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"Water, landscape and citizenship in the face of global change"
« Eau, paysage et citoyenneté face aux changements mondiaux »

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WORKSHOP 4 - *Citizenship and social participation in management water landscapes*

Mr Pietro LAUREANO
Architect and Urbanist, President of ICOMOS Italy

The water atlas, traditional knowledge for the fight against desertification

Because the true paradises are the paradises that we have lost.
Marcel Proust
If there is a Paradise it is on the Earth, it is here, it is here, it is here.
Sa'adi

I speak of water, where water there is not. I speak of the life in the desert areas where two billion people live today. They do not use the local water; they use water that comes from external resources. This condition is unsustainable and will be the cause of downfalls and conflicts. But in all deserts there are places where local resources are used and we can estimate that they permit still to 150 million people to live. These places, where the water necessities are resolved locally, are called Oases.

The existence of an oasis is not a natural result of chance; it depends on carefully designed and managed activities. It is the result of a comprehensive program for the organization and management of desert ecosystem by creating niches and micro-environments that contrast with the overall cycle of aridity and realise the oasis landscape. An oasis requires a complex of highly elaborate knowledge that combines an assortment of skills with a refined awareness of the places transmitted through time and generations. It is a fragile ecosystem entirely entrusted to the care of its inhabitants. A paradise of life and harmony with the environment that can easily be lost. In oases, people preserve humankind's most important experiences of survival in arid and hostile areas. It is an important lesson today because the

desert, in an extreme and amplified way, shows what is now happening across the whole planet. In the face of global change, desertification, water scarcity and ecosystem collapse, the oasis is a metaphor of our common future: a fate of desolation and pollution, or the choice of protection and restoration of the landscape.

Figure 1 The oasis of Taghit, Algeria (Laureano, Water Atlas)

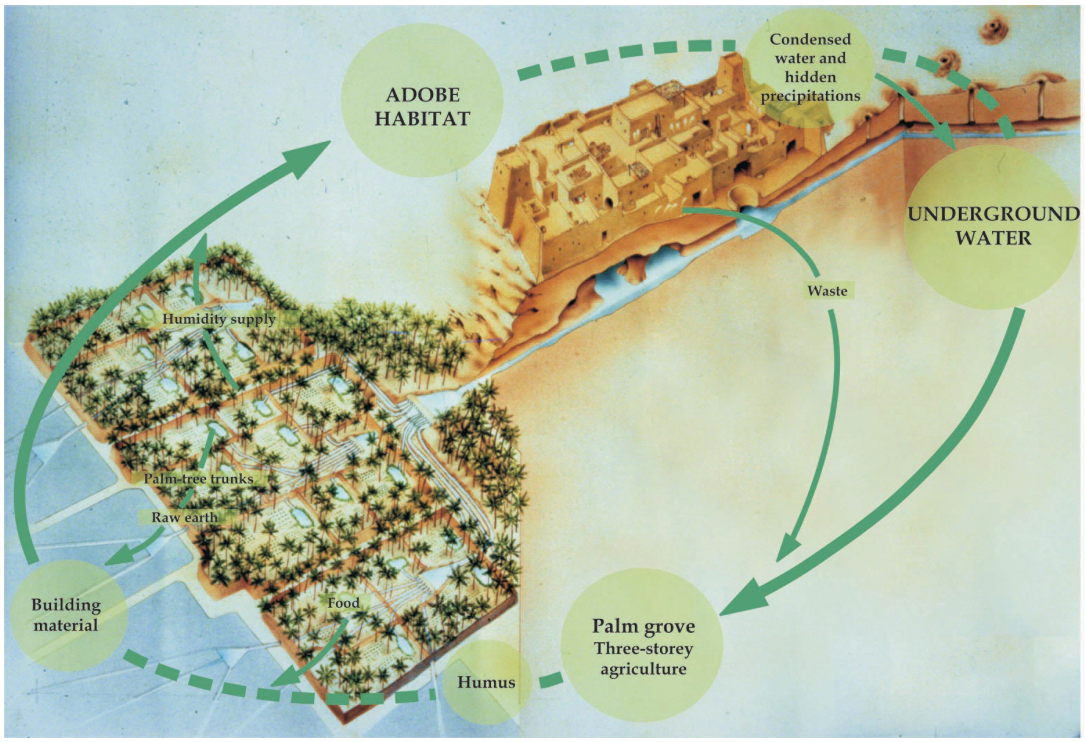

Figure 2 the oasis ecosystem (Laureano, Water Atlas)

