

**FINAL REPORT**  
**Rangeland Rehabilitation through Water  
Conservation/Concentration**

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Photo Courtesy: Bill Thompson



**Project Description:**

Rangeland ripping/furrowing demonstrations have been implemented on ranches in Pecos, Val Verde, Glasscock, Crockett, Ector, and Presidio Counties. A tractor or bulldozer was used to simultaneously rip and furrow along elevational contours in an effort to concentrate limited precipitation, enhance infiltration, reduce soil loss, and ultimately increase plant production at the sites. Paired watershed plots were installed in Val Verde and Crockett Counties to complement and document the benefits of the demonstrations. Additional plots will be installed in Presidio County. Rainfall intensity, runoff volume and sediment loss from each pair of plots will be measured for two years. A rip/furrow treatment will be applied to one of the plots while the other will serve as a control. Soil physical and chemical properties such as particle size distribution and organic matter content may affect plot response to treatment. Therefore, soil morphology descriptions and physical and chemical analyses are essential to the evaluation of treatment success and for selection of additional treatment sites.

**Project Accomplishments:**

Microcatchments were installed in Presidio County. Soil pits were excavated adjacent to the microcatchment sites in Presidio, Crockett and Val Verde Counties. Soil pedons were described and sampled. Soil texture and organic carbon analyses were completed in the laboratory. A portion of the funds provided salary for an undergraduate geology student from Sul Ross State University who developed observation, data collection and laboratory analysis skills.

Complete pedon descriptions for each site are included in this report (see Appendix). However, the most central factors in site response and also site selection are slope gradient, soil depth, soil texture and organic matter content.

**Slopes** were similar (1-2%) among sites. Gentle slopes where sheetwash occurs are most desirable because the furrows would fill in quickly in areas where slope gradient is sufficient to cause rill and gully erosion.

**Soil Depth:**

Rangeland ripping should be implemented on deep soils where runoff that will be concentrated along the upslope edge of the rips can be stored. The soils are deep (>50 cm) at all three study sites.

**Soil Texture:**

Soil texture is one factor that influences infiltration capacity. As clay content increases, macroporosity decreases, thus reducing infiltration. Conversely, sand content is positively related to infiltration capacity. Soil particle size distribution was determined for each site, by horizon, using the Bouyocous hydrometer method (Hons, 1984). Sand (Figure 1) in the surface horizon was greatest (56%) at the Val Verde site, followed by the Crockett County site with 27%. The surface horizon at Presidio contained only 6% sand.

Therefore, we would expect the microcatchments at the Val Verde County site to generate the least runoff. However, there are other physical factors that influence infiltration, such as soil organic matter content.

