STRATEGY 1

Increase understanding of co-benefits of healthy and restored GDEs, including carbon dynamics

Why this strategy is needed

In addition to being valuable to plants and wildlife in Nevada, GDEs are important resources for human uses, including drinking water, agriculture, water quality improvements, and recreation (Brown et al. 2011; Saito et al. 2020). Quantification of co-benefits of healthy GDEs can be valuable for effective management, as well as for funding restoration and management efforts. For example, an area where very little data exist is carbon dynamics in relation to water availability and GDEs. The Nevada Division of Environmental Protection (NDEP) prepares an annual report on greenhouse gas emissions in Nevada, but only includes forests for natural area carbon sequestration. In arid and semi-arid regions like Nevada, GDEs like springs, wetlands, wet meadows, and riparian areas may have a disproportionately large carbon sequestration role compared to the rest of the landscape, and probably also compared to forests per unit area (Reed et al. 2021). Research in Sierra meadows and Central Nevada riparian ecosystems has indicated that healthy and restored areas can significantly enhance carbon sink potential (Morra et al. 2023; Reed et al. 2021). Restoration and conservation of GDEs may be important opportunities for nature-based solutions with co-benefits for carbon dynamics, water security, and critical habitat for plants and wildlife, but more data and analysis are needed at different GDE types across Nevada.

Examples of actions associated with this strategy

- Gather and analyze data on carbon dynamics in GDEs in Nevada
- Develop models and framework tools to estimate co-benefits
- Quantify ecosystem services of GDEs
- Project novel ecosystem states[3] for GDEs to understand effective management options

Challenges and considerations

Actions associated with this strategy alone will not have much impact, but they can be used to support management activities, policies, or increased funding to implement actions based on this science. The need to pair science with other management activities through this strategy may enable more partnerships between researchers and land stewards. Also, education can contribute to modified behavior. Studies to implement this strategy will likely require considerable funding and time (e.g., understanding carbon benefits in GDEs may require $0.5-1M over 3-5 years) and the translation of study results to action will be needed. Importantly, there may be pushback specifically on natural climate solutions if they are perceived to enable continued polluting operations.

Qualitative assessment of the effectiveness of Strategy 1's ability to reduce the impacts of each GDE stressor and threat.

STRESSOR RISK	EFFECTIVENESS
S1: Groundwater pumping status	*Somewhat Likely*
S2: Declining groundwater level trends	*Somewhat Likely*
S3: Current climate	
S4: Ungulate impacts	*Somewhat Likely*
S5: Non-native species presence	*Somewhat Likely*
S6: Surface diversions	*Somewhat Likely*
S7: Urbanization	
THREAT RISK	**EFFECTIVENESS**
T1: Appropriation status	*Somewhat Likely*
T2: Potential withdrawal proximity to GDEs	*Somewhat Likely*
T3: Future climate	*Somewhat Likely*
T4: Non-native species spread	*Somewhat Likely*
T5: Future urbanization	*Somewhat Likely*

3. Novel ecosystems are ecosystems that have transitioned to an entirely new state with new species combinations and changes in ecosystem functions because of human actions (Hobbs et al. 2006; Seastedt et al. 2008). For example, changes in climate may shift species distributions as new ecosystems are created and historic ecosystems disappear, requiring changes in conservation objectives (Pecl et al. 2017).