Loss of traditions, agony of the landscape

In history, people have always had to face scarcity of resources, the unpredictability of the environment and the variability of the climate. These conditions have allowed man to acquire knowledge appropriate to the local situation, to deal with adversity, manage ecosystems, carry out technical, artistic and architectonic works and realise urban complexes that are universally recognised for their beauty and harmony. There are techniques, skill and crafts of water catchment and distribution, protection of soils, recycling, and the optimal use of building materials and energy. It constitutes the historical knowledge of communities. With emigration and the dramatic transfer from traditional habitats to new urban agglomerations, the rapid abandonment of the agricultural sector by large segments of the population and the superficial suggestion of the absolute superiority of modern technology, the conservation and transmission of this knowledge is lost.

With the disappearance of people's capability to keep and pass on the local techniques and traditions, the way of realising and managing landscapes of absolute beauty and value is lost forever. Not only places of cultural and natural heritage disappear but we also forgot an extraordinary source of knowledge and cultural diversity from which appropriate innovative solutions can be derived. The acquisition and dissemination of this knowledge does not mean a return to the past, but their innovative reintroduction. Traditional knowledge is a dynamic system able to incorporate innovation and subjected to the test of the long term: it thus achieves local and environmental sustainability. This productive field of research is the mission of the International Traditional Knowledge Institute (ITKI) promoted by UNESCO and implemented by IPOGEA which launched a world inventory programme entitled TKWB Traditional Knowledge World Bank (www.tkwb.org). It is a wiki-like system on the internet, open to experts and people to share knowledge and appropriated techniques, particularly relating to water: a Water Atlas, because the difference between life and death is water, and the real essence of our world is not Planet Earth but Planet Water.

To apply traditional knowledge is not simply to use technical solutions that can solve a specific problem. It means re-interpreting the logic of tradition: the multi-functionality; the interpenetration of technical, ethical and aesthetic values; the use of resources on cycles under constant renewal, based on the principle according to which each activity has to start up another one, without waste.

TABLE 2 The Modern Knowledge vs. the Traditional Knowledge

The table point out the differences of the Modern Knowledge and the Traditional Knowledge
(Pietro Laureano)

MODERN KNOWLEDGE	**TRADITIONAL KNOWLEDGE**
Specific solution	Multifunctional
Immediate efficacy	Functional over long period
Specialisation	Holism
Dominant powers	Autonomy
Separation	Integration
External resources	Internal inputs
Confliction	Symbiosis

Monoculture	Connection and complexity
Uniformity	Diversity
Inflexibility	Flexibility
Costly maintenance	Self-regulation and intensity of work
Internationalisation	Consideration of the context
Costliness	Saving
Attention to mere technical details and rationalism	Symbolism and full of significance
Dependence	Autopoiesis

The oasis effect

To build an oasis people produce their own water using the natural laws of the desert to create humidity. A depression is dug; it is protected by surrounding it with dry palm leaves; in the night the humidity condenses. In order to create the shadow necessary for other cultivation, a date palm is planted and the oasis is born. Over time, thanks to diversified and complex techniques of water production, territorial planning and microclimate creation, it became possible to extend the palm grove, to grow food crops along terraced canyons, on green islands clustered among the dunes or on the border of the salt depressions. In each instance, although the scale on which it is applied varies, the same principle is at work, it is *the oasis effect*: the establishment of a self-driving and self-regenerating virtuous cycle. In order to confirm that the oasis landscape is the result of the human action, it is enough to think that the date palm, the very essence of oasis farming, is not a spontaneous plant but the result of domestication and cultivation.

