Water and Traditional Knowledge. Learn from the Past for a Sustainable Future

Modern technology alone cannot provide us with adequate answers and solutions to global problems like desertification, flooding and water scarcity. In the future, a key role towards sustainable management of water on our planet will almost certainly take the form of a re-evaluation and rediscovery of " traditional" knowledge and techniques.
This is knowledge that was tried and tested by our predecessors in close contact with nature over the course of centuries, in their quest to face hostile environmental conditions and devise strategies that would benefit all community members.

What is "traditional knowledge"?
Today, with the world on the brink of ecological collapse, the traditional knowledge of our predecessors can really teach us how to interact with the environment in a more "sustainable" way, using natural resources without depleting them.
So what exactly do we mean by traditional knowledge and techniques? We might define traditional knowledge as the sum of local solutions and techniques, which include farming practices, models of water management, everyday habits, artifacts and even behavior and spiritual values. But let's take some concrete examples. Think for example of the terracing used for agriculture, techniques for collecting rainwater in basins and cisterns, tunnels, underground drainage (passageways to take water underground and create oases in the desert), techniques for extracting humidity from the air (using dry stone walls in arid regions, useful for condensing small but very precious quantities of water in the air), etc.

Terracing: what purpose does it serve?
Made by digging into hills and slopes, terracing has for thousands of years been an ingenuous solution in many countries for exploiting hilly and mountainous areas which otherwise would be extremely difficult to cultivate. Indeed crops normally need flatlands and plains to grow. Terracing actually creates small flat areas, bordered by dry stone walls which sustain the ground. A system of terraces is thus created that look like a series of wide steps on the landscape. This technique is of course useful for agriculture, but it also protects hills and mountainsides from rainwater erosion which could turn large quantities of earth and rock into landslides. Throughout the world, from China to the Mediterranean, this technique has turned arid hillsides and precipices into fields and luxuriant gardens, just by modifying the slope of the land and retaining some of the rainwater that would otherwise fall straight down into the valley

Illustrations 1-2: © Philippines Travel Guide.com
Terracing sistems in the Philippines.

Illustration 3: © Texas A&M University
Terracing sistems in Bolivia.

Rice fields

From earliest times, the populations of China, Indonesia, the Philippines and many other regions of south east Asia have transformed wet and humid lands into highly productive rice fields. Rice, still widely used in China and India, is commonly cultivated immersed in water and sometimes alongside edible fish (this too is a form of traditional knowledge which keeps weeds that are potentially harmful to rice under control and simultaneously fertilizes the land in a natural way). This type of cultivation therefore both protects the environment and maintains its biodiversity.

The rice-fish agricultural system of China

In Asia fish farming in wet rice fields has a long history. A unique ecological symbiosis exists in the traditional rice-fish system: fish provides fertilizer to rice, softens the soil, and eats larvae and weeds in the flooded fields. On the other hand, rice provides shade and food for fish. It seems a perfect combination, beneficial to both local farmers and the environment. The high quality food of fish and rice are helpful to maintain farmers' living standard. In addition, this traditional rice-fish agricultural system reduces the use of chemical fertilizers, pesticides and herbicides for insect and weed control, helps in agro-biological conservation and field environmental protection.

Illustration 4: © FAO Food and Agriculture Organization of the United Nations
Rice-fish system in Longxian village of Zhejiang (China).

Multipurpose techniques

Each traditional practice may reasonably be considered as multipurpose, (having several purposes or functions) and multiuse (a solution to several different problems at the same time). Terracing, for example, not only protects slopes from erosion but it is also a means of collecting water and for reconstructing the ground. They also have a landscaping and aesthetic function. As well as being productive, sound both technologically and environmentally, they also take aesthetic and social values into consideration.

What are underground drainage tunnels?

Drainage tunnels are underground passageways built in many dry regions of the world to convey and canalize the water of an underground stratum or to "make" water in the subsoil by adopting the principle of atmospheric temperature range. Once particularly widespread throughout the Middle East and North Africa, this technique allows for minimal water loss in a particularly hostile environment like the desert. Thanks to underground passageways, evaporation of the water is avoided. Depending on where they are found , these passageways may have different names and characteristics. They are also found in China, in the Yemen and in many Mediterranean countries such as Turkey, Greece, Italy and Spain.

The Qanat (Iran)

Underground drainage tunnels in Iran, called qanat, sometimes reached a depth of 300 metres. They were built in the subsoil, expertly exploiting a slight slope to guarantee a slow but constant flow of water that prevented the erosion of the tunnel walls. Thanks to this technique, the water kept the purity and temperature of the underground strata. On some occasions the qanat were used as if they were air conditioners, cooling the air in the overhead areas.

