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Water – A Precious Resource

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Why do we consider water to be a precious resource? Is it scarce? All life depends on water. Our bodies consist of around 70% water. We can only survive for 3 days without water. Water also plays a key role in balancing temperature extremes between the seasons, between day and night, as well as between different regions. It moderates weather extremes.

Water vapor is the most abundant greenhouse gas in the atmosphere, with its concentration in the atmosphere varying between 1% and 4%. There are about 1400 million cubic kilometres of water on and around the earth. It is found in four different "environments", which are all forming part of the water cycle:

- In the oceans.
- On land.
- In the atmosphere.
- In living organisms.

It can exist in the three distinct phases, namely solid, liquid, and gaseous, but water is never lost from the water cycle. In some stages of the water cycle, it is however not available for human or agricultural use.

About 97.25% is found in the oceans, covering 70.8% of the earth's surface. The oceans play a key role in regulating global temperatures and

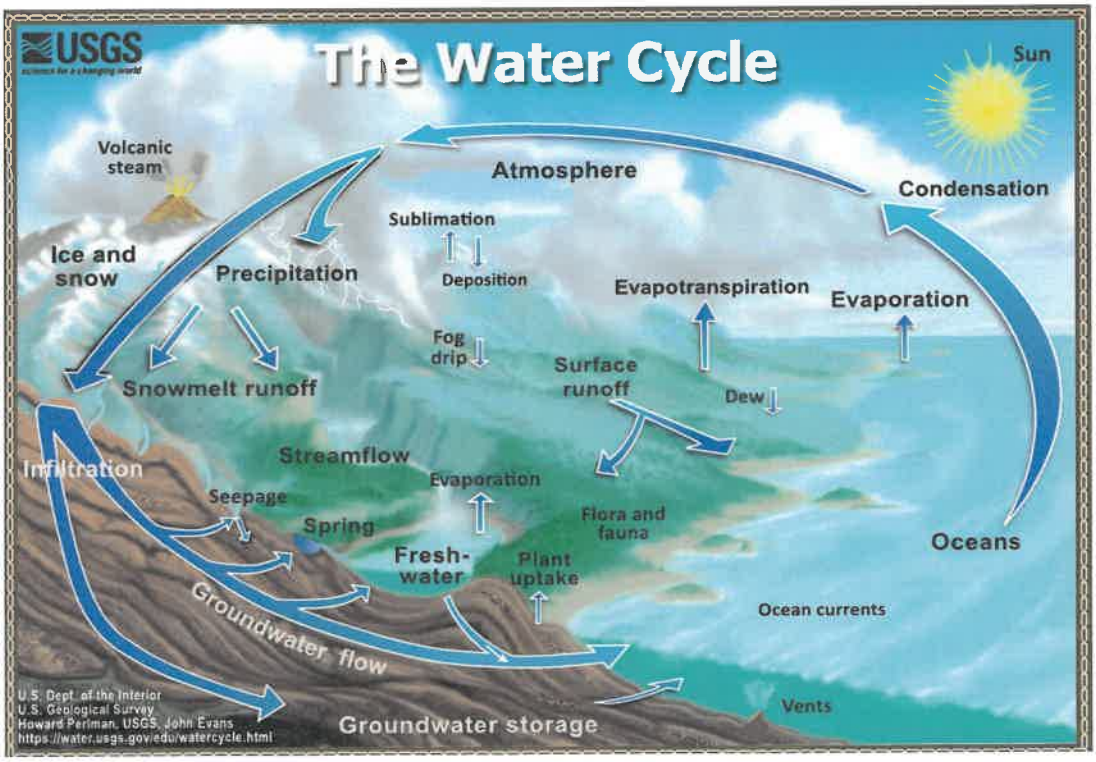

Figure 1: The water cycle John Evans, Howard Perlman, USGS http://ga.water.usgs.gov.edu/watercycle.html

humidity, as well as supplying a portion of the moisture for precipitation on land.

Water on land consists of:

- Solid form - snow and glaciers, forming 2.05% of the volume of all water on earth. It contains about 70% of the world's freshwater reserves.
- Visible surface water in rivers - only 0.0001% of the volume of all water on earth.
- Lakes, including salt lakes and inland seas - 0.01% of the volume of all water on earth.
- Groundwater - 0.68% of the volume of all water on earth.
- Soil moisture - 0.005% of the volume of all water on earth, exceeds the volume of water in all rivers of the world many times over. Water in the soil is therefore, in terms of amount and usefulness, more important than surface water. This misunderstood treasure is however, overlooked and neglected, and as a result often decimated.

The volume of water in the atmosphere (in all three phases) is approximately ten times greater than the volume of the water in all rivers. Just as the oceans regulates the global temperatures on earth, the water in the atmosphere plays a key role in regulating the local temperatures.

Water in living organisms, consists of approximately 0.00004% of the volume of all water on earth. This water is of vital importance for every living organism. All physiological processes in the organism occurs in an environment consisting mainly of water. The water content in plants differs according to the species and is often much higher than in animal tissues.

As we can see from the figures mentioned above, fresh water which is suitable for human use and agricultural use is only a small portion of the total volume of water on earth. It is found as groundwater, soil moisture, in rivers, streams, lakes and dams.
These water resources are however not equally distributed across the earth. Some areas, like large parts of South Africa is dry, as can be seen in Figure 2.

