Columbia Basin Groundwater Overview

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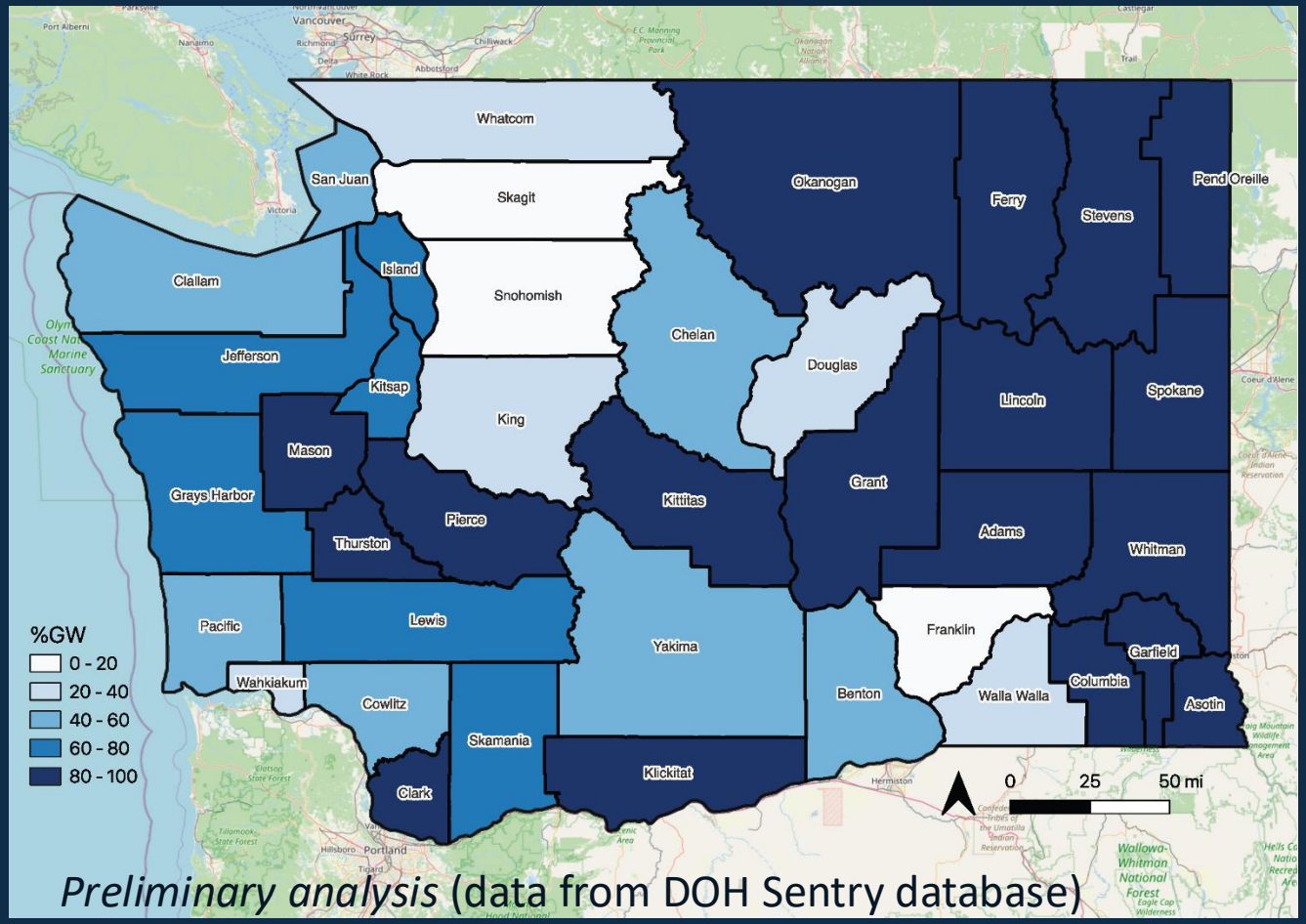
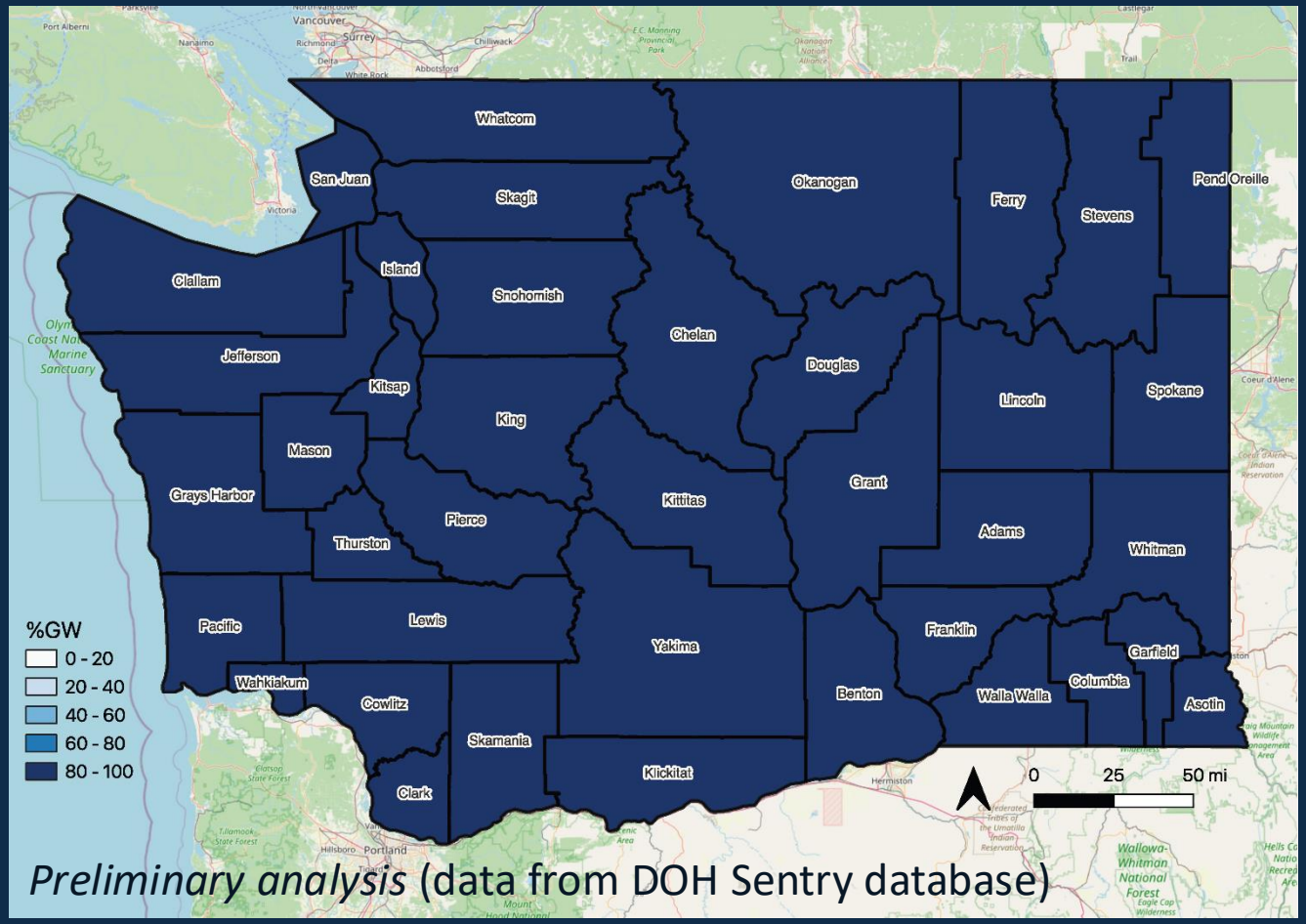
Photo taken on site with Patrick Cabbage

Municipal dependence of groundwater across Washington: Group A+B systems



- % of population on a groundwater source
- Group A (≥15 connections for ≥ 180 days/year or ≥25 people per day) and B systems
- “Permanent,” “Active”

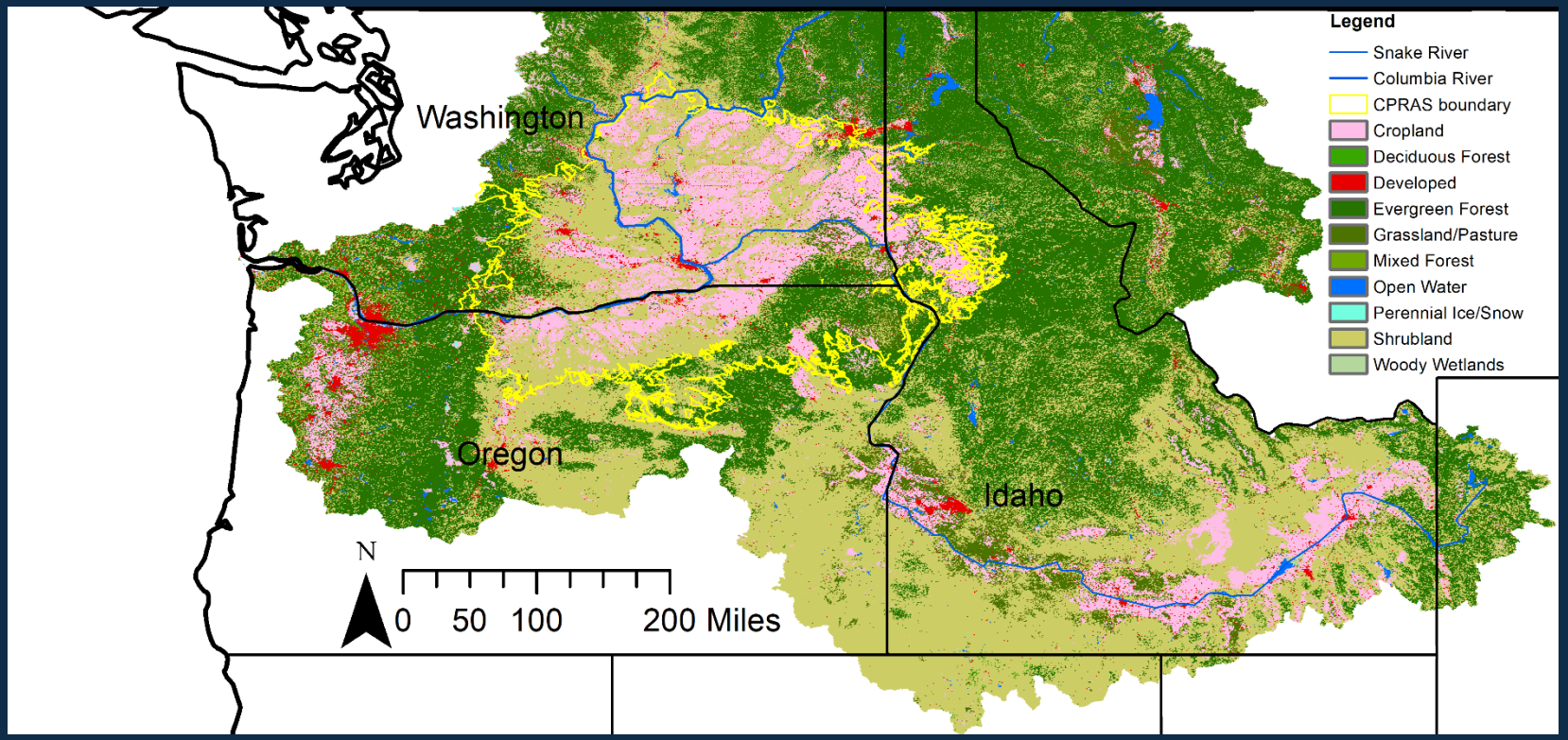
Municipal dependence of groundwater across Washington: Group B systems