Each palm that grows in the desert has been planted and carefully nurtured and irrigated. If the leaves are not cut, it does not become a tree. It is not a tree in fact; it is a plant. Left to its natural state, it is a bush that has neither trunk nor branches. The inhabitants of the oases cut the leaves in order to raise the palm and they inseminate it artificially, brushing it with the flower of the palm male, because in the deserts natural pollination by insects is insufficient. The palm provides shade and precious dates, and attracts other organisms; dead insects create the humus and thus the desert becomes fertile.

The hidden waters

There are many different techniques necessary in order to have water in the desert. One of the most interesting is the technique of the *catchment tunnels* known in Iran as *qanat,* in Morocco as *khettara* and in Algeria as *foggara*. It is a very complex system of catchment, drainage and condensation formed by long underground horizontal galleries that convey by gravity the water to the oases. A catchment tunnel must be laid out in such a way that it ends amid the tilled fields, with a point of outlet accurately determined in relation with the orography. Otherwise it would be impossible to move the water by gravity. The underground tunnel must therefore be calculated, from the lowest point to the highest, so that the water may flow without eroding the floor of the channel or transporting detritus and sand that would diminish its diameter or block it entirely.

Vertical shafts are drilled every four or eight meters to connect the tunnel with the surface and enable material from the excavation to be removed. Piled up around the mouths, the excavated earth forms the characteristic small craters that mark the tunnel's path. Later the shafts, which may reach a depth of 150m, will be used to descend into the tunnel for maintenance work. They have a specific role in the

structure's particular mechanisms of water production regulating the pressure, the temperature and the circulation of internal air in order to favour the humidity absorption. Actually the catchment tunnels are not conduits that convey groundwater from springs or wells to the point of use. In the driest conditions there are no springs at their extremity. Catchment tunnels are realised to capture the micro flows along their length, from the rocks to create open air water. In this sense they work as production devices, as *water mines*. The horizontal tunnels and the vertical shafts filter and absorb the underground traces of water, the humidity in the soil and the moisture of the atmosphere. The water is created by drainage, condensation and by ventilation in the vertical shafts. These events are very nearly imperceptible but, in the ecology of the desert, they are a fundamental phenomenon that we call occult precipitation. This enables the gazelle to drink by licking the night dew on wet stones, and beetles and lizards to absorb the moisture that they need from the air.

The difference between day and night temperatures makes humidity condense on the ground overnight; the evaporation forms that typically hard crust of desert sands which squeaks when crushed. Prudently managed, occult precipitation is able to create significant water reserves: the hidden waters of the desert. The catchment tunnel collects the atmospheric water vapour and stores it in the subsoil before it disappears with the onset of the next day. The water is tapped under the sands and, through a network of superficial channels, irrigates the palm grove. So here the humidity, which in the desert remains at a very low level between 0 and 5 percent, reaches 80 percent. The palm grove works proactively by attracting and accumulating moisture that is condensed in the sands and comes back by catchment tunnels into the system in a continuous autocatalytic water cycle. In this way a salt lake, a desolate highland, a sterile canyon, can become a palm grove and an oasis of life.

Participation and co-operation

The oasis demonstrates that life depends on the contribution of different organisms; it is the fruit of this association and symbiosis. A people's survival depends on mutual aid. We cannot create the oasis without the alliance of the families and their co-operation. When water depends on meticulous harvesting techniques, careful management and distribution systems, the habitants work together to maintain the ecosystem. In the desert, the land does not have value and property, only the water is precious and determines with the irrigation quotas the extension of the oasis space. There is a complex system of managing and sharing the water. When a father dies he leaves it to his sons, and superficial channels bring the water in the respective fields. When people marry they link their water.

Through the distribution of inheritance, marriage, or by purchase and sale, water quotas are broken up or put back together all the time, and an interlacing system of repartitions, links and bypasses, the latter being necessary at the intersection of two or more channels to avoid mixing flows, characterises the cultivations. A pattern with the structure of a graph is created. It visualises the familiar relationship, the state of property and the succession of generations, in a diagram of kinship that is physically constructed by the water network. As invisible water landscape, and as a garden of remembrance, the oasis design is form and records its history in the way its waters flow.