In these areas that are dry, water is indeed a scarce resource. This is, however, no reason for despair. Fortunately, it is possible to implement certain interventions, which facilitates retention of water for a longer time in and on the landscape, before it reaches the ocean again.
It can be seen as interventions that restore the proper functioning of the water cycle in that area.

It is scalable -from a few hundred square meters (urban dwelling and yard) to whole

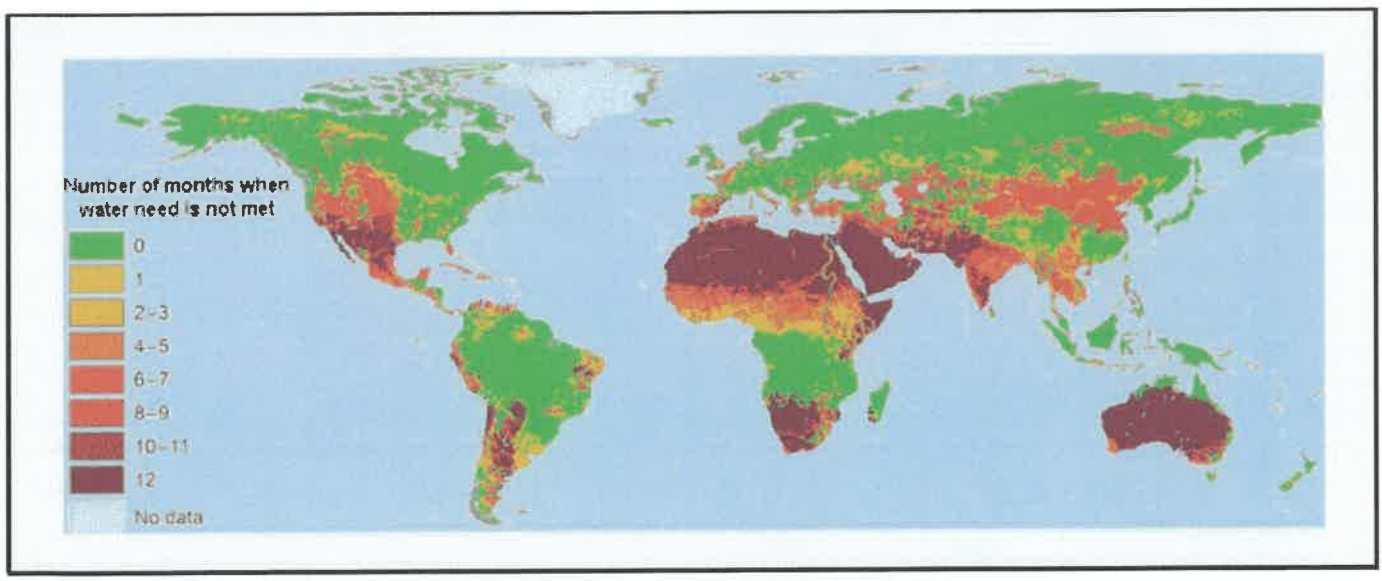

Figure 2: Drought areas of the Earth, (from M. M. Mekonnen and A. Y. Hoekstra, Four billion people facing severe water scarcity, *Science Advances, 2 (2016) e1500323)*

catchments consisting of thousands of square kilometres. The larger the area, the more profound the effects.

Over time several land use practices have unintentionally had the effect that water retention in and on the landscape decreased, while simultaneously these practices caused run-off of water to increase.

The net result is a drier landscape, denuded of vegetation and with most fertile topsoil eroded and washed away. The remaining soil contains little organic matter, which relates directly to having a low water holding capacity.

To restore the water cycle in an area, an intentional effort is needed to implement interventions that:

- slow the flow of run-off water on the soil surface,
- spread the water over the soil surface,
- facilitates infiltration of the water into the soil profile,
- cool soil and reduce evaporation from the soil,
- increase organic material content in the soil.

These interventions are mostly low-tech, have a low cost and make use of locally available materials. Some of the methods are listed below:

- Technological measures:
  - Shallow infiltration ditches on the contour (swales),
  - Depressions, infiltration pits and water holes,
  - Small dams or ponds in watercourses, streams, creeks, and ravines,
  - Protecting and using the meanders of watercourses and blind tributaries,
  - Structures for enabling the discharge and spreading of runoff water into flood plains,
  - Construction of small weirs,
  - Erosion prevention and control measures.
- Biotechnical measures
  - Biotechnological measures are like technological measures, but here vegetation is used:
    - Borders,
    - On contour strips of grass, shrubs, or trees,
    - Areas with undisturbed natural indigenous vegetation.
- Preventative measures
  - Measures for protecting the soil, like contour ploughing, conservation agriculture and no-till cultivation,
  - Controlled grazing,
  - Minimizing the impermeable hard surfaces areas with no vegetation in urban areas,
  - Replacement of impermeable surfaces with permeable ones,
  - Constructing the barriers along rivers and waterways through urban areas further from the centre of the streambed, allowing water to infiltrate on floodplains,
  - Protecting indigenous forests from looting and damaging insects.

More information is provided in a publication "Changing climate, the role of water and what you can do to drought-proof your land", which can be ordered from ARC-NRE publication office Elmarie Stoltz at StoltzE@arc.agric.za or contact Fanie Vorster at vorsters@arc.agric.za

Figure 3. Typical gabion retaining structures