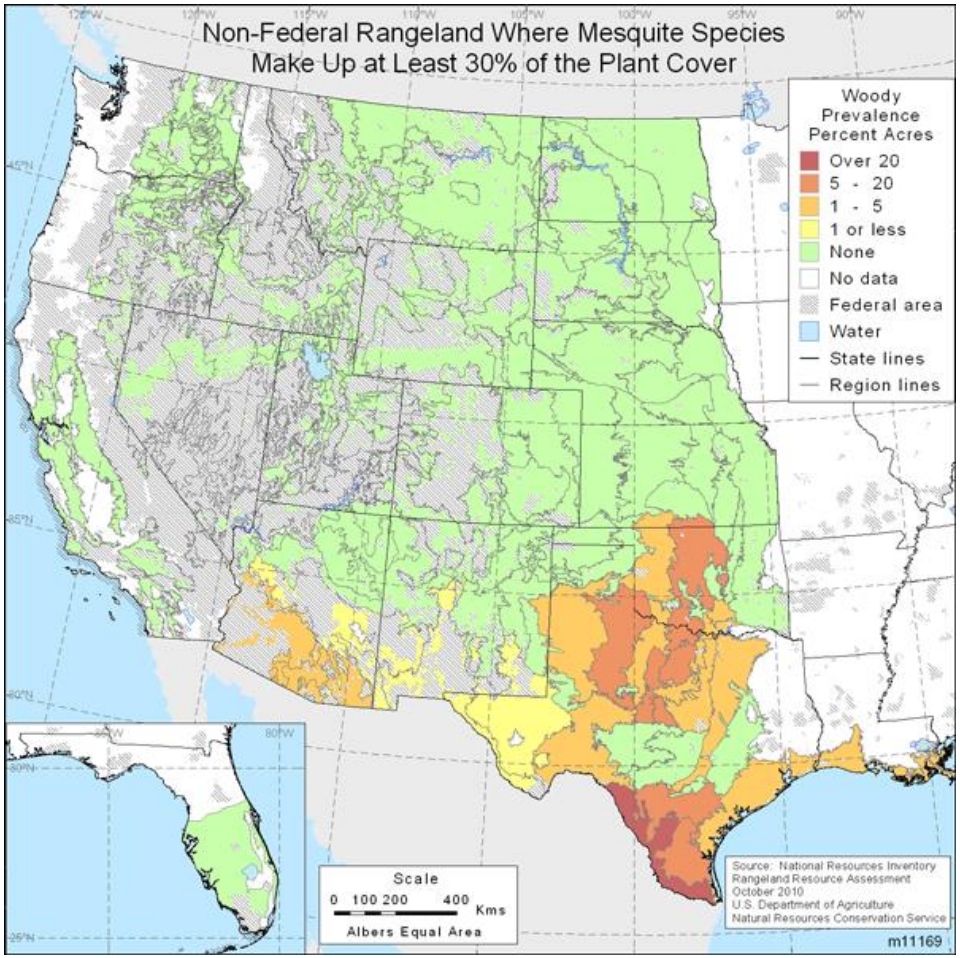
LOCAL = 216 SWCDs

STATE = TSSWCB

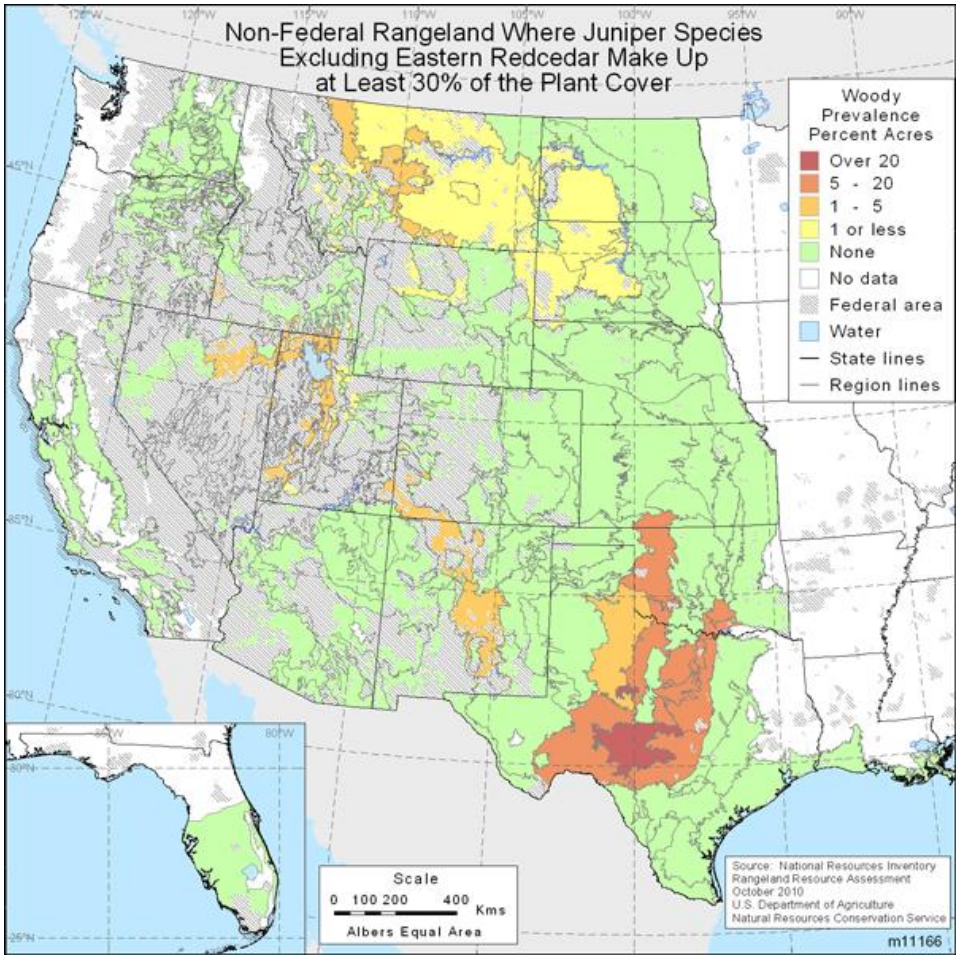
FEDERAL = USDA-NRCS

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 30%



USDA NRCS NRI Rangeland Juniper 30%



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).

The TSSWCB administers this program to increase the availability of surface and ground water supplies through the selective removal 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.

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

Stakeholder Committee

- Association of Texas Soil and Water Conservation Districts
- Texas and Southwestern Cattle Raisers Association
- Texas Commission on Environmental Quality
- Texas Water Development Board
