Hans Günter Brauch
Úrsula Oswald Spring
Czeslaw Mesjasz
John Grin
Patricia Kameri-Mbote
Béchir Chourou
Pál Dunay
Jörn Birkmann
(Eds.)

VOL 5 / HEXAGON SERIES ON HUMAN AND ENVIRONMENTAL SECURITY AND PEACE

Coping with Global Environmental Change, Disasters and Security

Threats, Challenges, Vulnerabilities and Risks

Springer

52 Traditional Knowledge in Coping with Desertification

Pietro Laureano

52.1 Rural, Urban and Cultural Desertification

The misuse and the overexploitation of resources are the main causes of desertification which according to the United Nations Convention is defined as: "deterioration of the lands in the arid, semiarid and semi humid dry areas due to different factors including climate changes and human activity" (UNCCD 1994, article 1a, 1995, 1995a). The definition highlights two fundamental aspects of desertification: a) desertification is not the creation of a desert but of soil degradation; and b) human intervention is a fundamental factor besides the role of climate conditions.

Therefore desert and desertification are two very different things. The desert constitutes a precise environmental model that occurs in a specific climatic context with its own laws, biological activities, and an appropriate human use. Desertification produces an environment in full decay and totally devoid of ecological balance. The difference lies in a specific variable: time. The natural establishment of the desert has followed the very long geologic times enabling the species to follow the changes with a process of transformation and evolution, and therefore allowing the creation of environments that in spite of the harsh climate are rich in adaptation and in the biodiversity of the species.

On the contrary, the processes of desertification and the climate changes triggered by human intervention are rapid. The biological and physical structure of the planet has not had time to adapt to them, resulting in desolation and decay. A socio-economic and cultural degradation corresponds to the physical one. Poverty, emigration, and the loss of identity cause the disappearance of the cultural heritage related to the knowledge and management of places.

In order to understand the desertification phenomena the key factor is the soil (Rubio 2002). In geology what is commonly defined as soil is the superficial layer of the earth's crust where the organic and inorganic components mix together, swarmed with bacteria, worms, and other micro-organisms (Bennet 1939). The intense biological activity turns it into humus, a colloidal compound saturated by organic substances deriving from the decomposition of animal and vegetable waste. It is the soil that makes plant life possible, the presence of which is so common in temperate areas that it is taken for granted. Life is instead the complex result of the continuous interaction between chemical, physical, and above all biological factors and, besides protecting the soil, it ensures its constant regeneration. Vegetation, and in general all biological activity related to the availability of water and to climate conditions, determine the soil features and constitute the prior conditions for the existence of topsoil. Seeds can put down roots in the soil and derive sustenance from it. For their part, plants protect the humus and ensure that it is constantly regenerated, thanks to dry cast-off plants. Surfaces which are bare of vegetation are exposed to the harsh atmospheric agents, to the brutality of erosion which crushes the rocks and produces sand. All of this in turn reinforces the erosion factors and worsens the drought in that hard silicon particles are blown away by the wind, thereby becoming an abrasive force which can destroy even the hardest of rocks. Sand contributes to the disappearance of running surface water by settling in and filling up river beds, thus forcing the water to change its course and to become stagnant over vast surface areas where the water can evaporate or seep below ground.

This is how the constantly increasing degradation circuit of desertification is triggered. Soil, water, and vegetation are interconnected in such a close way that the absence of any of these factors can cause the absence of another factor with a multiplying effect. Interfering with each one of these components triggers the desertification process that may occur under all climate conditions, but will variously develop depending on the ecosystems' degree of vulnerability (Safriel 2007).

Thus, it may be asserted that even the desert can undergo a process of desertification. Precisely in the environments with a more critical and difficult balance, characterized by a strong interaction between the processes, each intervention from the smallest to the most macroscopic one may produce lasting devastating effects. In the Sahara the traces left by vehicles during the Second World War are still evident on the characteristic microvegetation of the soil that sixty years later has still not recovered. In general the environment reacts to the roughness of the seasonal differences and to the cyclical climate alterations. Once the period of crisis has passed, the environment has the potential to return to its initial situation. Because of overexploitation due to human action, which intensifies its destructive activity against the species and the residual varieties just when the resources are becoming rarefied, any capability of recovery disappears even when the favourable conditions have been re-established.