- % of population on a groundwater source
- Group B water systems (<15 connections and <25 people per day)
- “Permanent,” “Active”

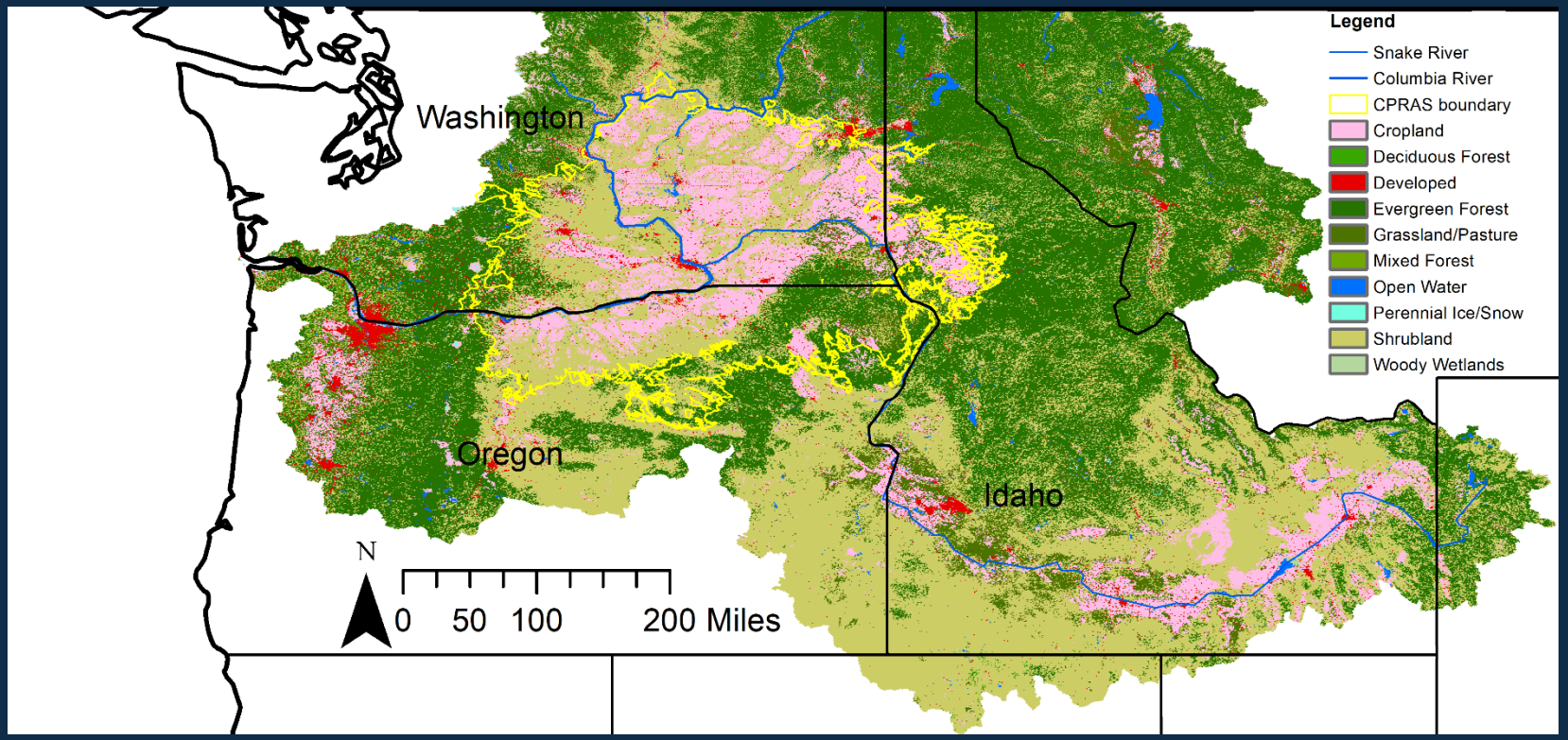
Columbia Plateau Regional Aquifer System

- 26% irrigation water use from CPRAS in 1985-2007 [Vaccaro et al., 2015]



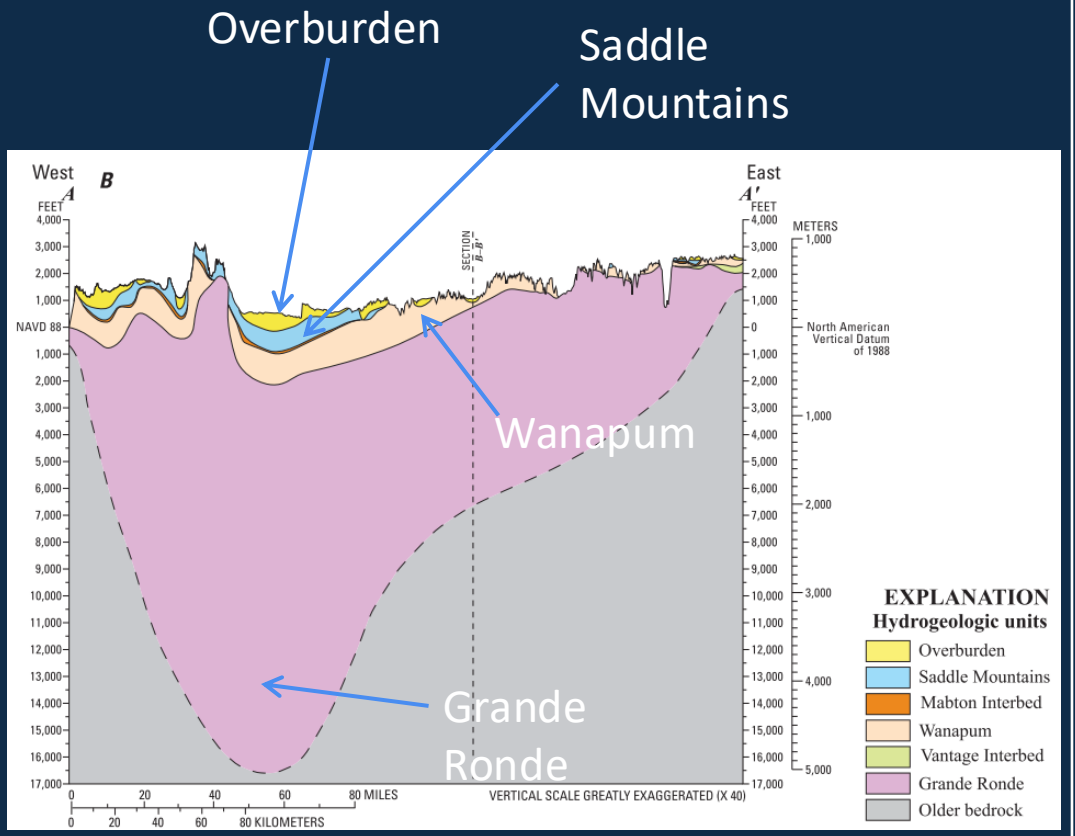
Goal

- What are the historical trends and future vulnerabilities in the CPRAS? Do they vary by aquifer layer?



Primary layers

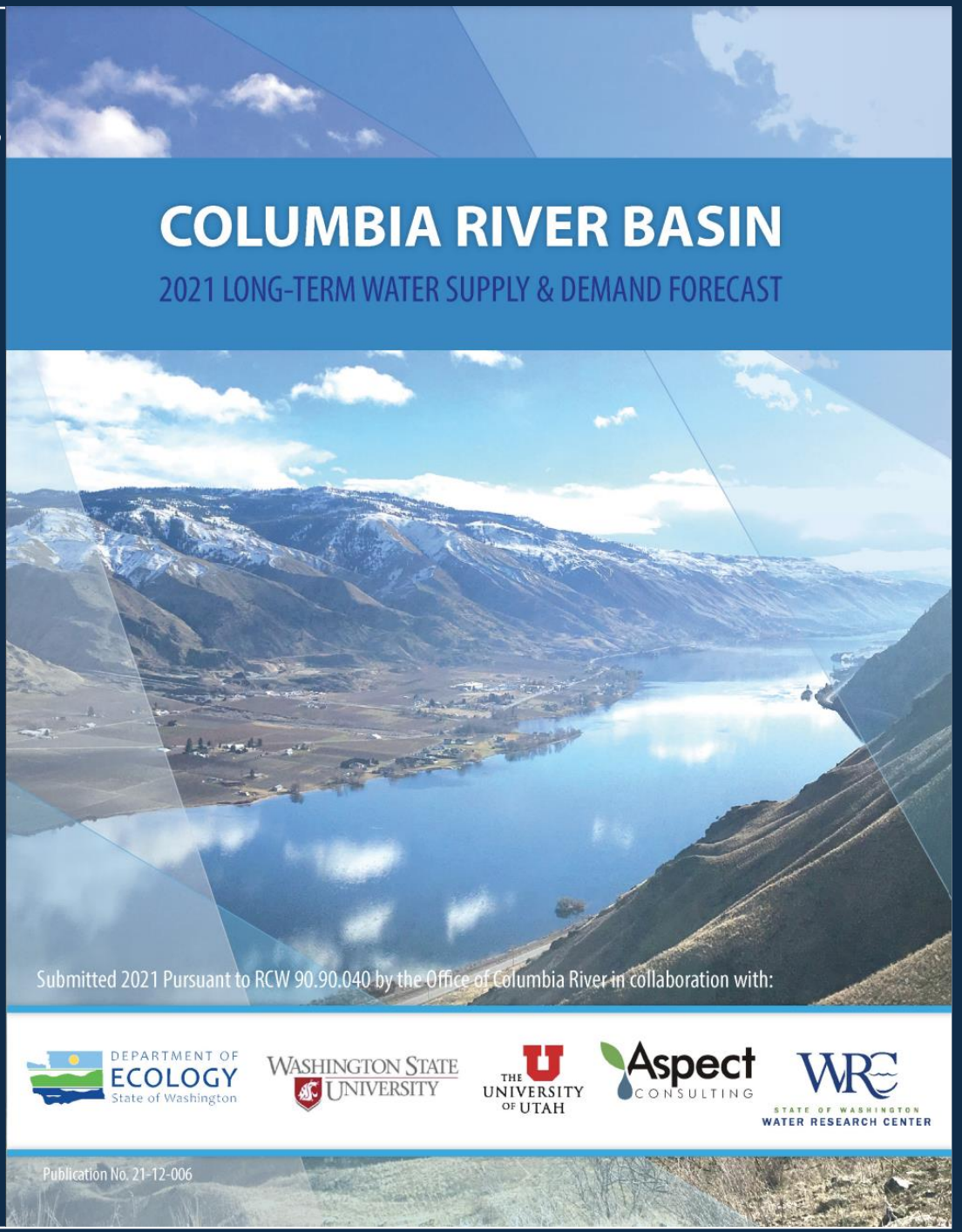
- 44,000 mi^2
- Overlying sedimentary deposits, underlying CRBG



Vaccaro, *et al.*, 2015. http://dx.doi.org/10.3133/pp1817.