- Texas Tech University

Science Advisory Committee

- Texas Tech University
- Texas Water Development Board
- Texas Institute for Applied Environmental Research at Tarleton State University
- USDA Agricultural Research Service
- US Geological Survey

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

HB1808
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)
- any 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

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.

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

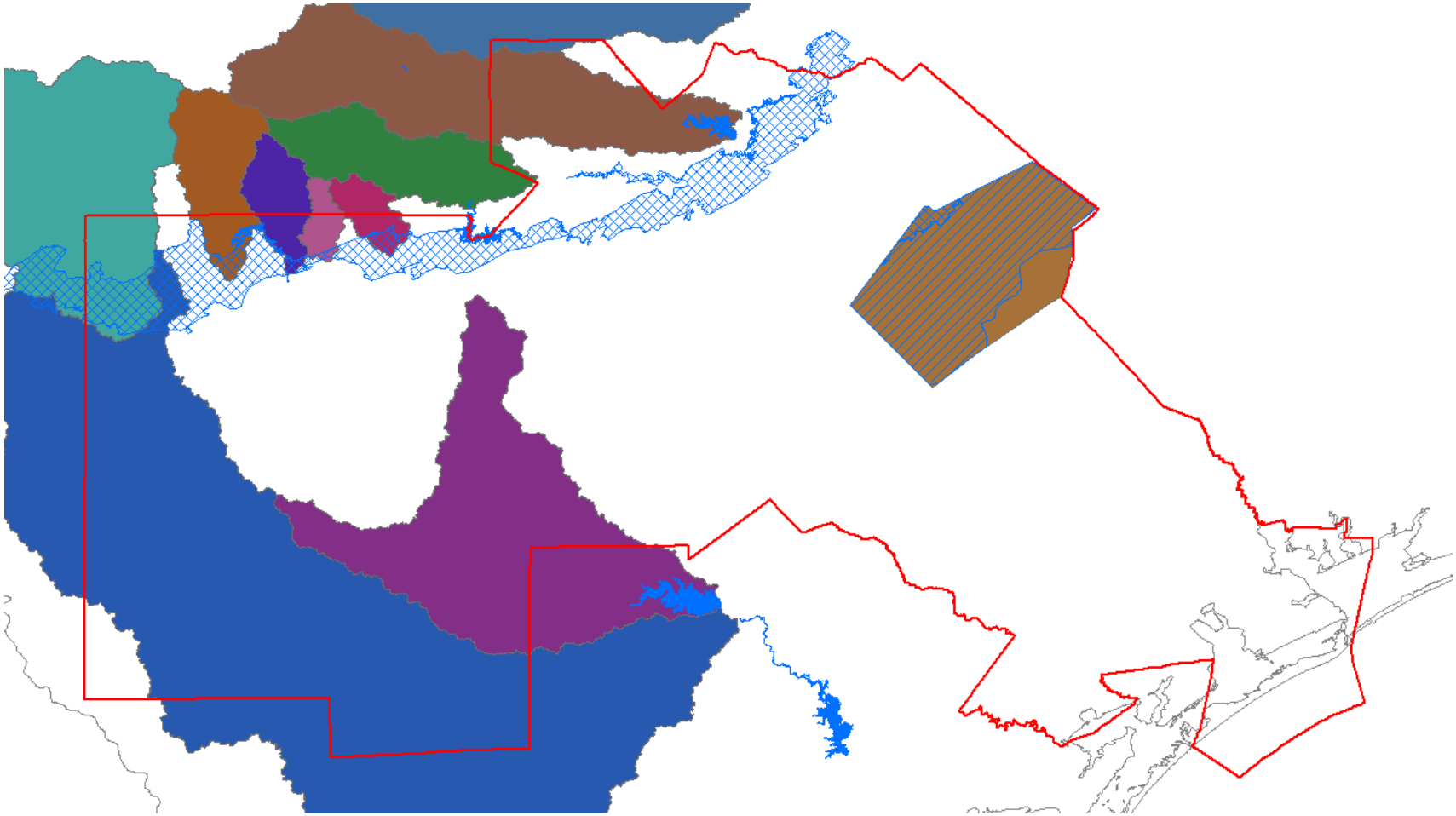
Policy
Feasibility Studies

- 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
- recommended that for all new feasibility studies the SWAT model be used, or alternatively the EDYS model.