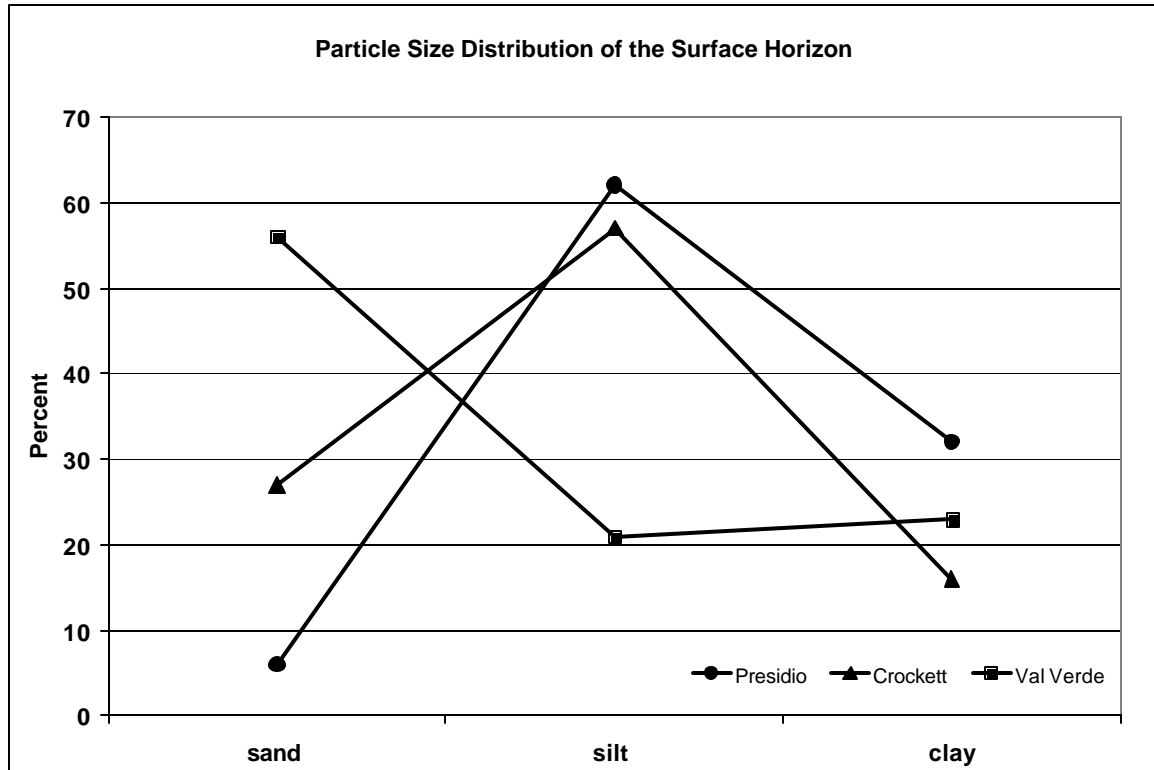


Figure 1. Particle size distribution of the surface horizon for pedons described in Presidio, Crockett and Val Verde Counties, Texas.

**Organic Matter Content:**

The upper two horizons from each soil pit were analyzed for organic matter content using dichromic acid digestion and back-titration with ferrous sulfate (Nelson & Sommers, 1982). Soil organic matter content decreased with depth at all locations (Figure 2). The Val Verde County site soil had the lowest organic matter content, 2.7% and 1.6% in the A1 and A2 horizons, respectively. Organic matter content was greatest at the Crockett County site (7.4% in the A horizon and 3.3% in the AB horizon), followed by the Presidio County site with 3.2% in the A horizon and 2.6% in the AB horizon. Soil organic matter is positively related to water holding capacity, cation exchange capacity and nutrient availability (Brady, 1990). Thus, based on organic matter content, we would expect to see the most positive forage response, and least runoff at the Crockett County site. A comparison of rainfall characteristics and runoff volumes among the sites will be published in a year-end summary.

