

WATER SECURITY: WHAT ABOUT GROUNDWATER?

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Globally, groundwater extraction has facilitated significant social development and economic growth, enhanced food security, and alleviated drought in many farming regions

BUT

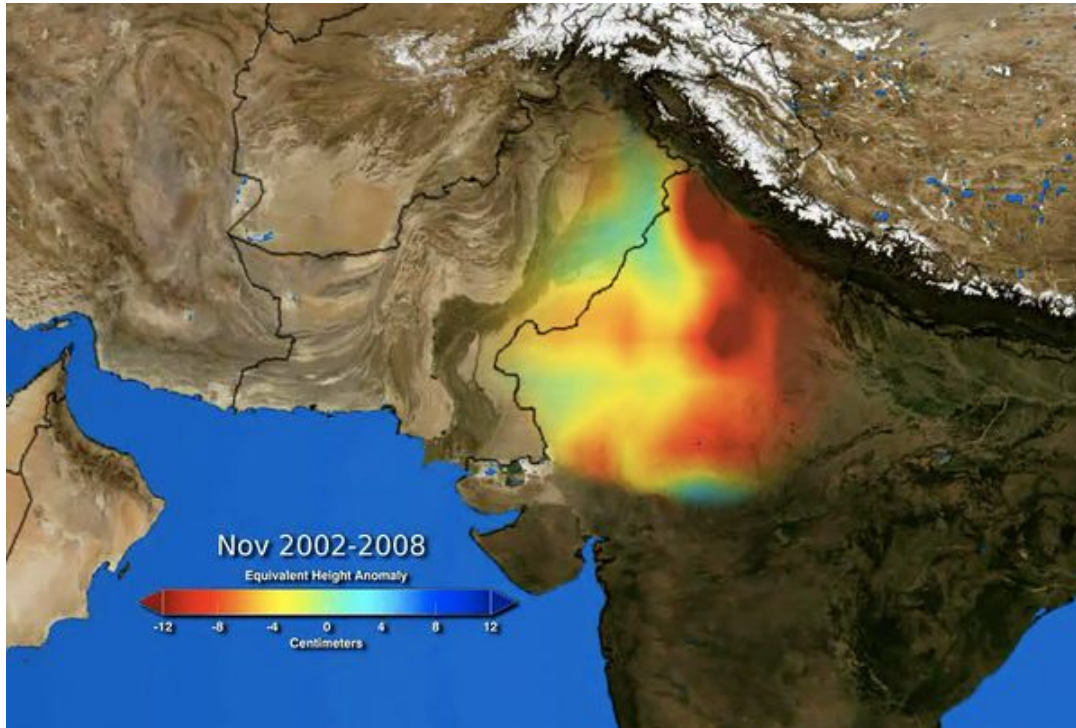
Groundwater development has also depressed water tables, degraded ecosystems and led to the deterioration of groundwater quality, as well as to conflict among water users.

The effects are not evenly spread.

Gleeson et al. 2010; Nature Geoscience

Groundwater as a Resource

India – between 2003-2008 - An average of 54 km³—enough to fill more than 21 million Olympic swimming pools—was lost every year.



National Geographic Daily
News “NASA Satellites Track
Vanishing Groundwater”

GRACE-Gravity Recovery and Climate Experiment

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"Our results are providing new information on the declining water levels in the Central Valley [California], where one quarter of the food consumed in the United States is grown," "Our studies are revealing rapid depletion rates over the last six years that could ultimately put food production in the region at risk."

**James S. Famiglietti, Univ. California, Irvine as quoted in
National Geographic Daily News "NASA Satellites Track
Vanishing Groundwater"**

Food Security

How secure is Canada's groundwater?