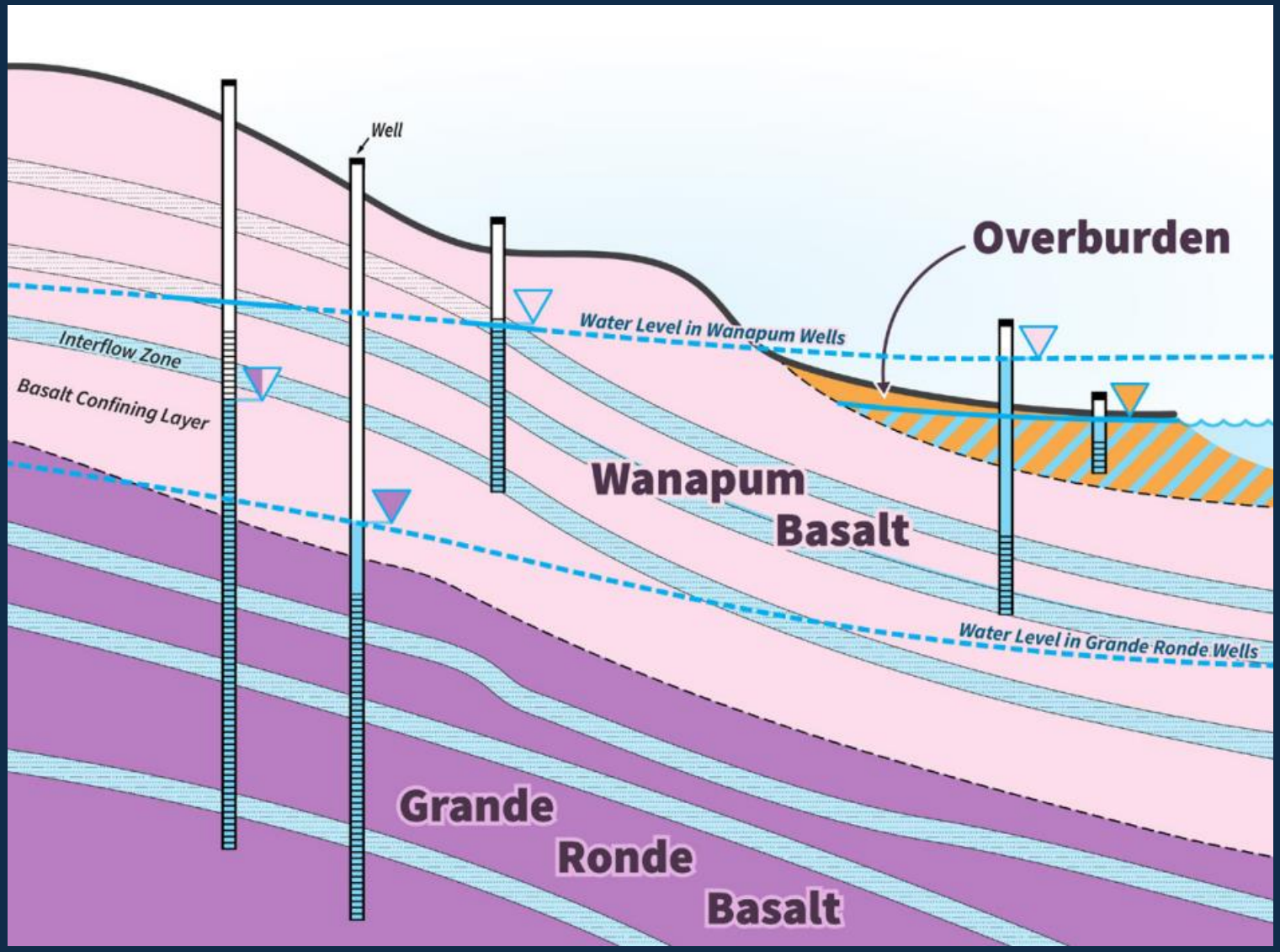
Context: "Forecast Report"

- Mandated by the state legislature
- Every 5 years
- Estimate current and future water supply and demand
- Groundwater was late to join!



Hall *et al.*, 2022. https://ecology.wa.gov/Water-Forecast

Depth-to-water observations



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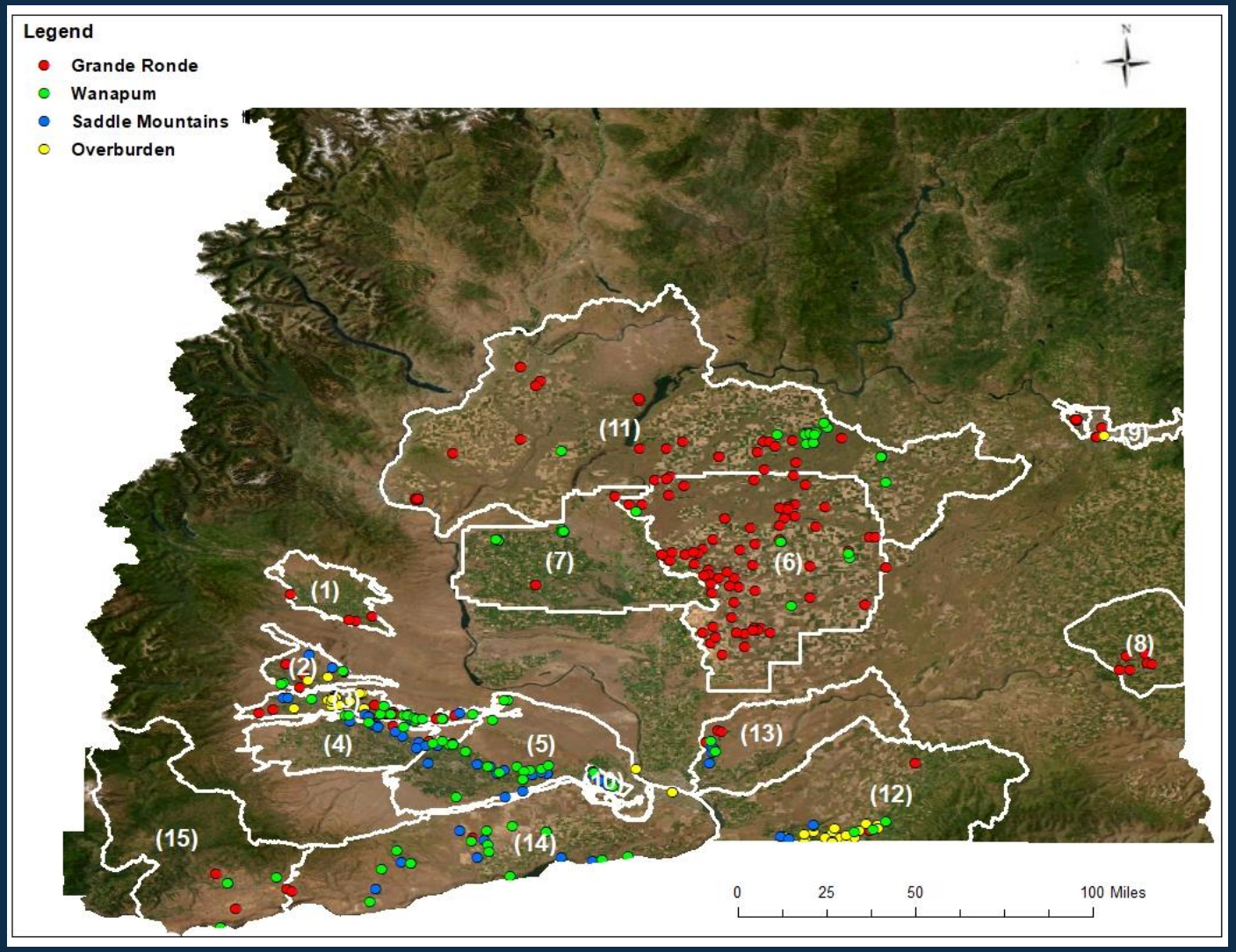
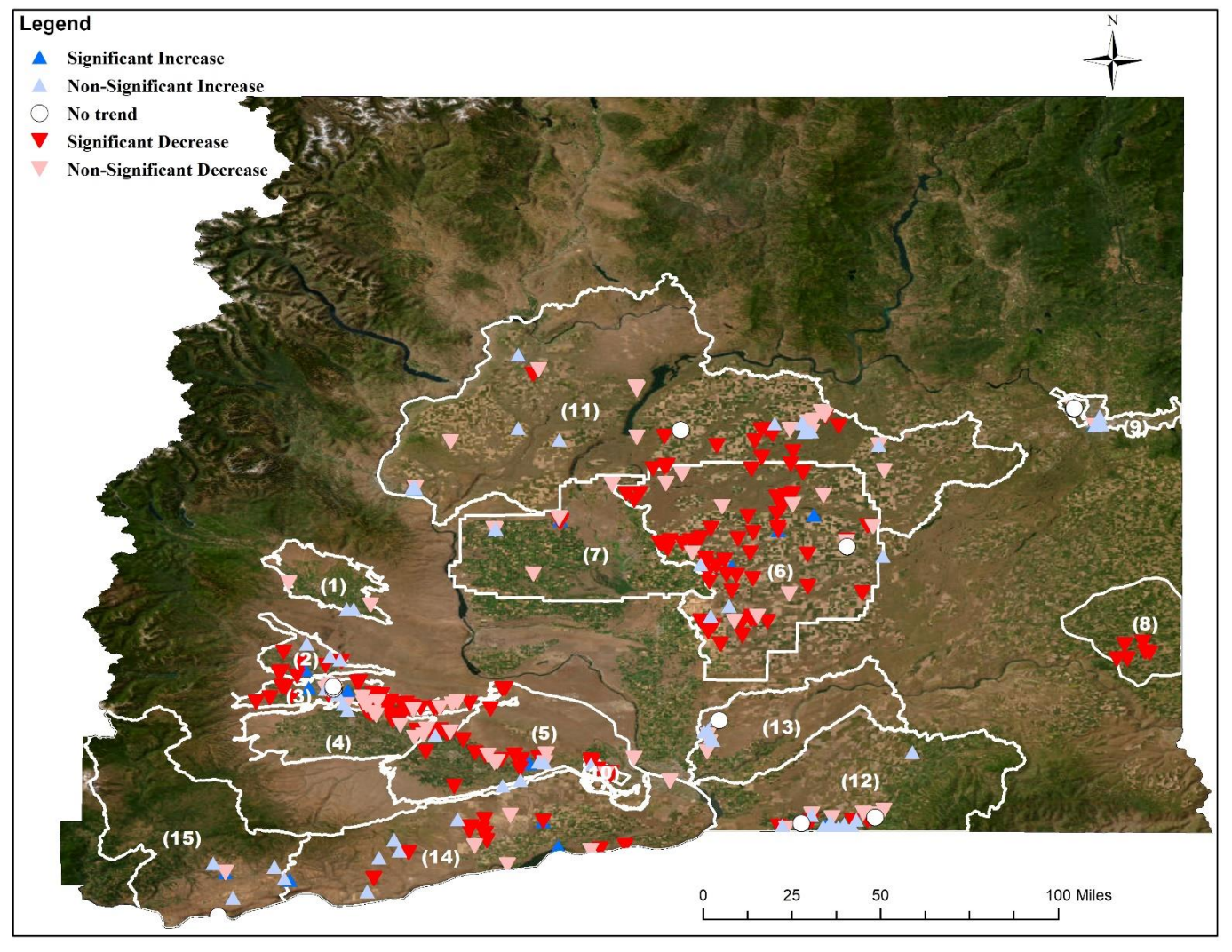