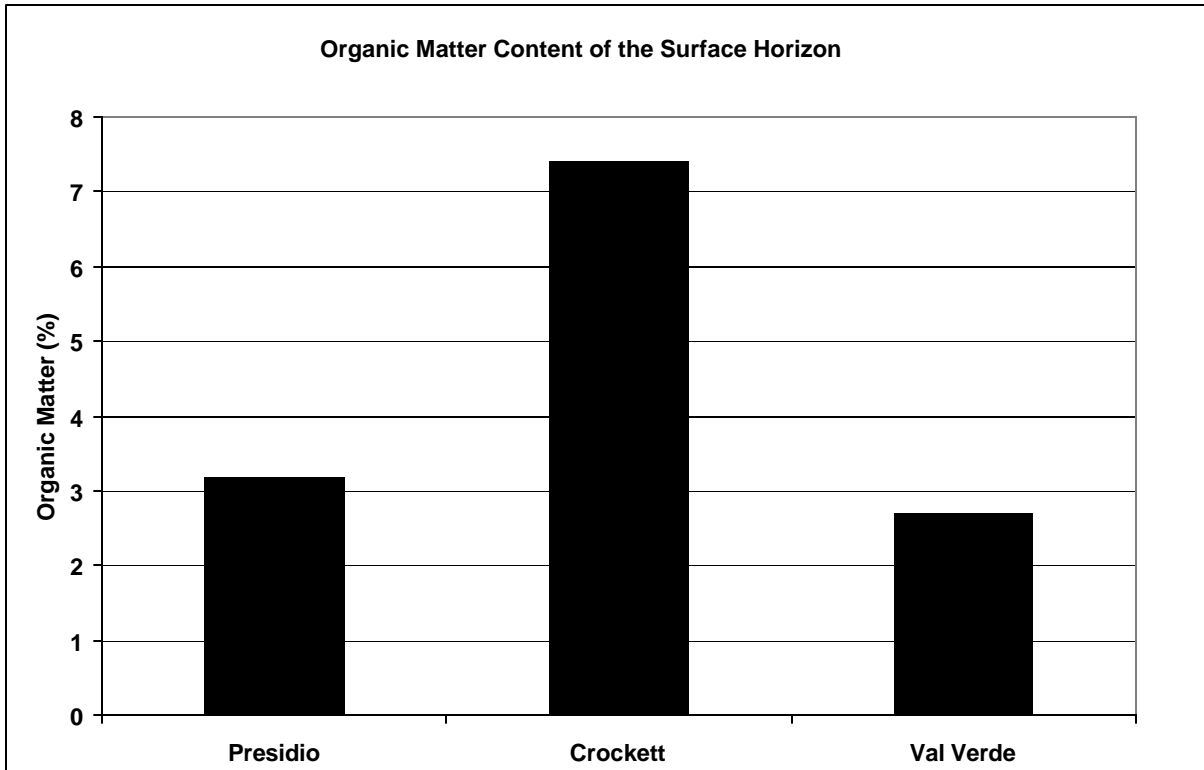


Figure 2. Organic matter content (%) in the surface horizon of pedons described in Presidio, Crockett and Val Verde Counties, Texas.

**Summary:**

The tables above illustrate soil particle size and organic matter content. Val Verde County site upper horizon had the highest sand content (56%), but the lowest organic matter content (2.7%), while the sand content in the upper horizon at Crockett County site contained less sand, 27%, and the greatest organic matter content (7.4%). This information has been analyzed separately from the runoff data, but both will be interpreted in conjunction with plant cover and soil surface feature records. The results will be summarized in a year-end report that will be posted on the District VI website. A color pamphlet that defines rangeland recovery and provides guidelines for site selection and implementation of ripping techniques to reestablish vegetation on degraded rangelands will be published next spring.

**Further Study:**

In addition to slope, soil depth, soil texture and organic matter, rainfall characteristics are also an important factor to consider when implementing rangeland ripping. In areas with low rainfall, the rips should be spaced farther apart, as it will take more runoff area to support vegetation than in areas where rainfall is greater than about 13 inches.

**Contacts:**

Field days at Crockett County (25 participants) and Val Verde County (34 participants) were conducted in the Fall of 2002. Additional field days are scheduled for October

2003. A spring tour of the Presidio County site is planned for the Big Bend Chapter Native Plant Society of Texas.

**Acknowledgments:**



Bill Zuberbueler, John Allen – Val Verde CEA, Bill Hubbard, James Steen – Presidio CEA, Art Roane and Roy Walston – Crockett CEA and the Texas Water Resources Institute of the Texas A&M University System Ag Program

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## Appendix

### Presidio County

**Print Date:** 03/10/2003

**Description Date:** 03/05/2003

**Describer:** Lynn Loomis and Alyson McDonald

**Site ID:** 30104B1-001

**Pedon ID:** S03TX377-001

**Soil Name as Described/Sampled:** Marfa

**Country:** United States

**State:** Texas

**County:** Presidio

**MLRA:** 42 -- Southern Desertic Basins, Plains, and Mountains

**Soil Survey Area:** TX377 -- Presidio County, Texas

**Map Unit:** 502 -- MARFA CLAY LOAM, 0 TO 1 PERCENT SLOPES

**Quad Name:** San Estaban Lake, Texas

**Location Description:** Bill Hubbard Ranch

**Datum:** NAD83

**UTM Zone:** 13

**UTM Easting:** 588029

**UTM Northing:** 3336635

**Existing Vegetation:** Nuttall's milkvetch, bladderpod, buckwheat, soap tree yucca, threeawn, blue grama, plains pricklypear, sixweeks grama, tobosa

### **Diagnostic Features:**

A--0 to 7 centimeters; very dark grayish brown (10YR 3/2) broken face silty clay loam, dark grayish brown (10YR 4/2) broken face, dry; 6 percent sand; 62 percent silt; 32 percent clay; moderate coarse subangular blocky structure parting to moderate medium subangular blocky structure parting to moderate fine subangular blocky structure parting to weak very fine subangular blocky structure; very friable, soft, moderately sticky, moderately plastic; common fine roots throughout and common very fine roots throughout; many very fine moderate-continuity tubular pores; 1 percent nonflat subangular indurated 5- to 20-millimeter igneous rock fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary; 3.18% organic matter content.

AB--7 to 17 centimeters; very dark brown (10YR 2/2) broken face silty clay, very dark grayish brown (10YR 3/2) broken face, dry; 10 percent sand; 47 percent silt; 43 percent clay; moderate coarse subangular blocky structure parting to moderate medium subangular blocky structure parting to moderate fine subangular blocky structure parting to weak very fine subangular blocky structure; very friable, moderately hard, moderately sticky, very plastic; common fine roots throughout and common very fine roots throughout; common fine low-continuity tubular and common very fine low-continuity tubular pores; 25 percent continuous distinct very dark grayish brown (10YR 3/2), dry, clay films on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary; 2.56% organic matter content.