Water Security

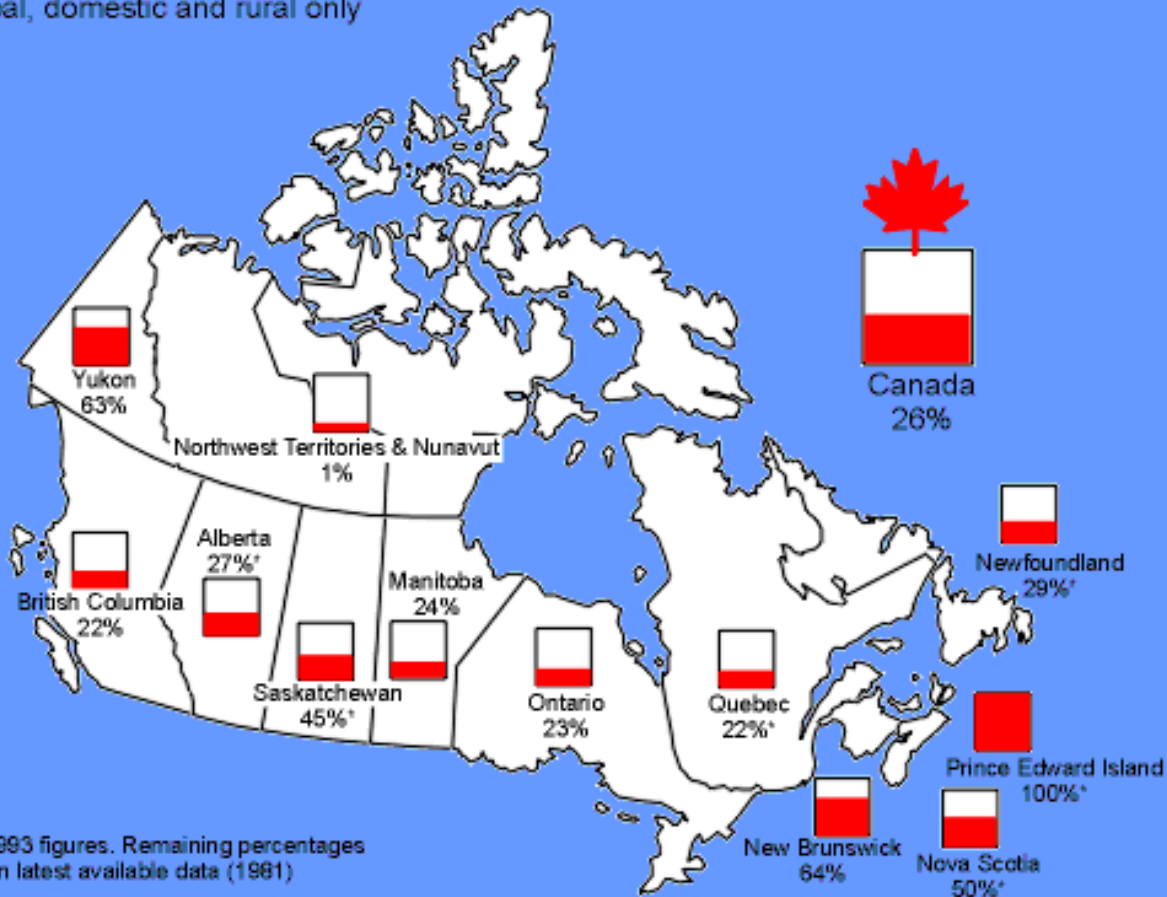
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Percentage of population reliant on groundwater

