DESERTIFICATION

a visual synthesis

UNCCD

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Confederaziun svizra

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FOREWORD

Often, when people think of drylands, they associate them with deserts and hostile living conditions, economic hardship and water scarcity. But that is not what drylands are all about. If managed well, the drylands are also fertile and capable of supporting the habitats, crops and livestock that sustain nearly one-third of humanity. Drylands offer opportunities for local populations and provide tangible regional and global benefits. For a variety of reasons, such as market failures, weak investment incentives, gender inequalities and some enduring myths, the benefits to be gained of working with the drylands and their vibrant communities are not fully realised. There is a genuine risk and rapidly growing concern that desertification will undermine nascent opportunities and the world will lose the inherent potential of the drylands.

Desertification means land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors including climatic variation and human activity. It affects the livelihoods of rural people in drylands, particularly the poor, who depend on livestock, crops, limited water resources and fuel wood. The critical social and economic importance of natural resources, agriculture and animal husbandry mean that in many countries, combating desertification and promoting development are virtually one and the same. We need to correct an image of desertification as an unstoppable monster slowly consuming the world's fertile lands, plants, livestock and people. Practical solutions to desertification exist at many levels and are being successfully employed by communities around the world.

Yet in no other ecosystem are the interactions between the challenges of climate change and the conservation of biodiversity so closely linked to food security and poverty reduction. In the drylands, we need to address these issues jointly and understand how they affect each other to find practical solutions that work for affected communities. This requires cooperation between experts in different fields and in the mechanisms provided by the global community. In this, the United Nations Convention to Combat Desertification (UNCCD) plays an important role between dryland and non-dryland countries, promoting scientific and technological excellence, raising public awareness and mobilizing resources to prevent, control and reverse desertification/land degradation and mitigate the effects of drought.

With this very visual and easily readable booklet we aim to explain current thinking about the drylands in a concise and accessible manner.

Luc Gnacadja
Executive Secretary
United Nations Convention to Combat Desertification

ABOUT THIS BOOK

This book is intended as a basic information kit that tells "the story" of desertification, land degradation and drought at the global scale, together with a comprehensive set of graphics. The book indicates trends as they have taken place over the last decades, combining and connecting issues, and present priorities. It also provides information on the United Nations Convention to Combat Desertification (UNCCD) and how it works to forge a global partnership to reverse and prevent desertification/land degradation and to mitigate the effects of drought in affected areas in order to support poverty reduction and environmental sustainability.

This book was produced in cooperation with **Zoi Environment Network**.

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1 GLOBAL DRYLANDS*

Definition of drylands

Drylands are arid, semi-arid and dry sub-humid areas. In the context of sustainable development the term generally excludes hyper-arid areas (deserts). When land degradation occurs in the world's drylands, it often creates desert-like conditions. In environmental terms, drylands are charac-terized by:

- Low, infrequent, irregular and unpredictable precipitation;
- Large variations between day and night-time temperatures;
- Soil containing little organic matter, and a lack of water; and
- Plants and animals adapted to climatic variables (drought-resistant, salt-tolerant, heat-resistant, and able to cope with a lack of water).

	Aridity Index (AI) = Average annual precipitation/Potential Evapo-Transpiration	Share of world's land surface	Length of growing period in days	Share of world's land surface
Arid	0.05<AI<0.2	12.1%	1 to 59	7%
Semi-arid	0.2<AI<0.5	17.7%	60 to 119	20%
Dry sub-humid	0.5<AI<0.65	9.9%	120 to 179	18%
Total drylands	**0.05<AI<0.65**	**39.7%**	**1 to 179**	**45%**

There are different definitions of drylands. UNEP bases its definition on the aridity index. For comparison's sake the FAO uses the length of growing period. These different definitions lead to different figures. The present information kit uses the UNEP definition.

Most of the planet's 2 000 million dryland residents live in developing countries. The vast majority lives below poverty line and without adequate access to fresh water. Drylands take up 41.3 per cent of the Earth's land surface and up to 44 per cent of all cultivated land is in the drylands. Drylands support 50 per cent of the world's livestock, account for nearly half of all farmland, and are major wildlife habitats. Because of the difficult climate conditions, drylands have given rise to an incredible diversity of highly specialized species. This biodiversity is essential for maintaining the eco-balance and protecting human livelihoods, which depend on it. A relatively high number of endemic species occupy these areas, which include diverse habitats such as sandy land, forest and woodland, savanna and steppe, wetlands, ponds, lakes and rivers.

