“Water conservation starts where the first rain drop falls”.

-President Lyndon B. Johnson
The Hydrologic Cycle

- Rain Clouds
- Precipitation
- Surface Runoff
- Infiltration
- Soil
- Deep Percolation
- Percolation
- Groundwater
- Ocean
- Cloud Formation
- Evaporation
- From vegetation
- Transpiration
- From soil
- From ocean

While falling from vegetation.
Lone Star Hydro – Il-logical Cycle

Panic → Rain → Apathy → Drought → Panic
Texas Population

- 1997 – 19 Million
- 2012 – 26 Million
- 36% increase
- 500,000/year
- 65% of increase occurred within Top Ten Populated Counties

Change in Total Population 1997-2012
26 Million People...

95% Privately-owned

171 million acres...

- Wildlife
- Minerals
- Air/Water
- Timber
- Recreation
- Range
TX Land Use*

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Million Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rangeland</td>
<td>96.1</td>
</tr>
<tr>
<td>Crops</td>
<td>25.6</td>
</tr>
<tr>
<td>Pasture</td>
<td>15.8</td>
</tr>
<tr>
<td>Forestland</td>
<td>10.6</td>
</tr>
<tr>
<td>Developed</td>
<td>9.7</td>
</tr>
<tr>
<td>Water</td>
<td>4.1</td>
</tr>
<tr>
<td>CRP</td>
<td>4.0</td>
</tr>
<tr>
<td>Federal</td>
<td>2.9</td>
</tr>
<tr>
<td>Other</td>
<td>2.3</td>
</tr>
<tr>
<td><strong>Total Area</strong></td>
<td><strong>171.1</strong></td>
</tr>
</tbody>
</table>

*2003 USDA-NRI*
What is Rangeland Health?

- Rangeland health as defined by the Society for Range Management is “the degree to which the integrity of the soil, vegetation, water and air, as well as the ecological processes of the rangeland ecosystem, are balanced and sustained.”
Why Rangelands are Important

- Produce/provide:
  - Forage for livestock
  - Wildlife habitat
  - Water
    » Quality
    » Quantity
  - Recreational opportunities
  - Energy
Texas Rangelands

- Usually managed for multiple uses
- Cannot maximize one product without detriment to others
Rain is Precious: Factors Affecting the Fate of Rainfall

Many factors determine what happens to the rainfall received. Some of the primary factors include:

- type, quantity, and density of vegetative cover;
- storm intensity and duration;
- soil moisture prior to the storm event;
- soil water holding capacity;
- and slope.

These factors affect how much evaporates, infiltrates, moves through vegetation, and the amount and velocity of overland flow which may erode the soil surface and enter the stream.
Unhealthy Watersheds?

Most streams and rivers in Texas have been adversely affected by past human activities resulting in:

- Increasingly damaging floods
- Lower base flows
- High sediment loads
- Reduced reservoir storage capacity
- Invasion of exotic species
- Loss of natural riparian habitats
- Degraded water quality
Bunchgrass

Surface Runoff
24% of Rainfall

Infiltration
75.5% of Rainfall

Soil Loss
0.09 tons/ac

Sodgrass

Surface Runoff
45% of Rainfall

Infiltration
54.6% of Rainfall

Soil Loss
0.62 tons/ac

Bareground

Surface Runoff
75% of Rainfall

Infiltration
25% of Rainfall

Soil Loss
2.67 tons/ac
Effect of percent bare ground on infiltration and sediment yield
Water Holding Capacity

Pounds H₂O in 100 Pounds Of Soil

Percent Organic Matter

1  2  3  4  5

33 lbs. H₂O
55 lbs. H₂O
100 lbs. H₂O
140 lbs. H₂O
195 lbs. H₂O
At Risk
Plant Vigor-Leaves and Roots

Caring for the Green Zone, Riparian Areas and Grazing Management
Alberta Riparian Habitat Management Project, “Cows and Fish Project”
### How Grazing Affects Root Growth

<table>
<thead>
<tr>
<th>Percent leaf volume removed:</th>
<th>Percent root growth stoppage:</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>20%</td>
<td>0%</td>
</tr>
<tr>
<td>30%</td>
<td>0%</td>
</tr>
<tr>
<td>40%</td>
<td>0%</td>
</tr>
<tr>
<td>50%</td>
<td>2-4%</td>
</tr>
<tr>
<td>60%</td>
<td>50%</td>
</tr>
<tr>
<td>70%</td>
<td>78%</td>
</tr>
<tr>
<td>80%</td>
<td>100%</td>
</tr>
<tr>
<td>90%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Grazing Management Involves a Number of Decisions:

- Kind of animals
- Number of animals
- Grazing system
Practices to obtain proper distribution include:

- Strategic placement of water
- Construction of fences
- Strategic location of salt and feeding sites
- Prescribed burning
- Spot seeding
## Water Placement

<table>
<thead>
<tr>
<th>Distance from water-miles</th>
<th>Percent Pasture Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-0.5</td>
<td>50</td>
</tr>
<tr>
<td>0.5-1</td>
<td>38</td>
</tr>
<tr>
<td>1-1.5</td>
<td>26</td>
</tr>
<tr>
<td>1.5-2</td>
<td>17</td>
</tr>
<tr>
<td>2-2.5</td>
<td>12</td>
</tr>
</tbody>
</table>
No grazing system can compensate for overgrazing!

You must re-evaluate during the year and adjust as necessary.
Healthy Rangeland

• High quality/quantity water source
• Forage for livestock production
• Wildlife habitat.

Unhealthy Rangeland

• Increased runoff with high nutrient and sediment content
• Decreased infiltration which is needed for the production of native plants required by livestock and wildlife.
Proper Management Decisions

With proper range management:

• you keep more water on your place
• grow more forage
• the water that does leave will be high quality
Creeks are also water shedding or water catching creek systems
Management Techniques to Alleviate Riparian Impacts

- Riparian pasture
- Timing, duration, intensity
  - Appropriate rest periods
- Low-stress herding
- Off-stream water, shade, supplements
- Alternative foraging locations
- Permanent or temporary exclusion
- Hardened crossings
Land Conservation as Water Strategy?

- Should we consider the value of land conservation and land stewardship as a viable, cost-effective water strategy?
- Strategy in State Water Plan?