Report for 2003TX92B: Monitoring and Evaluation of the Pecos River Ecosystem Project

- Other Publications:
  - Pecos River Ecosystem Project: Past. Present and Future, Texas Water Summit, Austin November 2003

Report Follows

Monitoring and Evaluation of the Pecos River Ecosystem Project

In 1999, shallow monitoring wells were installed at two sites within a study area along the Pecos River in Loving County, Texas. In 2000, one site was treated with Arsenal herbicide to control saltcedar and the other site was left untreated. The wells are equipped with water level sensors and data loggers, which record the average hourly water level. The hourly water levels are used to calculate net drawdown or recharge for each day during the growing season (April – October). Water salvage from saltcedar control is estimated by comparing pre treatment water level data to post treatment water level data for both sites using the EPA Paired Watershed Study Design protocol. Preliminary analysis indicates saltcedar control may yield 50% to 70% reduction in water loss at the study site on the Pecos River.

If saltcedar control results in substantial water salvage, will downstream flows increase or will groundwater storage increase? This question will be addressed in three stages: (1) Characterize shallow aquifer: A map of alluvial sediments will be developed to diagram subsurface flow patterns. Previous borehole exploration revealed a clay layer, which may limit vertical water flow within the shallow aquifer. This task is to delineate the extent of the shallow aquifer by drilling additional boreholes at untreated and treated plots along the Pecos River. Soil and water samples will be collected and analyzed, as needed, to determine spatial variation in hydrological properties. **Boreholes were drilled and soil samples were collected in one foot increments to the depth of the water table. Particle size analysis has been completed for boreholes 1-4 (Tables 1-4). A soil classification triangle, which is based on percent particle size, was used to assign specific yield to each one foot increment;** (2) Installation of additional monitoring wells: There are 5 existing monitoring wells at each site on one side of the river. In order to better understand flow regimes, additional wells will be drilled on the other side of the river from the existing well network. Dataloggers will be used to record hourly changes in the water level in each of the new wells. Collected water level information will be processed to construct a flow net within the shallow aquifer. The flow net will be used to define the interaction between surface water and ground water, which will be used to assess volume and direction of flow. **Six new monitoring wells were established. The wells will be equipped with water level sensors and loggers. The water level information will be used to configure subsurface flow patterns;** and (3) Flow measurements: To establish the relationship between surface water and ground water, designated releases from Red Bluff Reservoir will be scheduled. Multiple releases will be monitored for a period of several days during the project period to detect any seasonal changes in the shallow aquifer response to saltcedar control. Seepage losses, or gains, by the river will be calculated and the factors that influence seepage losses and gains will be assessed.

During the releases, surface water flow will be measured at the upstream boundary of the untreated site, at the divide between untreated and treated sites and at the downstream boundary of the treated site. At the same time the hourly water level in each of the wells will be recorded to determine impacts of increased river flow on the shallow aquifer flow. conduct flow measurements with designated releases from Red Bluff Reservoir. **Stage 3 will begin this summer.**

A laser level was purchased with these grant funds. It will be used to record relative elevations among wells and boreholes, which will enable is to map the alluvial sediments and determine subsurface flow direction. Well pipe, well points, extensions for the bucket auger, and water level loggers also were purchased with the grant funds.

Figure 1. Monitoring well with datalogger, Pecos River, Loving County, Texas.

Table 1. Soil particle size distribution, texture and specific yield for borehole 1, Pecos River Site A, Reeves County, Texas.

Borehole 1	Sand (%)	Silt (%)	Clay (%)	Texture	Specific Yield (%)
0-1	8.29	27.54	64.17	clay	<1
1-2’	5.98	38.46	55.56	clay	<1
2-3’	13.22	45.56	41.22	silty clay	2
3-4’	31.40	39.53	29.07	clay loam	5
4-5’	25.49	26.30	48.21	clay	1
5-6’	19.29	26.55	54.16	clay	<1
6-7’	15.54	19.49	64.97	clay	<1
7-8’	6.53	22.86	70.61	clay	<1
8-9’	1.34	22.32	76.35	clay	<1
9-10’	2.72	24.86	72.42	clay	<1
10-11’	2.23	36.33	61.44	clay	<1
11-12’	1.68	23.03	75.29	clay	<1

Table 2. Soil particle size distribution, texture and specific yield for borehole 2, Pecos River Site A, Reeves County, Texas.