Map produced by ZOÏ Environment Network, September 2010
Source: UNEP World Conservation Monitoring Centre

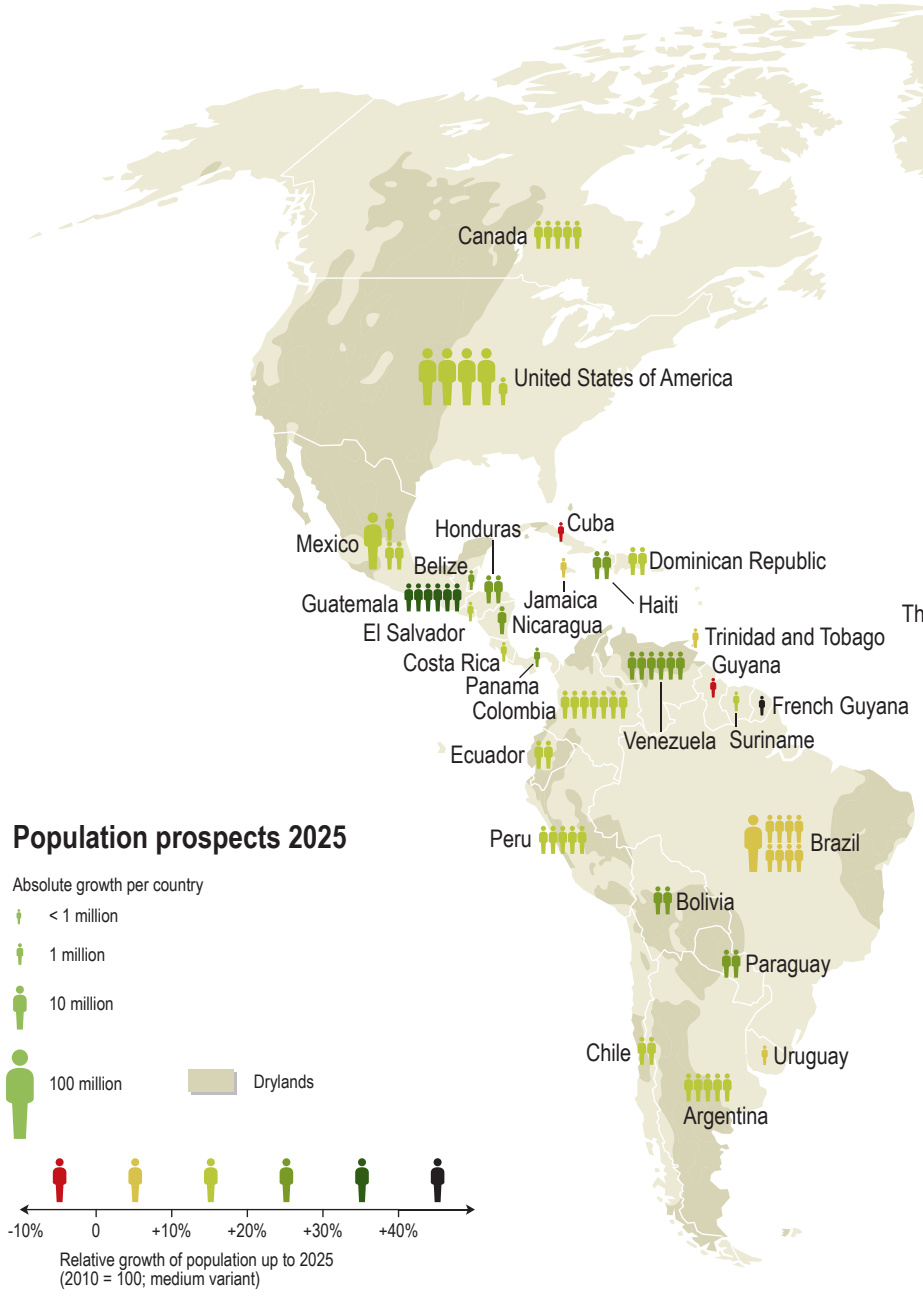

Iceland
Norway
Finland
Sweden
United Kingdom
Russia
Ireland
Poland
Belarus
Germany
Ukraine
France
Azerbaijan
Kazakhstan
Georgia
Kyrgyzstan
Mongolia
Uzbekistan
Portugal
Spain
Italy
Greece
Turkey
Turkmenistan
Tajikistan
DPR of Korea
Republic of Korea
Japan
Armenia
Tunisia
Iraq
Iran
Afghanistan
Morocco
Algeria
Libya
Egypt
Jordan
Pakistan
Bhutan
China
Nepal
Saudi Arabia
Oman
India
Myanmar
Bangladesh
Lao PDR
Thailand
Viet Nam
Mauritania
Mali
Niger
Chad
Sudan
Eritrea
Yemen
Senegal
Burkina Faso
Benin
Central African Republic
Djibouti
Gambia
Guinea
Nigeria
Ethiopia
Sierra Leone
Cameroon
Somalia
Liberia
Togo
Uganda
Sri Lanka
Malaysia
Côte d'Ivoire
Ghana
Congo
Kenya
Gabon
Rwanda
Republic of the Congo
Burundi
Tanzania
Indonesia
East Timor
Papua New Guinea
Angola
Zambia
Malawi
Zimbabwe
Madagascar
Namibia
Botswana
Mozambique
Australia
Swaziland
South Africa
Lesotho
New Zealand