Municipal, domestic and rural only



Groundwater Use in Canada

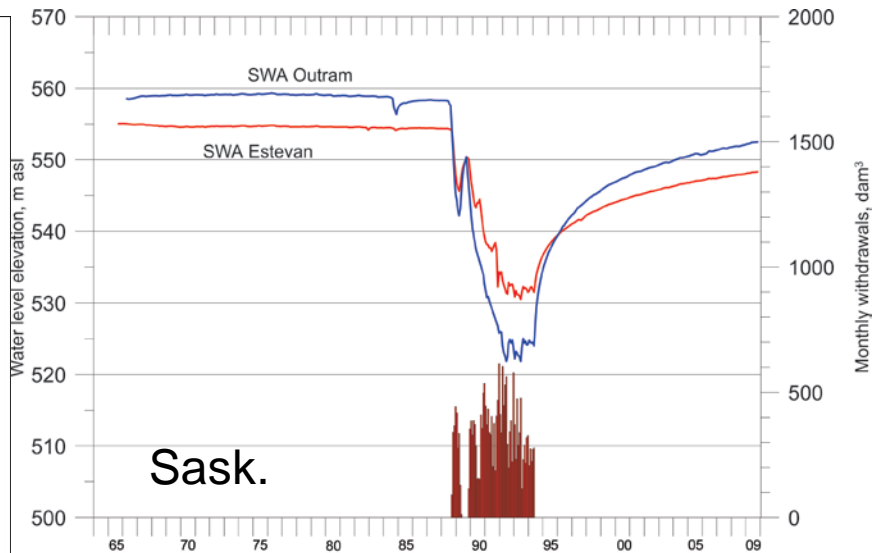
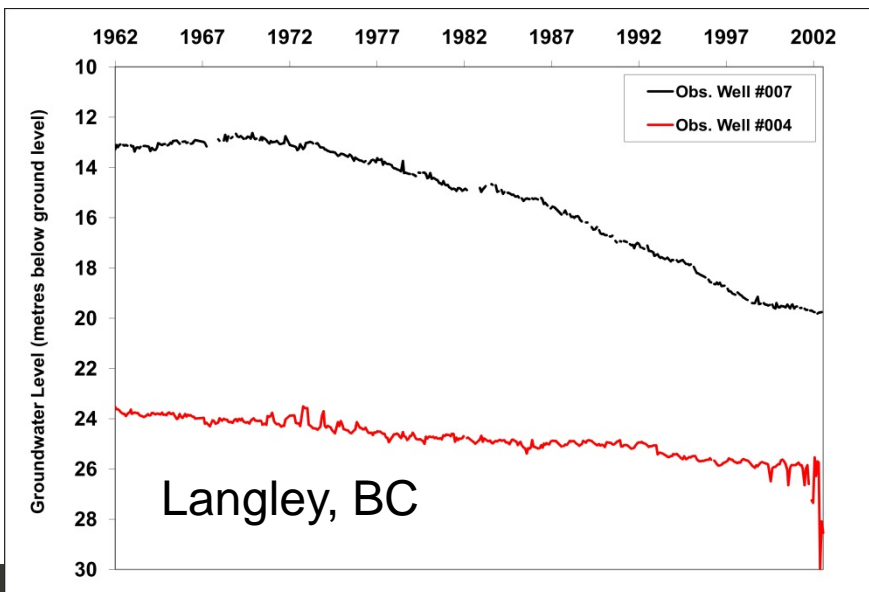
What are the greatest threats we face?

Threats to Groundwater

Groundwater Quantity

No widespread declines in groundwater levels, but there are localized quantity issues

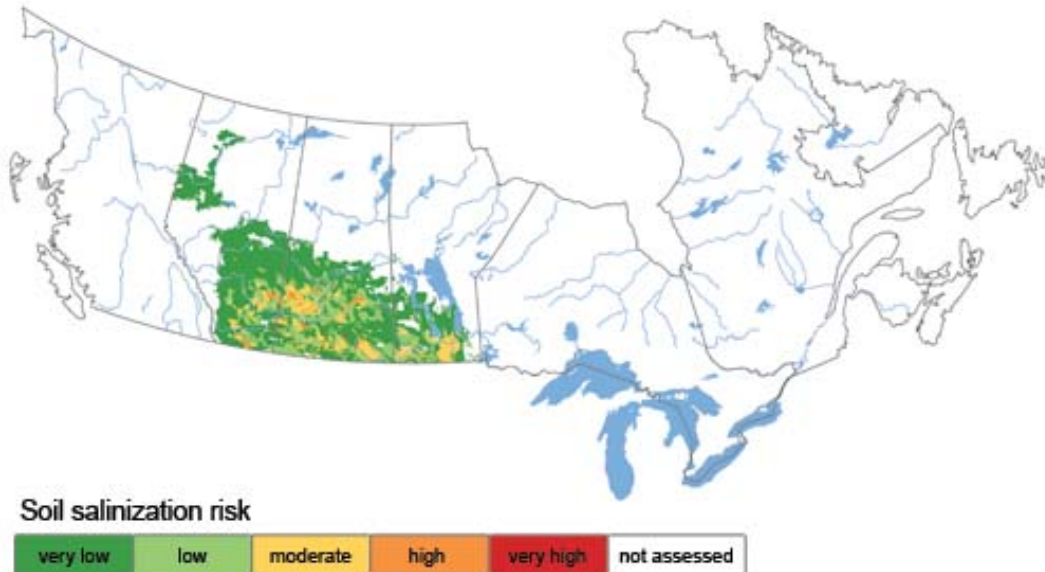
- Over-pumping (Estevan/Outram aquifers, SK; Langley, BC)
- Okanagan, BC – surface water fully allocated
- Climate Change?