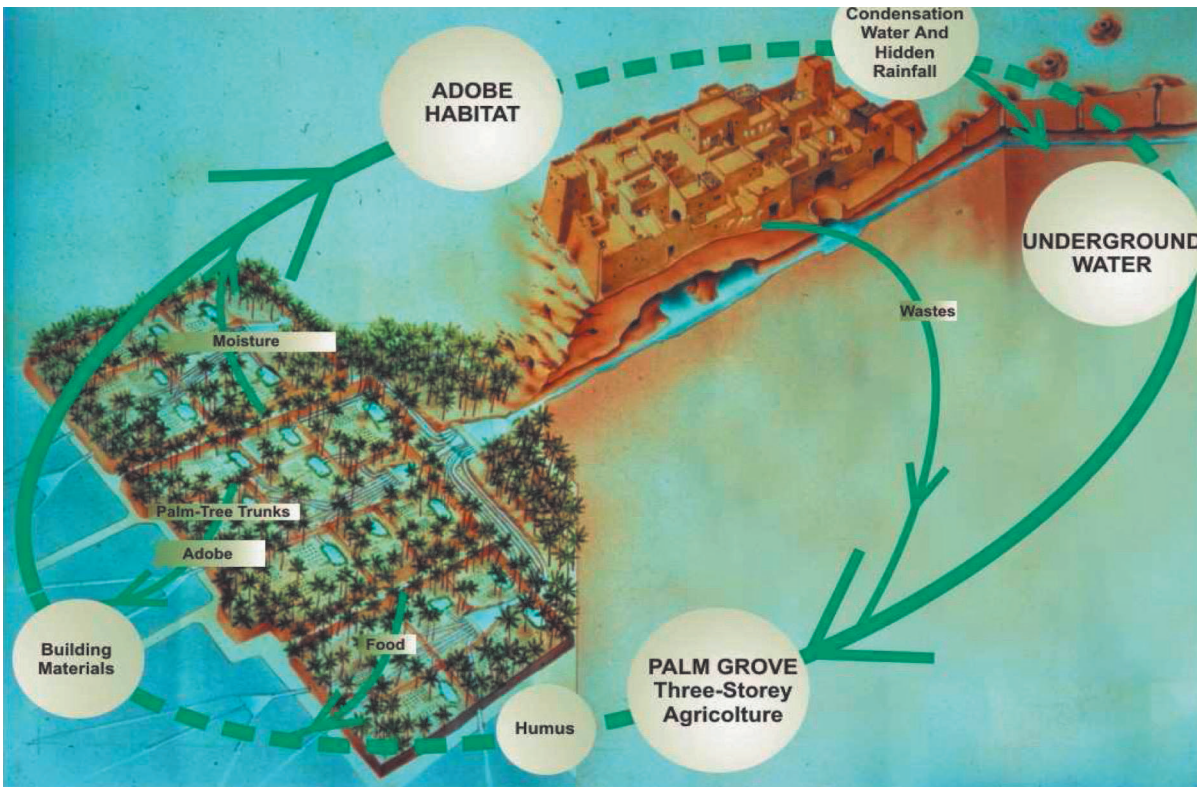
In the agricultural environment the process manifests itself through the following phenomena: water erosion with the creation of cracks and fractures, loss of fertility, alkalization and salinization of the soil; destruction of the humus; disappearance of the plant cover; formation of sand, mud and calcareous layers; exhaustion of the aquifers and drought; decay of the slopes and landslides. The chemical and physical degradation of the soil, induced by biological and physical mechanisms, reduce the vegetation and the original bio-productivity disenabling any kind of use. In the Sahel zone in the Sub-Saharan area, these processes start in a climatic area that receives more than 200 mm of rain per year, and also in a deeper strip in the south where the rains may reach 800 mm per year, i.e. areas that cannot be properly defined as desert. It is estimated that in these countries one million hectares of tropical forests are destroyed and 100,000 hectares of soil are irremediably covered every year with the advance of the sands produced by wind erosion. In Africa, altogether more than one billion hectares have been damaged by this phenomenon. Millions of people have been forced to emigrate elsewhere (Renaud/Bogardi 2006: 24). In Mali and Burkina Faso one sixth of the inhabitants have been forced to abandon their villages. In Senegal two fifths of the population of the upper valley of the homonymous river have been forced to emigrate. Mauritania is invaded by the sands. Here, the population established in the capital, Nouakchott, has increased from 9 to 41 per cent in twenty years, while the nomadic groups have fallen from 73 to 7 per cent (UNCCD 1995). Therefore, non-natural factors trigger an environmental mechanism of degradation which must therefore be ascribed to a single factor: human intervention. The process affects subtropical as well as temperate areas (Brandt/Thornes 1996; Mairota/Thornes/Geeson 1998).

While the traditional landscape with its small plots of land surrounded by dykes and ditches, tree rows or stone and mud walls, constitutes the optimal defensive device against weathering, the industrialization of agriculture based on heavy machinery needs vast homogeneous surfaces. The transformation into a monoculture also involves the slopes, the marginal and karstic areas where the natural harshness and vegetation provided shade, biological richness, and protection from erosion. Chemical addictives like pesticides and fertilizers transform the soil which becomes waterproof. Maintaining the aquifers becomes impossible and agriculture becomes increasingly dependent on artificial irrigation through the construction of big hydraulic basins.

The demographic growth, the abandoning of archaic techniques and social habits even though they were in harmony with the environmental potentials, as well as the imposition of new crops according to the requirements coming from the world market and the dissemination of the monoculture, are only some of the causes of degradation. Above all, the settlement of people gathered in small areas, according to the necessity of the modern economies, causes the increase in energy demand, which is satisfied with a massive devastation of the arboreal and forest heritage. The wounds inflicted on the woods trigger processes of continual and substantial collapse of the biological variety, quality, and productivity. Animals and plants are decreasing and the number of species is falling so much that they are no more able to provide a genetic answer to the altered circumstances, and are therefore destined to disappear.

