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Natural Materials to Absorb Water from Environment

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Abstract. In nature, there are a large number of materials to be discovered, all with different characteristics and for certain functions. In the case of plants, they are responsible for collecting, taking care and protect water naturally. In Mexico there are different plants of the cactus family, which catch and retain water for their existence, so some plants collect more volume of body water than they have. It is very important for this investigation. In Mexico and throughout the continent there is a common cactus or *prickly pear* that easily adapts to the environment and very rampant in this country, so that its study and analysis makes it one of the most important natural systems for this research, because 95% of it is water and the other 5% is organic material. Later, the common Maguey or agave plant is analyzed, which is important for the history of ancient Mexico, this long before the Spaniards arrived in America. The agave juice and whole plant were an important part of Mexican culture [1], even today is used in many regions and is an important part of the economy in this country. Last but not least is the barrel cactus plant, which surprisingly lets us see how natural systems build structural and formal elements in order to the creation and configuration of new materials that can significantly help to collect water.

Introduction

The hydrological cycle is the process by which ecological ecosystem receives water as rain or snow. This fall moisture replenishes rivers, aquifers and underground water sources. The water supply of a particular system depends on the climate, physiology, vegetation and geology of the region. In each of these levels, modern humans have abused the land and destroyed its ability to receive, absorb and store water. Deforestation and mining have destroyed the ability of watersheds to retain it. Monoculture and forestry have absorbed water ecosystems. The growing use of fossil fuel has caused air pollution and climate change responsible for floods, cyclones and recurrent droughts [2].

In addition to pollution problem, the global overpopulation is another issue, which has split the water supply in half and it has doubled in the last ten years. Another problem is water policy, which means that if ten years ago ten people could use one liter of existing water, now with the population growth they can only use less than half of it, but if any of these ten has purchasing power and other economic needs, the distribution of water becomes unequal in the property of this vital liquid.

The simplicity of the preceding exercise makes us understand that the problem of water shortage is due to three factors: pollution, overpopulation and water policies. Each country sets rules and policies according to global policies for water use, however, as already mentioned, there are many other factors involved in this real use.

Because of these factors mentioned before, it becomes a present priority to ensure water for human consumption for future generations and look for a simple and sustainable way is paramount.

In this sense, the study of Biomimicry allows us to emulate natural systems that can solve these problems. Along with the use of design strategies for water supply in metropolitan areas of different states of Mexico, it is expected that they can serve to other countries facing such problems. For this reason, Biomimicry is defined and used as the transfer of technology of living beings to develop design projects.

Keeping this in mind, different living organisms were observed in Mexico in order to understand and obtain information, which allowed us to emulate and practice its natural process for collecting, and accumulating the use of water in the most possible sustainable way.

Natural systems

There is an immense variety of living organisms in Mexico which man frequently acts on, but almost nobody has ever thought about what they do to live.

As a result three existing organisms were analyzed in Mexico as native plants, the common cactus or prickly pear (see fig. 1), maguey or agave see (fig. 2), and the barrel cactus, three of which are significantly used in Mexico.

The common prickly pear

Fig. 1 Common prickly pear located throughout northern, central and southern America. Photography: Arturo Santamaria Ortega, 2013, Coatepec Hill, Toluca, Mexico

The prickly pear is used in Mexico as common food and the maguey is an important resource for generating work. It is composed of fibers that are used in the textile industry. Some craftsmen use it to make sacks or high quality fabrics.

Prickly pear is a natural system that holds and stores water, 90% of its composition is water, and undoubtedly it is a good object of study. A cut prickly pear can stay up to six months retaining sixty percent of water. It grows in extreme drought places and produces colorful flowers. It is an excellent water container due to its outer shell doesn’t allow getting out the liquid because of its texture and an impermeable layer is formed around. Furthermore, its thorns grow and form the stems of the crown.

The common maguey or agave

Fig. 2 Common Maguey, there are approximately 273 families so far discovered. It is located throughout northern, central and southern America. In Mexico, there are 205 species which 151 are endemic. Photography: Arturo Santamaria Ortega, 2013, Coatepec Hill, Toluca, Mexico.

Meanwhile, the maguey has different uses, one of them is to get alcohol later processed in different ways, the most well-known being tequila, and also the fibers are used for textiles.

Maguey is a great device to get natural water, its branches are designed to retain and send rainwater into the center of the plant. Its smooth texture allows the water to flow down into the core of the plant and thus store water for long time.

Dried maguey can be used to thistle and thread and its thorns serve as tools to mark different traditional handcrafts processes.

The barrel cactus

Fig. 3 The Barrel is a cactus that has several interesting natural systems including holding water, but also capturing it. In a rainy day, it can store up to three times its volume, thanks to the shape of its spines. Photography: Arturo Santamaria Ortega, 2013, Zamorano Hill, Querétaro, México.

Finally, the Barrel is a cactus that has several interesting natural systems including collecting and storing water. In a rainy day, it can store up to three times its volume, due to the shape of its spines (see fig. 4). These water systems are similar to the polar bears hair's temperature mechanism, which allow them to preserve healthy heat to develop and live. This is another use of Biomimicry that will be the subject of the next steps of the project.

The barrel cactus' spine

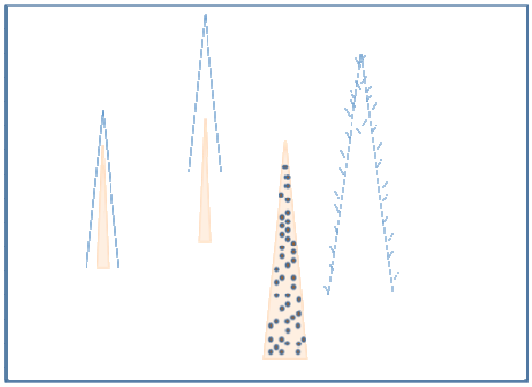

Fig. 4 The barrel cactus's spine contains little spines, which allow collecting water preventing it and out. Drawing: Arturo Santamaria Ortega, 2013.

Conclusion

It is considerably important to mention that the culture of water conservation should not only be for the benefit of humans but also for nature, which modifies its structures everyday trying to help humanity. At some point man will pay his stubbornness trying to improve his lifestyle at the expense of the planet.

While the water is still contaminated, we must care about its importance not only for men have a sustainable life, but also for other living beings.

That is why we should think of efficient use of proper water consumption, through new materials that emulate naturals systems and structures, which make them sustainable, and avoid mixing it with difficult pollutants to remove such as oils, soaps or chemicals pharmaceutical industries (although these ones are due to the lack of importance and seriousness to follow the policies of care and preservation of water).

Future generations depend on new ways to obtain and manage water as a resource, but more importantly, it is necessary to reestablish the natural balance with our planet and its resources.

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