



Photo: WWF-Cannon/Michel Gunther

GROUNDWATER REPLENISHMENT

AN AQUIFER IS A LAYER OF ROCK CONTAINING WATER. Underground aquifers store 97% of the world's unfrozen freshwater, and they provide drinking water to almost a third of the world's people – in Asia alone more than a billion people rely on groundwater for drinking, and in Europe it is estimated that 65% of public water supplies come from groundwater sources.

In Brief

- ✓ Many wetlands help recharge underground aquifers that store 97% of the world's unfrozen freshwater.
- ✓ Groundwater is of critical importance to billions of people as their only source of drinking water.
- ✓ Groundwater is the only source of water for many irrigation programmes – 17% of the world's cropland is irrigated.
- ◆ In the Messara Valley of Crete almost 50% of the recharge comes from stream beds in the catchment.
- ◆ Three rivers in Tunisia recharge aquifers during periods of flood – the rivers run dry at certain times of the year but the aquifers supply irrigation water year-round.
- ◆ A 223,000-hectare swamp in Florida has been valued at US\$ 25 million per year for its role in storing water and recharging the aquifer.
- ◆ In northern Nigeria the value of wetlands in recharging aquifers for domestic water use has been valued at US\$ 4.8 million per year.

The relationship between groundwater and wetlands is rather complicated. Some wetlands, such as peatlands, lie on top of an impermeable layer of rock or soil, preventing the passage of water between the aquifer and the wetland. Other wetlands owe their existence to groundwater that has come to the surface as springs, while still others occur on permeable soils overlying aquifers, allowing water to recharge the aquifer directly. In Tunisia, the Zeroud, Merguellil and Nebaana rivers recharge the aquifer during floods and, although outside this period the rivers run dry, the water in the aquifer supplies irrigation needs all the year round. In some situations the direction of flow of water between wetland and aquifer depends upon the prevailing conditions. For example, in some swamps in Belarus the wetlands recharge the aquifer when the water table is low, but the aquifer will recharge the wetland when the water table is high.

In the Messara Valley of Crete almost 50% of the recharge to the aquifer occurs through the stream beds in the catchment and in a wet year may exceed 19 million cubic metres. Direct removal of water from aquifers for agriculture is common all over the world, and in the Messara Valley 22 million cubic metres are withdrawn each year to irrigate olive

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trees and vines; this highlights the importance of the stream in maintaining the aquifer and ensuring agricultural needs can be met. In monetary terms the value of the recharge function is high. In the USA a 223,000-hectare swamp in Florida has been valued at US\$ 25 million per year for its role in storing water and recharging the aquifer.

Quite apart from their role in supporting fishing, agriculture and forestry, the Hadejia-Nguru wetlands in northern Nigeria play a major role in recharging aquifers that are used by local people for domestic water supplies. The value of this has been recently estimated as US\$ 4.8 million per year.



Currently 17% of the world's cropland is irrigated – sometimes leading to over-pumping of groundwater.

Photo: WWF/Michèle Depraz

In a number of countries the direct removal of water from aquifers for crop irrigation has increased dramatically in recent decades. Currently 17% of the world's cropland is irrigated and it is estimated to provide around 40% of the world's food. Irrigation has brought great benefits to many countries – but it is also raising serious concerns as the rate of extraction often exceeds the rate of replenishment.

On a local scale, the recharge function of the Garet El Haouria wetland in Tunisia depended upon winter flooding. Drainage canals to control the flooding removed this function and water abstraction from wells in the area for irrigation of citrus orchards and market gardens dramatically altered the hydrology of the area. Groundwater levels fell by 9m between 1980 and 1995 and some wells have been abandoned because of saltwater intrusion.

On a global scale, groundwater deficits have now become significant problems in, for example, India, China, the USA, and the Arabian Peninsula. Collectively, these countries are depleting their water resources every year at a rate equivalent to the annual flow of two Nile rivers! Such deficits not only raise concerns over food security in certain countries (e.g., irrigation was a key component of India's Green Revolution) but are also a concern because of the role groundwater plays in sustaining lakes, rivers and other wetland ecosystems. ◆

Wetland Values and Functions

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CONVENTION ON WETLANDS
CONVENCIÓN SUR LES ZONES HUMIDES
CONVENCIÓN SOBRE LOS HUMEDALES
(Ramsar, Iran, 1971)