Watershed Management ~ Fire and Grazing Effects

What is a Watershed?
- A surface water designation
- The area that flows into a distinct drainage (i.e., stream, river, creek, pond)
- Separated from other watersheds by ridge-top boundaries.

Watershed (Ecosystem) Services
- Regulation of climate
- Provision of shade and shelter
- Maintenance of soil
- Maintenance of healthy waterways
- Regulation of

Watershed Functions
- Hydrological Functions
  - Water __________
  - Water __________
  - Water __________
- Ecological Functions
  - Provide diverse sites for biogeochemical reactions
  - Provide habitat for plants and animals

How Does Grazing Affect Watershed Services and Functions?
1) ___________
   - ___________
     - ___________
     - ___________
   - ___________
2) ___________
   - ___________
   - ___________
3) ___________
   - ___________
   - ___________
4) ___________
   - ___________
   - ___________

Water is classified as:
- Surface water or overland flow - in a watershed context
- Underground water - rangeland focus is on aquifers & recharge zones
Water Capture

- **Precipitation** - Accumulation of water vapor forming rain drops, snow, or hail.

- **Interception** - Precipitation that strikes objects such as vegetation, litter, or rocks and may eventually enter soil... but not necessarily.

- **Infiltration** – water moving into the soil

- **Percolation** – water moving through the soil

Capture is dependent on:

- Vegetation
- Soil
- Landcover
- Storm intensity

**Infiltration**

**Infiltration rate**

![Graph showing infiltration rate over time for different types of grasses]
Depends on soil structure
- **Aggregation** =
- **Porosity** =

**Effect of Vegetation on Water Transit**
- **Litter accumulation** =

- **Biomass differences** =
- **Soil organic matter** = increases water holding capacity of soil and increases infiltration

Fire affects vegetation and therefore affects runoff

**Water Storage**
- **Surface Detention** – Water held in micro-relief formed by topography, vegetation growth, and accumulated litter. Is affected by micro-relief, slope, soil texture, soil structure, and soil depth.
- **Water Table** – Upper surface of the ground water (saturated zone) can be above the ground surface (e.g., streams, ponds, lakes).
- **Aquifer** – Large volume of water underground on the top of an impermeable layer of soil or bedrock
- **Recharge** – Water added to the water table or aquifer
- **Constructed water storage** – Reservoirs

**Water Release**

**Runoff**
- **Surface runoff** =
- **Interflow** = water below the surfacing moving horizontally. Can create springs and seeps.

**Water Release**

- **Evapotranspiration** =
- **Transpiration** =
- **Evaporation** =

Vegetation tends to reduce evaporation through shade and reduce wind at soil surface. However, loss from evaporation on leaves often outweighs reduced evaporation from shade and reduced wind.

- **Deep Drainage** – loss of water below the root zone
  - Low bulk density because of trampling can decrease deep drainage
  - Any factor that decreases infiltration will likely decrease deep drainage
Impacts on Runoff and Infiltration
- Water Inflow = generally little affect of grazing management on precipitation patterns
  - Overgrazing could ____ biomass & litter ____ albedo ____ convection precipitation events
  - Overgrazing could ____ air-borne bacteria ____ water droplet formation ____ precipitation

Interception
- Grasses = 10-20% interception
- Deciduous trees & shrubs = 25-50% interception (when leaves are on)
- Evergreen trees = 50 - 100% (for example essentially no rain may hit the ground under a full juniper tree.

Fire and Grazing at the Watershed Level
- Wildfires – Must Consider
  - Appropriate rest period following fire
  - Invasive plants – livestock can both control or introduce them
  - Seed bed preparation – hoof action can break up hydrophobic soils
  - Erosion potential is high following fire
- Prescribed Burning

Infiltration
Depends on the grazing effect on:
- 
- 
- Standing crop/litter biomass

Trampling Effects
“Herd Effect” or “Hoof Action”
- Compacts soil and break up soil aggregation at surface
- Effect depends on soil type, grazing intensity, climatic condition, etc.

Disturbs cryptogamic crust on soil =
  - Can increase infiltration in some area
  - But, usually decreases infiltration and increases erosion.

May enhance seed germination = Incorporates seeds into soil

Surface Detention Effect - Depends on grazing intensity & soil moisture:
- Can ____ surface detention and micro-relief at moderate grazing intensities
- At very heavy intensities on dry soils trampling can ____ micro-relief

Vegetation Impacts
- Decreased cover = ____ interception and ____ droplet impact
- Decreased above-ground biomass = ____ soil organic matter ... ____ soil aggregation
- Decreased below-ground biomass = ____ soil aggregation ... ____ percolation
- Type conversion from herbaceous to woody = affects interception & infiltration

Effect of Stocking Rate
- Effect depends on veg. type -
- Ungrazed areas generally have higher infiltration rages than grazed plots
- Moderate and light grazing intensities have similar infiltration rates
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Human Needs, Desires, and Influences
- Clean water supply
- Food
- Recreation
- Wildlife viewing
- Flood protection
- Others

Conclusions
- What happens at the top of the watershed affects the bottom of the watershed
- Many ecosystem functions and services are provided by watersheds
- Proper grazing management is critical to maintain these functions and services
  - Interception
  - Infiltration
  - Recharge
- The watershed is a complicated area with many interactions.