Threats to Groundwater

Groundwater Quantity

- Nitrate contamination from agriculture
- Dryland salinity - Prairies
- PEI / Gulf Islands – saltwater intrusion
- Numerous point sources of contamination



Agriculture and Agri-Foods
Canada, 2011

Threats to Groundwater

Broader Issues

- Little information on GW use in Canada
- Large regions where we know relatively little of the GW resource.
- Limited monitoring of groundwater across Canada
- GW and SW resources are not managed together
 - In BC, no regulation on groundwater use – FITFIR

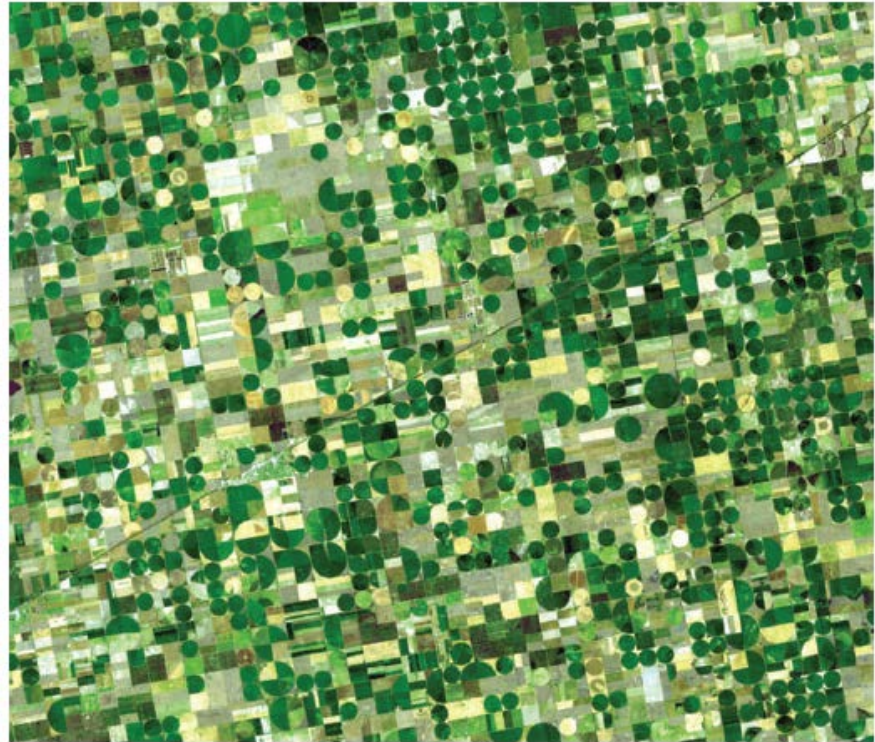
Threats to Groundwater

What should be our priorities for management and conservation?

Priorities

Gleeson et al. (2011) emphasize three practical approaches for groundwater sustainability:

- setting long-term sustainability goals;
- Backcasting;
- and management that is integrated, adaptive, inclusive, and local.



Satellite image of crops irrigated by groundwater from the High Plains aquifer in Kansas, USA