Bt--17 to 43 centimeters; black (10YR 2/1) broken face clay, very dark gray (10YR 3/1) broken face, dry; 27 percent sand; 26 percent silt; 47 percent clay; moderate medium prismatic structure parting to moderate coarse subangular blocky structure parting to moderate medium subangular blocky structure parting to moderate fine subangular blocky structure parting to weak very fine subangular blocky structure; friable, very hard, slightly sticky, very plastic; common fine roots throughout and common very fine roots throughout; common fine moderate-continuity tubular and common very fine moderate-continuity tubular pores; 40 percent continuous distinct very dark gray (10YR 3/1), dry, clay films on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bw--43 to 54 centimeters; very dark grayish brown (10YR 3/2) broken face loamy sand, dark grayish brown (10YR 4/2) broken face, dry; 84 percent sand; 5 percent silt; 11 percent clay; moderate medium subangular blocky structure parting to moderate fine subangular blocky structure parting to moderate very fine subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common fine roots throughout and common very fine roots throughout; common very fine low-continuity tubular pores; 1 percent nonflat subangular indurated 2- to 75-millimeter igneous rock fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Cb--54 to 71 centimeters; very dark grayish brown (10YR 3/2) broken face sandy clay loam, dark grayish brown (10YR 4/2) broken face, dry; 62 percent sand; 12 percent silt; 26 percent clay; single grain; loose, loose, nonsticky, nonplastic; few very fine roots throughout; many very fine high-continuity interstitial pores; 7 percent nonflat subrounded indurated 5- to 20-millimeter igneous rock fragments and 12 percent nonflat subrounded indurated 20- to 75-millimeter igneous rock fragments and 16 percent nonflat subrounded indurated 2- to 5-millimeter igneous rock fragments; noneffervescent, by HCl, 1 normal; abrupt wavy boundary.

ABb--71 to 83 centimeters; very dark brown (10YR 2/2) broken face silt loam, brown (10YR 5/3) broken face, dry; 12 percent sand; 72 percent silt; 16 percent clay; very friable, moderately hard, slightly sticky, very plastic; few very fine roots throughout; many very fine low-continuity tubular pores; 1 percent nonflat subrounded indurated 5- to 20-millimeter igneous rock fragments; noneffervescent, by HCl, 1 normal.

## Crockett County

**Description Date:** 04/04/2003  
**Describer:** Alyson K. McDonald  
**Site ID:** Crockett  
**Pedon ID:** Crockett

**Soil Name as Described/Sampled:** Angelo  
**Classification:** Clayey-skeletal, mesic Torrertic Pale ustolls  
**Pedon Purpose:** research site

**Country:** United States  
**State:** Texas  
**County:** CROCKETT  
**MLRA:** 81B -- Edwards Plateau, Central Part (proposed)  
**Quad Name:** Ozona, Texas

**Location Description:** In the House Pasture of Double T Ranch, NE of Ozona, Crockett County, Texas. Pedon is located between two demonstration microcatchments, which are adjacent to an area where wingripping and seeding was implemented.

**UTM Zone:** 14  
**UTM Easting:** 286237 meters  
**UTM Northing:** 3402777 meters

**Primary Earth Cover:** grass/herbaceous cover  
**Secondary Earth Cover:** rangeland, savanna  
**Plant Association Name:**  
**Existing Vegetation:** bladderpod, geranium, globemallow, little barley, pepperweed, rescuegrass, Texas bluebonnet, Texas wintergrass, tobosa, verbena

**Bedrock Kind:** limestone  
**Bedrock Depth:** 86 cm.

### **Diagnostic Features:**

A--0 to 14 centimeters; dark grayish brown (10YR 4/2) broken face, silt loam, very dark grayish brown (10YR 3/2) broken face, moist; 27 percent sand; 57 percent silt; 16 percent clay; moderate fine subangular blocky structure parting to weak very fine subangular blocky structure; friable, moderately hard; low excavation difficulty; many fine roots throughout and common medium roots throughout; common very fine low-continuity

tubular pores; 8 percent nonflat subrounded limestone fragments; violent effervescence, by HCl, 1 normal; clear smooth boundary; 7.4% organic matter content.