1 Kittitas
2 Selah
3 Yakima
4 Extended Toppenish
5 Eastern Benton
6 Odessa
7 Quincy
8 Palouse
9 Spokane
10 Red Mountain
11 Northern CPRAS
12 Walla Walla
13 Lower Snake
14 Rock Glade
15 Klickitat

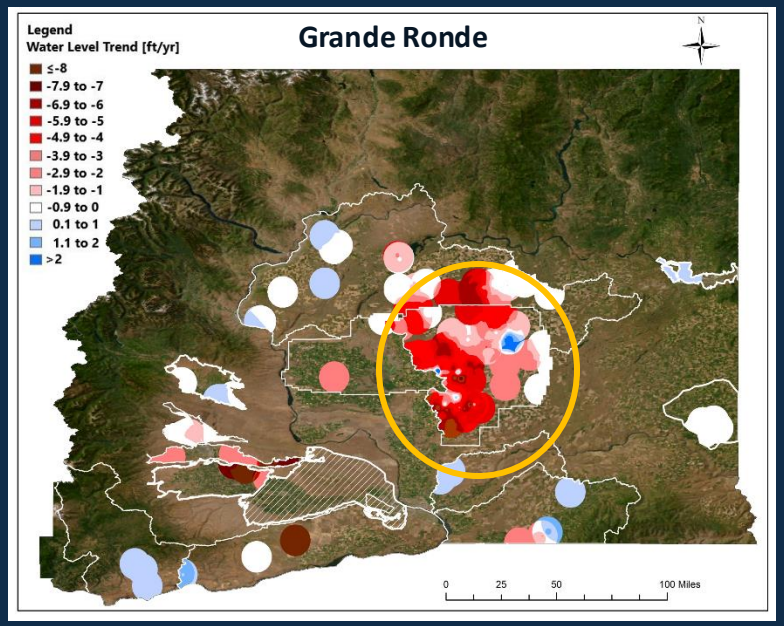
Asante-Sasu et al. (2025)

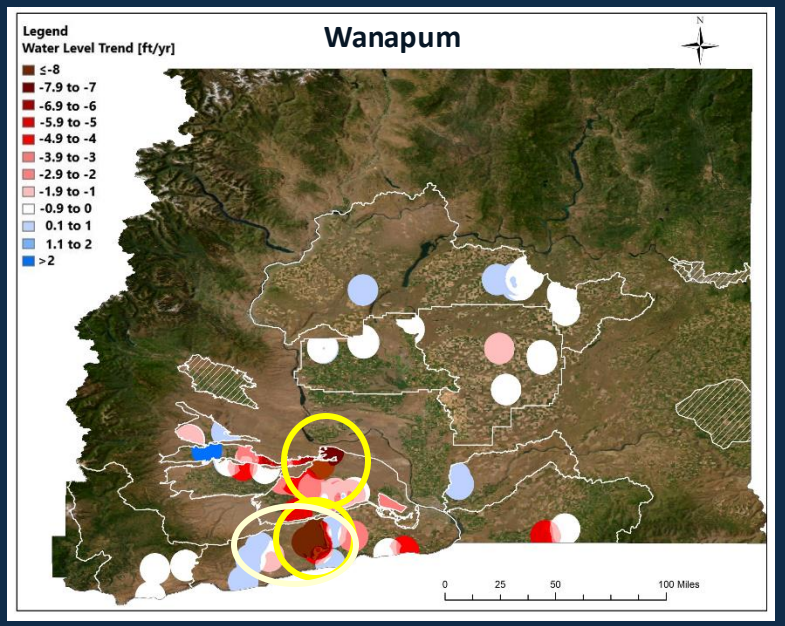
Groundwater trends

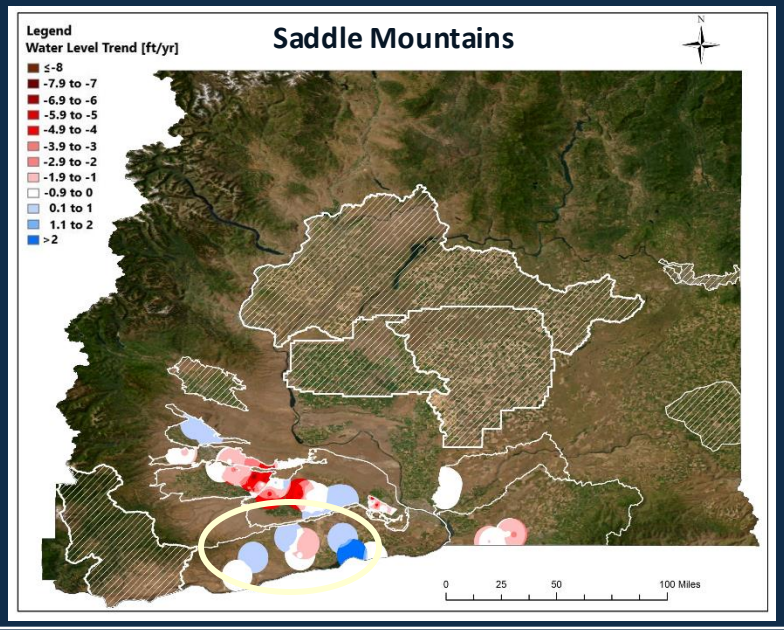


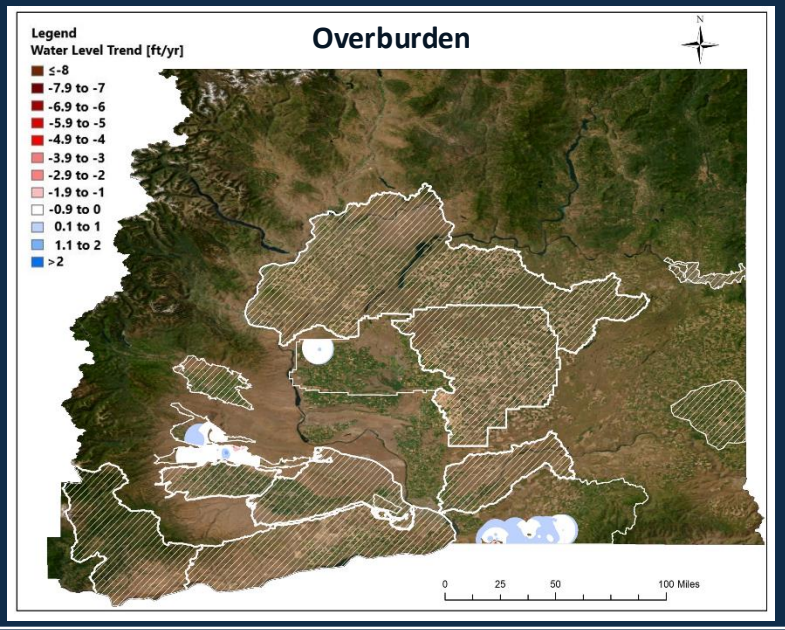
Asante-Sasu et al. (2025)