Sustainable Groundwater Development

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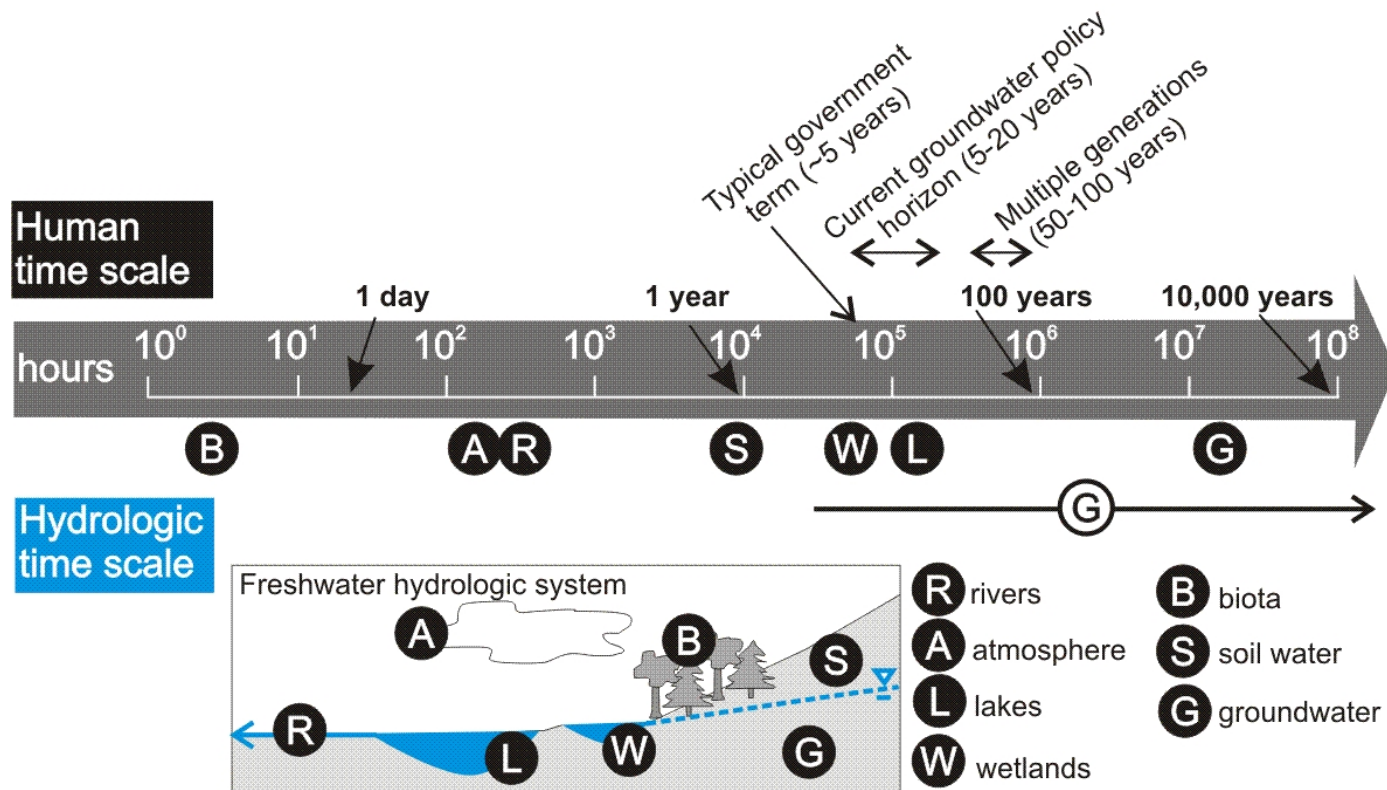
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(Council of Canadian Academies, 2009)

Sustainability Goals



Gleeson et al. 2011; Ground Water Journal

Time Scales – Residence Times

Planning for Sustainability

Given that groundwater replenishment can take a very long time, it is important that we manage the groundwater resource with a view to long term sustainability.

This suggests:

- Policy goals be set on a multi-generational time horizon (50-100 years) while acknowledging longer term impacts.
- Policies be developed by backcasting from policy goals to the policy time horizon (<50 years).

The policies, and the practices stemming from them, can later be modified using adaptive management.

