

## **RANGE HYDROLOGY**

The following notes were gathered from several range hydrology studies done in past years. Most of the studies were informal and not done according to strict scientific procedures. However, this information can be used along with data we are currently collecting from our National Range Study Team to develop a range hydrology database for use in working with cooperators, developing range site descriptions, and use in the WEPP model.

The SCS in Texas is currently involved in a concerted effort to gather range hydrology data using rainfall simulators on several critical range sites. Through our work with Ken Spaeth, SCS Range Hydrologist from Boise, Idaho, we have standardized our data collection procedures and developed a master plan for data collection. We recently had a weeklong range hydrology workshop to further develop and refine our knowledge and skills in this field. Technical papers are currently being developed on rainfall simulation studies from the Amarillo and Uvalde areas.

Texas is well ahead of other states in this effort. In the future we plan to expand our data collection to include other grazing lands such as pastureland, native pasture, and grazeable forest land.

### **FACTS TO REMEMBER**

1 acre inch of water equals 27,225 gallons  
1 gallon of water weighs 7.93 pounds  
1 acre inch of water weighs 216,000 pounds

It takes about 140 gallons (1185 pounds) of water to produce 1 pound of sideoats grama.

It takes about 240 gallons (1900 pounds) of water to produce 1 pound of mesquite.

## **RANGE HYDROLOGY STUDY NEAR POST, TEXAS BY DON BEDUNA**

### **Site Characteristics:**

Clay loam soil, 1% slope

Mesquite canopy was 19% (900 plants per acre)

Herbaceous vegetation was predominantly tobosagrass and buffalograss (1650 pounds per acre, 45% groundcover) which was overgrazed and in low vigor.

### **Study Methods:**

Rainfall simulation at rate of 5.5 inches per hour with runoff measured every 30 minutes.

### **Study Results:**

Of the 5.5 inches of water applied, 3.96 inches (72%) ran off.

## **TEXAS TECH RANGE HYDROLOGY STUDY DONE ON TEXAS TECH CAMPUS IN LUBBOCK:**

### **Site Characteristics:**

Moderate to dense mesquite canopy

Clay loam soil

### **Study Methods:**

Yearlong study in which evapotranspiration was measured

### **Study Results:**

23.6 inches of the 24 inches of rainfall that occurred during the growing season was transpired.

### **Conclusions:**

1. Herbaceous vegetation and shallow-rooted woody species use virtually all of the soil moisture in the root zone during the growing season.
2. The tap root of mesquite will use any deep water in the soil profile during the growing season.
3. The only water available for deep percolation is that which falls during the dormant season.
4. Less runoff occurs during the dormant season because storms tend to be frontal rather than convectional.

**RANGE HYDROLOGY STUDY IN LIVE OAK COUNTY, TEXAS:**

**Site Characteristics:**

Of the 28 inches of average annual precipitation, 23 inches (82%) falls during the growing season and 5 inches (18%) falls during the dormant season (December 6 - February 20).

**Study Methods:**

Yearlong study of runoff and transpiration

**Conclusions:**

Of the 23 inches that fall during the growing season:

90% runs off of bare ground regardless of woody canopy.

70% runs off of sparse vegetation with dense canopy.

40% off of moderate vegetation with moderate canopy.

20% runs off of good vegetation with no canopy.

Of the soil moisture that enters the soil profile during the growing season, virtually all of it is used for vegetative production where there is 20% or greater mesquite canopy.

None of the moisture is able to reach depths beyond the root zone to avoid consumptive use during the growing season.

All deep percolation and aquifer recharge comes from dormant season moisture. About 70-90% of the moisture that falls during the dormant season will percolate to underground reservoirs. The rest is lost through surface runoff, transpiration, etc.

**RANGE HYDROLOGY STUDY NEAR JOHNSON CITY, TEXAS:**

**Study Methods:**

Runoff was measured on rangeland with a medium-textured soil 24 hours after a low intensity rainfall event measuring 2 inches.

**Study Results:**

Bare Ground 0# vegetation	Poor Cover 1000# vegetation	Good Cover 5000# vegetation
75% runoff	45% runoff	0% runoff
25% infiltration	55% infiltration	100% infiltration

**RANGE HYDROLOGY STUDY NEAR MASON, TEXAS:**

**Study Methods:**

Yearlong study to determine infiltration, runoff, and evapotranspiration on a sandy loam soil with a 26-inch annual rainfall.

**Study Results:**

	Excellent Cover	Fair Cover
Total biomass	8508 pounds	3025 pounds
Runoff	3 in. (11%)	7 in. (27%)
Infiltration	8 in. (31%)	11 in. (42%)
Evapotranspiration	15 in. (58%)	8 in. (31%)

**RANGE HYDROLOGY STUDY NEAR SAN ANGELO, TEXAS:**

**Study Methods:**

Case study to determine the fate of a 4.5-inch rain that fell during a 2.6-hour period.

**Study Results:**

- On an area with 40% ground cover:  
Infiltration 4.1 inches (91%)
- On an area with 22% ground cover:  
Infiltration 2.6 inches (58%)

**RANGE HYDROLOGY STUDY NEAR ARDMORE, OKLAHOMA:**

**Study Methods:**

Rainfall simulation study during which a total of 4 inches of water was applied after one hour and 10 inches after two hours.

**Results:**

	Poor Vegetation 1750# - No canopy	Excellent Vegetation 5500# - No canopy
<u>Run Time (min.)</u>	<u>Infiltration (in.)</u>	<u>Infiltration (in.)</u>
15	1.2	2.0
30	.5	1.2
45	.6	1.0
60	.5	1.2
75	.4	1.3
90	.3	1.1
105	.3	1.2
120	.2	1.0
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	TOTAL 4.0	10.0

**Old studies by SCS in Western Gulf Region (Texas and Oklahoma)**

Good grass	5-7% runoff
Low Fair (forbs and annual grasses)	45% runoff
Poor cover (annual forbs)	60-65% runoff

<u>Vegetation</u>	<u>Infiltration</u>
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bare ground	.5 inches per hour
900 pounds	1.0 inches per hour
2100 pounds	8.3 inches per hour
5800 pounds	9.4 inches per hour