In situ groundwater level trends









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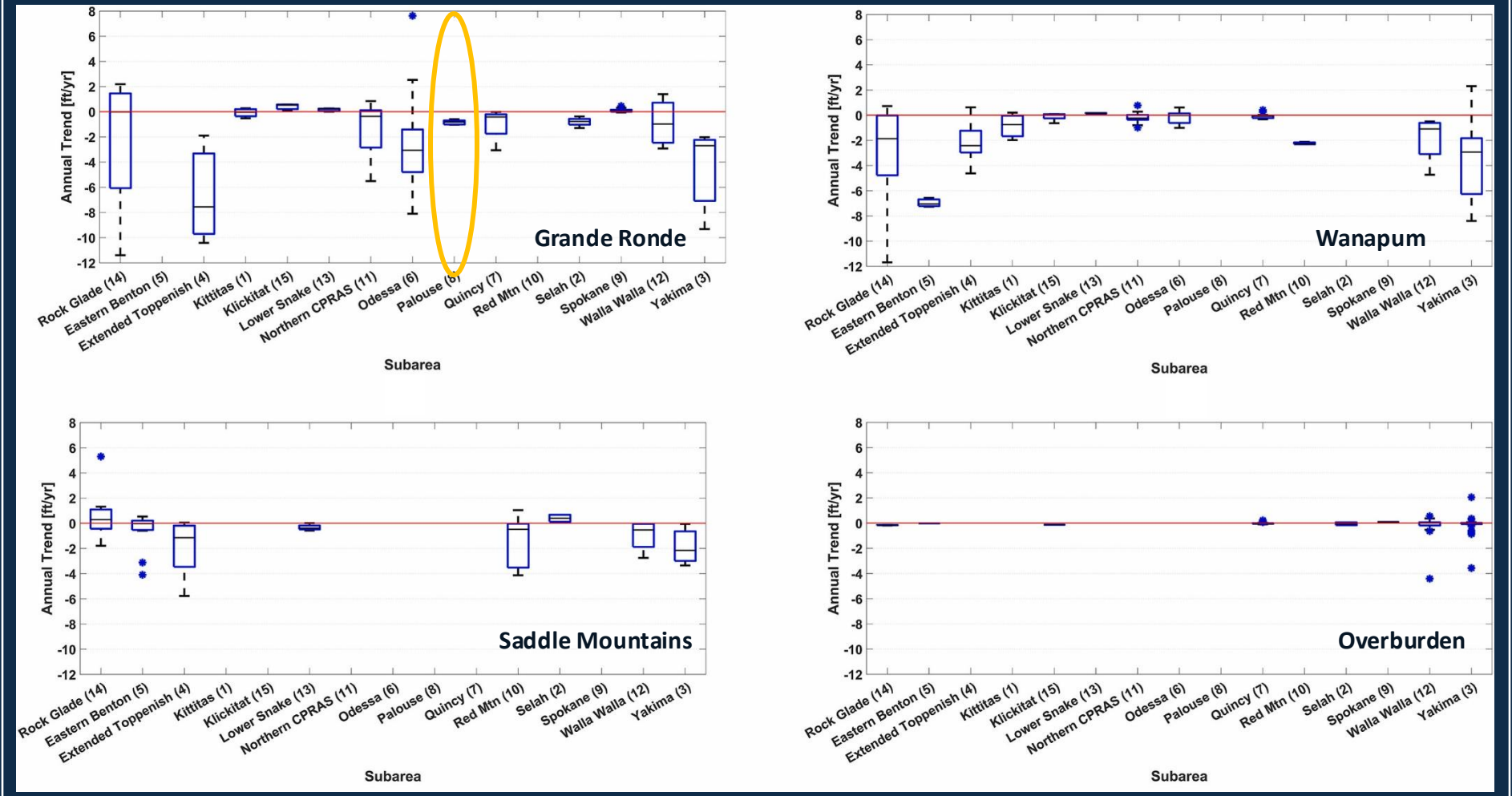
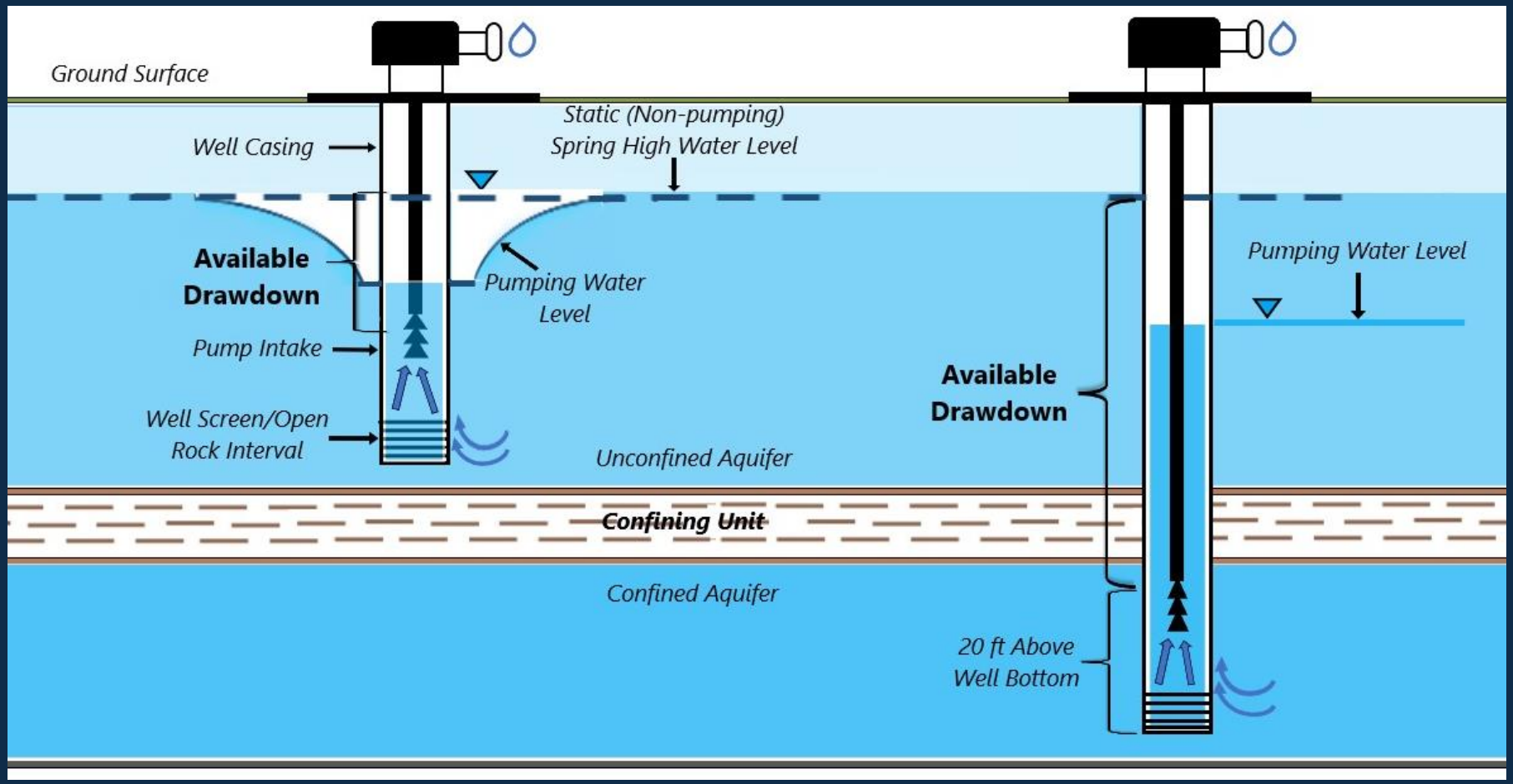
In situ groundwater level trends



Asante-Sasu et al. (2025)

Vulnerability: % change in Available Drawdown (ADD)



Asante-Sasu et al. (2025)

Vulnerability: % change in Available Drawdown (ADD)

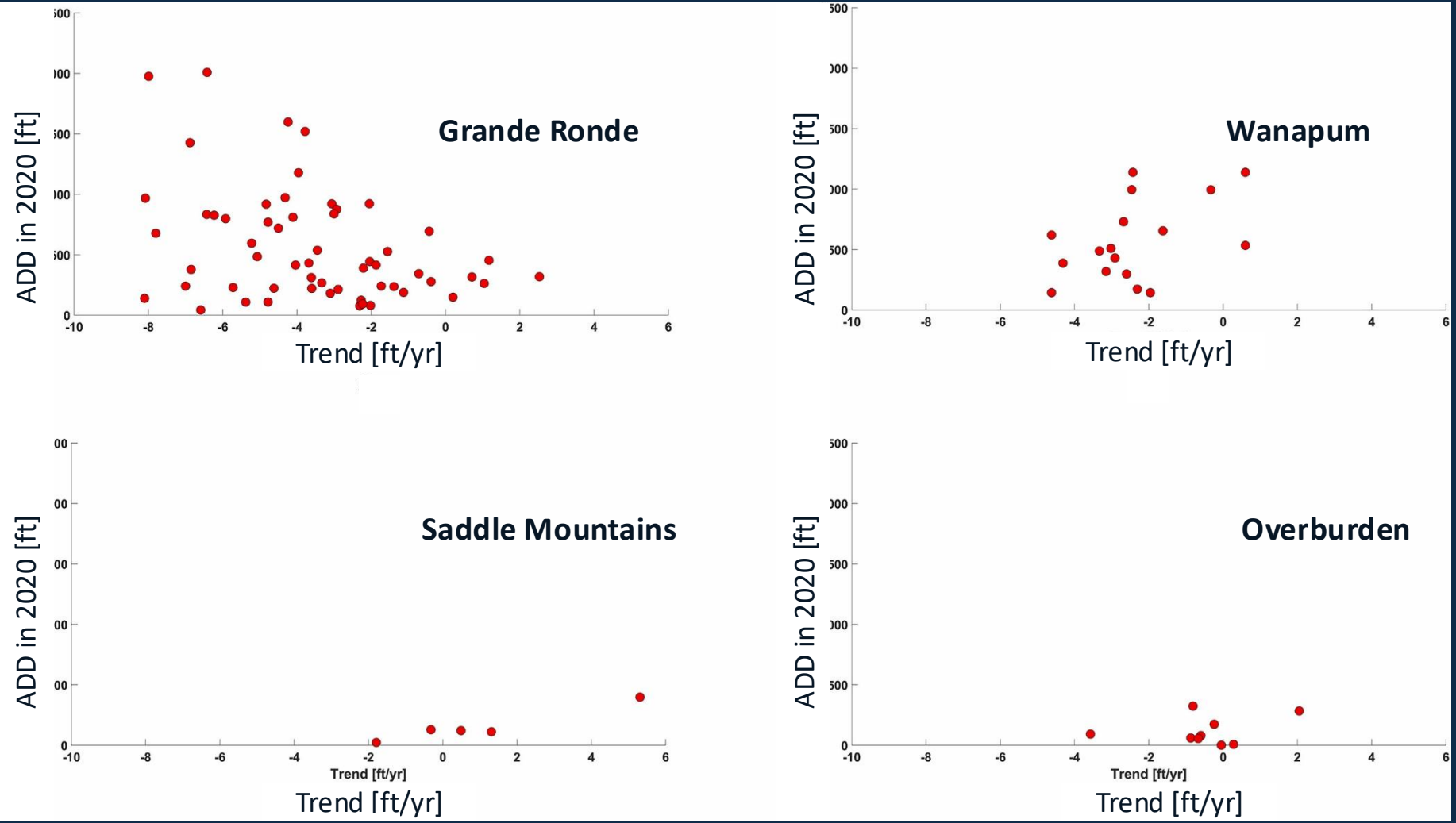
$$Percent\ change = \frac{ADD_{2040} - ADD_{2020}}{ADD_{2020}} \times 100\%$$

$$T_{p\%} = \frac{DTW_{p\%} - DTW_{2020}}{Trend}$$

- 25%: when the pumps may need to be lowered for continued water supply reliability
- 50%: significant reductions in well yields and the likelihood that the wells will fail to meet their demand requirements
- 75%: need for discontinued use of wells or an injection of significant investment to maintain reliability

Asante-Sasu et al. (2025)

Trends *and* ADD = vulnerability



Asante-Sasu et al. (2025)

