

Chapter 5 Highlights

1. Water scarcity—broadly, not enough supply to meet demand—can be quantified in many different ways, of which the *Falkenmark* and *WTA indicators* are the most widely used.
2. The world as a whole is not water-scarce, but many countries, regions, and cities are struggling with water scarcity. Although water scarcity is largely a local issue, the trade of virtual water around the world adds a global dimension to the problem.
3. Human consumptive use of water has led to declines in reservoirs and lakes, especially *terminal lakes*, where these declines are often accompanied by an increase in salinity and the loss of fisheries and other ecosystem services. When large areas of *playa* are exposed, the resulting toxic dust storms can have significant impacts on air quality.
4. Consumptive use has also decreased the flow of many rivers around the world, with serious impacts on the rivers themselves and on river-dependent wetlands, floodplains, deltas, and estuaries. In addition to declines in flow, rivers have also experienced broad changes to their *flow regimes*, changes that often include a dampening of natural seasonal variability. These hydrologic changes can affect sediment transport, water temperature, habitat connectivity, and biodiversity.
5. As a water source, groundwater has some advantages over surface water, but overuse of groundwater is leading to *groundwater depletion*, which has economic, social, and ecological impacts, including *land subsidence*, *saltwater intrusion*, increased water-supply costs, and inequitable water access.
6. Groundwater pumping has complex, site-specific effects on hydraulic gradients and flow paths. When pumping draws primarily from *capture*, it is using renewable water, but can affect river flow and should be co-managed with surface water. When pumping draws primarily from storage (as in a deep *fossil aquifer*), it is mining a non-renewable resource.
7. Groundwater depletion can be measured at large scales with the *GRACE* satellites, or at smaller scales using local data. Globally, somewhere around 15-20% of groundwater use consists of depletion.
8. In systems with access to both surface water and groundwater, like California's Central Valley, groundwater can serve as a reservoir that is drawn on during dry periods and replenished during wet ones, but overuse and more frequent droughts have converted it into a time-limited, non-renewable resource.
9. There are four basic approaches to mitigating scarcity: increase supply, increase storage, reduce demand, and reallocate water.