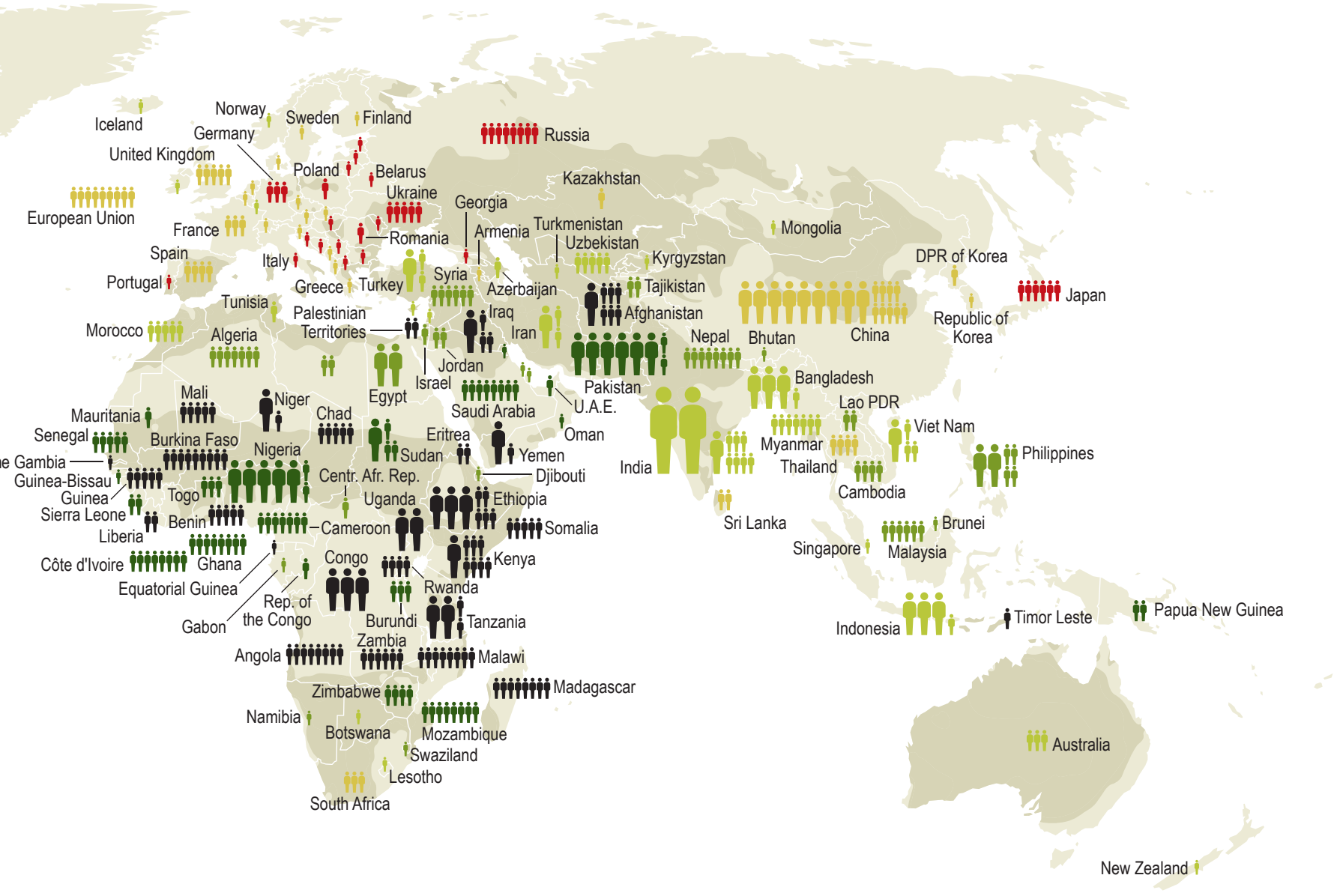
Drylands population

The following main types of human use are found in drylands: rangelands (59%); cultivated land (30%); and urban areas (2%). Other areas are defined as hyper-arid such as the world's driest places, the Atacama desert in Chile and the Namib desert in south-west Africa, the Gobi desert in Mongolia and western Inner Mongolia in China, as well as polar regions. The dominant land-cover for drylands consists of shrubs, followed by cropland, savanna, steppe, grassland, forest and urban areas.

Water scarcity is the predominant feature of drylands. While heavy rain may occur, rainfall typically varies, sometimes dramatically, from season to season, and year to year. In arid and semi-arid zones, the water balance is negative at year basis, meaning that more water evaporates than precipitates during one year. Therefore, water is scarce most of the time and human settlements may cluster around rare sources of water such as rivers, springs, wells, water catchments, reservoirs and oases.

	Dominant broad ecosystem	Total population	Share of global population (%)
Arid	Semi-Desert	242 780 000	4.1
Semi-arid	Grassland	855 333 000	14.4
Dry sub-humid	Rangeland	909 972 000	15.3
Total		**2 008 085 000**	**33.8**





Map produced by ZOÏ Environment Network, August 2010
Source: United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects: The 2008 Revision, New York, 2009 (→ http://data.un.org)

Dryland facts

- The total population of the world's drylands is 2 000 million, excluding hyper-arid (desert) areas. Drylands are thus home to almost one in three people in the world today.
- Drylands support 50 per cent of the world's livestock.
- The majority of the world's dryland population is in developing countries.
- Drylands store 46 per cent of the planet's carbon inventory.
- Drylands comprise 44 per cent of all cultivated land.
- Plant species endemic to the drylands make up 30% of the plants under cultivation today.
- The largest dryland areas are in Australia, China, Russia, the United States and Kazakhstan.
- At least 99 per cent of the surface area of six countries (Botswana, Burkina Faso, Iraq, Kazakhstan, Moldova and Turkmenistan) is classified as drylands.

LAND FOR LIFE 1

