

Executive Summary

DESERTS HARBOUR RICH ECOSYSTEMS

Deserts cut cross our planet along two fringes parallel to the equator, at 25–35° latitude in both the northern and southern hemispheres. The Desert Biome can be defined climatologically as the sum of all the arid and hyper-arid areas of globe; biologically, as the ecoregions that contain plants and animals adapted for survival in arid environments, and, physically, as large contiguous areas with ample extensions of bare soil and low vegetation cover. A map produced by overlaying areas under these three criteria shows a composite definition of the world's deserts, occupying almost one-quarter of the earth's land surface, some 33.7 million square kilometres.

Deserts landscapes are diverse; some are found on a flat shield of ancient crystalline rocks hardened over many millions of years, yielding flat deserts of rock and sand such as the Sahara, while others are the folded product of more recent tectonic movements, and have evolved into crumpled landscapes of rocky mountains emerging from lowland sedimentary plains, as in Central Asia or North America.

Over the last two million years — the Pleistocene period — climatic variations of the earth have transformed the world's deserts, forcing them to shrink during cold glacial periods and expand during the hot interglacials, leading finally to the current warming and aridization trend of the last 5 000 years, from the mid-Holocene to date. Some of the Ice-Age species still survive in arid mountain ranges, or desert “sky-islands”, as rare relictual organisms.

Most large deserts are found away from the coasts, in areas where moisture from the oceans rarely reaches. Some deserts, however, are located on the west coasts of continents, such as the Namib in Africa, or the Atacama in Chile, forming coastal fog-deserts whose aridity is the result of cold oceanic currents.

The deserts of the world occur in six global biogeographical realms:

- The **Afrotropic deserts** are found in the sub-Saharan part of Africa, and in the southern fringe of the Arabian peninsula. Their mean population density is 21 persons per square kilometre, and their human footprint (that is, pressures on the environment resulting from human activities) is relatively high, especially in the Horn of Africa and Madagascar.
- The **Australasian deserts** comprise a series of lowland arid ecoregions in the Australian heartland, covering in total some 3.6 million square kilometres, of which some 9 per cent is under some degree of environmental protection. Hardly inhabited at all, their mean population density is less than 1 person per square kilometre, and show, by far, the lowest human footprint among the global deserts.
- The **Indo-Malay** region harbours only two hot lowland deserts — the Indus Valley and the Thar — covering in total 0.26 million square kilometres, of which some 20 per cent receives some level of legal environmental protection. With a mean density of 151 persons per square kilometre, these are the deserts with the most intense human use in the world.
- The **Nearctic deserts** cover 1.7 million square kilometres in North America, of which 19 per cent is under some level of legal protection. Because of the growth of large urban conglomerates such as Phoenix in the United States, their mean population density is high (44 persons per square kilometre) and their mean human footprint (21) is the second highest of the world's deserts, especially in the Sonoran and Chihuahuan deserts.
- The **Neotropic deserts** in South America cover 1.1 million square kilometres, of which only 6 per cent receives legal protection. Their mean population density is 18 persons per square kilometre, and their mean human footprint (16) is lower than in their North American

counterparts, with most pressure concentrating in the Sechura Desert in the coasts of Peru.

- By far, the **Paleartic realm** concentrates the largest set of deserts in the world, covering a remarkable 16 million square kilometres that total 63 per cent of all deserts on the planet. Their population density is 16 persons per square kilometre, and their mean human footprint (15) is the second lowest on the planet, possibly because of their sheer inaccessibility and extreme aridity. The Sahara, an immense shield-desert, occupies 4.6 million square kilometres, or 10 per cent of the African continent. In sharp contrast with the flat Sahara and Arabian deserts, the deserts of Central Asia present folded mountains with high landscape heterogeneity and enclosed basins, some of which contain large lakes such as the Caspian and Aral Seas.

With summer ground surface temperatures of near 80°C, and only enjoying very ephemeral pulses of rain, species in deserts have evolved remarkable adaptations to harsh conditions, ranging from plants adapted to the fast use of ephemerally-abundant water or to extraordinarily efficient use of scarce water, to behavioural, anatomical, and physiological adaptations in animals. Some species from different deserts show striking resemblances in their appearances despite their differences in phylogenetic origins and biogeographic histories, a phenomenon known as convergent evolution. As a survival strategy, many desert species have symbiotic interactions and cooperate with each other through pollination, fruit dispersal, or by providing protective shade.