Life is not easy in extreme situations and the oases people have to work hard to maintain their ecosystem. The close link between human action and natural harmony imposes a series of interdictions, bonds and prescripts, as even the most ordinary gestures help maintain the overall balance. The norms of tradition are accepted because they are written into nature itself. They arise from the tenacity of those

who have found harmony with the harsh laws of the desert in order to obtain the resources necessary for life; water, above all, but also other means of subsistence; materials for building houses and humus for growing gardens; spiritual strength, collective knowledge and mutual solidarity. Techniques and solutions adopted are equally aesthetic, symbolic and utilitarian. Thus, in an oasis, the regular relationship between microcosm and macrocosm is not a metaphysical concept: it is based on specific material needs. The correspondence between the self and the world establishes a covenant between culture and nature. Symbol and tradition become the witnesses and guardians of the harmony of the cosmos. So the pattern of water sharing is memorised and reproduced in the carpet and also in the hairstyle of the women. Through art, symbolism and initiation, knowledge is transmitted, group cohesion is established and the community identity with own built environment is created. This is what we call Landscape.

The oasis model regained

The oasis is made from water. It is a landscape of water that we do not see. The water in the atmosphere, and the water that is underground. This water is not a substance: it is a cycle. When we see a drop we do not recognise the real nature of the water in an overall cycle. An oasis design is based on this cycle. We can think to the oasis structure as a three-dimensional urbanism that considers meteorological, surface and underground components. Using this vision and awareness, with IPOGEA, we have recreated an oasis that was completely abandoned in Algerian Sahara and rebuilt the overall water cycle. In the chosen area of Ighzer, near Adrar, it appears that one can see nothing: the desert is just desolated land. Using Google Earth, we recognised the patterns on the ground and the graphs that are the same as those reproduced on carpets and the symbolism of the oasis and that are the remains of abandoned catchment tunnels, canalisations and gardens. Then we went into the field where, early in the morning, the sand crusts show the traces of moisture and humidity and we are able to individuate the abandoned underground canalisation structures. On the base of our model it was possible to reconstruct, in co-operation with the local families and workers, the ancient system and restore the catchment tunnels. The water has gushed again and so the people came back, planted the palms and rebuilt the oasis. A barren and neglected desert area now has water, a palm grove and cultivated fields.

The oasis model, peculiar to arid deserts, can be applied to all situations in which the symbiosis of factors and the careful management of resources create ecosystems in harmony with the environment. It is therefore possible to imagine an enlarged oasis model extended to a wide range of settlement types based on self-creation and self-perpetuation and realise projects, based on the oasis model, for the preservation of endangered sites and landscape restoration. This we made in the city of Matera.

The Matera success story: from the shame of Italy to European Capital of Culture

Matera is situated in the South Italy, in the Region of Basilicata. Matera is a primordial dwelling settlement based on cave-houses carved in the stones and therefore called the “Sassi” (The Rocks). Matera was declared “a national shame” and 20,000 inhabitants were forced to move to new quarters. The abandoned houses became State property and were walled in order to prevent people living again in the caves. Consequently, Matera became a ghost town: the largest completely abandoned European historical centre. I came back to Matera to restore and live in a grotto and study the techniques that enabled Matera to exist. Matera is a landscape of water. We do not see the water, but Matera was built

to capture each drop of rainwater and bring this to the grottos by a complex gravitational network of channels and terraced fields that create the urban structure of the town.

It is a cultural landscape organised according to the shortage of resources, the need for appropriate and collective use and constantly recycle of them, land and water saving, the control of heat and solar energy. It is the persistence of a prehistoric landscape that can be still admired in the cavernous and underground mazes underlying the built up structures. Thanks to this interpretation in 1993, Matera was the first site of southern Italy to be inscribed on the UNESCO World Heritage. A process of restoration started aimed at the reuse of traditional technologies in an innovative way like rehabilitation of cisterns to harvest rainfall water, of terraced overhangs to realize gardens, of cave dwellings and underground rooms to optimise the internal microclimates. In this way Matera become a national and international tourist attraction.

