

Sierra Valley GSP Groundwater Dependent Ecosystems

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Outline

- What are GDEs
- Approach to mapping GDEs
- Preliminary GDE map
- Sensitive Species
- Assessing GDE change

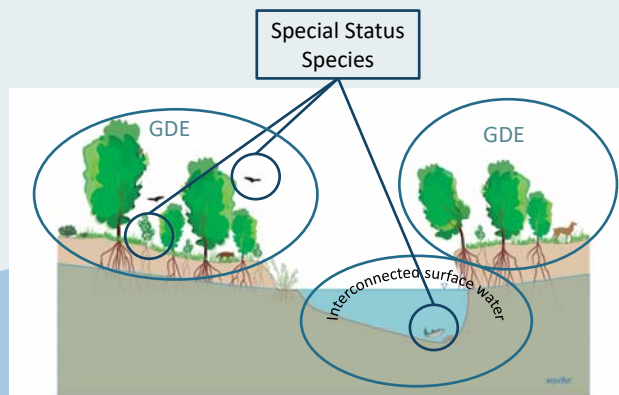


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Groundwater Dependent Ecosystems (GDEs)

DWR defines GDEs as ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface for some of their water needs.

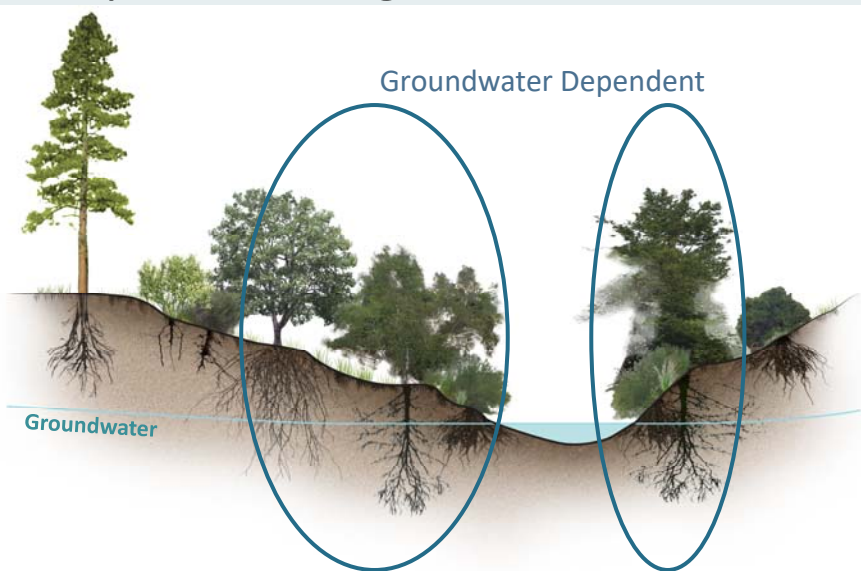
GDEs occur in a variety of different environments ranging from seeps and springs, to groundwater-dependent wetlands, to aquatic and riparian ecosystems associated with rivers that partially or entirely rely on groundwater.



Braudrick et al., 2018 (figure by K. Rodriguez and A. Merrill)

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GDE Mapping: Where is the groundwater dependent vegetation in Sierra Valley



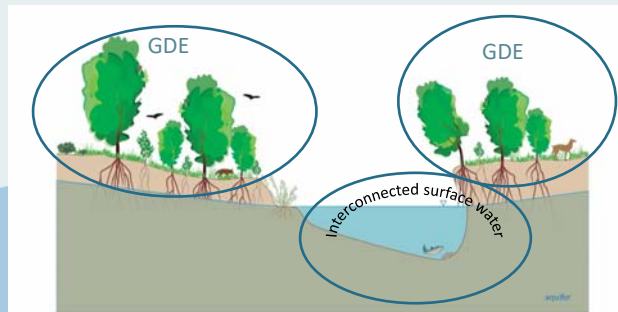
Based on species present plant communities can be:

1. Dependent on groundwater
2. Potentially dependent on groundwater
3. Not dependent on groundwater

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Part 1. GDE Mapping

1. What plants occur in Sierra Valley Groundwater Basin?
2. Are the plant species likely to be connected to groundwater?
 - How deep are their roots?
 - How deep is the groundwater?
3. What is the extent of interconnected surface water?