Also the urban areas are affected by desertification. In fact cities contribute both directly and indirectly to the process. Directly, the massive urbanization may be considered in itself a form of desertification due to the spread of concrete over large natural surfaces; but also indirectly through the absorption from the soil of the natural resources and their destruction in the areas with a high demographic concentration. A close relationship between urbanization and desertification may be found both in the non-industrialized countries and in the most developed ones. In the first case, the process of decay is triggered and extends starting right from the areas undergoing a modern and accelerated urbanization

Figure 52.1: The traditional oasis ecosystem. **Source:** Pietro Laureano (2001: 372). The oasis is a self catalytic system in which the first supply of water condensation and moisture is increased by the installation of palm trees which produce shade, attract organisms, and form humus. The palm grove determines a humid microclimate fed by hidden precipitations, water condensation, and underground drainage through the underground passageways of the foggaras. The adobe habitat does not waste wood for firing bricks, it is kept cool by the underground water passageway and provides waste to fertilize the fields. The system runs the water resource in a cycle of use which is not only compatible with the renewable quantities available but also increases them.



which impoverishes the surrounding territory. In the advanced economies the spread of the process of desertification is directly linked to the crisis of the historic city centres and the traditional arrangement of the landscape. The building systems that have a strong natural component and low consumption of resources have been substituted with a model based on massive building operations that waste energy and pollute the environment.

Thus, a process of physical and social desertification begins with the exodus of the population from the ancient centres and the consequent disappearance of the local systems. The impoverishment of the human resources corresponds to the architectural decay and to the erosion of the mountain, hilltop, and slope systems. Emigration, the loss of identity and values, are associated with the socio-cultural aspects of desertification.

52.2 The Knowledge of the Desert

The aridity of the desert is interrupted in specific cases that create niches and microenvironments that contrast with the general situation. A slight depression collects dampness, a stone shade and seed flourishes. Thus, favourable dynamics develop: the plant generates its protection from sunbeams, concentrates water vapour, attracts insects, produces biological material and the soil which nourishes it. A biological system used by other organisms bringing their contributions is created, and a microcosm is generated as the result of their coexistence. By using these processes people from the Sahara have developed oases. Originally, a single palm tree is planted into a hollow in the ground and surrounded by dry branches, which protect it from sand. As the time goes by, large tilled fields develop along terraced canyons or on green archipelagos among the dunes, thanks to complex and

diversified techniques of water production, territory arrangement, and microclimate formation. An oasis can be defined as a "human settlement living in harsh geographic conditions and exploiting rare local resources, to trigger a growing amplification of positive interactions and fulfil a fertile and self-sustainable environmental niche, contrasting with its hostile surrounding" (Laureano 1995: 24–25).

Therefore not only the palm groves constitute the oasis but the entire landscape formed by the habitat and all the architectural and environmental components. The organization of the ecosystem was realized by the people of the desert through the use of traditional techniques that consist of:

> practical (instrumental) and normative knowledge concerning the ecological, socio-economic, and cultural environment. Traditional knowledge originates from people and is transmitted to people by recognizable and experienced actors. It is systemic (inter-sectorial and holistic), experimental (empirical and practical), handed down from generation to generation, and culturally enhanced. Such a kind of knowledge supports diversity and enhances and reproduces local resources (UNCCD 2005: 109).

The way they are applied differs totally from modern technologies (table 5252.1).

Table 52.1: Characteristics of modern and traditional knowledge**. Source:** The author.

Modern Knowledge	Traditional Knowledge
Specific solution	Multifunctional
Immediate efficacy	Functional over a long period
Specialization	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
Internationalization	Consideration of the context
Costliness	Saving
Attention to mere technical details and rationalism	Symbolism and full of significance
Dependence	Autopoiesis

These in fact seek immediate effectiveness through a deep specialization of knowledge managed by dominant structures capable of involving resources external to the environment. Traditional knowledge measures its functionality in the long run using a shared knowledge that was created and passed on from generation to generation through the social practices, and uses internal renewable inputs. Thanks to modern technology, for instance, very deep wells have been dug out to pump water up to the surface. The results have immediately been visible, but have dried up bordering resources, and sometimes by drawing water from fossil pockets, with time they completely exhaust them. On the contrary, traditional knowledge uses systems for harvesting meteoric water or exploits run-off areas by using the force of gravity or water catchment methods, like the drainage galleries, allowing the replenishment and increasing the durability of the resource.