Illustration 5: © International Institute of Earthquake Engineering and Seismology - Qanat in Iran

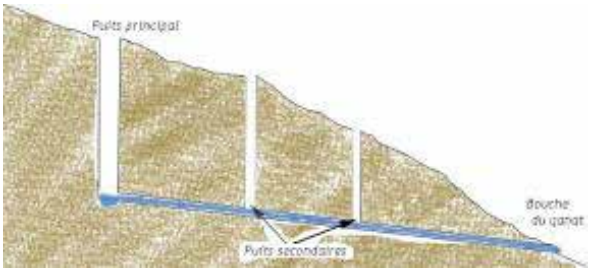
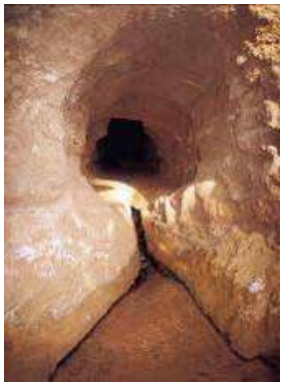


Illustration 6: © El Faïz (2005), Les maîtres de l'eau, Actes Sud, see references. Working plan of Qanat.

The Foggara or khettara of the Sahara

The foggara or khettara found throughout the Sahara desert are long underground tunnels, sometimes several kilometers long, which collect underground water and which were built to literally "make" water in the subsoil. This operation was made possible due to atmospheric temperature range which is a main feature of the Saharan climate. Linked to the surface by a system of wells, these tunnels were like "condensation chambers" which exploited the marked difference in temperature between day and night . The vertical wells served both to draw water and to make it easier for the rock dug out in the construction of the tunnel to be cleared away. Foggara and khettara were instrumental in the creation of oases in the desert.



Illustrations 7-8: © Laureano (2001), The Water Atlas, UNESCO, see references - The interior of the drainage tunnel called Foggara, Oasis of Timimoun (Algerian Sahara).

The Oases in the south of Morocco

The Tiznit region is located in south west Morocco. It is a desert region where there is very little rain indeed and the ground is dry and extremely difficult to cultivate. However, even in the most inhospitable of circumstances we find communities who have devised ingenious ways of surviving, and to do this they exploit some of the main features of their environment. The most important guarantee for survival in a region like Tiznit is to manage water wisely, not a drop can be wasted. Water is used both domestically and for subsistence agriculture, so the choice of what to cultivate is a fundamental one in this oasis, and cereals are selected which need little water to grow.

Illustration 9: © Laureano (2001), The Water Atlas, UNESCO, see references - Oasis of Ighzer (Algeria): a paradigmatic example of how traditional water knowledge and techniques may allow for survival in one of the most hostile environments of the world.

Illustration 10: © Centro Civiltà dell'Acqua - Traditional water canal in the Oasis of Tiznit (Marocco).

Managing water scarcity

The small streams, called oueds, which flow in the vicinity of Tiznit, bear water only a few times a year. Their beds are normally dry and only fill with water during rare periods of rain in the Spring and Autumn. The local communities simply had to learn how to manage underground water sources. In order to use this water they created long underground tunnels called foggara or khettara which exploit the force of gravity. A fundamental factor in the management of these water strata is to be aware that underground water is not infinite. It should never be drawn excessively but only in the quantities needed, otherwise there is a serious risk it will dry up.

Another traditional technique used in the Tiznit region is the exploitation of the oueds in the infrequent rainy moments of the year when they swell up with water. Barriers are created along the streams which allow for storage of water that can then be used for irrigation when required. Thanks to this system, the "water master" (abbar, he who distributes water according to pre-established rules) measures the water and then divides it out. So each inhabitant knows exactly when and for how long he is entitled to water for his crops. The example of Tiznit shows that as well as being due to careful consideration of the surrounding environment, the success of traditional techniques is strongly dependent on the solidarity and cohesion of the inhabitants. Those who are entitled to water (and therefore to land) are also required to actively collaborate in the upkeep of the drainage systems and the barriers on the oueds.