Braudrick et al., 2018 (figure by K. Rodriguez and A. Merrill)

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Mapping Approach

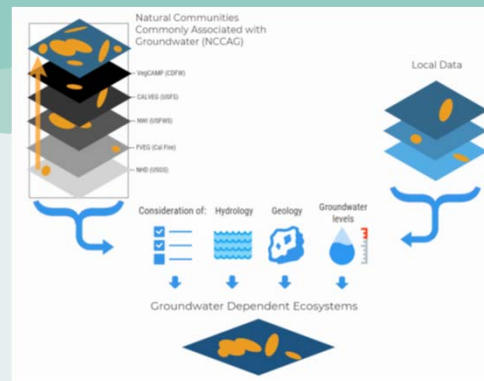
1. Overlay statewide vegetation maps (VEGCAMP, CalVeg, National Wetland Inventory, FRAP) based on map quality and age
2. Assess **potential GDEs** based on mapped vegetation type (e.g., phreatophytes)
3. Add local vegetation data not in DWR database and assess **potential GDEs** based on mapped vegetation type (e.g., phreatophytes)
4. Assess groundwater dependence of Potential GDEs based on:
 - Species present
 - Measurements of depth to groundwater (if known)
 - Local geology, presence of springs, seeps
5. Create a single map of GDEs
6. Identify GDE units based on common hydrology



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Mapping GDEs in Sierra Valley

1. Groundwater data are relatively sparse, particularly near potential GDEs
2. Vegetation maps are somewhat old (CalVeg from 2000 and NWI from 1984). A new vegetation map was being prepared but is currently on hold and won't be available until at least the 5-year update.
3. We defined potential GDEs as potentially groundwater dependent plants or wetland units where groundwater was within 30 ft of the ground surface or are along interconnected surface waters.



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Mapping Approach

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2. Assess **potential GDEs** based on mapped vegetation type (e.g., phreatophytes)
3. Add local vegetation data not in DWR database and assess **potential GDEs** based on mapped vegetation type (e.g., phreatophytes)
4. Assess groundwater dependence of Potential GDEs based on:
 - Species present
 - Measurements of depth to groundwater (if known)
 - Local geology, presence of springs, seeps
5. Incorporate interconnected surface water (Balance Hydrologics)
6. Create a single map of GDEs
7. Identify GDE units based on common hydrology

We used 1980 National Wetland Inventory, with 2000 Calveg

Used GDE definitions from Klausmeyer et al. (2018) coupled with aerial photos

New map not yet available may be available by the 5-year update

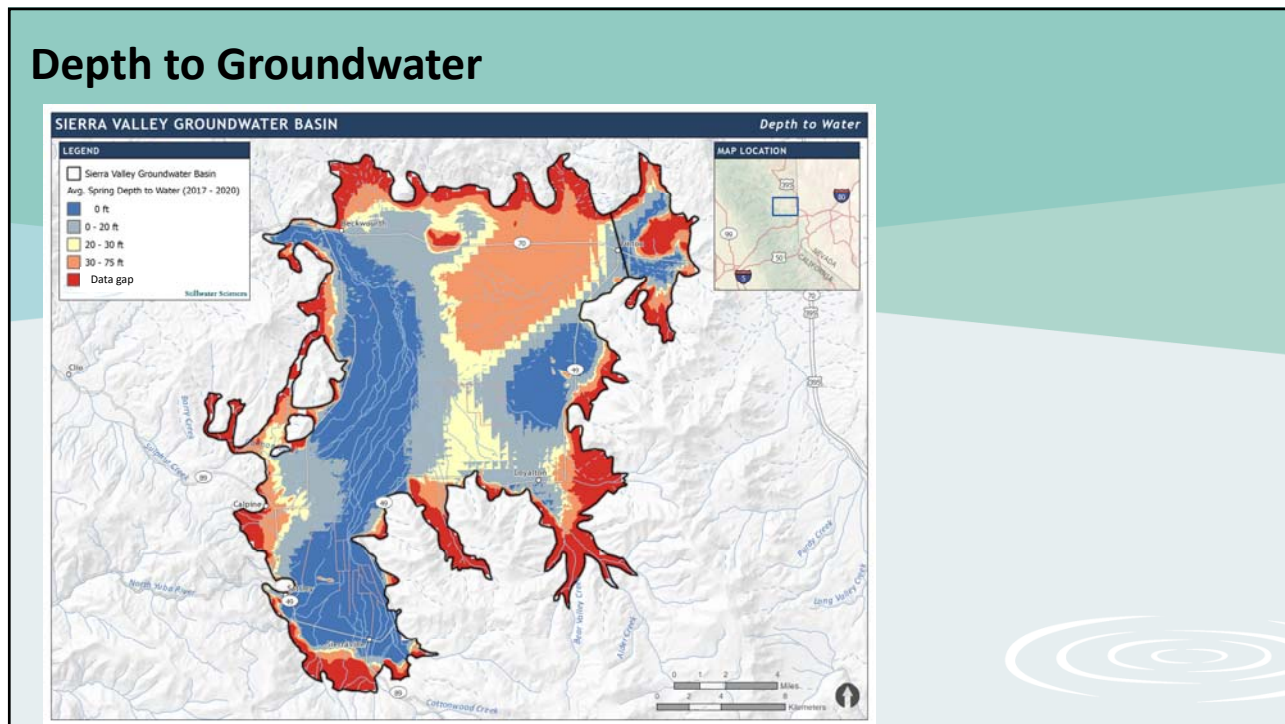
Used 2017-2020 average spring conditions for groundwater depth