Modern technological methods operate by separating and specializing, whereas traditional knowledge operates by connecting and integrating. According to the usual meaning of words such as *forest*, *agriculture* and *town*, they are completely distinct from each other and meet similarly different needs: *wood*, *food*, and *housing*. They correspond to specialized scientific systems: Silviculture, agriculture, and town planning. Local knowledge does not make an artificial distinction within the world of plants between the forest supplying commercial wood and tilled land supplying food (Shiva 1993a: 18). Forests, fields, and dwellings are unitary ecological systems. Forests and other marginal apparently non-productive areas, such as steppes and marshes, provide large quantities of food and water resources, and fodder and fertilizers for agriculture. They are also convenient to live in. The traditional town, in its turn, integrates with agriculture by replacing the forest in desert areas, by collecting fertilizers produced by the inhabitants' organic waste, and through its production of water collected on the roofs. This principle is so close to the way in which nature works, where everything that remains of a system is reused by other systems and the concept of waste and the possibility of resorting to external resources do not exist. It has allowed human beings to survive throughout history and is today proposed again by the modern theoreticians of sustainability (Pauli 1999).

By this logic, to the strong cohesion among society, culture and the economy, also aesthetic and ethical values are added. Traditional procedures operate a harmonious fusion between the landscape and the tra-

ditional aesthetic canons. A device for collecting or conveying water is never merely a technical structure but also has its own beauty. Fields in the oases are systems of production and relaxing places for contemplation as well. Little agricultural fields in desert areas are called *gardens,* just as in Southern Italy, eliminating the separation between the vegetable garden and the pleasure garden. Often, the works and procedures have a deep symbolic meaning and are a continuous game of suggestions and analogies between techniques, art, and nature. Systems of water distribution in the Sahara are reproduced in carpet drawings and in women's hairstyles. They are part of a complex symbolism linked to life and fertility. Spiritual principles make rules sacred and guarantee their perpetuation as in the case of the African sacred woods with their restricted access and of the whole set of taboo-objects, practices which guarantee the regeneration of forests, the saving of environmental resources and the land as reserves for nature and human communities.

Therefore, traditional techniques are an integral part of a strongly consolidated network of links and relations, supported by a global framework of signs and meanings. They work within a socially shared cultural structure: the historical system of science and local knowledge. It is therefore wrong to isolate each single technology, which is always highly contextualized, not only linked to an environmental situation, but to a precise historical moment and a complex social construction. The totality of traditional practices for managing resources constitutes the mediation through which a certain social form interacts with nature in realizing its technological dimension, an integral part of its cultural complexity, and view of the world. Thanks to this knowledge populations are able to gain greater resources from the environment compared to the ones naturally offered. Both factors, the cultural dimension and the environmental conditions, change continually in time and from place to place, thus creating and amplifying the cultural diversity.

52.3 Validity, Innovative Use, and Integration with Advanced Technology

The validity of traditional knowledge and the use of practices derived from it, variously named as endogenous knowledge, appropriate technologies, local knowledge, indigenous techniques, nature-based knowledge, sustainable knowledge, folk knowledge, and cultural knowledge (Gupta 1989; Warren/Rajasekaran 1993; Tahoun 2003), have been asserted for many years at various levels. In the scientific field, research on traditional knowledge has been implemented for more than twenty years with the specific aim of overcoming the top-down approach to the transfer of technologies as well as the problem of achieving a participatory relationship able to foster sustainability (Brokensha/Warren/Werner 1980). Many international bodies such as the *International Labour Organization* (ILO) (Bhalla 1977; ILO 1985), the *Organisation for Economic Co-operation and Development* (OECD) (Jequier/Blanc 1983), the *Food and Agriculture Organization* (FAO) (Saouma 1993), the *United Nations Educational, Scientific and Cultural Organization* (UNESCO 1994, 1994a, 1994b), the *United Nations Environment Programme* (UNEP) (Dowdeswell 1993) and the *World Bank* (Vernon 1989; Davis 1995) have declared its validity in research and documents. The interest of the United Nations' conventions is clearly highlighted in the report entitled *Building Linkage between Environmental Conventions and Initiatives* (UNCCD 1999).

Despite this full commitment and interest, the fields of application and the innovative dissemination of traditional knowledge are still below their real potential, the reasons may be summarized as follows:

- The lack of awareness that environmental damage, soil degradation, and desertification mostly result from the loss of traditional knowledge;
- The lack of information as to the validity and benefits of traditional knowledge from the experts responsible for national planning;
- The limited understanding of the role to be assigned to traditional techniques and their way of operating;
- The lack of communication and exchange of successful experiences;
- The unawareness of the innovative use of traditional knowledge.

It is necessary to clarify the modalities of use, the validity, effectiveness, the innovative force, and the possibility for integration of the traditional technologies with the modern ones.

52.3.1 Multifunctional Use and Cultural Integration

Traditional knowledge as an integrated learning organization constitutes a complex system with multifunctional characteristics and an integral part of the construction process of the collective identity as well

as of social cohesion. The rice cultivations in the Philippines and Indonesia which cover the mountain sides with an extensive system of terraces constitute a wonderful landscape created by the people. The beauty of these terraces does not result from aesthetic choices but depends on the harmonious application of the traditional engineering techniques in order to organize catchment areas, gather flowing waters and rainfalls, create terraces on which flows are channelled, and preserve the ground from washing away or eroding.