GW vulnerabilities

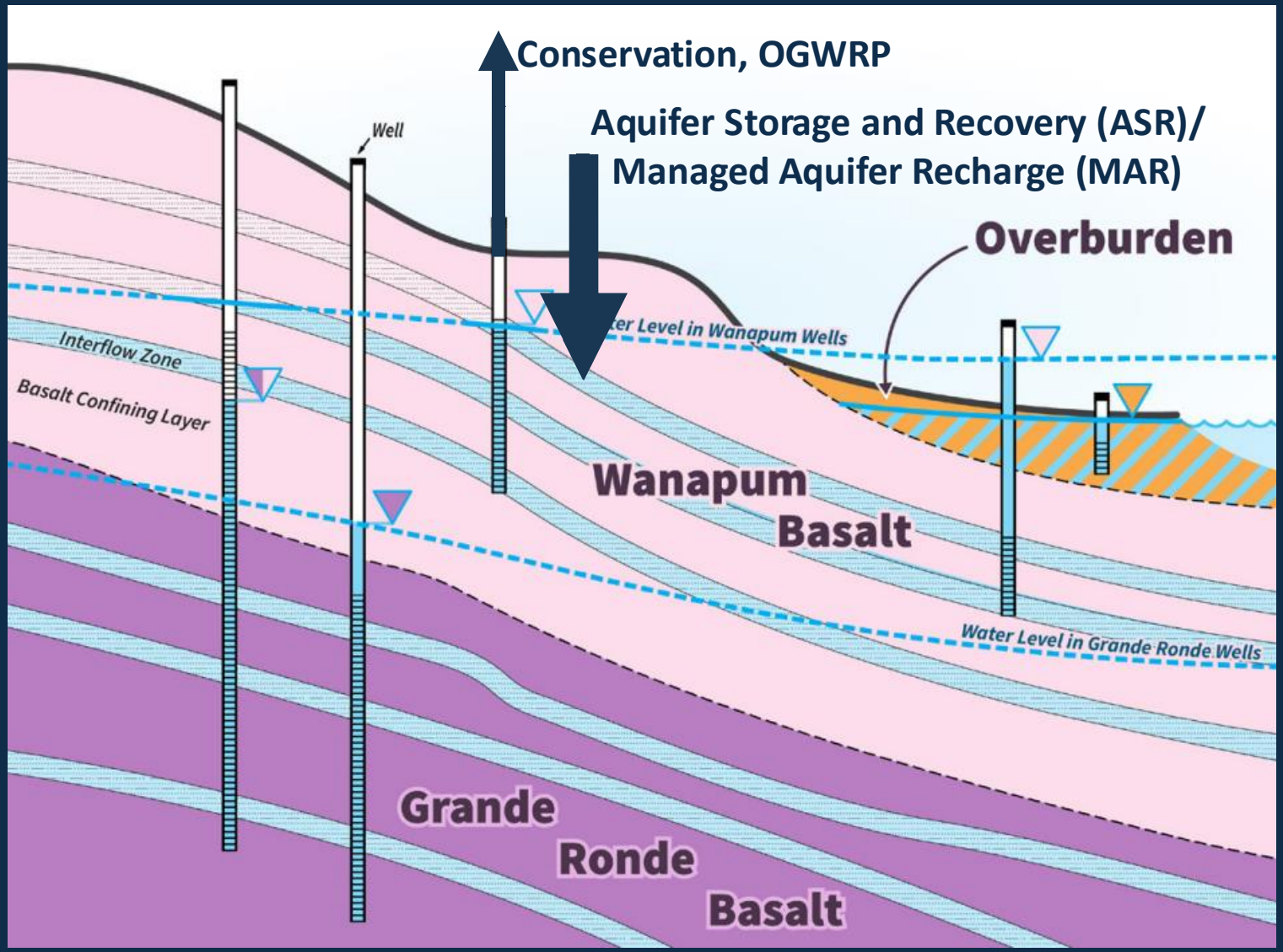
Subarea	% Change in ADD by 2040	Time to 25% change in ADD [years]	Time to 50% change in ADD [years]
Yakima	−10 to 0±2	90±20	>100±40
Odessa	−10±2	40±14	70±28
Palouse	−10 to 0±8	60±10	>100±20
Northern CPRAS	−10±7	40±23	70±46
Selah	−10 to 0±1	>100±72	>100±> 100

Subarea	% Change in ADD by 2040	Time to 25% change in ADD [years]	Time to 50% change in ADD [years]
Rock Glade	−20±7	20±17	50±34
Red Mountain	−10 to 0±1	>100±8	>100±16
Yakima	−10±5	50±15	90±30
Eastern Benton	−20±1	20±6	50±12
Northern CPRAS	−10 to 0±2	60±10	>100±20
Quincy	−20±3	30±2	50±4

- What data is helpful? What information is still missing?
- How does PBAC think about groundwater vulnerability?

Asante-Sasu et al. (2025)

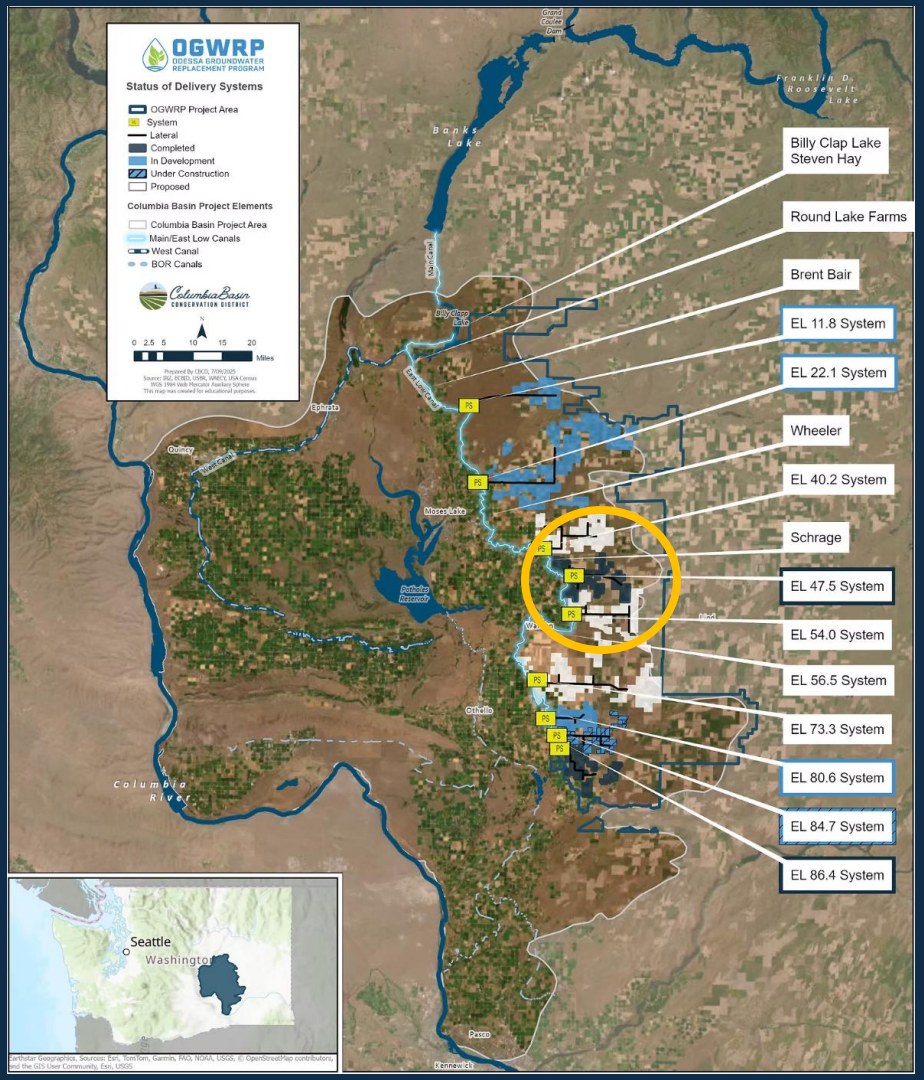
Mitigating declines



Hall *et al.*, 2022. https://ecology.wa.gov/Water-Forecast

Odessa Groundwater Replacement Program (OGWRP)

- 87,700 acres to come off groundwater
- 85 billion gallons of groundwater to be conserved per year
- Two systems completed (47.5, 86.4), two under construction (80.6, 84.7)
- Funding from state, federal, non-federal/non-state, landowners

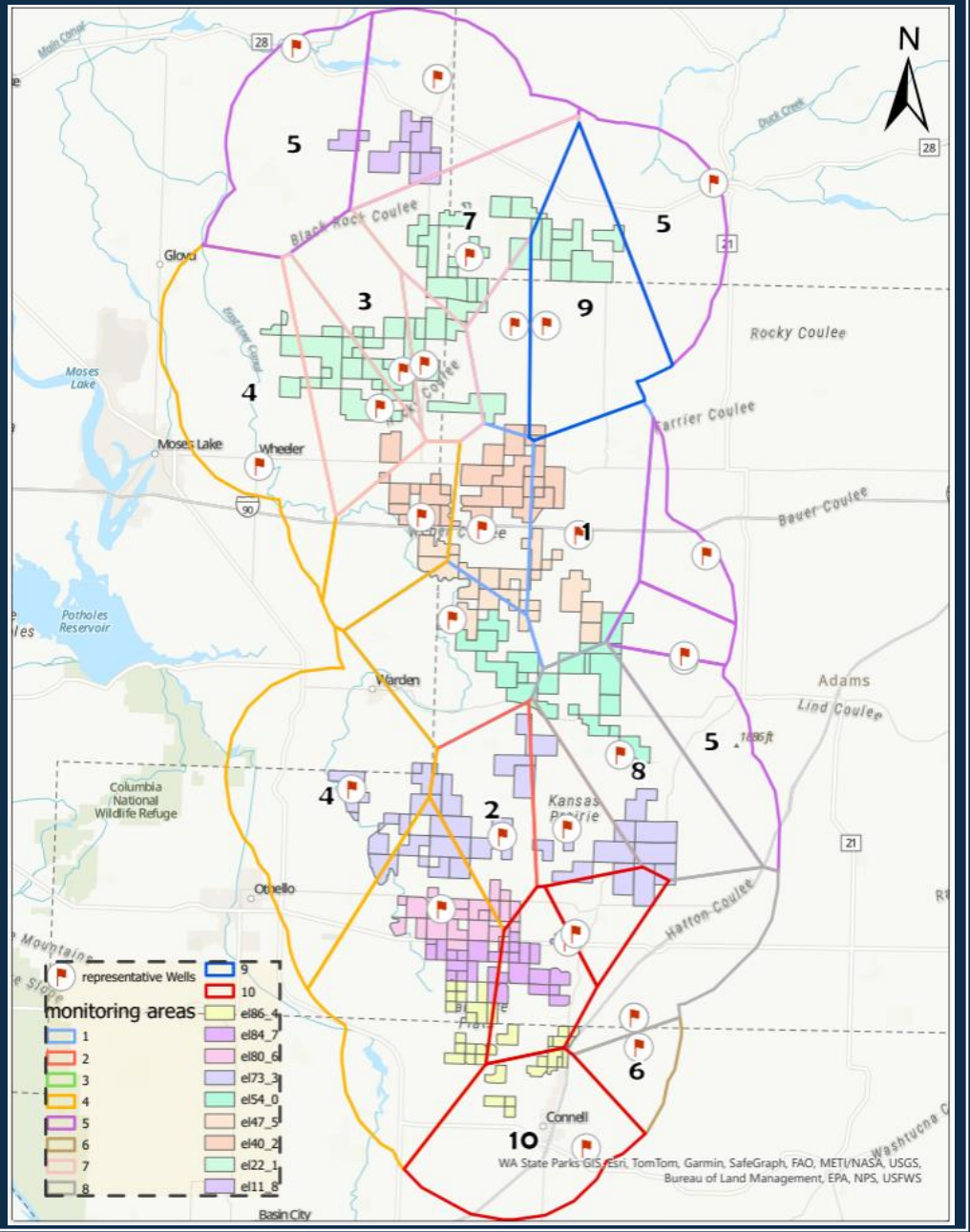


July 2025 update. https://www.ogwrp-programs.org/map-of-ogwrp

Odessa Groundwater Replacement Project site visit (7/17/25)