Figure 3 Matera landscape, Italy (Laureano, Water Atlas)

The town is now repopulated and has won the competition, against the most important and beautiful cities of Italy, for being the European Capital of Culture for 2019. This crowns a success started with the UNESCO narrative and inscription showing that disadvantageous conditions can be transformed into renewable resources. In the oases, like in Matera, the modernity has asserted the inadequacy in relation to progress and decreed their advanced agony. Oases on the contrary maintain their vitality and tenacity, and one might do better to ask how long the development model of large contemporary cities, based on the destruction of natural resources, will continue to work. It can be said that the desert is in constant agony. Yet precisely this is its word to the wise, the message of all the neglected villages and landscapes in the world. Amid its thirst, erosion and entropy, it holds the profound lesson in sustainability,

appropriate solutions and resilience. The diversity of Matera and the oases carries a deep wisdom, and the torment that is a condition intrinsic to their existence is a wake-up call to the entire planet.

> "The land of Egypt is choked by despair, civil war, foreign occupation of the Delta, but still the oases come with their products, humble, but essential. How often do the people of the oases come with their festival spices, mats and skins, with fresh plants, grease of birds?"
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> *Leiden Papyrus relating events dating from the second ancient egiptian interim period 1785–1570 BC.*

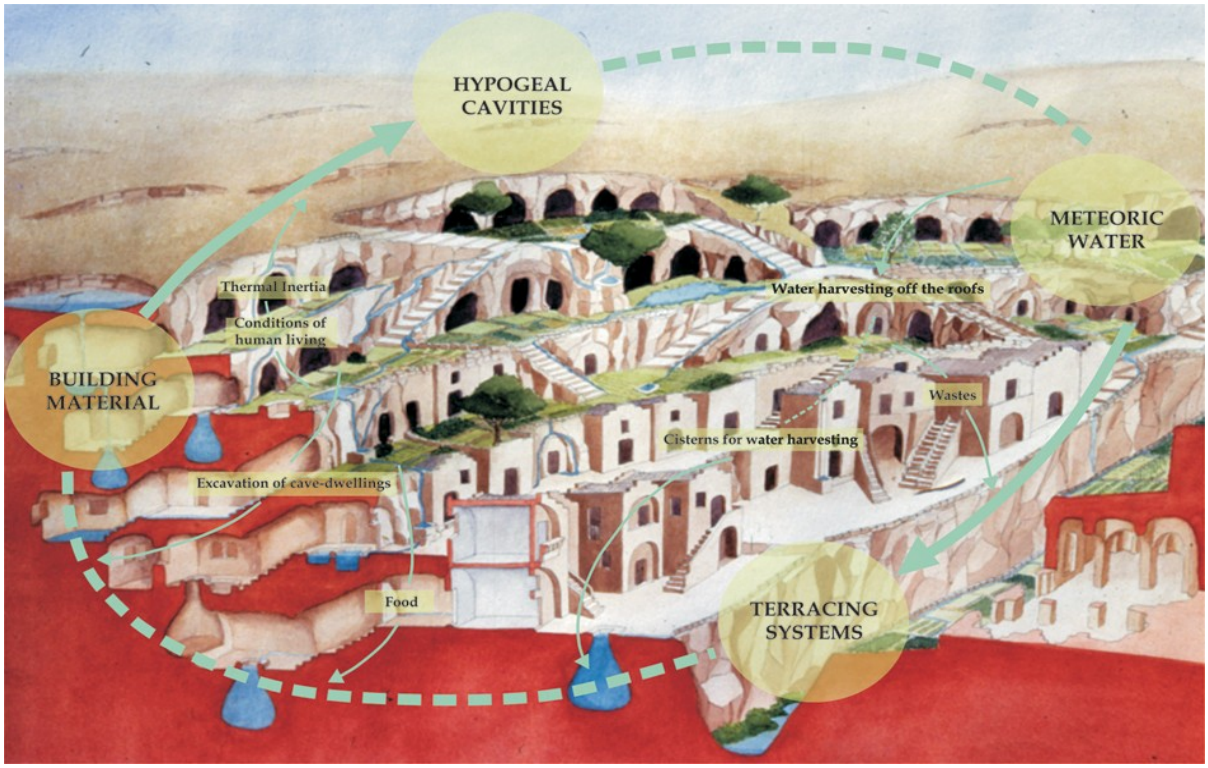

Figure 4 - the oasis ecosystem (Laureano, Water Atlas)

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