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Threats to groundwater dependent ecosystems

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Joint actions for more efficient management
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Threats to groundwater dependent ecosystems (GDEs)

GDEs dependence on groundwater can be variable, ranging from partial and infrequent dependence (seasonal or episodic), to total (entire/obligate) or continual dependence.

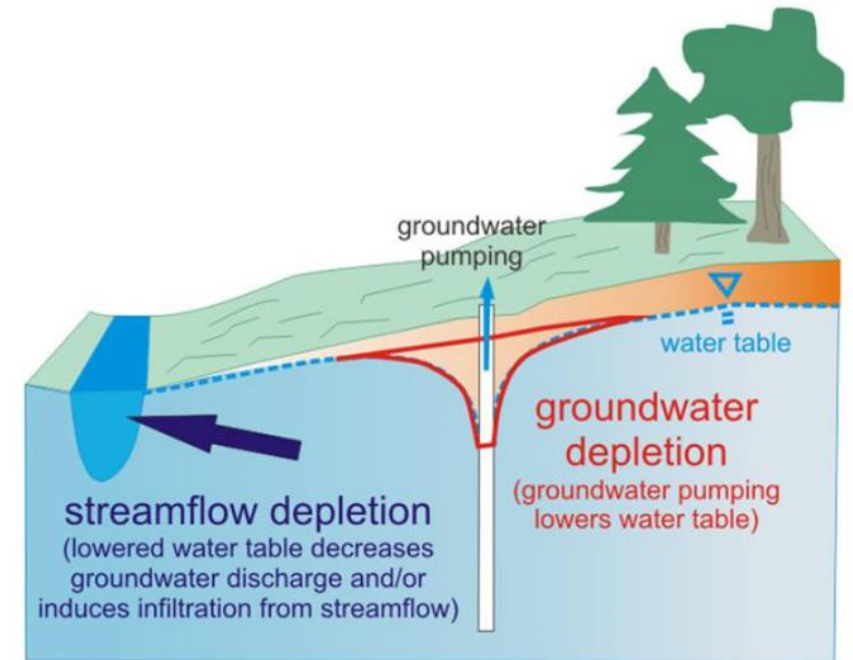
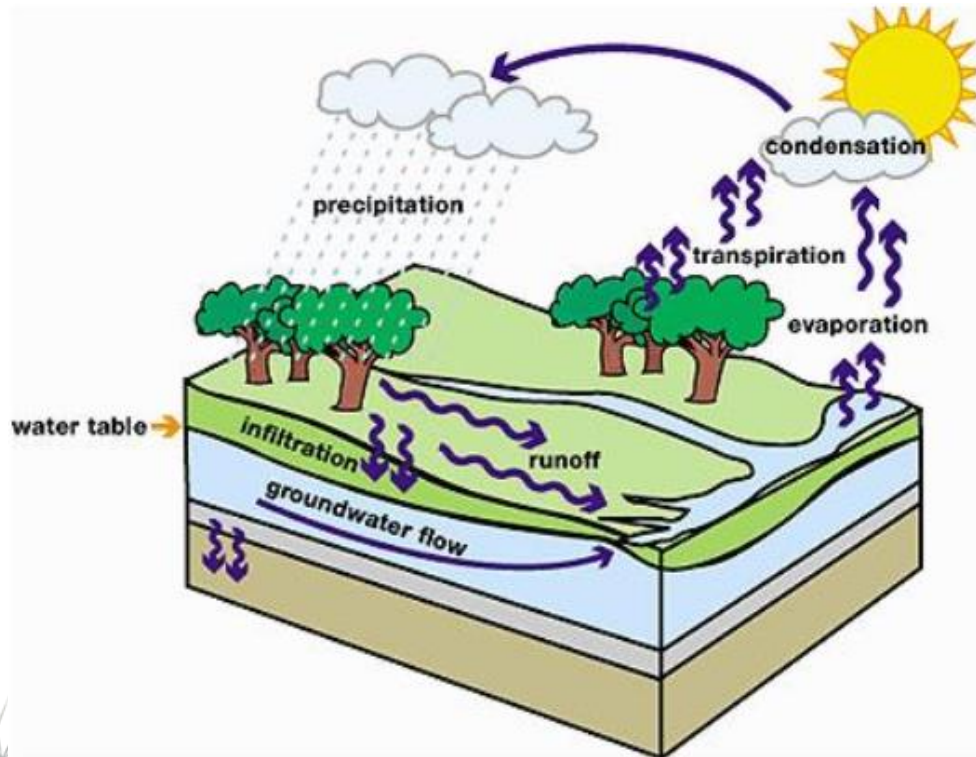
There are many activities that affect the health and condition of an aquifer and associated GDEs. These activities mainly can cause changes to:

- **water quantity** or groundwater regime and
- **water quality**



Groundwater quantity (impacts on groundwater regime)

Parameters of the groundwater regime that influence the viability of GDEs include the alteration of **water level** and **pressure regimes**.



Activities associated with water and land use development have the potential to alter any of these parameters, and therefore, the water regime required by particular GDEs.

Groundwater quantity (impacts on groundwater table)



Beaver activities



Deforestation

Groundwater abstraction
(agriculture, urban development,
drinking water etc.)



Climatic factors



Excavation of ditches and ponds



Mining (with GW level lowering)



Land use change



Groundwater quantity (impacts on groundwater table)

The degree to which GDEs are impacted by altered groundwater regime will depend on:

- the degree of the ecosystem's dependence on groundwater;
- the rate of groundwater level changes (drawdown);
- the time period in which the alteration takes effect;
- the seasonal timing of the alteration.

Highly or totally dependent ecosystems and those that occupy a very narrow ecological range may be completely eliminated by even relatively small changes in the groundwater regime!

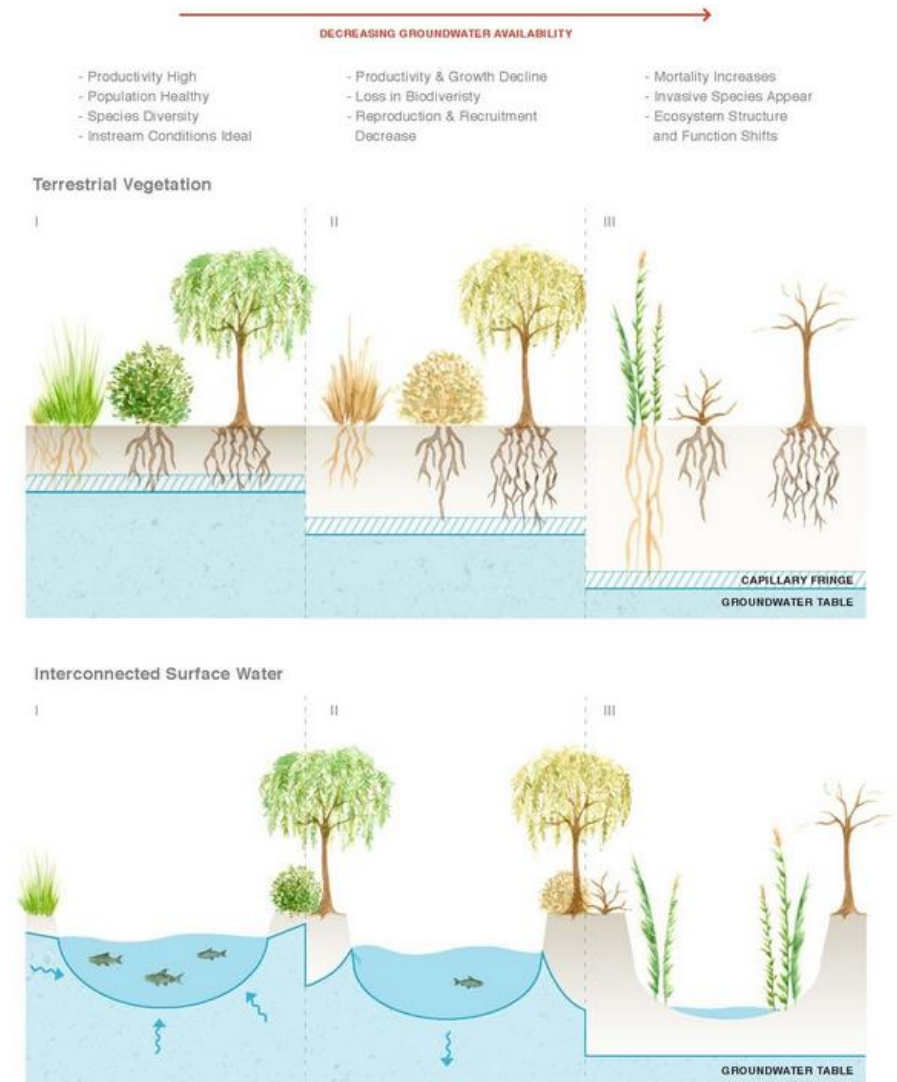


Groundwater quantity (impacts on groundwater table)

Some of the examples are:

- severe stress and partial or complete mortality of trees by disconnection of roots from the aquifer;
- the subsequent drying out of the ecosystem over time by prolonged period of drawdown;
- the impact is even worse when rapid or extended drawdown occurs during periods of environmental stress (summer or drought).

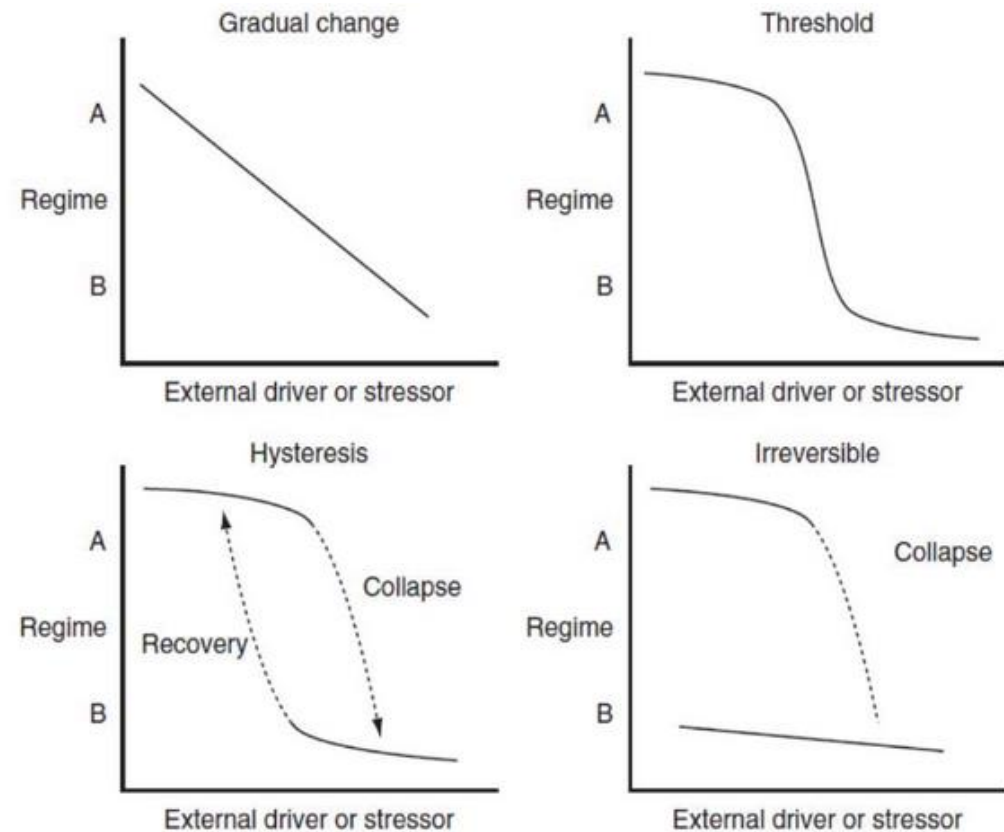
Ecological Responses to Groundwater Depletion



Groundwater quantity (impacts on groundwater table)

The condition of GDEs relies on a combination of timing and availability of groundwater but the response functions of these ecosystems are seldom known.