Past and future OGWRP water levels

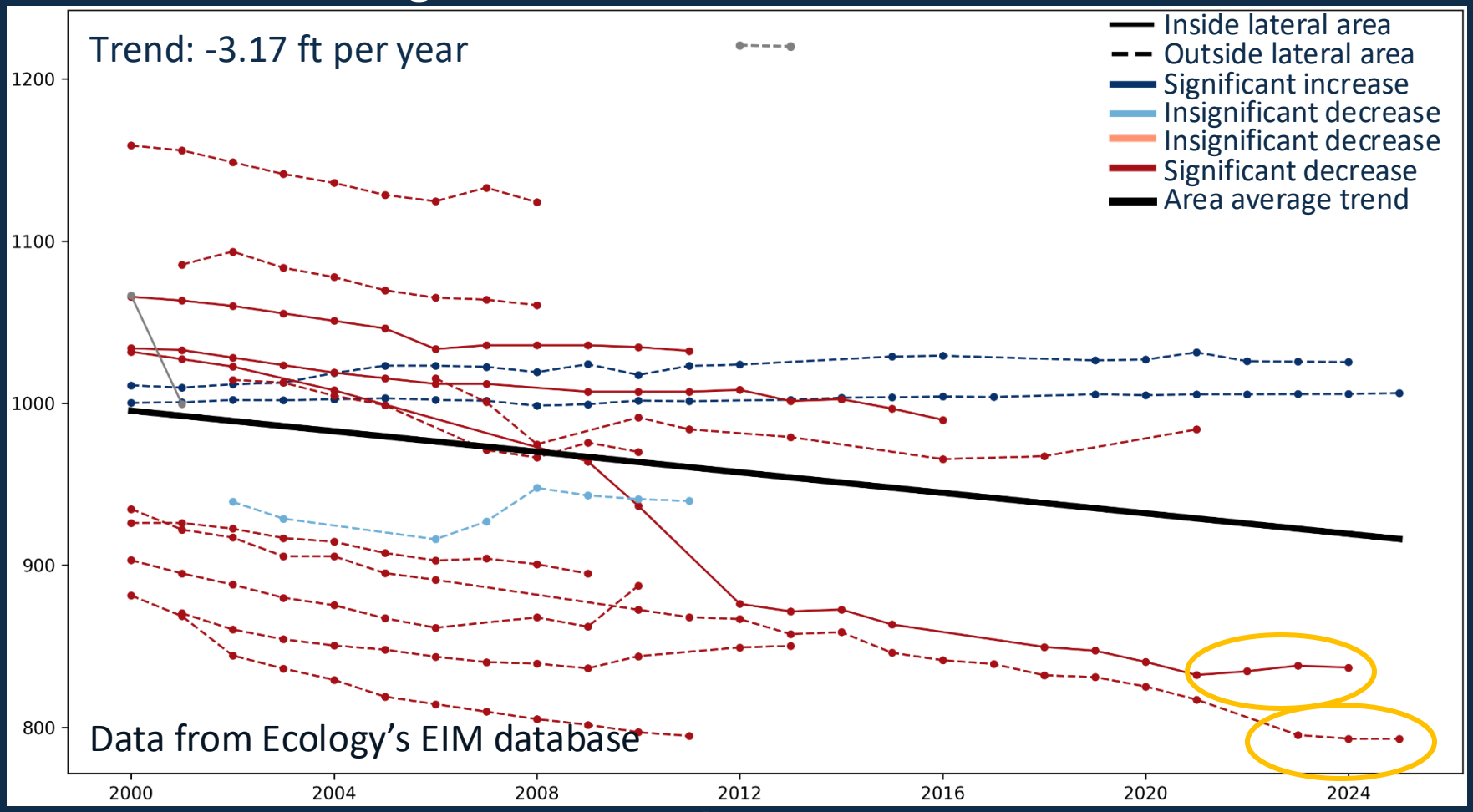
- "Cluster" areas where groundwater behaves with similar patterns
- Identify "representative wells" to track groundwater response to project implementation
- *Monitor anything that can be monitored!*



Draft results made by Elijah Moser

EL 47.5

- Completed in 2021
- 10,500 acres off groundwater



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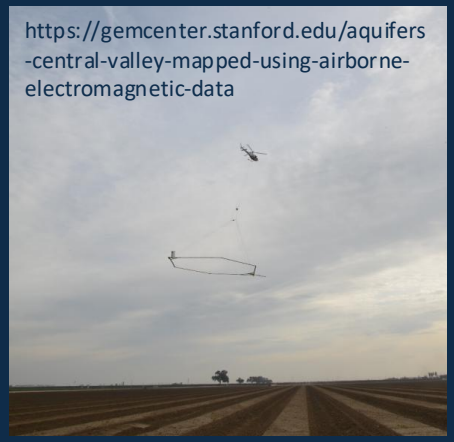
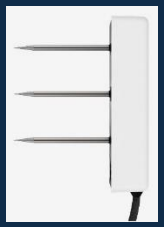
“Mapping the Waters”

Weather



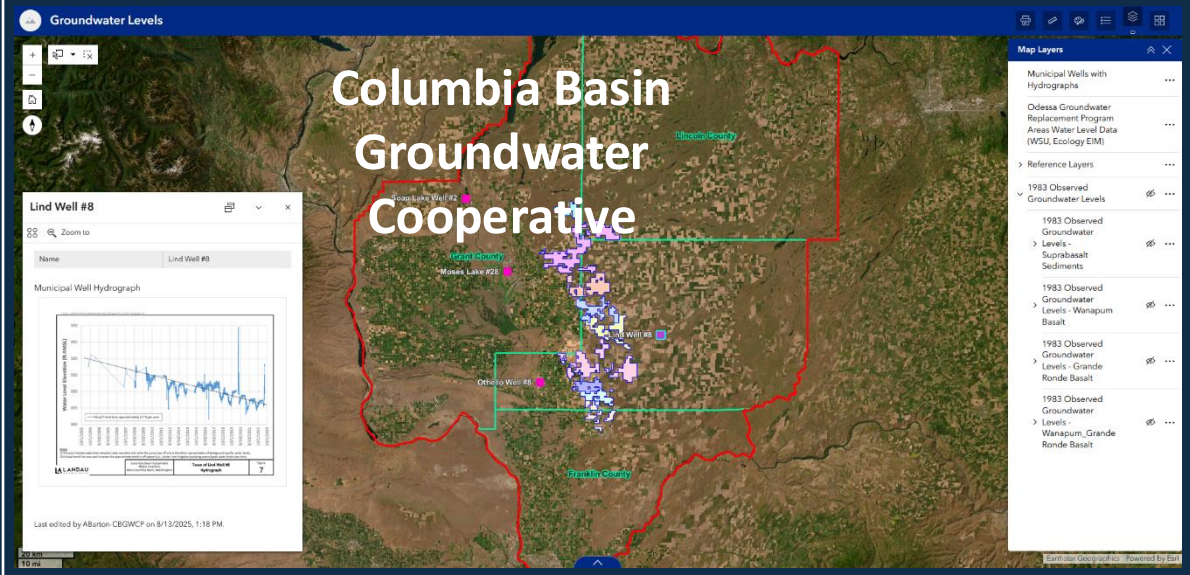
Subsurface structure (hopefully!)

Soil water potential, volumetric water content



Groundwater

Other fun overlaps



- ***Water Resources Vulnerability*** **with WA Depts of Ecology, Health, Fish & Wildlife, Agriculture, State Conservation Commission, State Climate Office**
- **2026 Long-Term Water Supply & Demand Forecast**

Dividing the Waters education sessions with Washington State judges

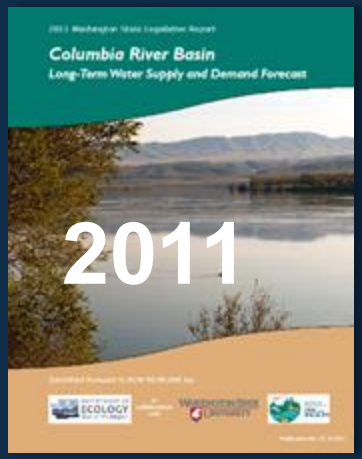
Legislative mandate

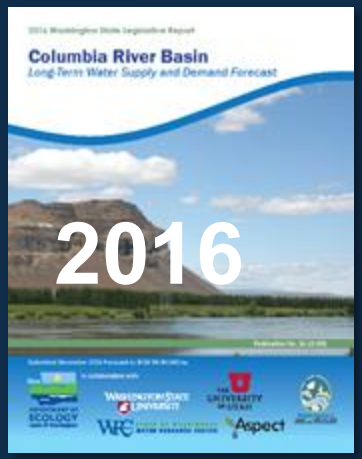
When the Office of Columbia River was established in 2006, the legislation stated:

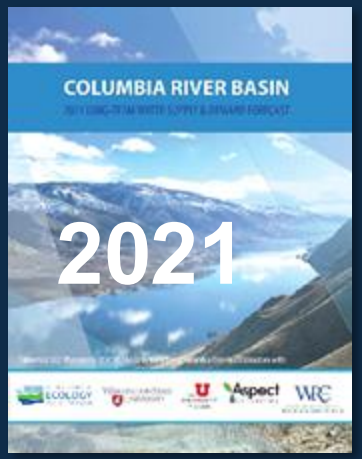
> To support the development of new water supplies in the Columbia river and to protect instream flow, the department of ecology shall work with all interested parties [...] to develop **a long-term water supply and demand forecast** [...] **and shall update the report every five years thereafter** (RCW 90.90.040(1)).

Evolution of Forecast

- OCR
- Technical team
- State caucus
- CRPAG
- Public comments







2006 2011 2016 2021 2026 2031

Available data, water rights, expert opinion, regression → Integrated surface water/crop modeling → Groundwater modeling; Policy and science modules → SW+GW modeling? Other?