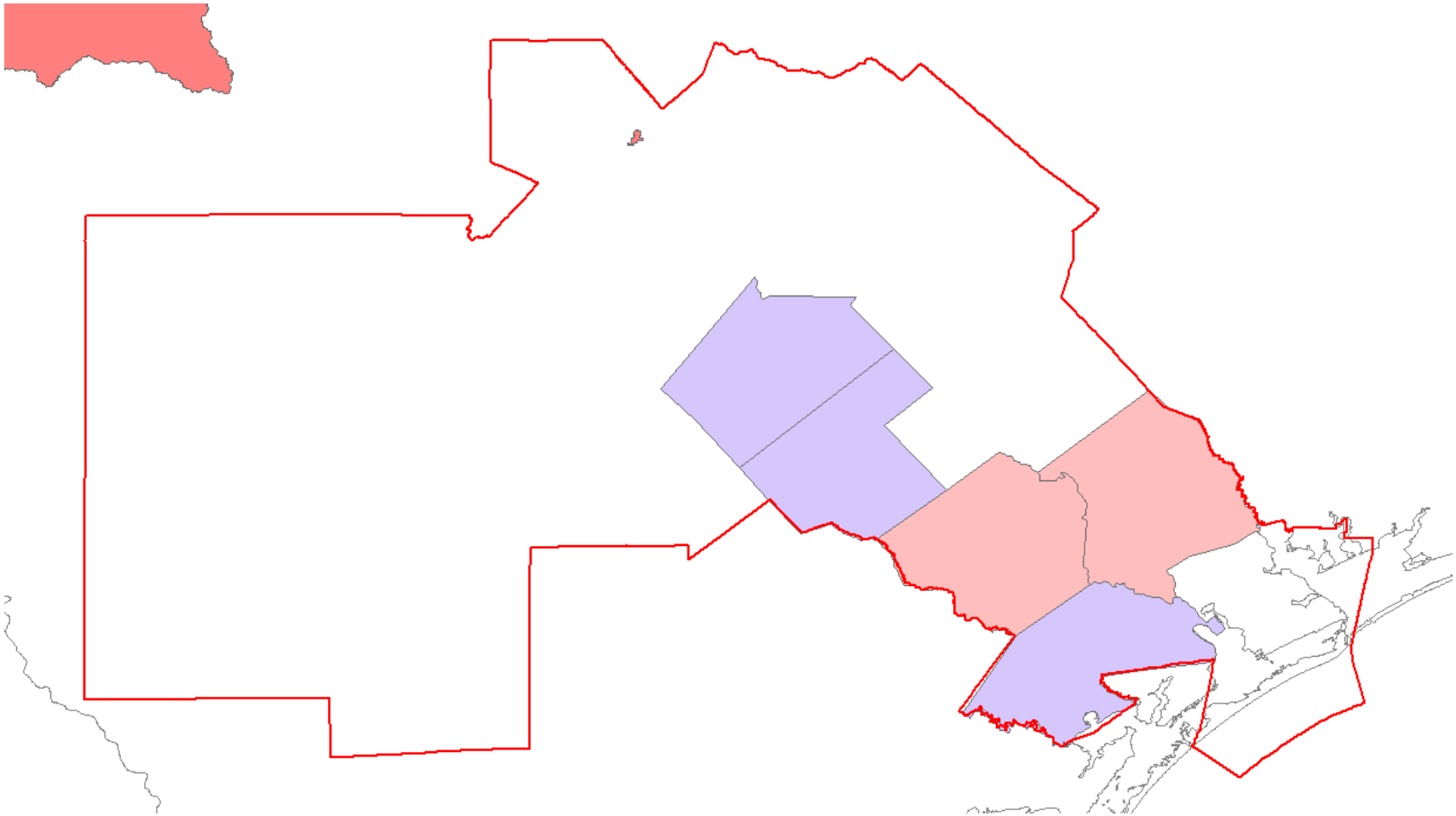
Policy
Feasibility Studies

- 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

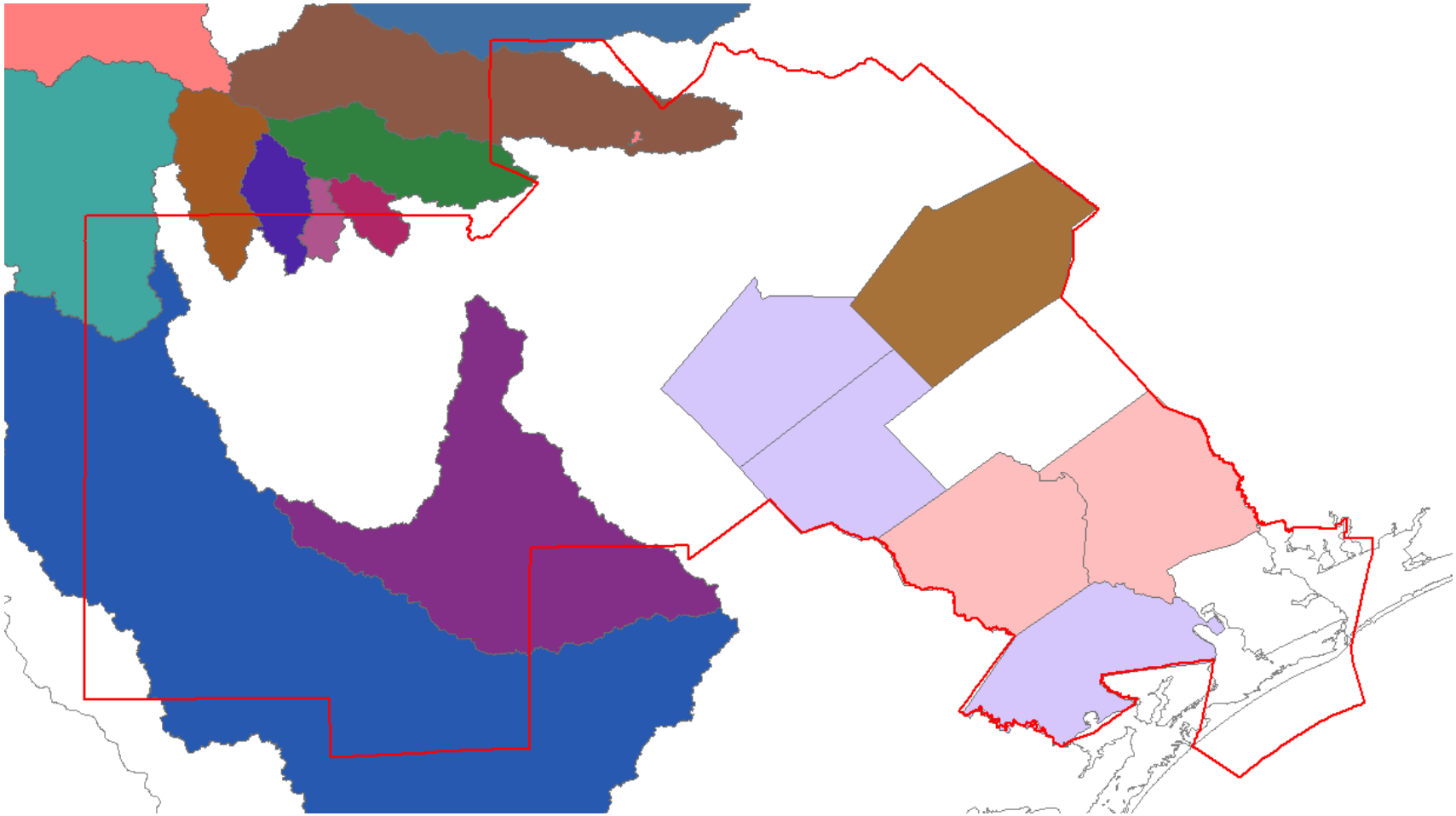
Completed Feasibility Studies in Region L



Feasibility Studies in Progress in Region L



TSSWCB WSEP Activities in Region L



