Water Needs for GDEs

Soldier Meadows © *David Page/Desert Research Institute.*

Quantifying vegetation use of and dependence on groundwater

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Background: This project will address the need to understand and quantify uses of groundwater by groundwater dependent ecosystems (GDEs) in Nevada and surrounding areas. The amount of groundwater required to sustain ecological functions of GDEs is a key uncertainty in water supply availability and reliability and an important component when considering sustainable water supplies for people and nature. With increased stress on groundwater supplies, having better information for water and resource managers on how much water can be used while maintaining important ecosystem functions that benefit both people and wildlife is a critical need.

Project Description: This three-year project (Oct. 2020 - Sept. 2023) will combine field observations, satellite remote sensing data, hydrologic modeling, statistical modeling, and state-and-transition simulation modeling to fill a gap in understanding of process-based connections between groundwater availability and ecosystem response, with the goal of using this information to support water management decision-making. The proposed project will generate estimates of groundwater requirements of GDEs, including both the amount of groundwater used by vegetation and sensitivities of vegetation to changing groundwater availability across gradients of climate, soils, and different types of GDEs (e.g., mesic meadow vs. xeric shrubland) in watersheds contributing to Nevada and the Great Basin. Results will be translated into a publicly available, quantitative, predictive, and easy-to-use framework called the Groundwater Requirements for GDEs framework. The framework will be used to generate timely, transparent, and scientifically defensible estimates of groundwater requirements to sustain GDEs and the services they provide based on GDE type, climate, soils, and groundwater availability. We will demonstrate the framework's utility by using it to identify regions in the study area with greater GDE sensitivities to changing groundwater availability.

Implications of the work: This project will provide information about sustaining ecosystem services GDEs provide for watershed health and water security for people, plants and wildlife. This information may help managers make decisions to address competing demands for water, water scarcity with drought, water conflicts and other water management issues.

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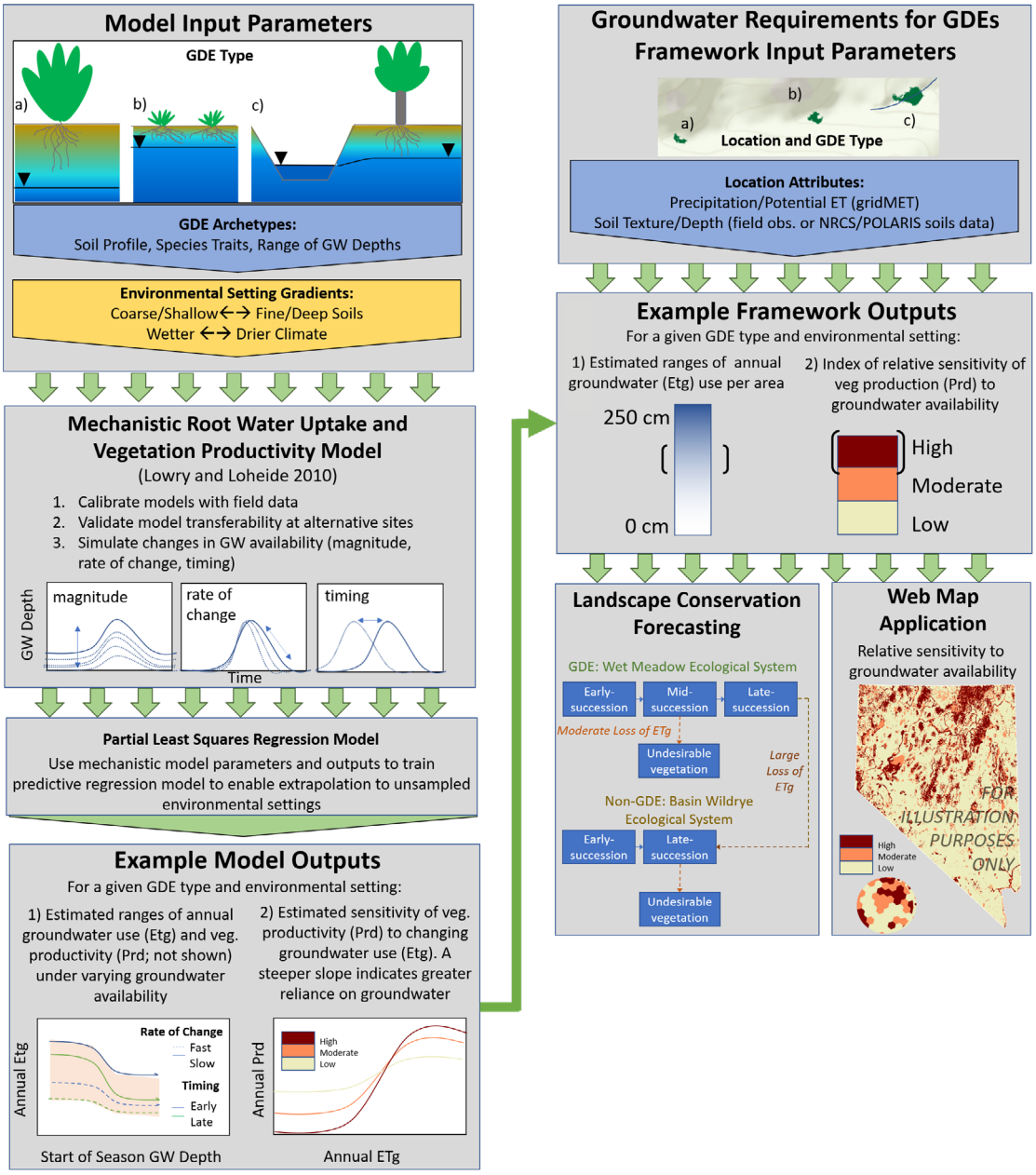
Soldier Meadows © *David Page/Desert Research Institute;* Aspen woodland phreatophyte community in Lamoille Canyon © *Simon Williams;* Spring at Torrance Ranch Preserve © *Simon Williams.*



Conceptual overview of modeling workflow design (left), and application of the Groundwater Requirements for GDEs framework (right). Mechanistic root water uptake and vegetation productivity models will be developed for 3-5 GDE archetypes, following the methods of Lowry and Loheide (2010; Water Resour. Res., 46, W06202). Model outputs will be used in the framework to provide estimated ranges of groundwater use (ETg), vegetation productivity (Prd) and vegetation sensitivity for a given GDE type based on climate and soils at its location. Framework applications include providing parameter estimates for model forecasts of long-term vegetation change in response to changing groundwater availability and an interactive web map application of spatially explicit estimates of groundwater use and sensitivity.