Rangeland Hydrology and Management

The Rangeland System

Vegetation  Climate  Soil  Livestock

Interactions

Range Management

Means Matching the Available Water (Climate) to-

• Herd Size
• Vegetative Potential
• Soil Potential
All Rangeland receives enough water to support grazing, IF
  - Vegetation is healthy
  - Stream networks are stable
  - Grass, animals, and water distribution are in balance

Water Moves Through a Rangeland System
- Enters as Rain or Snow
- Is Captured by Soil/Grass
- Is Stored in Aquifers
- Moves downhill as Streamflow

Water's Entry Into the System in the Collection Zone
Water has a Choice
- Run off the Surface
- Infiltrate into the Soil
**Sedimentation**

- Fills Reservoirs
- Causes Streambanks to Erode
- Impacts Downstream Bridges, Roads

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**On Site Effects of Poor Vegetation in Collection and Transport Zones**

- Decreased Standard of Living
- Lower Production
- Decrease in Streambank Erosion
- Decreased Streambank Erosion
- Decreased Downstream Peak Discharges
- Force Water Into Groundwater Storage
- GROW MORE GRASS!

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**Improving Infiltration**

- Improve
  - Grass Cover
  - Rooting Depth
  - Decrease Soil Bulk Density
- Effects
  - Decrease Soil Erosion
  - Decrease Downstream Peak Discharges
  - Force Water Into Groundwater Storage
  - GROW MORE GRASS!
INfiltration

Healthy Grass = Healthy Soil = Healthy Infiltration = MORE MEAT
Reduced Flooding
Stronger Baseflows

Runoff

Precip.

Infiltration

Storage

Groundwater

Grazing – and Range Management

• Grazing and browsing are the process by which animals eat plants to acquire nutrients and energy
• Range management is the process by which people manage where, when and how often livestock graze.
• Over Half of Afghanistan is Rangeland
• Serious Problems Occur on These Rangelands Due to a Combination of Many Factors
  – Drought
  – Over grazing
  – Over harvesting of fuel
  – Soil erosion
  – Loss of productivity
  – Loss of biodiversity

Hillside Grass in good condition

• Grass rebuilds the soil
• Plants produce seeds that produces a new generation of grass
• Provides erosion control for the hillside
• Minimizes loss of water by runoff
• Maximizes water absorption
**Over Grazing – Eating all of the Plant**

- The plant does not have enough green leaves to feed itself
- The plant cannot produce enough leaves
- The plant cannot produce enough roots
- The plant cannot store food in its roots for winter and to survive drought
- Does not leave enough cover on the land to hold snow and rain and prevent soil erosion

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**Proper Grazing – Eating Half the Plant**

- The plant has enough green leaves to feed itself
- The plant can produce plenty of leaves
- The plant can produce plenty of roots
- The plant can store enough food in its roots for winter and to survive drought
- Will leave enough cover on the land to hold snow and rain and prevent soil erosion

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**Measuring Half the Plant**

- The grazing height will be different for different grass species
- Grass plants can tolerate 50% grazing by weight, every year, and remain healthy

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• If 50% of the leaves are removed, only a small amount of the root growth is stopped.

• If 60% of the leaves are removed, as much as 50% of the root growth is stopped.

When weeds replace hillside grass:
• Weeds produce significantly less pounds of feed than grass
• Weeds do not have as much protein as a grass
  • This means skinny sheep
• Weeds are a high fire hazard
• Runoff increases
  • Rain or snowmelt only wets the soil surface
  • Soil erosion is increased

When weeds replace hillside grass:
• Livestock do not like to eat weeds as much as grass
• Weed roots crowd out new grass plants
  • Recovery of the hillside grass takes much longer
To get the best production of hillside grass:

1. Delay initial grazing of the grass plants until June.
2. Keep early grazing periods short when the grasses are just starting to grow.
3. Eat half and leave half during each grazing period.

To get the best production of hillside grass:

- Allow 28-30 days between grazing periods
  - For leaf re-growth
  - Allows surplus plant food to be stored in the roots
- At the end of the grazing season:
  - Leave half of the growth to produce enough plant food to fill the roots before the plants go dormant
  - Leave enough residue on the plant to provide insulation from the cold winter temperatures

Training the herders

- Keep the vegetation on the slope
  - Control grazing
  - Move the herds as they graze the plants down
  - Keep them out of the riparian areas
- Train the herders
  - Not to allow the sheep and goats to take all the vegetation
  - Recognize areas not to graze
  - Provide water for herds to use as they move
    - Spring development
Training the herders

- Keep the vegetation on the slope
  - Take only 50% of the plants each year
  - Leave some grass on the hillside
  - Rotate time of use
    - In each pasture
    - Each year
    - Early grazing should only happen 1 out of 3–4 years in each pasture

Training the herders

- How to measure 50% of the plants each year?
  1. Find a sample grass plant that has not been grazed
  2. Take all the seed heads and leaves in hand

Training the herders

- How to measure 50% of the plants each year?
  3. Cut the grass bunch off at ground level
    - Include all the seed heads and leaves down to the ground
  4. Hold all the cut parts of the plant in your hand
Training the herders

• How to measure 50% of the plants each year?

5. Tie the bundle of seed heads and leaves together with a leaf or string
6. Place the tie in about the middle of the bundle where you think half is

Training the herders

• How to measure 50% of the plants each year?

7. Place the middle of the bundle on your outstretched finger
8. Attempt to balance the bundle on your finger
9. Move the bundle back and forth on your finger until it balances

Training the herders

• How to measure 50% of the plants each year?

10. Once the bundle balances on your finger, this is approximately the center of the plant mass
Training the Herders

12. Cut the bundle at the point of balance
13. The bundle base is about half of the whole plant

• How to measure 50% of the plants each year?

12. Measure the height of the cut base bundle
13. This is 50% of the grass plant that must be left

This is an easy way for the herder to determine the “eat half and leave half” in the field.

Aquifer Storage in Collection Zone

Occurs When Surface Runoff and/or Groundwater has –
• A place to be stored
• The OPPORTUNITY to go into storage
Storage Landscapes

Headwaters – Collection Zone

Floodplains – Transport Zone

Degraded Headwaters

• Loss of Aquifer Storage
• Loss of Grass Production
• Sends Sediment Downstream

Healthy Headwaters

• Stores Groundwater
• Releases Water Downstream SLOWLY
• Produces GRASS
Increasing Aquifer Storage in Collection And Transport Zone - Structures

Aquifer Storage Structures

Check Dams – Grade Stabilization Structures

What happens when a channel degrades?

Channel incision – Bank widening

Groundwater level drops – loss of valley aquifer storage
Channel Degradation Process

- Loss of Aquifer Storage
- Sediment Delivered Downstream

Channel Degradation Process

Headcut

Channel Incision – Loss of Aquifer Storage

Initial Groundwater Level

Resulting Groundwater Level

Floodplains in the Transition Zone

Endosaturated

Episaturated
Episaturated Floodplains

- Filled After Flood Recedes
- High Flow
- Floodwater
- Excavated Pond
- Low Flow

Endosaturated Floodplains

- High Flow
- Excavated Pond
- Low Flow

Questions?