Sustainability OF Rangelands Using the ARES Database and RHEM Erosion Model for International Agricultural Systems

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INTRODUCTION

Global agricultural productivity is threatened by loss of topsoil associated with land management practices. USDA-ARS and its partners are developing the ARES database and the RHEM model to improve estimates of rangeland runoff and soil erosion as an index of soil health and sustainability. These tools can be used as part of a process for estimating the impact of management decisions and natural disasters on sustainability of livestock based agricultural systems and food security in arid and semi-arid rangelands.

Agricultural, Runoff, Erosion, and Salinity (ARES) Database

- A rainfall simulation database is under development to provide model inputs and validate outputs to assess soil health and sustainability of site-based erosion rates.

- Contains four decades of historical data with over 50 plant communities and 1,000 rainfall runoff and soil erosion events. Plant communities include aridlands, grasslands, sagebrush steppe, woodlands, and riparian areas.

- Data is derived from the Swanson rotating boom simulator (3 m x 10.7 m) and the Walnut Gulch simulator (2 m x 6 m) to capture rangeland hydrologic processes as a function of plant species and spatial variability.

- The ARES data is rigorously screened and organized into a relational database schema that is being vetted by government agencies and university collaborators

- ARES is continuously adding new plant communities and rainfall runoff and erosion data.

Walnut Gulch Simulator

Swanson Rotating Boom Simulator

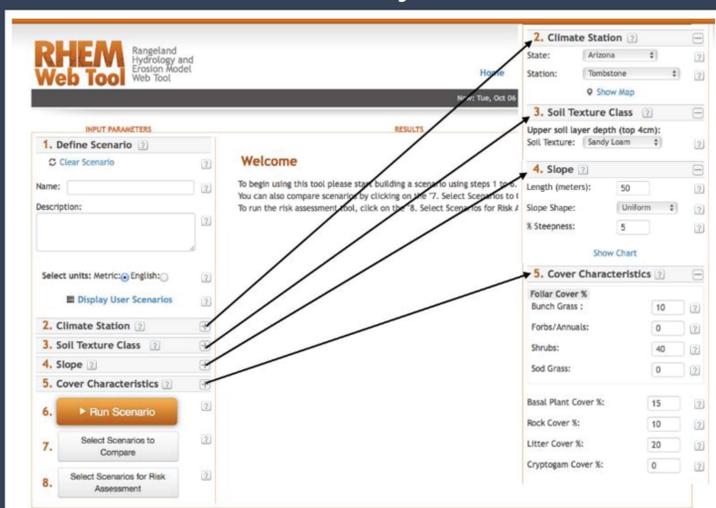## Rangeland Hydrology and Erosion Model (RHEM)

- Designed for government agencies, land managers and conservationists using science-based technology to predict hillslope runoff and erosion rates to assess the effects of conservation practices.

- RHEM estimates sediment rate and volume at the spatial and temporal scales of a single rainfall event.

- RHEM is designed to be used as a runoff and erosion calculator or an engine within other models that work at larger scales, such as the KINEROS2, APEX or SWAT watershed models.

- RHEM development is creating new methods to estimate runoff and soil erosion post wildfire and total dissolved solids in runoff solution

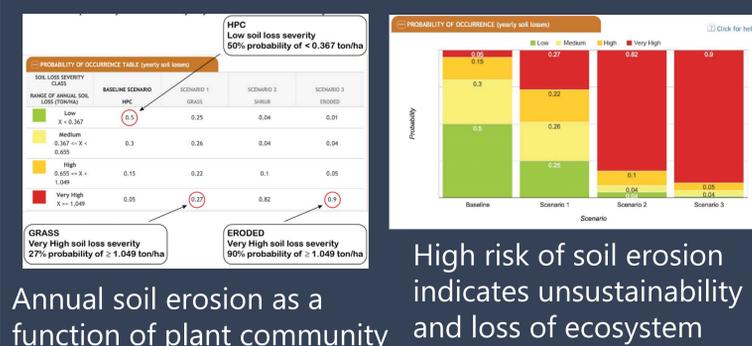## Integrating the ARES and RHEM Projects

- Operational ARES database will be hosted through the USDA National Agricultural Library and will support the Long-Term Agroecosystem Research program.

- Where site-specific data is limited, the ARES database can parameterize RHEM by correlating similar ecological sites in the database to local conditions.

- The ARES and RHEM projects are working to expand the network of international collaborators to address global needs.

- These integrated projects will help managers to assess the sustainability of livestock agricultural systems and the long-term productivity of rangelands.

Rangeland Hydrology and Erosion Model (RHEM) Web Tool

RHEM Web-based System Schematic

Risk Assessment Tool

Annual soil erosion as a function of plant community

High risk of soil erosion indicates unsustainability and loss of ecosystem

A web-based interface to parameterize models: http://apps.tucson.ars.ag.gov/rhem/

Scenario Comparison Tool

Annual soil erosion as a function of plant community