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

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

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

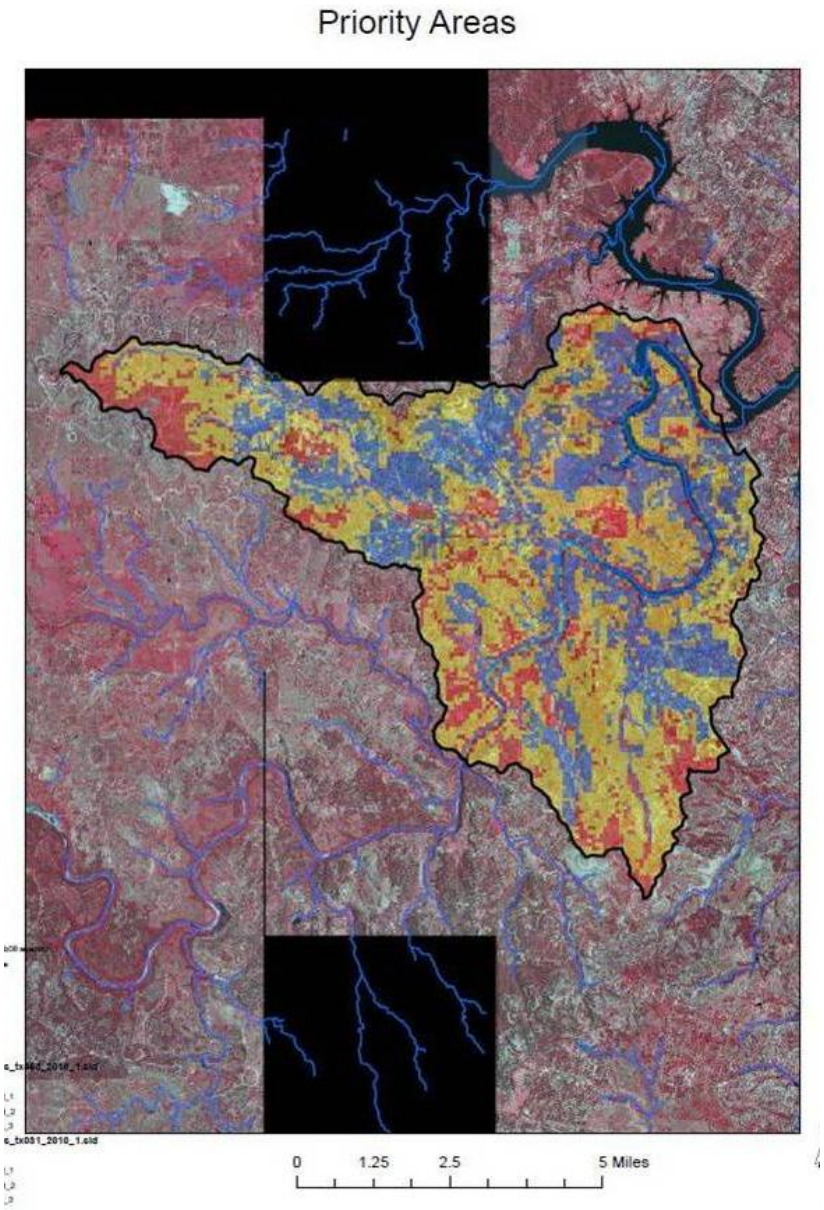
Cost-share assistance is provided through the WSEP to landowners implementing brush control on eligible acres.