Best practice: Desertification, land degradation and drought, and sustainable land management monitoring and assessment/research

Suriname: Combating the loss of soil fertility through the use of compost and natural pesticides

Saramacca, which lies halfway on the Atlantic coast in northern Suriname, depends mainly on agriculture, horticulture and petroleum extraction. The district traditionally had fertile soils, but fertility had reduced due to the overuse of synthetic fertilizers. Crops shrank over the years because of the depleted soil quality.

In order to retrieve fertile soil, the Caribbean Institute Suriname developed a biological method which controls the effects of pests and diseases during the crop harvesting period. The method uses a seed extract of Crotalaria striata or Smooth rattlebox, an herbaceous plant that dissolves in a certain proportion of water. This mixture is then poured around the crops every two weeks. The practice does not kill the pests, namely nematodes, but suppresses them enough for the crops to grow well. Another biological pesticide is the use of extracts of tobacco leaves to kill plant louses.

Although the farmers were not used to this new technology, they were highly motivated and actively participated in learning this method, receiving training, and eventually adopting the new practice. The transition not only helped farmers adopt competitive organic horticulture and develop a sustainable agro-supply chain, but also resulted in better crop yields.

(Source: PRAIS 4th UNCCD reporting and review process. Suriname)

2 WHAT IS DESERTIFICATION?

Desertification

Contrary to popular perception, desertification is not the loss of land to desert or through sand-dune movement. Desertification refers to land degradation in arid, semi-arid and sub-humid areas resulting from various factors, including climatic variations and human activities. When land degradation happens in the world's drylands, it often creates desert-like conditions. Land degradation occurs everywhere, but is defined as desertification when it occurs in the drylands.

Behind land degradation lies disturbance of the biological cycles on which life depends, as well as social and development issues. The term desertification was coined to convey this drama of pressing and interconnected issues in drylands.