The advantages

The advantages offered by traditional knowledge so far pointed out lie in the use of flexible, small-scale technologies which are easy to use, are low cost and of low environmental impact. Traditional knowledge uses renewable sources, recycles resources and uses material that is available locally. Traditional practices and techniques do not have a specific impact on the environment, that is to say no irreversible damage is done. The key to their longevity is their simplicity. All traditional knowledge is founded on the observation of the territory and environment where the people live, and this empirical observation allows for positive and sustainable strategies to be devised for using resources. Over the centuries, traditional knowledge has constantly come up with more efficient solutions for environmental management that are both sustainable and take local resources into account . It is also characterized by its striking ability to adapt to environmental variability and to catastrophic events, indeed flexibility is its defining feature.

The living heritage of communities

Traditional knowledge is not the invention of one person but rather the sum of the knowledge and inventiveness of an entire community. Because it is created by local communities, traditional knowledge also puts great value on the wealth of knowledge that has been drawn up locally over the course of time, representing an intimate awareness of the environment, its potentials and also its limits. It takes the management of natural resources very seriously indeed. Such wise and prudent management of natural resources is further nurtured by the drive to make all community members benefit, including the generations to come.

Spiritual and symbolic features cannot easily be exported into other contexts

It must be pointed out that traditional knowledge is always part of a wider system which incorporates beliefs, perceptions and behavior as well as social and spiritual values. Technical aspects are intimately bound up with non-material aspects, and it all works as part of a system of shared values. An agricultural technique is not recognizable only for its practical use in the cultivation of a particular crop, but can also have other defining features, for example social and cultural. Take for instance the sacred meaning of water, rituality, the social significance of an agricultural calendar which includes ceremonies like special dates and festivals. Traditional knowledge doesn't work without all of these ingredient put together, and so cannot be reduced to a mere list of techniques which can be mechanically exported from one region to another. They work in as much as unique to a given ecological and cultural context and are not interchangeable.

Traditional knowledge in crisis...

In "developed" societies, the traditional knowledge and techniques that have been devised and passed on over the centuries is now in deep crisis. Clear examples are, for example, the extensive use of cement rather than local material like earth, and the use of powerful motor pumps rather than drainage tunnels to extract underground water in arid zones. Terracing too has been abandoned in favor of monocultures in the plains. Although these new practices are less sustainable in the long term (as they tend to deplete local resources), they are rarely questioned at all. Yet the consequences can be disastrous. In China, for example, the turning away from terracing provoked the collapse of hill-slopes in some regions, with resultant loss of soil fertility, desertification, and increase in sandstorms which devastate the land and local communities. The foregoing is traceable not just to climate change, but to shifts in well consolidated, sustainable and "traditional" agricultural practices too.

Illustration 11: © Laureano (2001), The Water Atlas, UNESCO, see references - A water master from the Algerian oasis of Adrar, showing the perforated artifact to measure the water flows for its distribution.

The United Nations Convention to Combat Desertification (UNCCD)

The increasingly widespread tendency to look at re-evaluating traditional techniques stems from the growing conviction that local knowledge may be a vital tool in promoting more sustainable development. Towards this end, The United Nations Convention to Combat Desertification promoted a major survey project of traditional knowledge on a world scale (UNCCD, 2005). Indeed, the experience of many development cooperation projects clearly shows that when sophisticated western technology is applied to Third World countries, the result is often failure, and there can also be long term negative side effects which far outweigh any benefits.

Illustration 12: © United Nations Convention to Combat Desertification - Historic cisterns to collect rain water (Thula, Yemen).

Globally Important Agricultural Heritage Systems (GIAHS)

In order to safeguard and support the world's agricultural heritage systems, in 2002 FAO launched an initiative for the conservation and adaptive management of Globally Important Agricultural Heritage systems (GIAHS). The initiative aims to establish the basis for international recognition, dynamic conservation and adaptive management of these cultural systems and knowledge, as well as recognizing their agricultural biodiversity, and the need to secure food and livelihood for all throughout the world.

Past knowledge for future technology

In many dry regions of our planet, where subsistence agriculture relies on rainwater collection or on the sustainable withdrawal of underground strata, new technologies which are accessible to almost anyone , operate by digging deep wells and depleting the underground resources, creating at the very least new problems such as the build up of salts in the strata themselves. However traditional and modern technologies are not intrinsically in antithesis, but may exist harmoniously side by side. Today we have many means of taking a fresh look at the knowledge of ancient water cultures, and not just as a curiosity but as a useful tool in dealing with water scarcity, drought and flooding, problems which have been faced and resolved since earliest times with frequently more farsighted wisdom than today. Traditional knowledge is not so much an outright alternative to modern technologies as a precondition for their efficient and enduring application and use. Do you know of any interesting examples of this? Let us know!: *info@civiltaqua.org*

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