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

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

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

USGS
science for a changing world

Brush Management: Watershed Modeling of the Upper Guadalupe River and a Paired Watershed Study at the Honey Creek State Natural Area

Johnathan R. Bumgarner, P.G., and Ryan Banta, Ph.D.

Presented to the Texas Water Development Board

UGWM in cooperation with TSSWCB and UGRA; HCSNA with NRCS, TSSWCB, SARA, EAA, TPWD, GBRA, and SAWS

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

June 2012

UGWM: Scope

- Develop and calibrate a model of the Guadalupe River watershed above Canyon Dam.
- Simulate the effects of brush management on water yields.
- TSSWCB feasibility study: using study results to guide application.

USGS
science for a changing world

Prepared in cooperation with the Texas State Soil and Water Conservation Board and the Upper Guadalupe River Authority

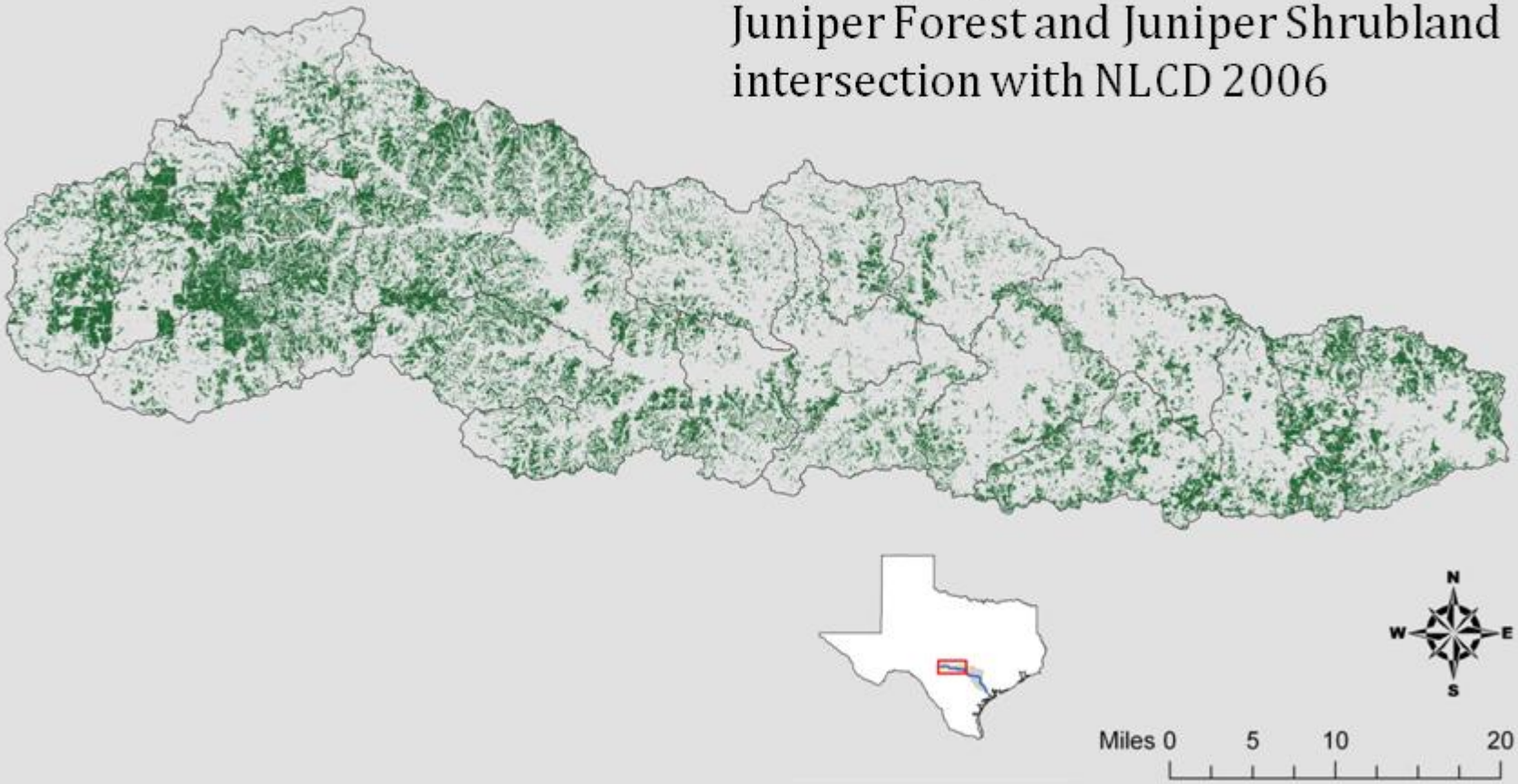
Simulation of Streamflow and the Effects of Brush Management on Water Yields in the Upper Guadalupe River Watershed, South-Central Texas, 1995–2010

Scientific Investigations Report 2012–5051

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

Scenario Analysis

- 23 brush-management subbasins
- Texas Ecological Systems dataset: Juniper Forest and Juniper Shrubland intersection with NLCD 2006



Scenario Analysis: Results

- Water yields to Canyon Lake increased for each simulation on average by 6% (140 to 1,900 acre-ft/yr with a total of 21,000 acre-ft/yr)

- The mean simulated increased yield from approximately 3 acres (114,000 gallons) is slightly less than the average annual water supply for the average U.S. household [1]

  [1]American Water Works Association estimate of 127,000 gallons

- Sensitivity appears to increase with average annual precipitation but additional analysis is needed to correlate.