The soil of degraded land has less capacity to support plant growth, resulting in the loss of vegetation and economic productivity. Despite the fact that animals and plants are able to adapt to the drylands, desertification has serious consequences for the environment. It is often caused by human activities, such as overgrazing, over-cultivation, deforestation and poorly planned irrigation systems. Extreme climatic events, such as droughts or floods, can also accelerate the process.

Facts on land degradation

- Between 1981 and 2003, 24 per cent of global land was degraded.
- Rangeland accounts for 20 to 25 per cent of degrading land.
- Cropland accounts for 20 per cent of degrading land.
- Worldwide some 1 500 million people depend on degrading land.
- Between 1981 and 2003, 16 per cent of degraded land was improved.
- Rangeland comprised 43 per cent of degraded land.
- Cropland comprised 18 per cent of degraded land.
- Land covering 12 million hectares, equivalent to Bulgaria or Benin, is lost every year.
- Annual land lost could produce 20 million tonnes of grain.

Depending on the type of agricultural technique employed, different forms of land degradation occur. For example, these can be:

- loss of nutritive matter (due to agricultural over-exploitation);
- loss of topsoil surface due to wind and water erosion, particularly due to the loss of vegetation;
- landslides caused by the action of water and the effects of vegetation loss;
- increased salinity and soil acidification due to irrigation malpractice; and
- soil pollution due to excessive use of chemical fertilizers.

Desertification occurs because dryland ecosystems are extremely vulnerable to over-exploitation and inappropriate land use. Poverty, political instability, deforestation, overgrazing and improper irrigation practices can all undermine the productivity of the land. There is no linear process of cause and effect leading to land degradation in the drylands, but its drivers, which interact in complex ways, are known. Such drivers are climatic, especially low soil moisture, changing rainfall patterns and high evaporation. Most of them are human-related, and include poverty, technology, global and local market trends and socio-political dynamics. It is important to note that poverty is both a cause and consequence of land degradation. Other consequences of desertification include:

- diminished food production, soil infertility and a decrease in the land's natural resilience;
- increased downstream flooding, reduced water quality, sedimentation in rivers and lakes, and silting of reservoirs and navigation channels;
- aggravated health problems due to wind-blown dust, including eye infections, respiratory illnesses, allergies, and mental stress;
- loss of livelihoods forcing affected people to migrate.

There is a fine line between drylands and deserts – once crossed it is hard to return. It is much more cost-effective to prevent drylands from degradation than to reverse it. Restoring soil lost by erosion is a slow process. It can take 500 years for 2.5 centimetres of soil to form but only a few years to destroy it. Although the figure varies a great deal depending on how costs are measured, estimates by UNEP in 1993 suggested that desertification and drought account for USD42 000 million income lost worldwide every year, equivalent to all official aid to Africa in 2009. On top of this figure is the uncountable cost in human suffering and lives lost due to hunger and the need to abandon once-productive land. Not only are these statistics disturbing, they can be prevented.

Between 1981 and 2003, 24 per cent of the land has been degraded globally. About 1 500 million people depend directly on these degrading areas. Nearly 20 per cent of the degraded land is cropland, and 20 to 25 per cent is rangeland.

Despite the grave problems of drylands, such regions are areas of great potential for development. The fact that more than half the world's productive land is dryland emphasizes the critical importance of wise management at the global, national and local levels. Impoverished land and impoverished people are two sides of the same coin. Sustainable land management can support land users to respond to changing market demand with adapted and traditional technologies to generate income, improve livelihoods and protect ecosystems.

2.1 DRIVERS OF DESERTIFICATION

Land degradation reduces or destroys soil productivity, vegetation, arable and grazing land, as well as forest. In the most extreme cases, hunger and poverty set in and become both the cause and consequence of further degradation. While this book seeks to present a wide range of causes and impacts to foster understanding of desertification, it is by no means exclusive. Further it is important to recognize that issues can only be generalized to a certain extent beyond which, each country and region must be viewed in their individual context.

2.1.1 Climatic variations

Drought means the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems. High, sustained temperatures lasting for months with infrequent and irregular rainfall lead to drought and difficult growing conditions for plants and trees. As a result, severe hydrological imbalances jeopardize natural production systems. When violent winds and heavy downpours destroy the vegetation – carried away by the sudden gush of water – harvests and livestock suffer. As a consequence, the income of the rural communities diminishes.