To be completed once both maps are finalized

To be determined

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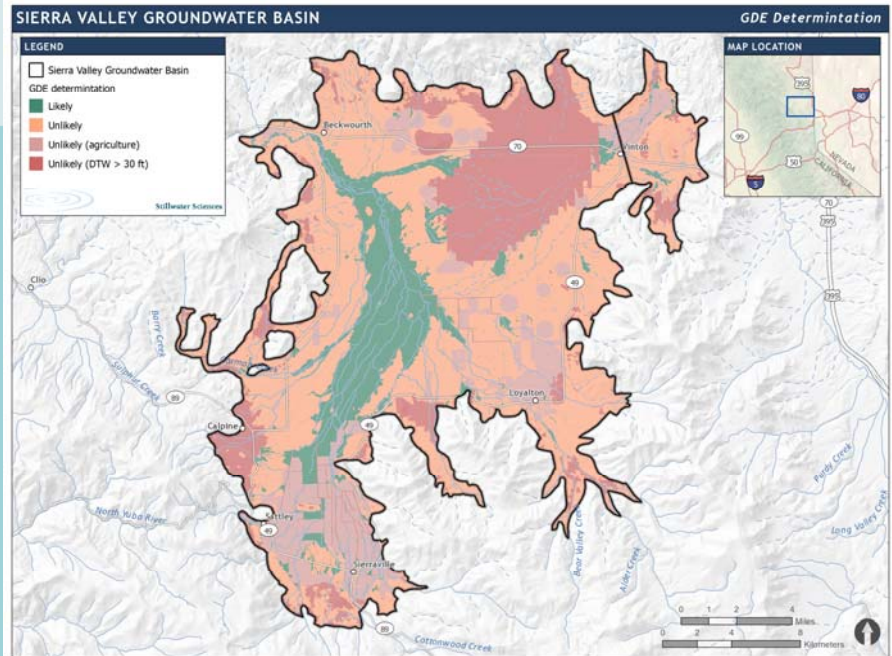
Depth to Groundwater



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Potential GDEs (Draft)

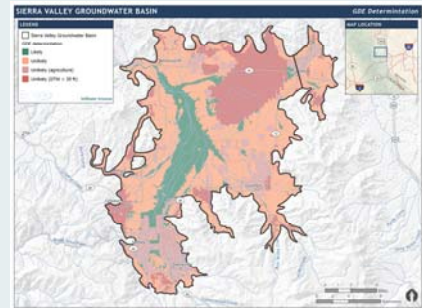
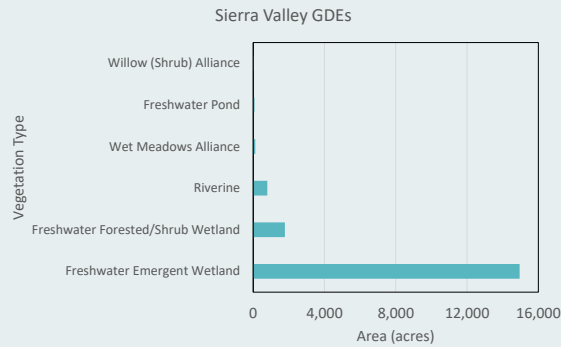
- There are 17,784 acres of likely GDEs in Sierra Valley
- Most of the GDEs include the wetlands in the eastern half of the basin
- Need to update GDEs on the basin margin
- GDE mapping is limited by relatively low- quality vegetation mapping



