

What are our existing capabilities for measuring and valuing groundwater ecosystem services? What further tools are needed?

- What lessons have you learned, and/or what approaches can you share in relation to using ecological, economic, hydrogeological or special-purpose ecosystem services models for ecosystem services?
 1. Not all GDEs are equal!
 - Need for understanding hydrogeological controls
 2. Many good tools/approaches for measuring and modeling at various scales
 - Environmental tracers, geophysics cf. hydraulic methods
 3. Alternative knowledge systems provide significant opportunities for understanding systems
 - e.g., indigenous knowledge and cultural values

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- What challenges have you experienced in **measuring, modeling** and/or valuing water ecosystem services?
 1. Scale of measurement rarely appropriate for scale of management (e.g., baseflow systems).
 2. Seasonality of flow regimes
 - Access limitations, representative of critical conditions?
 3. Comparison of different knowledge systems
 4. Modeling tools don't always capture level of complexity required for predicting change
 5. Uncertainty shouldn't prevent progress!



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- What data is currently available for groundwater ecosystem services? What data is not available, but is needed?

Available

- Mapping of current/historical GDEs (e.g., atlas)
- Case studies of groundwater flux estimation

Needed

- Ecosystem responses to changes in hydrological and/or biogeochemical regimes
- Cumulative (regional) impacts of groundwater extraction on GDEs, and associated time lags



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- What steps should we be taking to improve measurement and valuation of groundwater ecosystem services?

Measurement

1. Multi-disciplinary team approaches
 - bridge the gap between ecologists and hydrogeologists, etc.
2. Longer-term investment in monitoring and evaluation projects
 - 1-2 years inadequate

Valuation

3. Education and community awareness of non-extractive services
4. Economic valuation of ES
 - Provision of food/water, regulating services, cultural requirements, ecosystem support etc.