Borehole 2	Sand (%)	Silt (%)	Clay (%)	Texture	Specific Yield (%)
0-1’	12.54	29.32	58.14	clay	<1
1-2’	37.39	49.36	13.25	loam	12
2-3’	34.55	45.38	20.06	loam	8
3-4’	29.04	49.21	21.75	loam	8
4-5’	73.63	19.20	7.17	loamy sand	25
5-6’	78.08	14.81	7.11	loamy sand	28
6-7’	88.78	6.28	4.94	sand	35
7-8’	81.14	11.28	7.58	loamy sand	25
8-9’	78.72	10.27	11.01	sandy loam	20
9-10’	43.57	35.80	20.62	loam	10
10-11’	1.04	43.85	55.11	clay	<1
11-12’	3.92	24.77	71.31	clay	<1
12-13’	7.43	26.62	65.95	clay	<1
13-14’	4.82	23.21	71.97	clay	<1
14-15’	1.16	40.83	58.01	clay	<1
15-16’	1.13	23.99	74.88	clay	<1
16-17’	17.06	34.03	48.92	clay	1
17-18’	40.49	41.04	18.47	loam	10

Table 3. Soil particle size distribution, texture and specific yield for borehole 3, Pecos River Site A, Reeves County, Texas.

Borehole 3	Sand (%)	Silt (%)	Clay (%)	Texture	Specific Yield (%)
0-1	27.72	51.84	20.44	silt loam	8
1-2’	42.25	41.92	15.83	loam	12
2-3’	5.32	30.69	63.99	clay	<1
3-4’	16.22	31.74	52.04	clay	<1
4-5’	39.63	46.66	13.71	loam	15
5-6’	36.02	40.01	23.97	loam	5
6-7’	36.57	42.13	21.30	loam	8
7-8’	27.17	49.97	22.86	loam	7
8-9’	45.05	38.58	16.37	loam	12
9-10’	33.15	48.41	18.44	loam	10
10-11’	57.76	29.57	12.67	silt loam	17
11-12’	77.02	15.67	7.31	silt loam	28
12-13’	80.22	15.61	4.16	loamy sand	28
13-14’	80.29	13.40	6.32	loamy sand	28
14-15’	84.85	11.04	4.12	loamy sand	35
15-16’	55.99	31.65	12.36	sandy loam	20
16-17’	24.48	38.67	36.86	clay loam	3
17-18’	23.16	26.12	50.72	clay	<1
18-19’	16.42	23.36	60.22	clay	<1
19-20’	7.41	28.11	64.48	clay	<1
20-21’	7.58	29.20	63.21	clay	<1
21-22’	4.65	28.09	67.27	clay	<1
22-23’	3.08	39.01	57.91	clay	<1

Table 4. Soil particle size distribution, texture and specific yield for borehole 4, Pecos River Site B, Reeves County, Texas.

Borehole 4	Sand (%)	Silt (%)	Clay (%)	Texture	Specific Yield (%)
0-1	7.56	26.84	65.60	clay	<1
1-2’	23.59	26.59	49.82	clay	1
2-3’	34.39	44.60	21.00	loam	5
3-4’	45.75	38.37	15.87	loam	15
4-5’	46.83	38.32	14.85	loam	12
5-6’	57.97	27.20	14.83	sandy loam	15
6-7’	69.10	20.12	10.78	sandy loam	15
7-8’	49.62	15.20	35.18	sandy clay	<1