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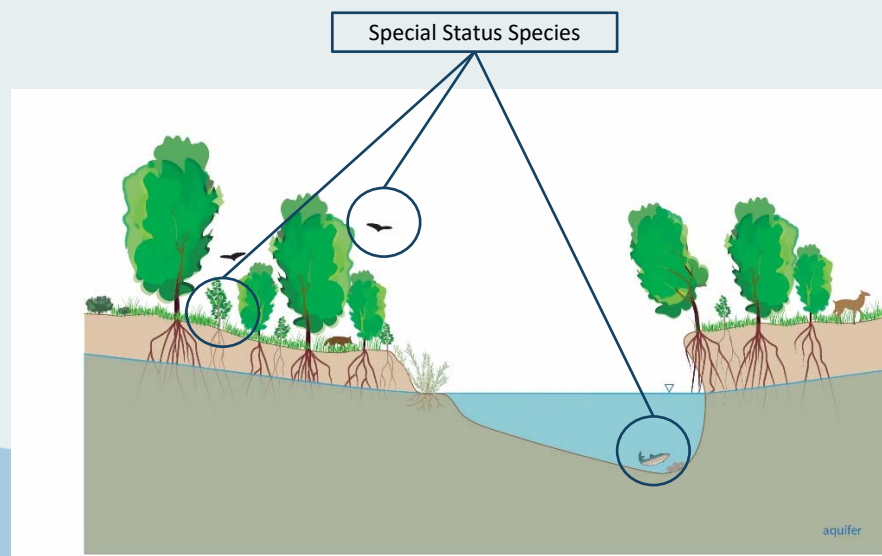
Potential GDEs

- GDEs include
- Most of the GDEs include the wetlands in the eastern half of the basin
- GDE mapping is limited by relatively low-quality vegetation mapping



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Part 2: Sensitive Species: Who are the beneficial users of groundwater and interconnected surface water?

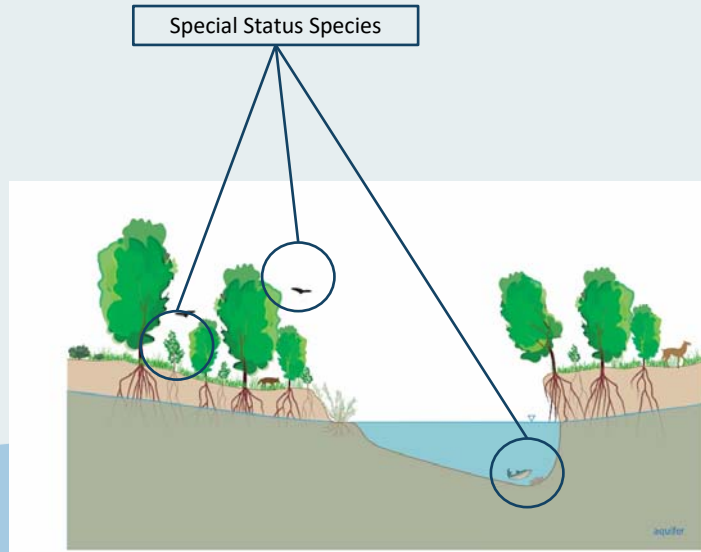


Braudrick et al., 2018 (figure by K. Rodriguez and A. Merrill)

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Part 2: Sensitive Species: Methods

1. Query CNDDDB and Freshwater Species Database within the Sierra Valley Basin plus a 1-mile buffer
2. Assess groundwater dependence of the special status species based on their habitat requirements



Braudrick et al., 2018 (figure by K. Rodriguez and A. Merrill)

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Who are the likely special-status users of GDEs?



Photo by Andrew Wright/Lighthawkphoto

Type	Number of species
Plants	6
Sensitive Natural Communities	1
Invertebrates	1
Amphibians	4
Birds	13
Mammals	5
Mollusks	2
Total	32

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What Groundwater Dependent Special Status Wildlife Species are Present? (Draft)