Table 6. Effects of brush management on water yields simulated by the Soil and Water Assessment Tool watershed model of the upper Guadalupe River watershed, south-central Texas, 1995–2010.

[gal, gallons; --, value is not applicable because the flow from the subbasin is direct drainage to the lake]

Brush-management subbasin (fig. 8)	Subbasin area (acres)	Total area modified for brush management simulation (acres)	Percent of subbasin modified	Increased average annual water yield to the subbasin reach per acre of ashe juniper replaced with grasslands (gal)[1]	Increased average annual water yield to Canyon Lake per acre of ashe juniper replaced with grasslands from each subbasin (gal)[2]
1	45,369	13,475	30	21,000	18,200
2	42,270	17,035	40	29,200	28,500
3	45,138	10,969	24	20,600	18,600
4	37,717	13,540	36	20,600	19,800
5	50,379	7,557	15	17,800	17,600
6	49,977	13,894	28	20,200	19,900
7	44,312	15,376	35	22,800	22,500
8	45,287	14,356	32	42,100	41,600
9	27,095	5,527	20	71,500	70,600
10	39,486	9,477	24	45,800	45,700
11	31,697	7,005	22	6,370	6,640
12	36,106	6,282	17	61,900	60,800
13	50,332	5,738	11	27,400	27,300
14	41,192	5,149	13	15,200	15,000
15	52,853	4,493	9	18,700	19,100
16	46,664	6,393	14	33,200	33,200
17	47,758	5,301	11	29,300	29,200
18	35,501	4,686	13	56,000	54,700
19	30,848	7,496	24	73,300	72,700
20	34,697	3,886	11	58,500	58,500
21	28,626	4,494	16	45,400	44,700
22	30,873	10,558	34	38,100	38,100
23	24,614	5,218	21	119,000	--

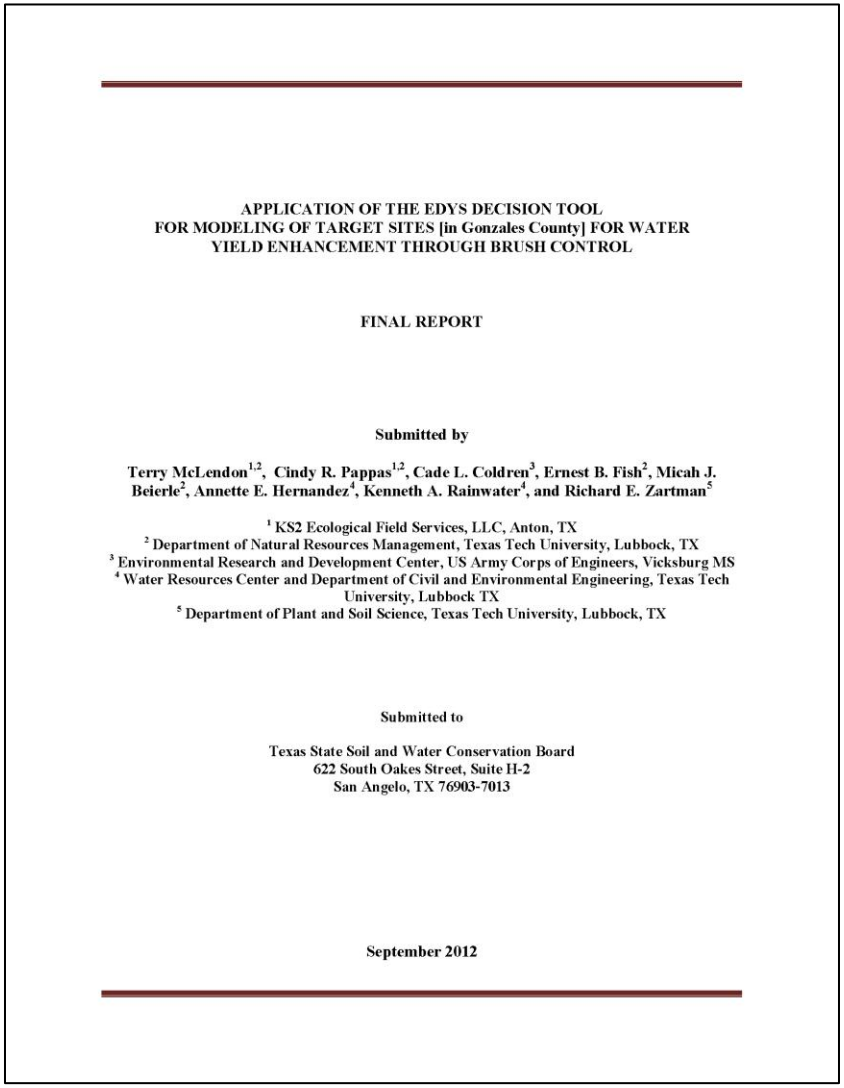
Upper Guadalupe River WAM

- 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
  - William H. Asquith and Johnathan R. Bumgarner
  - Anticipated publication late 2013-early 2014