AB--14 to 40 centimeters; dark grayish brown (10YR 4/2), clay, very dark grayish brown (10YR 3/2), moist; 22 percent sand; 36 percent silt; 42 percent clay; moderate medium subangular blocky structure parting to moderate fine subangular blocky structure; firm, hard; low excavation difficulty; common fine roots throughout and common medium roots throughout; common very fine low-continuity tubular and common fine moderate-continuity tubular pores; 15 percent nonflat subrounded limestone fragments; violent effervescence, by HCl, 1 normal; gradual smooth boundary; 3.25% organic matter content.

Bk--40 to 60 centimeters; brown (10YR 5/3) broken face, silty clay, brown (10YR 4/3) broken face, moist; 19 percent sand; 37 percent silt; 44 percent clay; very friable, moderately hard; low excavation difficulty; common fine roots throughout and common medium roots throughout; many very fine low-continuity tubular pores; 10 percent nonflat subrounded limestone fragments; strong effervescence, by HCl, 1 normal; gradual smooth boundary.

Br--60 to 86 centimeters; yellowish brown (10YR 5/4), clay, dark yellowish brown (10YR 4/4), moist; 13 percent sand; 33 percent silt; 54 percent clay; moderate medium subangular blocky structure parting to moderate fine subangular blocky structure parting to weak very fine subangular blocky structure; very friable, hard; moderate excavation difficulty; common medium roots throughout and common fine roots throughout; many very fine low-continuity tubular pores; 12 percent nonflat subrounded limestone fragments; strong effervescence, by HCl, 1 normal; gradual smooth boundary.

## Val Verde County

**Description Date:** 07/08/2003  
**Describer:** Alyson McDonald and Larry Garrett

**Site ID:** Val Verde  
**Pedon ID:** Val Verde

**Soil Name as Described/Sampled:** Langtry  
**Classification:** Loamy, calcareous, mesic Torrertic Haplustolls  
**Pedon Purpose:** research site

**Country:** United States  
**State:** Texas  
**County:** VAL VERDE  
**MLRA:** 81D -- Southern Edwards Plateau (proposed)  
**Quad Name:** Seminole Canyon, Texas

**Location Description:** On Zuberbueler Ranch northwest of Comstock, Val Verde County  
Texas

**UTM Zone:** 13  
**UTM Easting:** 281656 meters  
**UTM Northing:** 3286354 meters

**Primary Earth Cover:** grass/herbaceous cover  
**Secondary Earth Cover:** rangeland, shrubby  
**Existing Vegetation:** croton, honey mesquite, king ranch bluestem, littleleaf sumac, lotebush, sixweeks grama, tasajillo, tiquilia

**Bedrock Kind:** limestone  
**Bedrock Depth:** 73 cm.

### **Diagnostic Features:**

A1--0 to 34 centimeters; brown (10YR 4/3), sandy clay loam, dark brown (10YR 3/3), moist; 56 percent sand; 21 percent silt; 23 percent clay; strong medium subangular blocky structure parting to moderate fine subangular blocky structure parting to weak fine subangular blocky structure; very friable, slightly hard; low excavation difficulty; many very fine roots throughout; common very fine low-continuity irregular pores; 1 percent flat angular limestone fragments and 1 percent nonflat subrounded limestone fragments and 2 percent flat subangular limestone fragments and 2 percent flat subangular limestone fragments; violent effervescence, by HCl, 1 normal; clear wavy boundary; 2.7% organic matter content.

A2--34 to 45 centimeters; yellowish brown (10YR 5/4), sandy clay loam, brown (10YR 4/3), moist; 57 percent sand; 16 percent silt; 27 percent clay; strong medium subangular blocky structure parting to moderate fine subangular blocky structure parting to weak fine subangular blocky structure; moderate excavation difficulty; common very fine roots throughout; common medium low-continuity vesicular and common fine low-continuity irregular pores; 1 percent fine threadlike carbonate threads on faces of peds; 8 percent flat subangular limestone fragments and 8 percent nonflat subrounded limestone fragments and 2 percent flat angular limestone fragments and 10 percent nonflat subrounded limestone fragments; clear wavy boundary; 1.5% organic matter content.

AB--45 to 73 centimeters; brown (7.5YR 5/4) broken face, sandy clay loam, dark brown (7.5YR 3/4) broken face, moist; 3 percent rubbed fiber; 50 percent sand; 19 percent silt; 31 percent clay; moderate fine subangular blocky structure parting to moderate very fine subangular blocky structure; very friable, slightly hard; high excavation difficulty; common very fine roots between peds; many medium low-continuity irregular pores; 3 percent medium spherical on vertical faces of peds; 3 percent nonflat subrounded limestone fragments; violent effervescence, by HCl, 1 normal; clear wavy boundary.