True deserts are not the final stage of a process of desertification; they are unique, highly-adapted natural ecosystems, both providing life-supporting services on the planet and supporting human populations in much the same ways as in other ecosystems.

DESERTS ARE THE HOME OF DIVERSE CULTURES AND LIVELIHOODS

Deserts are home to many human populations of the world. Currently around 500 million people live in deserts and desert margins, totalling 8 per cent of the global population. Among the greatest

contributions of desert cultures to the world are the three “religions of the Book”, Judaism, Christianity and Islam, which have had tremendous impact far beyond their areas of origin.

Humans have learnt to survive in deserts, compensating for their poor morphological and physiological adaptations to desert climates with a panoply of behavioural, cultural and technological adaptations to the dry environments. Traditionally, desert livelihoods were of three types — hunter-gatherers, pastoralists, and farmers. Hunter-gatherer tribes, such as the Topnaar of the Namib, are known for their in-depth knowledge of local food plants and wild animal species. Pastoralism, on the other hand, makes use of domesticated animals, such as camels or goats, to produce products such as milk, leather, and meat. Desert agriculture occurs mostly around oases and desert rivers, which often provide silt and nutrients through flooding cycles.

These ways of life, however, are changing rapidly, from hunter-gatherers to cattle ranchers, and from nomadism and transhumance to tourist-targeted activities. Irreversible damages have been caused in previously good agricultural grounds in deserts by large-scale modern developments, such as dam constructions for water and energy supplies. In recent times, extraction of minerals, use of the vast open spaces for military facilities, energy-intensive urban developments, and tourism, have increasingly changed the ways of life for some desert populations.

Resource use and management in deserts for these developments focuses and depends heavily on water and energy, two key resources. Recent increases in the pace of desert urbanization are the result of the relocation of expansive land developments, mining and power engineering, the growth of transport infrastructure, and improvements in water extraction and supply technologies. The high, or even complete, dependency of large desert cities on imported resources has become economically feasible as they generate sufficient income from their economic activities.

Due to the extremely slow rate of biological activity in deserts, these ecosystems take decades, if not

centuries, to recover from even slight damage, such as the tracks left behind by an off-road vehicle on a lichen-covered hill. Moreover, because traditional livelihoods in deserts require large areas, they are particularly vulnerable to political and environmental changes. A good example of this is how the lives of nomadic herders in the Gobi floundered under the changes from Mongolia's transition from a socialist system to a market-driven economy.

DESERTS PLAY AN IMPORTANT ROLE IN THE GLOBAL ENVIRONMENT AND ECONOMY

Deserts interact strongly with the rest of our planet. Global-scale climate change during the 1976–2000 period has shown increased temperatures in nine out of twelve deserts studied. Average projected changes for 2071–2100 show a temperature increase of between one and seven degrees Celsius in all world deserts. Rainfall, on the other hand, could increase or decrease with climate change: while the Gobi Desert in China will most likely receive more rain, the Sahara and Great Basin deserts could become drier. In general, a warmer planet will bring more rainy pulses to winter-rain deserts and more drought pulses to summer-rain deserts. Large desert rivers originate mostly outside deserts, and many could face declining water flow from climate change.

These changes will, undoubtedly, impact the ecology of deserts. For example, nearly half of the bird, mammal and butterfly species in the Chihuahuan Desert are expected to be replaced by other species by 2055. Annual grasses that are prone to wildfire are likely to extend their coverage in some deserts, invading native scrubs and increasing the risk of soil erosion.

Deserts also have strong linkages to non-desert environments. Decreased rainfall in some deserts as a result of climate change will represent increased emissions of cross-boundary dust storms with, literally, far-reaching consequences. Most dust particles in the global atmosphere originate from the deserts of northern Africa (50–70 per cent) and Asia (10–25 per cent). Nutrients carried by desert dust, such as phosphorus and silicon, enhance growth in oceanic phytoplankton by increasing the productivity of some marine

ecosystems, and also of nutrient-poor tropical soils, as observed from Saharan dust deposited in the Amazon basin. Desert-generated dust also reduces visibility, interfering with ground and air traffic away from deserts and increases the incidence of respiratory illnesses.

Deserts provide migratory corridors for many species. Non-desert birds on cross-desert migration across the Sahara compete increasingly with the human population of the region for rare oases that cover only two per cent of the area. The desert locust (*Schistocera gregaria*) is normally found in 25 countries of the Sahel and the Arabian Peninsula, but during epidemic outbreaks can spread over up to 65 countries, consuming 100 000 tonnes of vegetation a day, from India to Morocco, and even crossing the Atlantic to the Caribbean and Venezuela.