2.1.2 Human activities

In countries where major economic resources are dependent on agricultural activities, there are few alternative sources of income, or none at all. Soil is damaged by excessive use when farmers neglect or shorten fallow periods, which are necessary to allow the soil to recover sufficiently to produce enough food to feed the population. This in turn causes the soil to lose organic matter, limiting plant growth and reducing vegetation cover. The bare soil is more vulnerable to the effects of erosion. Four human activities are the most immediate causes:

- Over-cultivation exhausts the soil;
- Overgrazing removes the vegetation cover that protects it from erosion;
- Deforestation destroys the trees that bind the soil to the land; and
- Poorly drained irrigation systems turn croplands salty.

Extractive industries advance land degradation by lowering water tables, disturbing land and accelerating soil erosion. Inadequate knowledge on sustainable land management, unfavourable trade conditions in developing countries, non-ecological tourism and other socio-economic and political factors, which intensify the effects of desertification, create another form of impact. These factors interact with the causes above and are often the underlying drivers of man-made desertification.

2.2 EXAMPLES OF LAND DEGRADATION

2.2.1 Soil salinization

There are several severe consequences linked to increased land degradation. In irrigated lands, where water from underground reservoirs is often polluted, evaporation brings mineral salts to the surface, resulting in high salinity. This will render the soil unsuitable for crops which cannot withstand high salt concentrations. Similarly, vegetation cover may not be given enough time to re-establish itself during intensive grazing periods or when grazing activities affect plots that have already been cultivated.

2.2.2 Deforestation

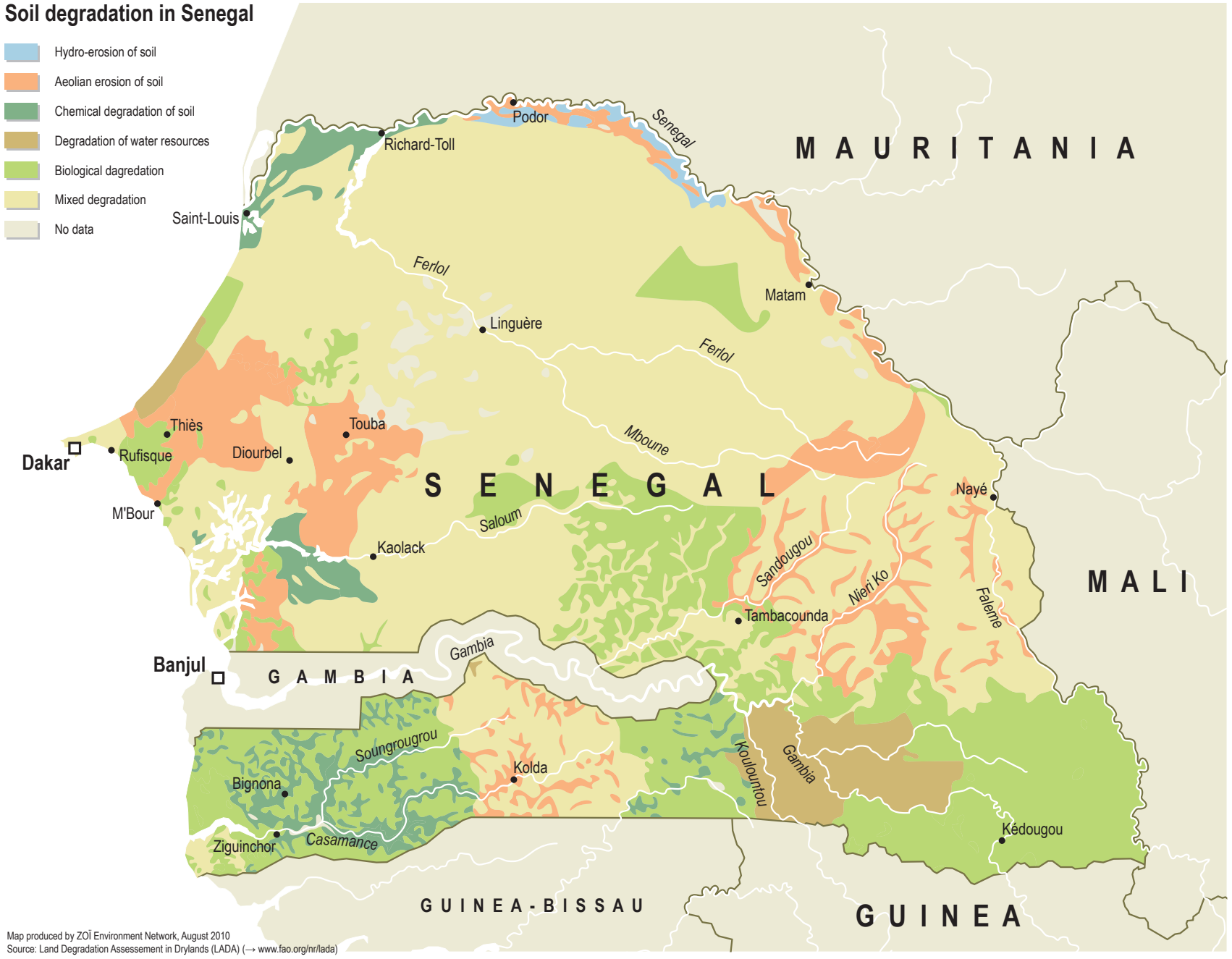
Water speeds up erosion, as a direct result of tree clearing and deforestation, and the forest ecosystem disappears. This has severe consequences for soil fertility as well as for the preservation of animal and plant species. In fact, roots maintain soil structure and can limit soil erosion since they help water infiltration, which reduces water run-off, encouraging the composition of rich, productive soil. Leaves falling from trees reduce the action of the wind on the soil surface. Dead tree parts fall to the ground, decompose and enrich the soil with organic matter.

