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How Emerging Technologies and Biomimicry can Help Solving Water Problems: Desert case Studies

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By 2050, the global population is expected to rise to nine billion and there have been significant calls for a change in the way the world is dealing with growing water shortages. The approaching water crisis will threaten half of humanity by 2030. Our ever-increasing population is stretching our ability to provide clean water for our needs, from agriculture and manufacturing to the most basic one of all: drinking water.

In the desert, where water is scarce and few living things are to be found, some species possess the most amazing designs to survive. In some parts of deserts, finding water is a long journey. However, even when water is found it doesn't mean it is safe, as it can be contaminated. Many solutions are emerging; yet, they have to be simple, no costly and easy to maintain and to be applied. New technologies and biomimicry are constant solutions to make water collection and purification easy, dependable and affordable. Biomimicry is an approach to innovation that seeks sustainable solutions to human challenges by imitating nature's patterns and strategies. The goal is to work in inventing products that are well-adapted based on nature long experience. In fact, nature has already solved many of the problems we are facing. In the following paragraphs we discuss some of the emerging innovations in water technology that may have some answers to our water related problems.

Fog harvesting: Even in areas without considerable rainfall, at certain times of the day the air contains enough moisture to be captured and stored. Fog collection refers to the collection of water from fog using large pieces of vertical canvas to make the fog condense into droplets of water and flow down towards a trough below the canvas. It has the advantage of being passive, requiring no external energy source to perform its collection.

Sustainable water filtration: Sometimes, the problem is the lack of clean water and the ability to purify it. In areas with access to contaminated water, sustainable water filtration systems can make the difference between life and death. Many low-tech methods using plants, tree seeds, ashes, or manure are sometimes found. Other purifiers are even simpler, and use just the sun. Among them: Eliodomestico [1] and the Watercone [2].

Laser cloud seeding: This is a new technology invented by researchers from the University of Geneva. Laser pulses generate clouds by stripping electrons from atoms in the air, encouraging the formation of hydroxyl radicals, which convert airborne sulphur and nitrogen dioxides into particles that act as seeds to grow water droplets.

Biomimetic dew harvesters: The Stenocara beetle lives in the extreme conditions of the Namib desert in Southern Africa. Many articles described how the way this beetle collects the water is so vital to its survival. Recently, it was demonstrated that such insects can collect dew on their backs and not just fog as previously thought. This made possible by the wax nanostructure on the surface of the beetle's elytra. These findings can help improving the water yield of man-made dew condensers that mimic the nanostructure on the beetle's back [3]. In fact, examining the features of this beetle's back under an electron microscope, scientists established that it's a perfect model for water-trapping tent and building coverings, or water condensers and engines.

Wind turbine: French-based company Eole Water is testing a wind turbine in the United Arab Emirates that it says can produce hundreds ofL of drinking water a day from the dry desert air. Tests on the outskirts of Abu Dhabi have been able to produce 500 to 800L a day. The company believes volume can reach 1,000L a day with a tower-top system.

Warka water: Warka Water [4], an inexpensive, easily-assembled structure that extracts gallons of fresh water from the air. The invention from Arturo Vittori, an industrial designer, and his colleague Andreas Vogler doesn't involve complicated gadgetry or feats of engineering, but instead relies on basic elements like shape and material and the ways in which they work together. The rigid outer housing of each tower is comprised of lightweight and elastic Juncus stalks, woven in a pattern that offers stability in the face of strong wind gusts while still allowing air to flow through. A mesh net made of nylon or polypropylene, which calls to mind a large Chinese lantern, hangs inside, collecting droplets of dew that form along the surface. As cold air condenses, the droplets roll down into a container at the bottom of the tower. The water in the container then passes through a tube that functions as a faucet, carrying the water to those waiting on the ground.

Sietch Nevada (an oasis in the desert): Frank Herbert's seminal sci-fi classic Dune, set mainly on the dystopian desert world of Arrakis where water has become a form of currency, is the basis for a futuristic concept city design in America's arid interior: Sietch Nevada. Designed by Matsys Designs, the concept envisages a drought-stricken future where water-hoarding societies are forced to battle against constant drought and 'water wars'. An underground city of tunnel and cave networks, Sietch Nevada stores water in aquifers below the honeycomb-structured dwelling areas and tunnels which act as both transportation passages and irrigation channels. The underground city draws power from above, harvesting surface water, generating energy from renewable sources and growing food with the use of urban agriculture and aquaculture techniques.

Cloud seeding with laser beams: Cloud seeding as a concept has been around for decades, with the usual intention being to increase precipitation. This usually involves inserting silver iodide crystals, dry ice or other chemicals into clouds in the rarefied atmosphere

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to increase cloud formation. While cloud seeding has traditionally been undertaken by aircraft dispersal or by ground-based dispersion devices, such as generators or canister-filled rockets, recent research has been looking into the potential of using lasers. Researchers at the University of Geneva have already used lasers to generate small clouds on demand in the lab, according to science journal Nature Photonics. The researchers will now try to optimize laser wavelength, focus and pulse duration to increase the effect and produce droplets large enough to fall as rain.

LEAF self-generating water resource: One example of future water creation technology on the brink of production could transform many lives in humid regions of the world. Pune-based Indian student Anurag Sarda's solar powered LEAF Self-Generating Water Resource won first prize at the international Time to Care Sustainable Design Award. Capable of producing 20L of drinking water every day, the LEAF is an 18-foot tall water condensation unit. Similar to a natural leaf, the unit transforms condensation into water, which is then purified via an attached sand filtration unit and finally collected in an earthen pot. LEAF utilizes solar energy to generate electricity and cool its upper metallic surface, facilitating the formation of dew, which is then collected via the leaf-like shape of the structure. The unit is extremely low maintenance, with the filter simply needing to be cleaned every now and then.

Iceberg rodeo: This system was invented by French engineer Georges Mougin over three decades ago, when challenged by a Saudi prince to tow an iceberg from the Antarctic to the Arabian Peninsula. While Mougin's project was originally beset by difficulties, the use of glacial ice that would otherwise melt into the ocean could be one potential solution to the global water crisis for the world's arid regions in years.

Obviously, more than one solution is necessary in order to reduce or solve the issue of water scarcity that the world faces today. Any action is important and must be taken into consideration. Our world currently faces a dilemma regarding a limited water supply and if the issue continues to progress without significant alterations, the consequences will be detrimental.

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