Traditional techniques relating to water management in the Ladakh region in India are another example. These enable fertile mountain oases to be created in otherwise arid lands. The techniques for using the water resources provided by seasonal snow melting are based on a system of rights and rules closely linked to the social structure, to the norms regulating the traditional division of work between sex and age groups, as well as to the ecological situation of each oasis village. The great social cohesion and spiritual motivation has enabled these people to apply modern techniques such as methods for using solar energy, in harmony with their ideals, and to reject others such as chemical fertilizers regarded as harmful for the soils (Wacker 1997).

52.3.2 Technological Effectiveness and Productiveness

Traditional technologies are not less competitive than modern ones. They achieve results differently and consider a series of contextual factors omitted by modern techniques. The procedure is sometimes less immediate and needs more work. However, this is not a negative feature in many countries that face the problem of unemployment. Indeed, the application of a technique determines effects both before and after the use of the necessary resources and has more general consequences on the entire economic, social, and environmental model. These interactions are not taken into account in the application of a modern technique based on specific and immediate yield criteria. On the contrary, traditional techniques are selected and accepted through a process of environmental, historical and social considerations, appraised according to their validity in the long term, their contextual benefits, and their overall sustainability.

Failure to evaluate these aspects has led to unsuccessful projects for development cooperation which have not taken into account the necessity of proposing technologies that could be managed through the local knowledge system and the social categories, mainly women. Within this framework, the case of the irrigated perimeter of Ras Djebel in the northeastern part of Tunisia, 30 km from Biserta, is a significant example. Here a traditional kind of cultivation is applied, following the oasis model and the Maghrebian and Andalusian models of arboriculture and vegetable gardens. Fields are divided into small plots according to complicated procedures of inheritance and marriages that continuously divide and re-compose the properties. In this way, 2,000 hectares of land can be divided into 4,500 plots. Traditional irrigation is carried out through harvesting subterranean waters by means of family-managed wells or irrigation, thanks to superficial channels running all over the agricultural area. A project aiming at modernizing the system created a 15,000-m^3 tank, fed by a lake located on a hill. The agricultural perimeter was then subdivided into larger parts, each supplied by a modern water drawing system that irrigates large areas by sprinkling. Such a perimeter involved the removal of small property boundaries. The peasants distinctly rejected the new division of the plots and the new methods of irrigation on the basis of social, productive, and symbolical reasons which can be summarized as follows:

- The use of family wells enables each owner to manage his own water independently. Such water was previously free whereas there is a charge for the water provided by the project.
- The division of small land plots responds to ancestral structures which extend the domestic space into the agricultural one. In this way, women can work in the fields and at the same time feel at home.
- Irrigation through sprinkling is considered negative since it 'favours the burning of the leaves and the appearance of new diseases'.
- Groundwater is commonly considered as 'alive since it originates from the earth and feeds the plants', in opposition to the water of the project which is held as 'a dead water coming from a stagnant basin and thus harmful to agriculture'.

Despite these oppositions, the project was carried out with disastrous consequences. Indeed, after the project was implemented, a 20-meter lowering of the water table as well as a 3 g/1 increase of salinity were verified (Bouayard-Agha 1997: 22–23).

52.3.3 Validity and Application

Traditional techniques are generally considered valid only for the less developed economies. This stance is contradicted by the fact that situations in which traditional technologies persist, and their role in the economy and society is consolidated and stabilized, can be proved specifically in the more advanced countries. The values of tradition, manufacturing practices, and the craftsmen's skills are the basis on which the great added value of economically important productions for many advanced countries is founded. In particular the typical food production (oil, cheese, wine, etc.) safeguards both the aesthetic and environmental quality of the landscape, since the old production systems are available thanks to the maintenance of traditional soil management techniques, as for instance is the case of the regions of Valais in Switzerland, the Loire Valley in France, and Tuscany in Italy. Thus, it is wrong to consider traditional knowledge as marginal compared to the great economic and technological processes under way. Even from a quantitative point of view, their use still supports most of humankind which is distributed throughout the less industrialized countries. Paradoxically, in these places where traditional techniques are still used in a massive way, these are considered by the modernist thought as a phenomenon of backwardness, whereas, in advanced countries, they create an image and provide added value. Tradition is then a fundamental component of successful modernity and creative industry. Traditional knowledge constitutes a dynamic system capable of incorporating innovation valued through local wisdom: today's appropriate innovation is tomorrow's tradition.

52.3.4 Paleo-technology and High Technology

Traditional technologies do not have less technological consistency than the modern ones. Sometimes they are the most refined technologies, other times they are very simple but still more appropriate, that is ecologically compatible and locally manageable. Furthermore, traditional knowledge is re-proposed through every possible innovative use that is in conjunction with modern technologies, which can operate within the same logic. In the moist areas to the west of Calcutta, the traditional fishing and agricultural practices cover approx. 10,000 ha of territory. Here the world's largest network of urban sewage water re-use is in use. Thousands of peasants convey millions of litres of sewage water from Calcutta towards their land. They consider these waters as an advantageous nutrient supply and not as something harmful they should get rid of. At the same time, they provide an extraordinary contribution to the waste water drainage system of Calcutta completely free of charge.

