**Objectives**

1) To estimate the components of overland flow shear stress on disturbed and undisturbed rangelands by applying the Darcy-Weisbach friction partitioning method to field collected experimental data.

2) To investigate the vegetation cover limit at which the soil shear component is substantially reduced, limiting the erosion rate.

**Study Areas**

![Central Site (unvegetated)](image1)

- Burn Site
- Unvegetated Site
- Cut Site

**Methods**

1. Average slope, ground cover, vegetation cover, and microtopography were measured for each plot (All plots are 2x4 m).

2. All plots were pre-net prior to experiments.

3. Water was released at different inflow rates approximately 4 m above of runoff collection point.

4. Each inflow rate, flow velocity was measured by salt tracer method while the width and depth of each flow path were measured by ruler at several transects.

5. Total outflow discharge rate was determined from timed runoff samples collected during simulations.

6. Total flow discharge was proportionally distributed to the flow paths.

**Concentrated versus Sheet Flow**

\[ R_c = \frac{\text{depth of flow} \times \text{width of flow}}{\text{the hydraulic radius of flow}} \]

**Empirical Hydraulic Friction Equations**

Flow

\[ f_i = \frac{10^{R_i^2} - 1}{10^{R_i^2}} \]

Concentrated

\[ 10^{R_i^2} = \frac{f_i}{f_{c,0.52}} \]

Sheet

\[ 10^{R_i^2} = \frac{f_i}{f_{s,0.52}} \]

where:

- \( f_i \): the specific weight of water (N m^-1 s^-1)
- \( R_i \): the hydraulic radius of the plot
- \( f_{c,0.52} \): the hydraulic friction factor of the unvegetated surface
- \( f_{s,0.52} \): the hydraulic friction factor of the vegetated surface

**Shear Stress Partitioning Equations**

Empirical equations that predict the ratio of soil shear stress to the total shear stress.

\[ \tau_{soil} = \frac{K}{\tau_s} \]

where:

- \( \tau_{soil} \): shear stress on soil
- \( \tau_s \): shear stress on the total ground area
- \( K \): soil shear reduction by vegetation cover

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