Deserts have provided trade corridors from times immemorial through which goods and cultures travelled. Water-soluble salts, such as gypsum, borates, table salt, sodium and potassium nitrates have been historically a product of deserts. Evaporite minerals, such as soda, boron, and nitrates, are common in deserts and are not found in other ecosystems. A sizeable share (30–60 per cent) of other minerals and fossil energy used globally is exported from deserts, including bauxite, copper, diamonds, gold, phosphate rock, iron ore, uranium ore, oil, and natural gas.

Because of their warm climate, deserts also export agricultural products, produced under irrigation, to non-desert areas. Agriculture and horticulture are already profitable in many deserts, as in Israel and Tunisia, and have great further potential. A new non-conventional desert export is derived from aquaculture, which paradoxically, can be more efficient in water use than desert plants, and can take advantage of the deserts' mild winter temperatures and low cost of land. Biologically-derived valuable chemicals, produced by micro-algae as well as medicinal plants, are also manufactured in deserts, capitalizing on their high year-round solar radiation, and exported to global markets. Besides the ongoing export of wild plant products from deserts to non-deserts, there is a pharmaceutical potential in desert plants which is yet to be tapped.

The growth of desert cities, clearly evidenced in industrial countries in the mid-twentieth century, has attracted the migration of non-desert people into desert habitats, drawn by new employment opportunities and the availability of cheap housing. In recent years, the influx of tourists to deserts, seeking the dry and sunny climate, has encouraged migration to deserts as well. Finally, in developing countries, specifically in Sub-Saharan Africa, periodic droughts in non-desert drylands draw thousands of rural migrants and nomads to adjacent desert cities in search of food and employment.

Research carried out in deserts has enriched the knowledge of the history of our universe and planet, and of life on earth. Deserts attract scientists of every discipline, ranging from testing grounds for planetary exploration equipment, to research on meteorites (well-preserved due to the slow rate of desert rock weathering), to astronomical observations, and archaeological and geomorphologic studies. Many areas of research benefit from the desert's clean atmosphere, low human disturbance, dry climate, sparse vegetation cover, minimal cloud cover, and thin soils — features that contribute to good preservation conditions and high detectability of scientifically-relevant objects and phenomena.

Our understanding of global processes, the development of much of our modern research, our ability to cope with global environmental change, and the preservation of much of our global heritage depend to a large extent on the way we manage and preserve the world's deserts. What happens in deserts affects every one of us.

DESERTS PRESENT DEEP CHALLENGES FOR SUSTAINABLE DEVELOPMENT, BUT ALSO GREAT OPPORTUNITIES

Aside from the direct effects of reduced vegetation cover from overgrazing and deforestation, the problem of human-induced land degradation and desertification does not appear to be as serious an issue in most true deserts as it is in many semi-arid and sub-humid regions. Deserts are less susceptible to land degradation, firstly because their biological productivity is very low, and secondly because vast desert areas are almost devoid of human interference and are thus safe

from human impact. When the problem is present, it tends to concentrate on the deserts' edge or on the more humid parts inside the biome, such as oases, and desert mountain sky-islands.

In these more vulnerable portions of the global deserts, however, impacts can be significant. Removal of vegetation cover, especially due to grazing, increases soil loss. Disturbance to the fragile desert surface, by military and recreational activities, leaves long-lasting damages. Mining activities and the remnants of these have contaminated freshwater bodies with high concentrations of heavy metals and chemical substances, as seen in parts of Argentina and Chile. Oil extraction causes air pollution, spills and chronic leakages that affect both surface and subsurface organisms. Irrigated portions of deserts in China, India, and Pakistan face declining yields due to increasing salinity. In China, deterioration of the plant cover in the headwaters region of the Yangtze River has created major flooding problems downstream and massive water erosion in the Loess Plateau. While biodiversity hotspots — the biologically-richest and most endangered terrestrial ecoregions — occupy 12 per cent of deserts, almost exactly the same proportion as for hotspots globally, the proportion of the desert biome with IUCN protected area status is much less (5.5 per cent) than the same figure for all ecoregions (9.9 per cent).