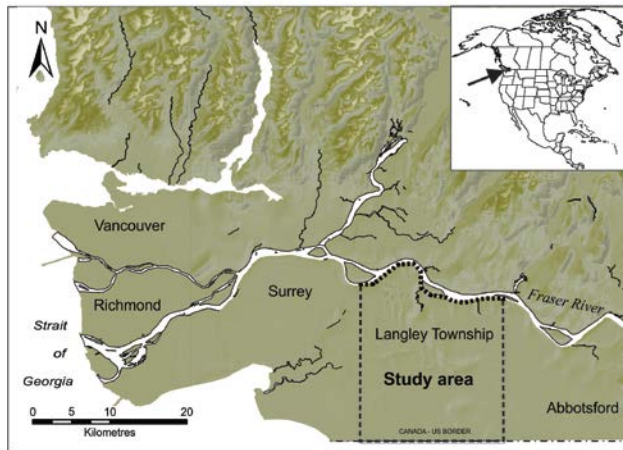
Multi-Generational Planning Horizons

Assessing Water Security

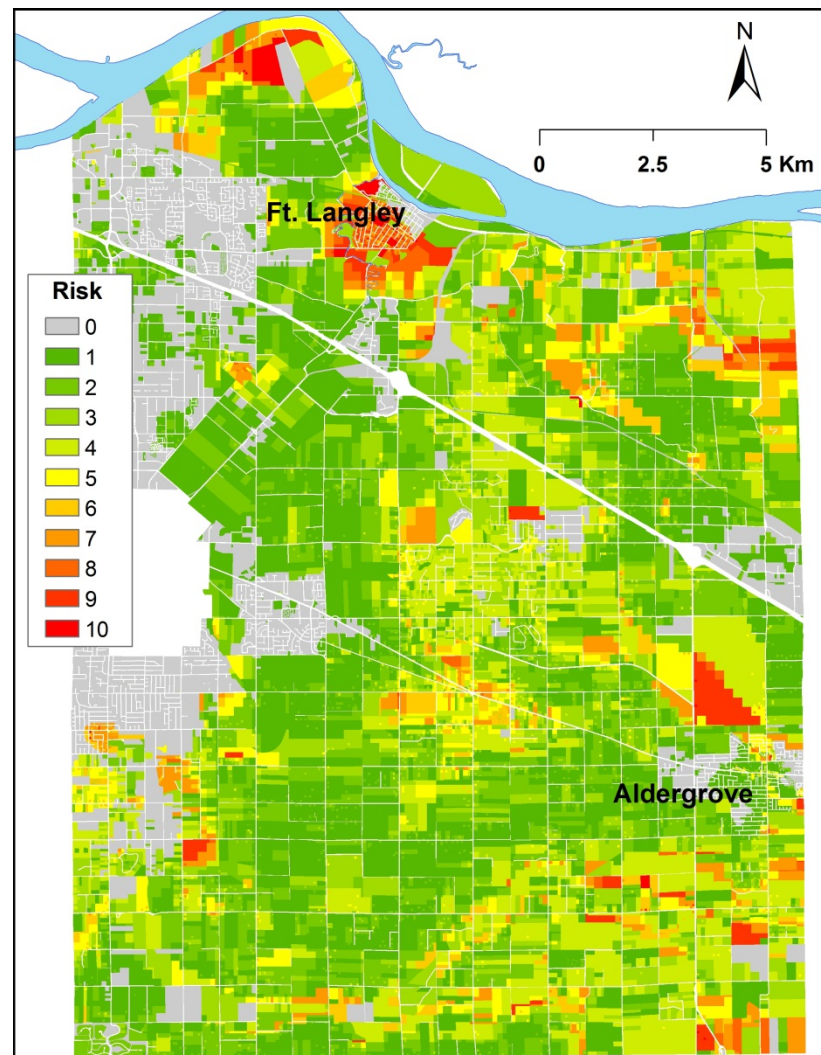
- Selecting appropriate place-based indicators of groundwater quantity and quality
- Implementing a long-term monitoring program to evaluate these indicators on an ongoing basis
- Considering “risks” to water quality and quantity that relate to uncertainty in future events.
- Then, implement necessary changes in management (groundwater usage and measures for protection) to achieve goals (Risk Management).

**Water Security Guidance Document: Product of
Canadian Water Network Project**

Taking Action



With areas of high risk identified, it is possible to look at the indicators (susceptibility, hazards and loss) individually to reduce risk exposure by increasing resistance or building capacity.



Risk Assessment / Management – Groundwater Quality

Moving Forward

- The path towards providing groundwater for current and future generations, while protecting ecological integrity and resilience, lies in establishing long-term (multi-generational) planning horizons based on values and goals, and then acting to achieve those goals.
- Assessing Water Security requires place-based indicators of status and risk to groundwater that are evaluated on an ongoing basis.
- Management of groundwater should be integrated, adaptive, inclusive, and local.
- Groundwater management should not be carried out in a vacuum. Decision-making related to land use, surface water use, etc. should consider consequences to groundwater over the long term.

Conclusions

Thank You