In Liguria where in the Cinque Terre region there is one of the largest systems of *terraced slopes* in the Mediterranean, this traditional practice that protects the soils, and catches and channels the waters, has been perpetuated through innovative agricultural mechanization. Agricultural work on terraces is hard due to tiring transport systems which are operational only on foot. Traditionally there were techniques of transport by means of sledges drawn up the hill by ropes. Already at the beginning of the century these were substituted with mechanical funicular systems on rails. The same technique is re-proposed today with appropriate *monorail* systems that enable the ascent of the slope without disturbing the landscape or the ecosystem.

In Burkina Faso *zai* is a particular traditional technique able to regenerate highly degraded soils. The soil is dug with holes that fill up with water in the humid season and are used as dump sites for rubbish and manure in the dry season. This practice attracts termites that digest rubbish, thus its absorption by the plants' roots. Furthermore, the tunnels dug by the termites increase the soil's porosity. Seeds are then sown in the holes, giving very high crop yields. Innovative practices which promote original forms of symbiosis between humankind and animals or micro-organisms are today re-proposed to rehabilitate degraded soils or soils made suitable for human living in extreme areas.

52.4 Knowledge from the Past for a Sustainable Future

The enormous hydraulic resources deriving from the river basins of the Nile, Mesopotamia, the Indus, and river systems of China, determined the formation of the great empires that have been defined by Karl August Wittfogel (1957) as *hydraulic societies*. The socio-economic model is the one of an increasingly expanding empire supported by a massive population growth triggered by the agricultural potential and maintained by an imperial conquest, the income coming from the exploitation of a vast quantity of workers and by spending resources on monuments or wars. The long term results of this are the hypertrophy of the population and of the territory, authoritarianism, state cen-

tralization, and the increasing destruction of the environment leading to an ecological catastrophe.

Within the great empires, in marginal areas with scarce resources, or in the fringes of the empires in protected areas, oases and cities were created in inaccessible places and transformed into self-supporting centres. These *autopoietic societies* use the gathered experience of traditional knowledge and become centres of innovation for the amplification and proper use of local resources. This is the way the desert communities were organized and in general those societies often based on hydraulic systems, those which developed in harsh natural conditions (Laureano 2001).

The geographical continuity of the desert areas, extending from China to the Mediterranean and Africa through the three most ancient continents, favours the elaboration of appropriate solutions through the exchange and increase of knowledge.

Complex ecosystems are created based on the use of the local resources, but which assume a larger dimensional scale by exploiting their position to control the trade routes and convey huge economic incomes. This is how the fantastic hydraulic and soil management systems were realized in Petra (Jordan), and in Marib (Yemen), ancient capitals of the Arabic desert now only archaeological remains, and in the Saharan oasis-towns such as Ghardaia that are still intact and vital. The ever increasing effort to organize space depended on the economic benefits ensured by the role undertaken within an international exchange economy: the caravan gold routes in the Sahara, the incense route in Arabia, the silk route in Palestine and in the East.

The community's acceptance of the necessary tasks for preserving the geographic positions depends on delicate environmental, economic, and cultural equilibria. When even only one of the aspects of the holistic conception of the world or a ring in the chain of the resource management is missing, the entire system is destined to collapse. This is the cause for the collapse of various ancient civilizations, a current issue today because of the menace represented for contemporary society by climate change (Mays 2007; Diamond 2007a)

However, the knowledge is not completely lost. It survives among the populations living in the apparently undeveloped areas or the interstices of the advanced society and the places protected for their cultural value. Knowledge is a great potential because the local know-how, which improves under the harshest environmental conditions, and the existence of intact ancient structures are a valuable heritage on which new models of sustainability have to be based. The historical settlements, the traditional landscapes, and the local knowledge provide solutions to be safeguarded and which can be re-proposed, adapted, and renewed by means of the modern technology. It is not a question of reapplying or transforming the single procedures but rather of understanding the logic of those models which have allowed societies to positively advance their status and to make technical, artistic, and architectural implementations, fundamental in the history of the civilizations. Knowledge about the most distant past can lead to the founding of new technological paradigms: the capability of enhancing the inside resources and managing them at a local level; the versatility and the interpenetration of technical, ethical, and aesthetic values; the production not per se but for the good of the community and based on the principle according to which each activity has to start up another one without waste; and energy use based on cycles in constant renewal.

Hexagon Series on Human and Environmental Security and Peace (HESP)

Edited by Hans Günter Brauch, Free University of Berlin, UNU-EHS and AFES-PRESS

Vol. 1: Hans Günter Brauch, P. H. Liotta, Antonio Marquina, Paul Rogers, Mohammad El-Sayed Selim (Eds.): *Security and Environment in the Mediterranean - Conceptualising Security and Environmental Conflicts. With Forewords by the Hon. Lord Robertson, Secretary General of NATO, and the Hon. Amre Moussa, Secretary General of the League of Arab States* (Berlin – Heidelberg – New York: Springer, 2003).