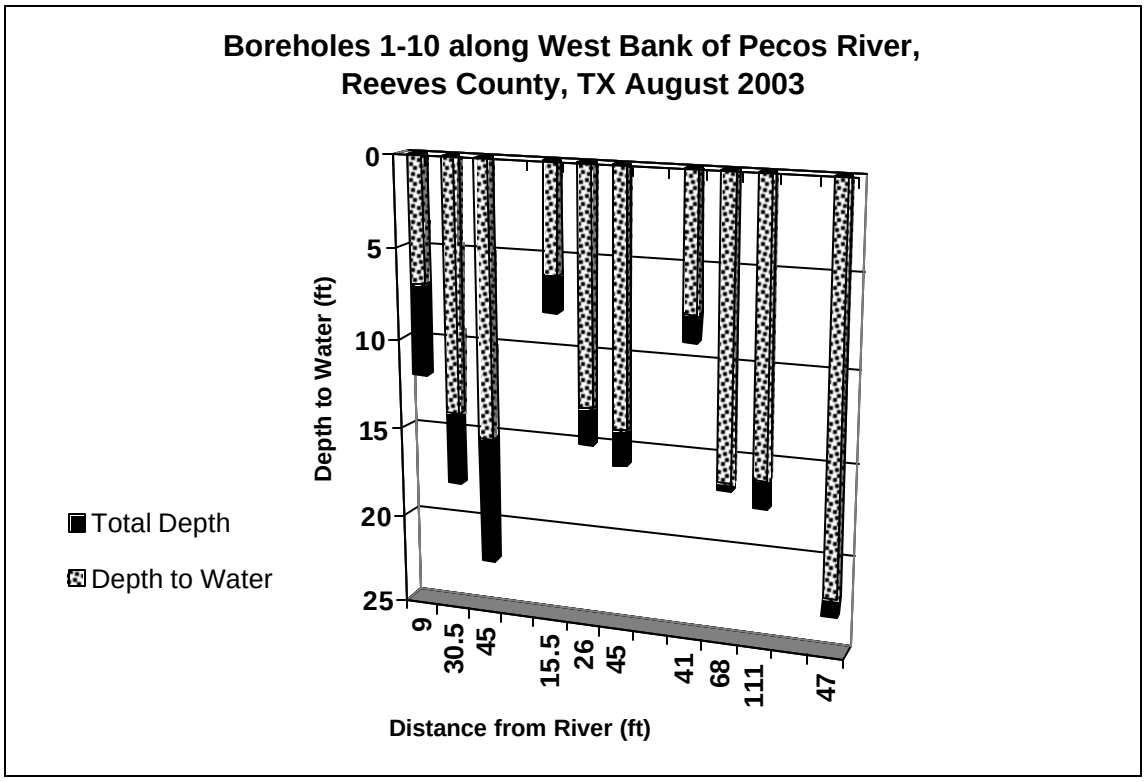

Figure 2. Total depth and depth to water, boreholes 1-10, Reeves County, Texas. Depths are from soil surface and do not include elevational differences.

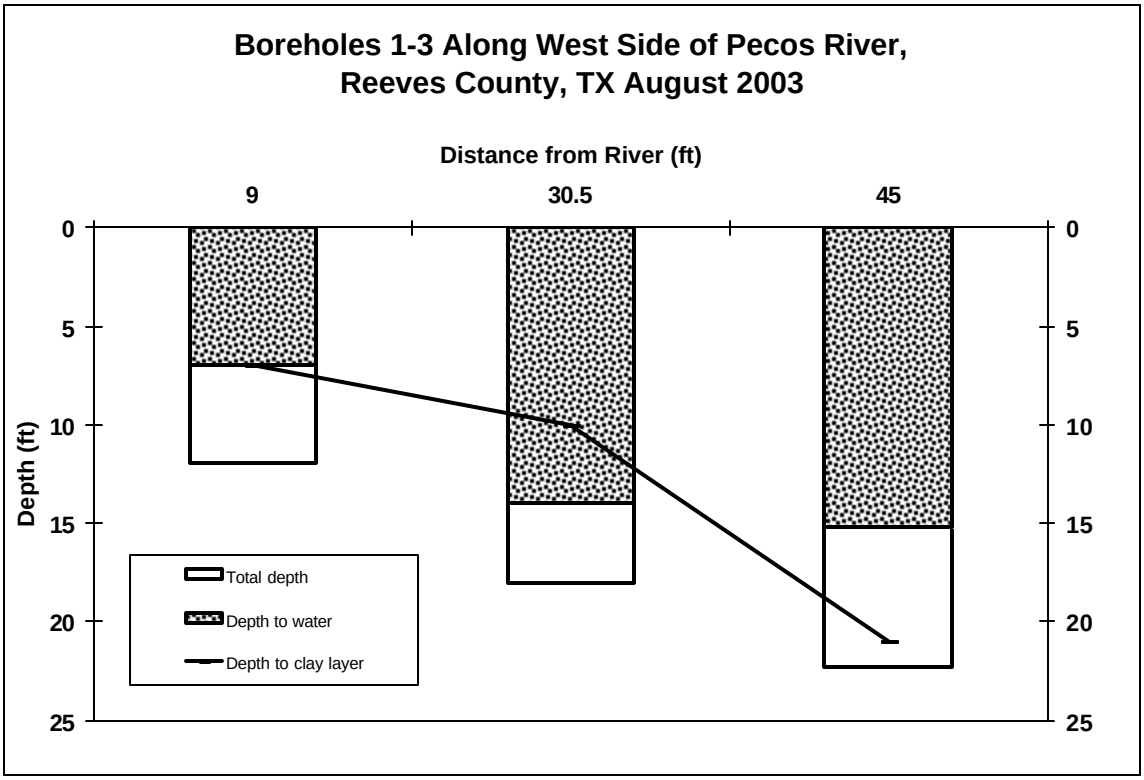

Figure 3. Total depth, depth to water and depth of clay layer, boreholes 1-3, Pecos River Site A, Reeves County, Texas. Depths are from soil surface and do not include elevational differences.

Poster Presentation:

'Pecos River Ecosystem Project: Past. Present and Future', Texas Water Summit, Austin November 2003

Graduate Degree Program:

I am a PhD student in the Department of Rangeland Ecology and Management. I will complete my coursework in Fall 2005 and Spring 2006.

Future Work:

This funding allowed me to purchase equipment and set up a well network and prepare for the next project phase, which includes seasonal seepage runs, water level monitoring and construction of flow nets.