- Tentative summary = Brush control in the watershed increases lake levels during times of lowest quartile precipitation

Brush Control in Gonzales County

- Quantify potential enhanced water yields from brush control in Gonzales County
- Target species = huisache, eastern red cedar, mesquite, McCartney rose
- EDYS - Ecological DYnamics Simulation model
- KS2 Ecological Field Services, LLC & Texas Tech University



APPLICATION OF THE EDYS DECISION TOOL
FOR MODELING OF TARGET SITES [in Gonzales County] FOR WATER
YIELD ENHANCEMENT THROUGH BRUSH CONTROL

FINAL REPORT

Submitted by

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Submitted to

Texas State Soil and Water Conservation Board
622 South Oakes Street, Suite H-2
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September 2012

Summary of 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

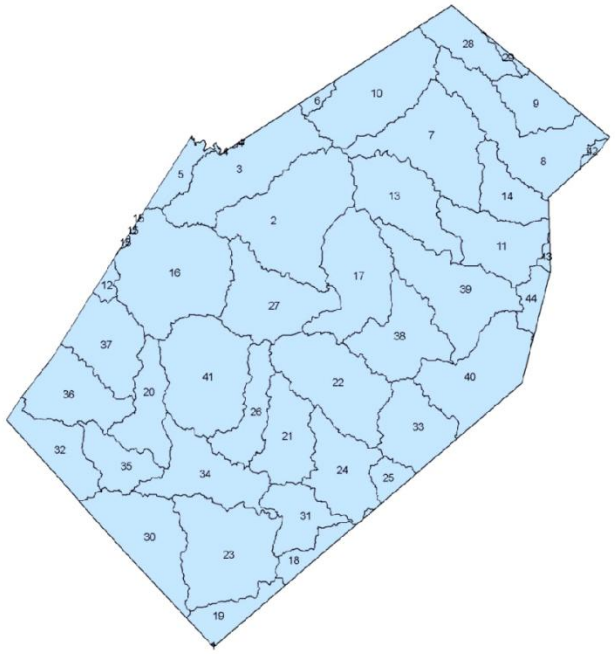

Figure 2.1 Spatial distribution of the 44 sub-watersheds used in the EDYS model application for Gonzales County, Texas.

Table 4.2 Average annual water balance values (inches) for each of the 44 sub-watersheds in Gonzales County based on EDYS simulations under Scenario 2 (100% removal of target woody species). Values are 10-year means: 2002-2011.

SUBWSD	PPT	INTRCP	EVAPOR	TRANSP	TOTAL ET	RUNOFF	UPSTOR	DPSTOR	GRNDWT	NET YIELD
01	32.15	0.82	1.23	24.70	26.75	1.19	4.22	0.00	0.01	5.40
02	32.15	1.14	1.57	28.56	31.27	0.68	3.24	1.71	4.75	0.88
03	32.15	1.08	1.78	24.16	27.02	0.83	3.57	0.73	0.00	5.13
04	32.15	1.16	0.83	25.60	27.59	0.50	3.10	0.96	0.00	4.56
05	32.15	1.04	1.65	24.79	27.48	0.47	3.92	0.28	0.00	4.67
06	32.15	1.16	0.87	24.96	26.99	0.63	3.70	0.83	0.00	5.16
07	32.15	1.20	1.59	28.07	30.86	0.89	3.31	0.67	3.58	1.29
08	32.15	1.00	1.71	24.40	27.11	0.72	3.29	1.27	0.24	5.04
09	32.15	0.93	1.41	24.01	26.35	1.01	3.57	1.23	0.01	5.80
10	32.15	1.07	1.14	24.31	26.52	0.92	3.55	1.16	0.00	5.63
11	32.15	1.04	1.06	24.42	26.52	0.61	3.01	2.09	0.08	5.63
12	32.15	1.17	1.12	25.66	27.95	0.52	2.92	0.76	0.00	4.20
13	32.15	1.18	1.43	28.42	31.03	0.67	3.58	0.09	3.22	1.12
14	32.15	1.14	0.96	25.03	27.13	0.64	2.73	1.65	0.00	5.02
15	32.15	1.15	1.16	24.45	26.76	0.56	4.36	0.47	0.00	5.39
16	32.15	1.10	2.30	26.37	29.77	0.91	3.22	0.75	2.50	2.38
17	32.15	0.85	6.25	22.82	29.92	0.65	3.62	0.25	2.29	2.23
18	32.15	1.05	1.11	24.48	26.64	0.75	3.81	0.95	0.00	5.51
19	32.15	1.08	1.88	24.24	27.20	0.73	4.03	0.19	0.00	4.95
20	32.15	1.16	1.74	24.69	27.59	0.58	3.81	0.17	0.00	4.56
21	32.15	1.06	1.28	25.90	28.24	1.50	3.34	1.99	2.92	3.91
22	32.15	0.99	1.34	27.36	29.69	0.64	3.15	1.98	3.31	2.46
23	32.15	1.11	1.28	25.60	27.99	0.99	4.21	0.75	1.79	4.16
24	32.15	1.10	1.09	25.56	27.75	1.52	2.67	2.89	2.68	4.40
25	32.15	1.10	1.18	24.66	26.94	0.74	3.39	1.08	0.00	5.21
26	32.15	1.07	1.23	25.25	27.55	0.68	3.70	0.22	0.00	4.60
27	32.15	1.04	1.83	24.87	27.74	0.81	3.43	0.22	0.05	4.41
28	32.15	0.95	1.60	26.15	28.70	0.71	4.17	0.22	1.65	3.45
29	32.15	1.01	1.02	29.23	31.26	0.80	3.86	0.12	3.89	0.89
30	32.15	1.15	2.79	23.58	27.52	0.64	3.88	0.11	0.00	4.63
31	32.15	1.13	1.13	26.55	28.81	0.96	2.97	1.86	2.45	3.34
32	32.15	1.00	1.93	23.89	26.82	0.64	3.64	1.05	0.00	5.33
33	32.15	1.08	1.11	23.12	25.31	2.23	2.62	1.99	0.00	6.84
34	32.15	1.14	1.71	24.70	27.55	0.75	3.82	0.14	0.11	4.60
35	32.15	1.11	1.22	25.10	27.43	0.66	3.92	0.14	0.00	4.72
36	32.15	1.10	1.27	27.56	29.93	0.55	3.73	0.95	3.01	2.22
37	32.15	1.16	1.37	27.52	30.05	0.55	3.31	0.93	2.69	2.10
38	32.15	0.96	3.87	22.16	26.99	0.75	3.39	1.02	0.00	5.16
39	32.15	1.03	1.37	27.33	29.73	0.80	3.21	1.74	3.33	2.42
40	32.15	0.95	1.19	23.69	25.83	1.72	3.27	1.33	0.00	6.32
41	32.15	1.08	2.54	24.12	27.74	0.66	3.72	0.03	0.00	4.41
42	32.15	0.94	0.88	24.49	26.31	0.85	2.90	2.93	0.84	5.84
43	32.15	0.95	0.97	23.90	25.82	0.69	3.16	2.48	0.00	6.33
44	32.15	0.90	1.25	26.68	28.83	0.59	3.18	3.23	3.68	3.32
MEAN	32.15	1.06	1.57	25.30	27.93	0.82	3.48	1.04	1.12	4.22