ISBN: 978-3-540-40107-0

Vol. 2: Hillel Shuval, Hassan Dweik (Eds.): *Water Resources in the Middle East: Israel-Palestinian Water Issues – from Conflict to Cooperation* (Berlin – Heidelberg – New York: Springer-Verlag, 2007).

ISBN: 978-3-540-69508-0 (Print)
ISBN: 978-3-540-69509-7 (Online)
DOI 10.1007/978-3-540-69509-7

Vol. 3: Hans Günter Brauch, Úrsula Oswald Spring, Czeslaw Mesjasz, John Grin, Pál Dunay, Navnita Chadha Behera, Béchir Chourou, Patricia Kameri-Mbote, P.H. Liotta (Eds.): *Globalization and Environmental Challenges: Reconceptualizing Security in the 21st Century* (Berlin – Heidelberg – New York: Springer-Verlag, 2008).

ISBN : 978-3-540-75976-8 (Print)
ISBN : 978-3-540-75977-5 (Online)
DOI 10.1007/978-3-540-75977-5

Vol. 4: Hans Günter Brauch, Úrsula Oswald Spring, John Grin, Czeslaw Mesjasz, Patricia Kameri-Mbote, Navnita Chadha Behera, Béchir Chourou, Heinz Krummenacher (Eds.): *Facing Global Environmental Change: Environmental, Human, Energy, Food, Health and Water Security Concepts* (Berlin – Heidelberg – New York: Springer-Verlag, 2009).

ISBN: 978-3-540-68487-9 (Print)
ISBN: 978-3-540-68488-6 (Online)
DOI 10.1007/978-3-540-68488-6

Vol. 5: Hans Günter Brauch, Úrsula Oswald Spring, Czeslaw Mesjasz, John Grin, Patricia Kameri-Mbote, Béchir Chourou, Pal Dunay, Jörn Birkmann (Eds.): *Coping with Global Environmental Change, Disasters and Security - Threats, Challenges, Vulnerabilities and Risks* (Berlin - Heidelberg - New York: Springer-Verlag, 2011).

ISBN: 978-3-540-12345-6 (Print)
ISBN: 978-3-540-12345-6 (Online)
DOI 10.1007/978-3-540-12345-6

In Production

Vol. 6: ThanhDam Truong, Des Gapter (Eds.): *Transnational Migration: The Migration - Development - Security Nexus*. Hexagon Series on Human and Environmental Security and Peace, vol. 6 (Berlin - Heidelberg - New York: Springer-Verlag, 2011).

Vol. 7: Úrsula Oswald Spring (Ed.): *Water Resources in Mexico. Scarcity, Degradation, Stress, Conflicts, Management, and Policy*. Hexagon Series on Human and Environmental Security and Peace, vol. 7 (Berlin - Heidelberg - New York: Springer-Verlag, 2011).

In Preparation

Vol. 8: Jürgen Scheffran; Michael Brzoska; Hans Günter Brauch; Peter Michael Link; Janpeter Schilling (Eds.): *Climate Change, Human Security and Violent Conflict: Challenges for Societal Stability*. Hexagon Series on Human and Environmental Security and Peace, vol. 8 Berlin - Heidelberg - New York: Springer-Verlag, 2011).

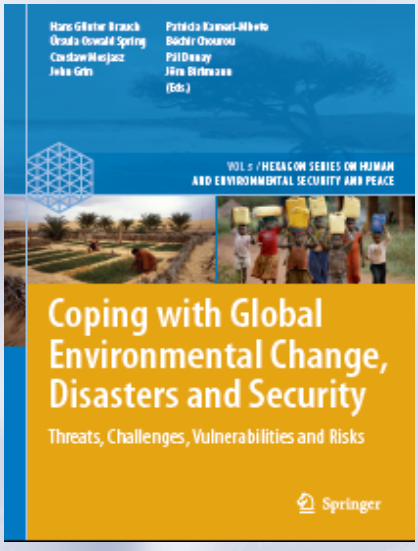
Vol. 9: Czeslaw Mesjasz: *Stability, Turbulence or Chaos? Systems Thinking and Security*. Hexagon Series on Human and Environmental Security and Peace, vol. 9 (Berlin - Heidelberg - New York: Springer-Verlag, 2012).

Authors or editors who would like to have their publication project considered for inclusion in this series should contact both the series editor:

PD Dr. phil. habil. Hans Günter Brauch, Alte Bergsteige 47, 74821 Mosbach, Germany
Phone: 49-6261-12912 FAX: 49-6261-15695
Email afes@afes-press.de
http://www.afes-press.de and http://www.afes-press-books.de/html/hexagon.htm

and the publisher:

Dr. Christian Witschel, Editorial Director, Earth Sciences, Geosciences Editorial,
Springer-Verlag Tiergartenstraße 17, 69121 Heidelberg, Germany
Email Christian.Witschel@springer.com
http://www.springer.com



This is the third and final volume of the *Global Environmental and Human Security Handbook for the Anthropocene* (GEHSHA).