2.2.3 Environmental degradation

Land degradation can also trigger a cycle of environmental degradation, impoverishment, migration and conflict, often jeopardizing the political stability of affected countries and regions. Populations in drylands often endure very harsh economic conditions, suffering from low per-capita-income and high infant mortality rates. Soil degradation in drylands further exacerbates the problem. The decline in the fertility of land reduces crop production and prospects of additional income.

Degraded land may also cause downstream flooding, poor water quality, sedimentation in rivers and lakes, and silting up of reservoirs and navigation channels. It can cause sand and dust storms and air pollution, resulting in damaged machinery, reduced visibility, unwanted sediment deposits, unsafe communication, risks to health, and mental stress.

All this draws a dramatic and negative picture of increasingly difficult development. But there are solutions and grounds for hope. Desertification can be reversed, but only if far-reaching changes are made in local and international action. Step by step, these changes will ultimately lead to sustainable land use and food security for a growing world population. Combating desertification is really just part of a much broader objective: the sustainable development of countries affected by drought, land degradation and desertification (DLDD).



Map produced by ZOÏ Environment Network, August 2010
Source: Land Degradation Assessement in Drylands (LADA) (→ www.fao.org/nr/lada)

LAND FOR LIFE 2

Best practice: Sustainable land management technologies, including adaptation

Great Green Wall in China

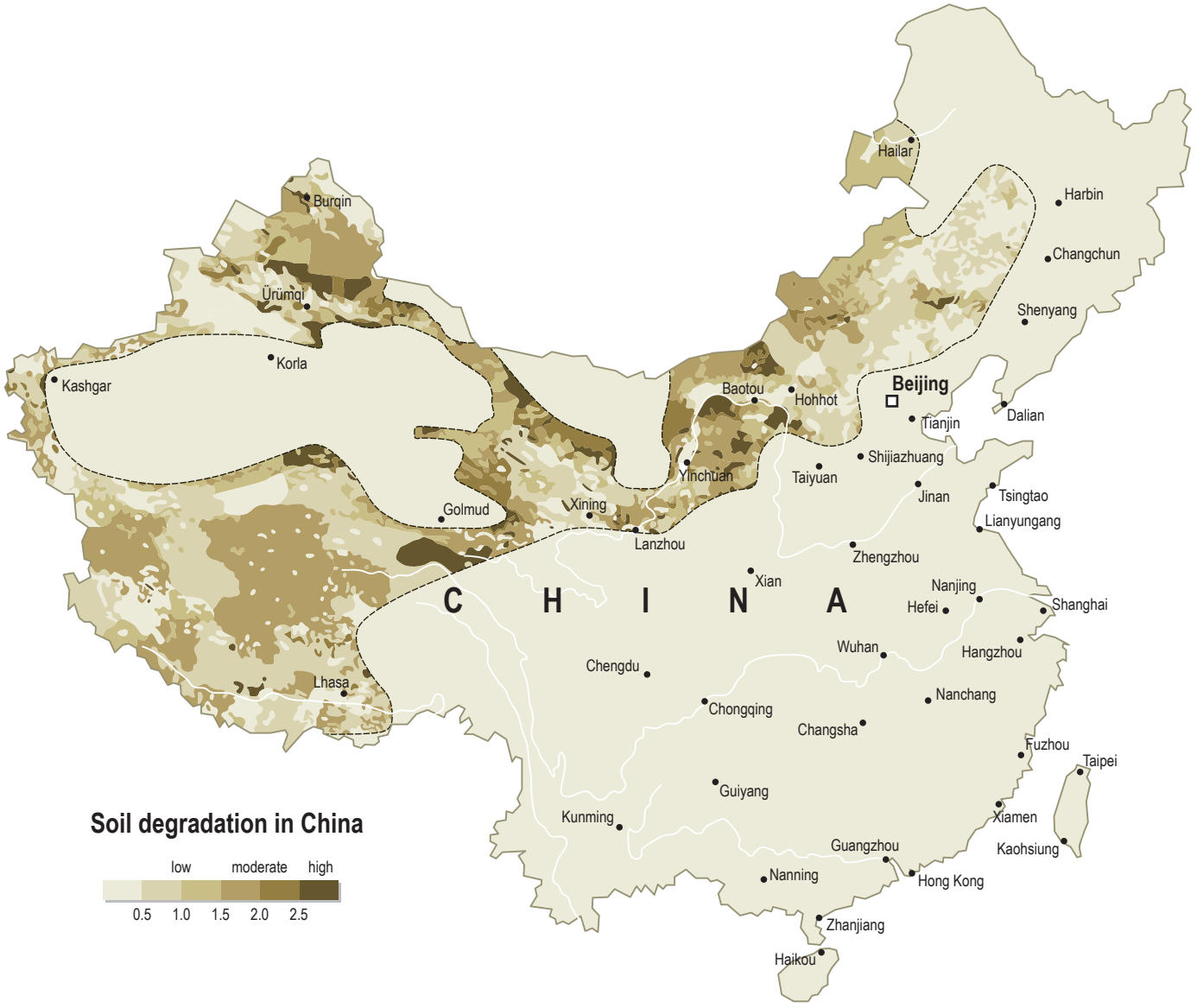
According to China's State Forestry Administration (SFA) and Ministry of Land and Resources, deserts now cover almost one fifth of the country's territory, while the area threatened by desertification amounts to more than one-quarter of China's landmass. The impact of this is felt most acutely in the driest areas in western China, which are also among the poorest. The government estimates that the livelihoods of 400 million people are either threatened or affected by desertification, land degradation, the encroachment of the Gobi, Taklimakan and Kumtag Deserts as well as other deserts and sandy lands in western China.