2026 Forecast

- Impacts Analysis - Lead: Sonia Hall
- **Groundwater Modeling - Lead: Sasha McLarty**
  - Monthly CPRAS model
  - Updated irrigation demand
- Water Conservation - Lead: Julie Padowski
- Back-to-back Drought - Lead: Mike Brady
- Climate Data Improvements - Lead: Mingliang Liu
- Temporary Worker Housing Demand - Lead: Dan Haller

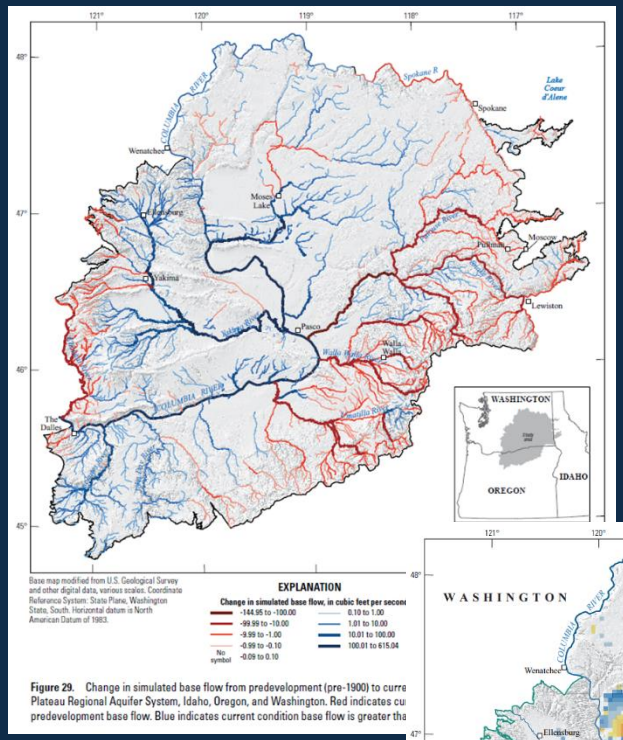


Figure 29. Change in simulated base flow from predevelopment (pre-1900) to curre
Plateau Regional Aquifer System, Idaho, Oregon, and Washington. Red indicates cu
predevelopment base flow. Blue indicates current condition base flow is greater tha

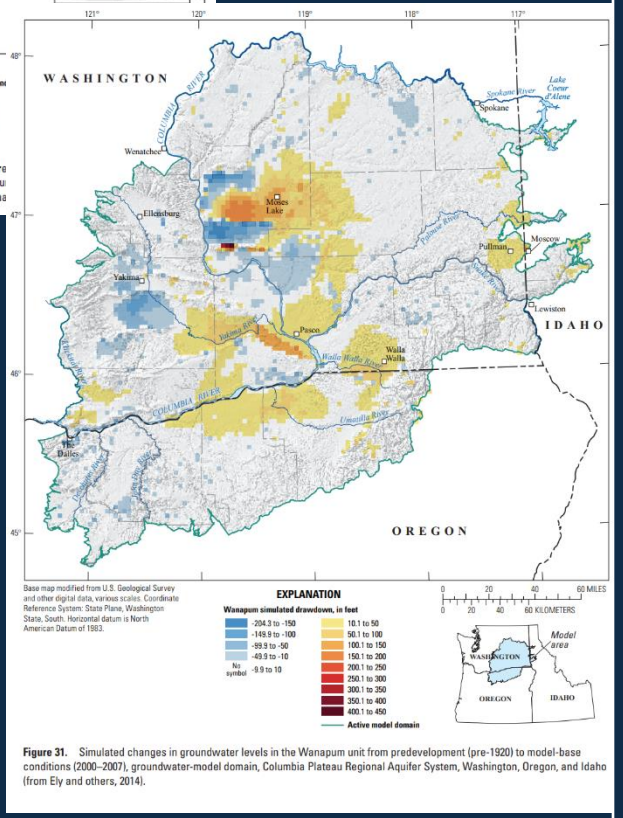
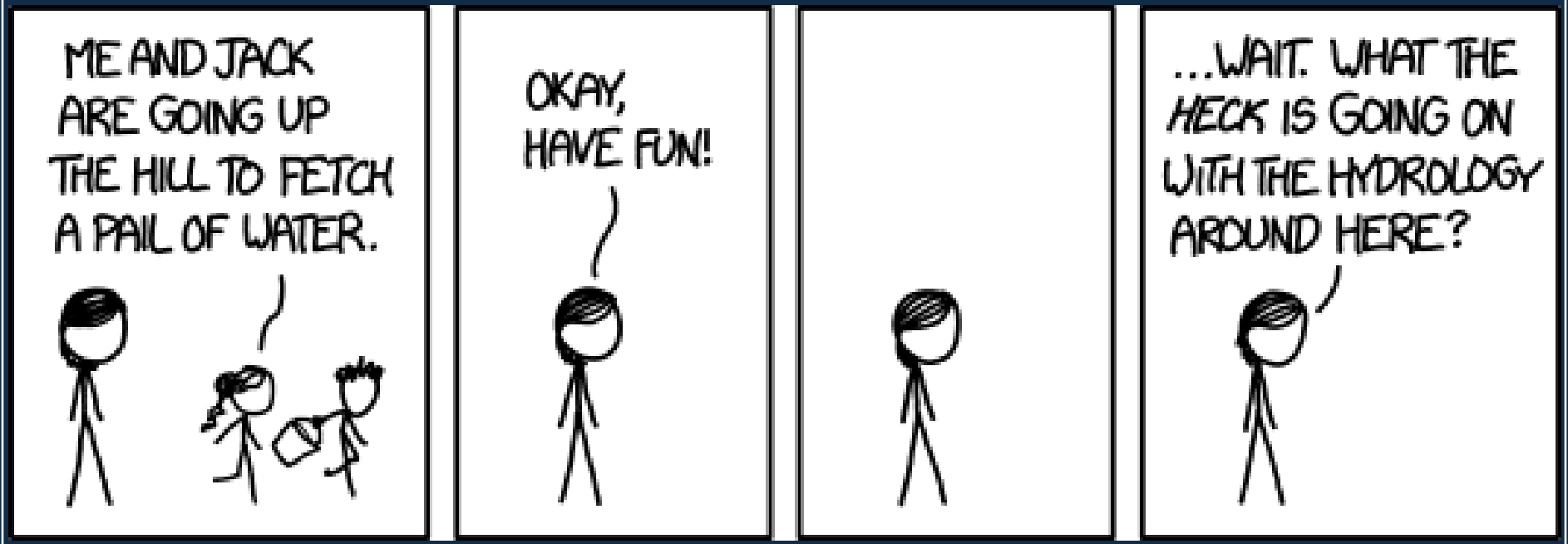


Figure 31. Simulated changes in groundwater levels in the Wanapum unit from predevelopment (pre-1920) to model-base conditions (2000–2007), groundwater-model domain, Columbia Plateau Regional Aquifer System, Washington, Oregon, and Idaho (from Ely and others, 2014).

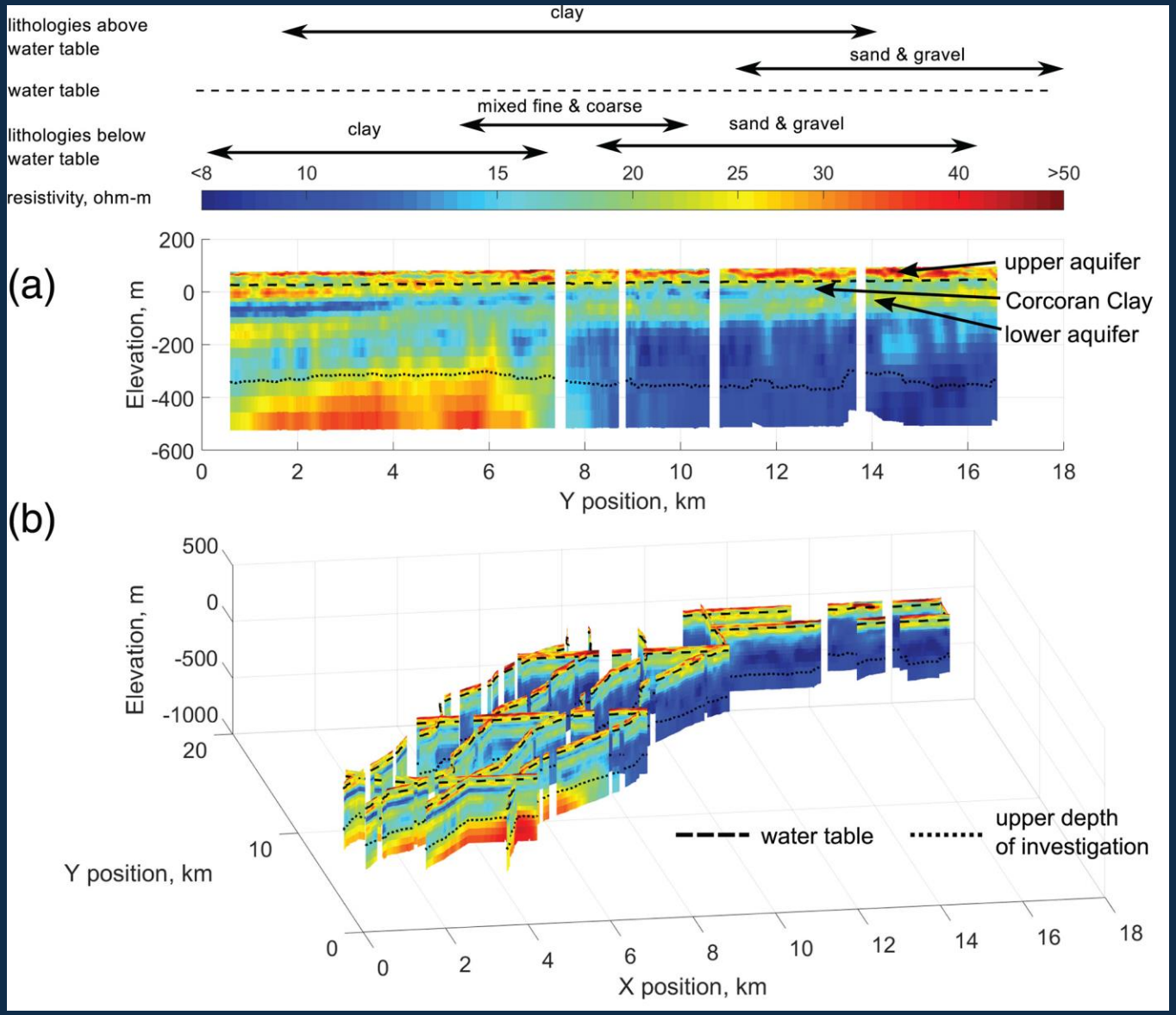
Thank you! Questions?

- What data is helpful? What information is still missing?
- How does PBAC think about groundwater vulnerability?



https://xkcd.com/1662/

Airborne Electromagnetic Surveys



Knight *et al.,* 2018, https://ngwa.onlinelibrary.wiley.com/doi/10.1111/gwat.12656.