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Regional assessment of Groundwater Recharge and Water Harvesting potential in semi-arid lands.

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Water balance calculations based on gridded monthly climate data offer a tool for partitioning available precipitation between surface runoff, soil water storage, evapotranspiration and recharge to groundwater. Using a dynamic model in which vegetation biomass and soil organic matter also respond to the availability of water, we can distinguish regional patterns of hydrological regimes along the spectrum from humid to arid conditions..
Groundwater recharge is at its most significant when precipitation is of the same order as potential evapotranspiration. In arid climates, most water is lost to evapotranspiration through vertical exchanges, allowing little storage of soil water and significant recharge only in large events and primarily along channelways. In humid climates, most of the precipitation drains laterally in the shallow subsurface, so that although groundwater recharge increases absolutely with precipitation, it decreases as a proportion of the total, and therefore lessens the importance of groundwater as a resource.
The benefits of water harvesting are most achievable where rainfall is marginally inadequate for rainfed agriculture, allowing supplementation by harvesting of surface runoff or groundwater, preferably from renewable sources. The reliability of harvesting methods also depends strongly on the inter-annual variability of rainfall, which generally increases towards more arid regions, providing an additional constraint on the sustainability of harvesting systems.
These principles are exemplified by maps for Europe and Africa, generated by the model from the climatic data and showing the broad regional patterns of recharge and water harvesting potential.