Table 4.3 Difference in net annual water yield and potential increased annual water yield resulting from the 100% removal of target woody species (Scenario 2) compared to no treatment (baseline, Scenario 1) on each of 44 sub-watersheds in Gonzales County based on EDYS simulations. Values are 10-year means: 2002-2011.

Sub-watershed	Net Yield (inches)			Acres	Potential Increased Annual Yield (ac-ft)
	Baseline	Treated	Difference		
01	2.78	5.40	2.62	20	4.4
02	- 1.61	0.88	2.49	36,853	7,647.0
03	3.94	5.13	1.19	27,695	2,746.5
04	3.50	4.56	1.06	101	8.9
05	4.15	4.67	0.42	5,782	202.4
06	3.89	5.16	1.27	1,669	176.7
07	- 1.72	1.29	3.01	28,757	7,213.2
08	3.45	5.04	1.59	27,852	3,690.4
09	4.38	5.80	1.42	10,897	1,289.5
10	4.33	5.63	1.30	27,407	2,969.1
11	4.16	5.63	1.47	18,251	2,235.7
12	3.44	4.20	0.76	2,010	127.3
13	- 3.29	1.12	4.41	21,119	7,761.2
14	3.97	5.02	1.05	11,213	983.4
15	3.18	5.39	2.21	302	55.6
16	0.63	2.38	1.75	36,075	5,261.0
17	- 0.17	2.23	2.40	24,731	4,946.2
18	4.10	5.51	1.41	5,491	927.2
19	3.92	4.95	1.03	7,928	680.5
20	3.56	4.56	1.00	13,756	1,166.3
21	- 0.85	3.91	4.76	15,913	6,312.2
22	- 0.17	2.46	2.63	26,818	5,877.5
23	0.56	4.16	3.60	29,999	8,999.7
24	0.63	4.40	3.77	17,894	5,621.8
25	4.20	5.21	1.01	4,024	338.7
26	3.80	4.60	0.80	12,077	805.1
27	3.75	4.41	0.66	22,524	1,238.8
28	0.17	3.45	3.28	10,844	2,964.1
29	- 2.07	0.89	2.96	1,115	275.0
30	4.00	4.63	0.63	22,354	1,173.6
31	0.75	3.34	2.59	11,598	2,503.2
32	3.94	5.33	1.39	13,568	1,571.7
33	5.89	6.84	0.95	16,348	1,294.2
34	3.70	4.60	0.90	19,978	1,499.2
35	3.47	4.72	1.25	10,683	1,112.9
36	- 1.76	2.22	3.98	17,969	5,959.7
37	- 1.19	2.10	3.29	17,824	4,886.6
38	4.43	5.16	0.73	19,978	1,215.4
39	- 1.37	2.42	3.79	26,687	8,428.6
40	5.20	6.32	1.12	24,825	2,317.1
41	3.71	4.41	0.70	29,605	1,726.1
42	4.57	5.84	1.27	916	96.8
43	4.85	6.33	1.48	880	108.5
44	1.78	3.32	1.54	4,767	611.8
MEAN			1.89		

Carrizo-Wilcox GAM in Gonzales County

- Proposed study with HDR and SARA
- Using the EDYS-based Feasibility Study for brush control in Gonzales Co., extrapolate Carrizo recharge enhancement
- Run Carrizo Groundwater Availability Model with brush control enhanced recharge to calculate potential increase in MAG
- Package results consistent with Region L procedures/analysis as a potential Brush Control WMS for consideration by the RWPG

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