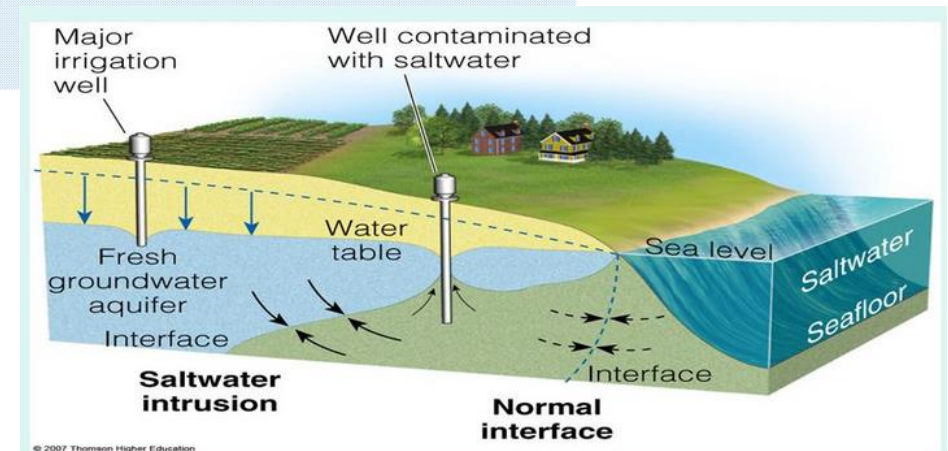
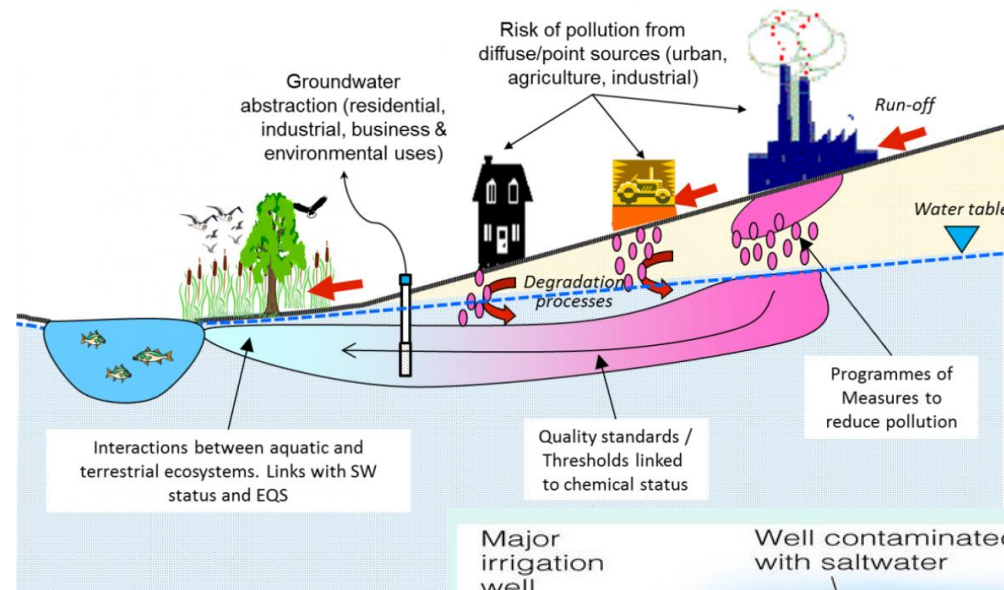
Some GDEs might show a linear response - as the water table drops, the condition decreases. Other ecosystems may respond in a stepped fashion with minimal change in condition until a threshold of water availability is reached.



Groundwater and groundwater quality threats

The changes of natural water chemistry can result from a various types of causes and, therefore, have many different impacts depending on whether the change is caused by:

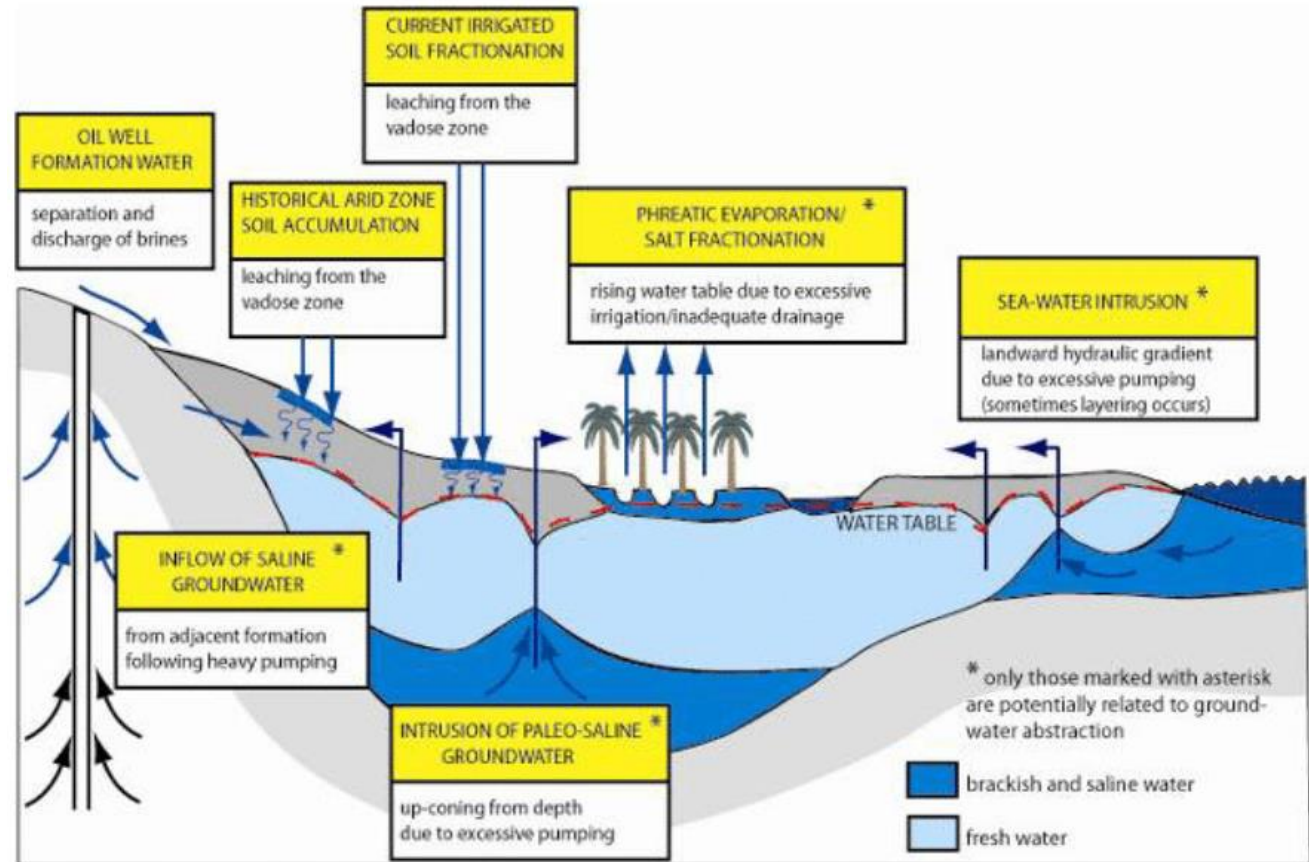
- point source pollution;
- diffuse source pollution;
- alterations to natural patterns of hydrological connectivity such that a water of lesser quality is drawn in from other formations, seawater or surface water bodies.



Groundwater quality (impacts on groundwater table)

Groundwater level changes in the aquifer can result in internal aquifer chemical changes such as:

- the exposure of acid sulfate soils;
- contamination by saltwater intrusion through drawdown of shallow coastal aquifer;
- the salinization of soil and water by raising the water table through excessive irrigation.



Most symbols for diagrams courtesy of the Integration and Application Network (ian.umces.edu/symbols/), University of Maryland Center for Environmental Science

Conceptual model of impacts on flow regime from extraction

Groundwater quality

Urban and industrial developments as well as intensive agricultural land use can adversely affect groundwater quality and, therefore, the ecosystems that are dependent on the groundwater.

Changes in water quality can occur by the following:

- nutrients from fertilizers and septic tank effluent;
- agricultural pesticides;
- metals and oil products from urban land uses (e.g. leakages from underground fuel tanks can contaminate groundwater).

Exposure to such contaminants can pose a direct short and long term threat to the ecology of GDEs.



Thank you!

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Joint actions for more efficient management
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