All chapters were anonymously peer reviewed.

Hexagon Series on Human and Environmental Security and Peace (HESP), volume 5

More information on this book series at: http://www.afes-press-books.de/html/hexagon.htm

More information on this volume at: http://www.afes-press-books.de/html/hexagon_5htm

Hans Günter Brauch, Free University of Berlin, Germany; **Úrsula Oswald Spring**, National University of Mexico, Cuernavaca, Mor. Mexico; **Czeslaw Mesjasz,** Cracow University of Economics, Poland; **John Grin**, University of Amsterdam, The Netherlands; **Patricia Kameri-Mbote**, Strathmore University, Nairobi, Kenya; **Béchir Chourou,** University of Tunis-Carthage, Tunisia; **Pál Dunay,** Geneva Centre for Security Policy; **Jörn Birkmann**, UNU-EHS, Bonn (Eds.)

Coping with Global Environmental Change, Disasters and Security

Threats, Challenges, Vulnerabilities and Risks

This policy-focused *Global Environmental and Human Security Handbook for the Anthropocene* (GEHSHA) addresses new security threats, challenges, vulnerabilities and risks posed by global environmental change and disasters. In 5 forewords, 5 preface essays 95 peer reviewed chapters, 164 authors from 48 countries analyse in 10 parts concepts of military and political hard security and economic, social, environmental soft security with a regional focus on the Near East, North and Sub-Sahara Africa and Asia and on hazards in urban centres. The major focus is on coping with global environmental change: climate change, desertification, water, food and health and with hazards and strategies on social vulnerability and resilience building and scientific, international, regional and national political strategies, policies and measures including early warning of conflicts and hazards. The book proposes a political geo-ecology and discusses a 'Fourth Green Revolution'.

Forewords by **Achim Steiner**. Exec. Director of UNEP; **Konrad Osterwalder**, Rector, UNU; **Jean-Francois Bureau**, Assistant Secretary General, NATO; **Joy Ogwu**, former Foreign Minister of Nigeria; His Royal Highness, **Prince Hassan Bin Talal** of Jordan

Part I Introduction.- Part II Securitization of Global Environmental Change.- Part III Economic, Social, Environmental and Human Security Dangers in the Near East, Africa and Asia.- Part IV Threats, Challenges, Vulnerabilities and Risks for Urban Centres in Hazards and Disasters.- Part V Coping with Climate Change, Soil and Desertification, Water Management, Food and Health.- Part VI Coping with Hazards, Social Vulnerability and Resilience Building.- Part VII Coping with Global Env. Change: Scientific, International and National Political Strategies, Policies and Measures.- Part VIII Remote Sensing, Vulnerability Mapping and Indicators of Env. Security Challenges.- Part IX Towards an Improved Early Warning of Conflicts and Hazards.- Part X Summary and Conclusions.

2011, lii, 1816pp., 184 figures, 78 tables and 38 boxes, Hardcover

Hexagon Series on Human and Environmental Security and Peace, Vol. 5

€ 299.00 (+ VAT) **$ 409.00 (+ VAT)** **£ 269.50 (+ VAT)**

ISBN: 978-3-642-17775-0 - e-ISBN: 978-3-642-17776-7 - DOI: 10.1007/978-3-642-17776-7

Order Now!

Yes, please send me

___ **copies Brauch (Eds.), Coping with Global Environmental Change, Disasters and Security, HESP 5, ISBN: 978-3-642-17775-0 ▸ € 299.00**
___ copies Brauch (Eds.), Facing Global Environmental Change, HESP 4, ISBN: 978-3-540-68487-9 ▸ € 249.99 / $ 379.00 / £ 226.50
___ copies Brauch (Eds.), Globalization and Environmental Challenges, HESP 3, ISBN: 978-3-540-75976-8 ▸ € 259.99 / $ 359,00 / £ 233,00

◯ **Please bill me**
◯ **Please charge my credit card:** ◯ **Eurocard/Access/Mastercard** ◯ **Visa/Barclaycard/Bank/Americard** ◯ **AmericanExpress**

Number □□□□ □□□□ □□□□ □□□□ □□□ Valid until □□□□

Available from

Springer
Order Department
PO Box 2485
Secaucus, NJ 07096-2485
USA

▸ **Call toll-free** 1-800-SPRINGER
8:30 am – 5:30 pm ET
▸ **Fax your order to** (201) 348-4505
▸ **Web** springer.com
▸ **Email** orders-ny@springer.com

Springer
Customer Service Center GmbH
Haberstrasse 7
69126 Heidelberg
Germany

▸ **Call:** + 49 (0) 6221-345-4301
▸ **Fax:** +49 (0) 6221-345-4229
▸ **Web:** springer.com
▸ **Email:** orders-hd-individuals@springer.com

Name
Dept.
Institution
Street
City / ZIP-Code
Country
Email
Date ✖ **Signature** ✖