People have responded to these problems by developing and implementing actions at the regional and national levels. For example, in many countries in North Africa, as well as Yemen, there is a wealth of traditional knowledge on soil and water conservation in deserts through sustainable land management practices, including the retention of suspended sediments in terraces. In an effort to make better use of investments in water-control structures, a series of protective measures have been implemented in watersheds in Tunisia and Morocco. The application of newer technologies and practices for improved fallow periods, micro-basins, windbreaks, and soil bunds has gained global momentum in light of participatory approaches to soil conservation. Since the introduction of its National Soil Conservation Program in 1983, Australia has substantially expanded and improved its soil and water

conservation technologies on private and public lands.

At the international level, several assessment efforts have included the desert ecoregions; among them, the Global Assessment of the Status of Human-Induced Soil Degradation (GLASOD) conducted by the International Soil Reference Information Centre in 1988; UNEP's World Atlas of Desertification published by UNEP in 1992 and 1997; the chapter on drylands in the recent Millennium Ecosystem Assessment; and the currently on-going LADA (Land Degradation Assessment in Drylands) that started in 2006, under the auspices of several United Nations agencies. The Ramsar Convention has played a strategic role in the protection of oases and other desert wetlands. In 1994, UNCCD (the UN Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa) was adopted by the international community, and 191 countries worldwide have signed or ratified the Convention so far. However, the Convention is mostly oriented towards sub-humid, semi-arid, and arid ecosystems, that is, the desert edges, and excludes the hyper-arid deserts of the world. Currently, there is no global or regional response strategy focused exclusively on deserts.

There are several forces behind environmental changes in deserts, which are also challenges to future development: changes in population dynamics will mainly affect rural desert communities along the great desert rivers. Large population increases are expected in resource-intensive populations of deserts in the United States and in the United Arab Emirates. These population changes will affect the quantities of water and energy consumed and waste produced in the desert biome. Inward investment was the strongest driver of change in deserts in the recent past; most went to the extraction of oil, gas, and minerals. Developments for nuclear weapons testing, nuclear waste, space flight, parking lots for unused aeroplanes, and other activities that have treated deserts as barren wastelands, all affect the desert environment. Tourism, another driver of change, brings nine million visitors to Morocco and Tunisia every year; there was a three-fold increase

in tourism in Egypt in 2005, and Dubai claims to be the world's fastest-growing tourist destination.

Global climate change and its impact on water regimes is already a driver of change in deserts. While rising energy prices will bring higher incomes to some oil-producing desert countries, others without this resource will suffer, as the costs of energy and water are closely correlated in deserts. Security issues from northern Africa to Iran have made deserts less accessible and have changed environmental and socio-economic conditions in these regions. Environmental problems caused by past, non-sustainable development pose enormous challenges. By far the best-known case has been that of the Aral Sea basin where the existing recovery programme will only save part of the former sea, and reduce only a proportion of the dust that the now-dry basin emits.

While building more dams and drilling for more groundwater are still tempting to policy-makers, the water in rivers that cross deserts is already thoroughly utilized, if not over-used. Groundwater, often extracted in excess of meagre recharge, rates currently provides 60–100 per cent of freshwater needs in most deserts lacking a large river. Given the escalating water crisis in many deserts, better water-use policy is urgent. Water supply can only be improved by combining new technologies with traditional water-efficient management. Useful technologies that can play an important role in future water supply include: drip irrigation and micro-sprinklers; desalination of brackish water, rather than saline water, to reduce the cost per cubic metre of treated water; fog harvesting in coastal deserts; and small sediment-holding dams and terraces.

Tourism is another opportunity for development, as long as the risks and dangers associated with it, such as volatility in the face of political conditions, competition for water and other resources, damaged beauty and biological value, temptation for street and organized-crime, social inequity, and litter, are recognized explicitly in policy. Deserts have much to offer for ecotourism, the fastest growing sector of the tourism market, although there are concerns that the label may be used to cover activities that damage ecosystems, such as off-road motoring.

Only a very small fraction of the solar power potential in deserts has been harnessed, and with the decline in the production of fossil fuel as well as technological improvements, solar sources might supply a significant portion of global energy by 2050. Wind and solar energy installations can make use of the cheap space, large inputs of solar energy, availability of some windy sites, and the absence of objectors in deserts. However, lengthy power connections required from remote desert locations are a disadvantage in both solar and wind energy production in deserts.

