Policy Brief

New research shows that groundwater levels are declining at rapid and accelerating rates in many global aquifers. It also reveals cases where depleted aquifers have recovered after human interventions.

Background

Groundwater is a vital water resource globally, providing drinking water to billions of individuals and supplying nearly half of all water used for irrigation. Excessive withdrawals can, however, deplete groundwater resources.

Rapid and accelerating groundwater decline

A new study analyzed millions of groundwater levels in 170,000 wells in over 40 countries to identify groundwater level changes over time. Two of the findings of the study are:

1. Rapid groundwater declines are widespread, especially in arid climates with extensive croplands.
2. In many of these cultivated drylands, groundwater declines have accelerated over the past 40 years.

Consequences of groundwater decline

Rapid and accelerating reductions in groundwater levels can lead to undesirable outcomes including (a) seawater intrusion, which can contaminate coastal aquifers, (b) land subsidence, which can damage infrastructure and flood coastal communities, (c) streamflow depletion, which can reduce water availability to downstream water users, including wildlife, and (d) wells running dry, which can impair access to clean and convenient fresh water.

Table 1. Observed rates of 21st century groundwater decline

Country	Aquifer system	Median rate of decline (m/year)
Afghanistan	Central Kabul Basin	0.73
Chile	Central Santiago Basin	0.63
China	Northcentral Piedmont (North China Plain)	0.75
India	Northwest Jaipur Alluvium & Mendha Basin	1.68
Iran	Rashtkhar Aquifer	2.62
Iran	Western Qazvin Plain	1.74
Mexico	Calera Aquifer	1.01
Morocco	Central Souss Basin	1.04
Saudi Arabia	Eastern Saq Aquifer	1.30
Spain	Cingla-Cuchillo Aquifer	1.60
USA	Cuyama Valley	1.45
USA	Chowchilla Basin (California Central Valley)	1.02

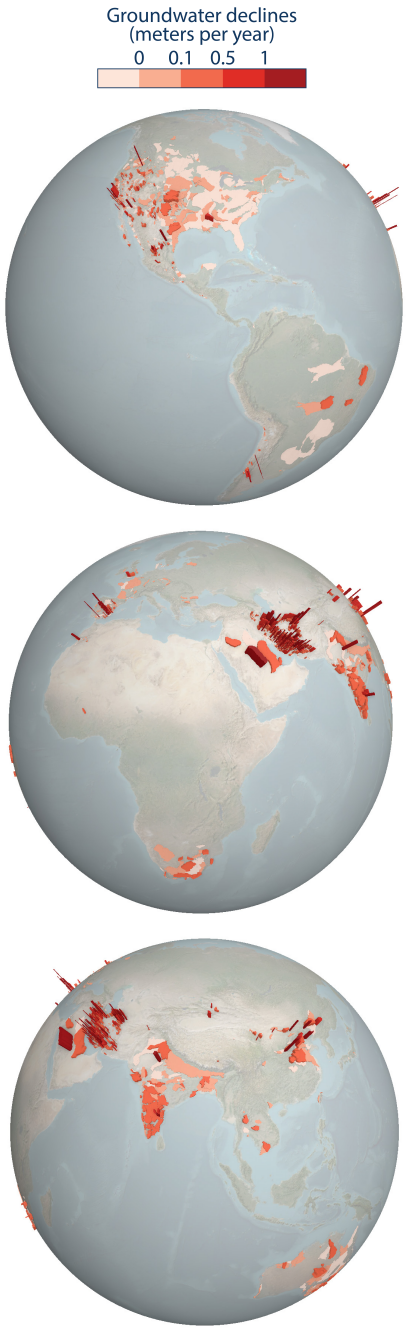

Fig. 1. 21st century groundwater declines. Dark red indicates rapid declines, and light brown indicates that groundwater did not decline. Rapid declines are evident in areas of the western US (top), Saudi Arabia and Iran (middle) and northern China (bottom).

Ram-Saq Aquifer, Saudi Arabia

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Addressing groundwater depletion

The research highlights cases where groundwater-level declines were reversed by interventions, such as (1) policy changes, (2) inter-basin water transfers, or (3) managed aquifer recharge.

Intervention 1) Policy change

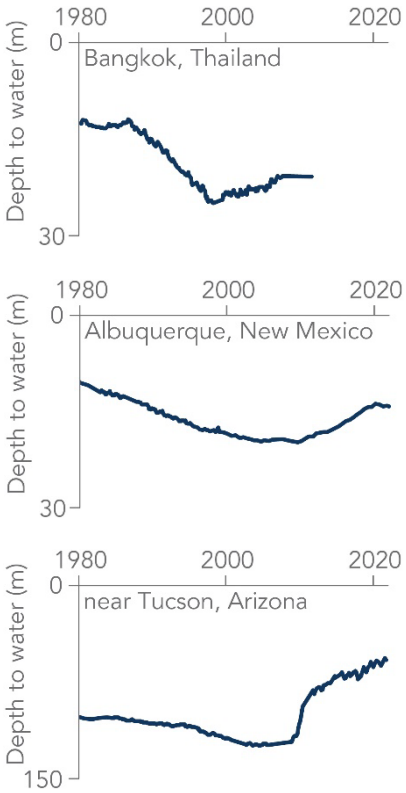
The implementation of new or altered policies has, in some cases, led to groundwater recovery. For example, in Bangkok (south Thailand), groundwater level declines of the 1980s and 1990s were reversed after the implementation of regulations designed to reduce groundwater pumping.

Intervention 2) Alternative water source

Substitution of groundwater for another water source has enabled some depleted aquifers to recover. For example, in Albuquerque (western US), groundwater levels are recovering after an inter-basin transfer of surface water alleviated groundwater demand.

Intervention 3) Managed aquifer recharge

Managed aquifer recharge involves intentionally replenishing aquifers, via infiltration ponds or injection wells. For example, in the Avra Valley of Arizona (west of Tucson in the southwestern US), a depleted aquifer is being refilled by water that has been diverted from the Colorado River.



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San Joaquin Valley, California