Invertebrates		Birds		Mammals	
Western bumble bee	Bombus occidentalis	American white pelican	Pelecanus erythrorhynchos	Fringed myotis	Myotis thysanodes
Amphibians		Bald eagle	Haliaeetus leucocephalus	long-eared myotis	Myotis volans
Foothill yellow-legged frog	Rana boylei	Bank swallow	Riparia riparia	Sierra Nevada red fox	Vulpes vulpes necator
Northern leopard frog	Lithobates pipiens	Black tern	Chlidonias niger	Spotted bat	Euderma maculatum
Southern long-toed salamander	Ambystoma macrodactylum sigillatum	Canvasback	Aythya valisineria	Yuma myotis	Myotis yumanensis
Sierra Nevada yellow-legged frog	Rana sierrae	Greater sandhill crane	Antigone canadensis tabida	Mollusk	
		Redhead	Aythya americana	Western pearlshell	Margaritifera falcata
		Swainson's hawk	Buteo swainsoni	Western ridged mussel	Gonidea angulata
		Tricolored blackbird	Agelaius tricolor		
		Western least bittern	Ixobrychus exilis hesperis		
		Willow flycatcher	Empidonax traillii		
		Yellow rail	Coturnicops noveboracensis		
		Yellow-headed blackbird	Xanthocephalus xanthocephalus		




Photo by Andrew Wright/Lighthawkphoto

Data sources:
California Freshwater Species Database (TNC 2021)
California Natural Diversity Database (CDFW 2020)

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What Special Status plant Species are Present are likely or possibly groundwater dependent? (Draft)

Plant	GDE Likelihood	Plant	GDE Likelihood
Lemmon's milk-vetch <i>Astragalus lemmonii</i>	Likely	Santa Lucia dwarf rush <i>Juncus luciensis</i>	Likely
Scalloped moonwort <i>Botrychium crenulatum</i>	Likely	Seep kobresia <i>Kobresia myosuroides</i>	Possible
Mingan moonwort <i>Botrychium minganense</i>	Likely	Modoc County knotweed <i>Polygonum polygaloides ssp. esotericum</i>	Possible
Sensitive Natural Communities		Sticky pyrrocoma <i>Pyrrocoma lucida</i>	Possible
Montane Freshwater Marsh		Montane Freshwater Marsh	Likely




Photo by Andrew Wright/Lighthawkphoto

Data sources:
California Natural Diversity Database (CDFW 2020)

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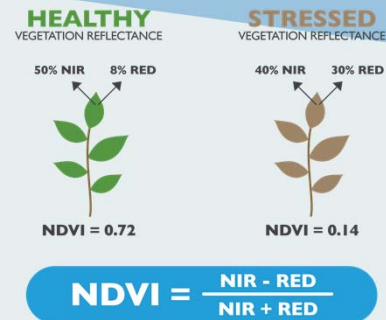
Tracking GDE Health

NDVI

Normalized Differential Vegetation Index

How green are the plants?

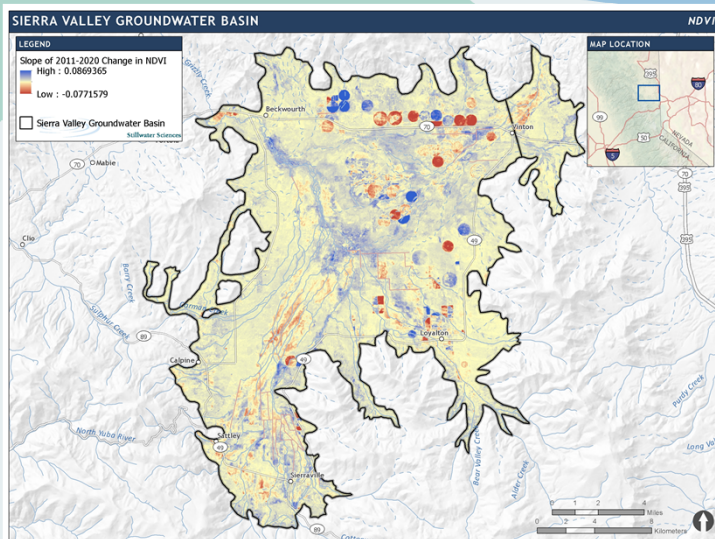
- ❖ Increases in NDVI correspond to higher plant density and leaf area



Source: <https://www.agricolus.com/en/indici-vegetazione-ndvi-ndmi-istruzioni-luso/>

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Tracking GDE health: NDVI change from 2011-2020



Preliminary data for illustrative purposes only

- Summer (July-September) NDVI from Landsat imagery
- 30-m resolution
- Data Processed in Google Earth Engine

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Summary

- Vegetation mapping is fair quality, a new map might be available by the 5-year update
- There are over 17,000 acres
- GDEs are concentrated in the western half of the basin
- There are 56 sensitive species in the basin, we are currently determining their groundwater dependence
- Remote sensing data can be used to assess changes in GDE health