DESERTS WILL CONFRONT GROWING PRESSURES IN COMING DECADES

The impacts of changes in precipitation and temperature patterns due to global climate change will be highly variable from one region to the next, but they are likely to be felt the hardest in desert margins and in desert montane areas, as these are where the principal arid rangelands are located. Because deserts are driven more by climatic pulses than by average conditions, even moderate changes in precipitation and temperature may create severe impacts by shifting the intensity and frequency of extreme periods, and subsequently creating catastrophic effects on plants, animals, and human livelihoods.

Climate change is expected to affect less the total amount of available water, and more the overall water regime and the timing of water availability in deserts. Deserts and desert margins are particularly vulnerable to soil moisture deficits resulting from droughts, which have increased in severity in recent decades and are projected to become even more intense and frequent in the future. Conversely, flood events are expected to be fewer but more intense, in which case less moisture would infiltrate into soils, and run-off and eroded sediment would concentrate in depressions, reinforcing the patchiness of desert ecosystems.

Deserts fed by melting snow or ice, such as the deserts of Central Asia and the Andean foothills, will be particularly vulnerable to a changing climate. As the volume of snowpack diminishes, river regimes will change from glacial to pluvial and, as a result, total run-off is expected to increase

temporarily and then to decline. Peak discharges will shift from the summer months, when the demand is highest, to the spring and winter, with potentially severe implications for local agriculture. Growing populations in deserts and accompanying aspirations for improved standards of living, will very likely increase water demand in expanding urban areas. The deterioration of both surface and groundwater resources by agrochemicals, mostly pesticides and fertilizers used in irrigated agriculture, and increasing salinity of return flow, are likely to continue into the future. Seawater intrusion into groundwater caused by sea level rises resulting from global warming may further deteriorate the quality of underground aquifers. Desert margins, oases, and irrigated lands within deserts have a higher biological potential and are subject to increasing population pressure, and thus tend to constitute potential hotspots of degradation. Land use will continue to intensify in the desert margins while expansion of croplands into deserts will be limited, except where fuelled by irrigation. Grazing by livestock and cutting of firewood will continue to increase inside deserts, but mostly concentrated in montane areas and on the desert margins.

A decline in the rate of expansion of irrigated areas is expected in the next decades, together with increased investments in drainage to fight salinization. This would still not be enough to stop the advance of this serious problem in potential degradation hotspots including the Nile delta, the Indus, Tigris and Euphrates, and northern Mexico. A considerable amount of unsustainable irrigated land will go out of production as aquifer exhaustion progresses, and new opportunities for rehabilitation of degraded lands and sustainable pasture management systems will emerge.

Piecemeal development of infrastructure, such as road networks, will occur more in desert sky-islands and, again, in desert margins. Desert wilderness areas (any area located more than five kilometres away from any infrastructure) are expected to decline from 59 per cent of the total desert area in 2005 to a low 31 per cent by 2050, a decline of 0.8 per cent per year on average. Species such as desert bighorn sheep (*Ovis canadensis*), Asian houbara bustards (*Chlamydotis*

macqueenii) and desert tortoise (*Gopherus agassizii*), that are sensitive to fragmentation of habitat or poaching, induced by increased access to the areas previously not accessible to people, will be affected significantly by this change. Relatively pristine natural rangelands inside deserts may decline by 1.9 per cent annually, and wetlands at an even higher pace, under pressure from irrigation and agricultural expansion. At greatest risk are the few patches of dry woodlands associated with desert montane habitats, which may decline by up to 3.5 per cent per year.

Currently, the desert biome holds on average an abundance of original species of 68 per cent, but the rate of biodiversity loss in deserts may double in the coming decades. A decline in original species to a mean of 62.8 per cent by 2030 and 58.3 per cent by 2050 is expected, as a result of the new pressures and impacts brought forward by agriculture and human land use (41 per cent of the loss), fragmentation associated with infrastructure (40 per cent), and climate change (6 per cent in 2000 and 14 per cent by 2050).

VIABLE OPTIONS EXIST FOR SUSTAINABLE DESERT DEVELOPMENT

Improved resource management for desert ecosystems. The extreme variability of desert ecosystems tends toward boom-and-bust cycles rather than a steady flow of environmental goods and services. Deserts, therefore, require policies that support dynamic responses to the variable and unpredictable desert environment. Mitigating the “bust” part of the cycle is an important component of the sustainable management of desert ecosystems, including not only emergency support during drought crises, but also proactive management to increase human and societal resilience, by creating diversified rural income opportunities that can sustain rural livelihoods during times of stress.

Making use of modern technology. Traditional wisdom on coping with drought, complemented by cutting-edge science and information technology holds great potential for sustainable desert resource management. Technical knowledge and reliable forecasts alone are insufficient, but need to be implemented to the benefit of the local

people. Climate change adaptation planning must therefore include the identification of vulnerable population groups and the exploration of effective and affordable livelihood strategies during times of climatic stress. Perhaps most importantly, management systems are needed that have the will and capacity to act on the most likely risk scenarios.

Renewable energy from the desert. Continuously high solar radiation makes deserts ideal locations for solar cell installations, the potential reach of which is not limited to deserts. Apart from technological feasibility, the adoption of solar energy as an alternative to fossil fuels depends on the global as well as national policy environments and concrete implementation strategies. Possible incentives to encourage the shift towards renewable energy sources include taxes on pollution-generating burning of fossil fuels, while providing loans and grants for the use of solar and other renewable energy resources.

“Soft path” for water development. Deserts, as the first environments confronted with water shortages and forced to rethink water use priorities, should be among the forerunners in developing and testing innovative, efficient, and globally-relevant, water-use technologies and policies. The “soft path” approach to water should focus on water-use efficiency and on lowering demand, supported by economic and institutional instruments, rather than on further attempts to increase water supply. In many desert regions, water prices currently do not reflect the true cost and value of water.

A strategy to discourage wasteful water consumption, which at the same time contributes to more equitable access to water, is to support low-income and low-volume users with transparent subsidies, financed by excessive water consumers. Raising public awareness about the need to conserve water is particularly important for new migrants into deserts who have not developed a “sense of place”, such as those moving into the desert cities of the U.S. Southwest.

Small-scale decentralized water supply facilities and the involvement of communities in the decision-making process about water

management, allocation, and use ensure more equitable access to water and potentially lower environmental impacts than the massive centrally-planned water schemes of the 20th century. Promotion of high value-added uses of water is critical to improve water-use efficiency. For example, the high-tech industrial sector enhances the value of each cubic metre of water used many times more than the agricultural sector. Within the agricultural sector, one possibility to improve water efficiency is to restrict irrigated agriculture in deserts to high-value crops (for example, dates), intensive greenhouse farming or aquaculture, while lower-value crops such as maize can be imported from more humid regions.

A NEW VISION FOR DESERT DEVELOPMENT

Whether global deserts will follow a path of intensive development, industrial-scale agriculture projects, and mega-cities attracting massive immigration at the expense of long-term sustainability, or an alternative path of sustainable development, spurred by a “sense of place” that is sensitive to the uniqueness of the desert environment and its traditional cultures, is going to be determined by largely our common visions and collective actions taken to fulfil them.

Current desert development and conservation seems to suffer from a lack of vision and coordinated programmes. Development schemes, such as programmes for irrigated agriculture or mass tourism, tend to spring up haphazardly with few attempts to coordinate them or to plan for their long-term sustainability. Immigration to the desert is often random and opportunity-driven, and new settlements sprawl over valuable landscapes and create problems for water supply and waste management. Without proper planning and a vision of sustainability, traditional lifestyles may wither and indigenous knowledge may become lost, victims of short-term, ephemeral economic projects.

A continuation of the energy- and water-intensive development model, and a non-renewable model in which water with subsidized costs is used for low-value purposes, will not be viable, as they lead to even more severe resource depletion and degradation. On the other extreme, increased isolationism with exclusive reliance on traditional knowledge runs the risk of losing access to new sustainable technologies and might lead to diminished opportunities for younger generations, and eventually, to reduced livelihood and economic development options.

A new, more balanced vision is needed, where deserts and their inhabitants are valued by both governments and civil society; where sustainability and the well-being of desert people are given the highest priority; where desert development is guided by a long planning horizon and based on an acute understanding of the limitations and potential of these very unique environments; where market forces are harnessed to promote desert-compatible development such as low impact services or high-technology development; where traditional livelihoods are given the opportunity to survive with dignity; and where wetlands, oases, desert mountains and other fragile environments at risk are protected.

Decisions can and should be made not to change the desert, but to live with it and preserve its resources for the future. The active participation of community groups should include taking charge of their own development, planning for risks, and adapting to changing conditions while preserving their deep connections to these remarkable landscapes. The challenge remains to harness not only local, but also global policy mechanisms and market incentives to develop a viable future for deserts, where both environmental conservation and economic development are achieved.