Rapid industrialization and sprawling cities have eaten up farmland and consumed water resources, compounding an already severe problem of scarce arable land. A boom in the timber and furniture business has led to ferocious tree-felling, exposing more and more vulnerable land to the encroaching sands. A prolonged drought in northwestern China has aggravated the problem, making it easier for the dry soil to be blown away by strong winds, and the intensity of the dust and sand storms has increased over the past years. Unfortunately, efforts focus mainly on sandstorms, which are only one symptom of the wider problem of land degradation.

In order to reverse land degradation, since 1978 a Great Green Wall of trees shrubs and grasses, costing some CNY50 000 million (USD6 300 million) has been planted in the Kubuqi Desert to protect northern cities from the rapidly spreading deserts. As a result, the SFA reported that desertification had slowed from roughly 3 400 km2 annually in the 1990s to about 2 000 km2 a year since 2001. According to the Fourth National Survey on Desertification and Land Degradation (2005-2009) carried out by SFA in 2010, 12 452 km2 of desertification-prone lands have been rehabilitated, meaning a total of 2 491 km2 annually has been reversed since 2004 (A Bulletin of Status Quo of Desertification and Sandification in China, Beijing, 2011).

Planting trees in a desert might sound foolish, but the Kubqi Desert is one of the wettest deserts in the world and just 20 cm below the dusty surface, the sand is relatively moist. Xinjiang poplars and several species of willow specially chosen for the desert climate, form the backbone of the new forests. Planted in the spring or autumn, the saplings are protected by wooden frames, which are sunk deep into the sand to prevent movement. These give the young trees stability and the time to take root. Planted correctly, they grow quickly and their spidery roots help to stop the migration of sand and thereby stabilize mobile sand dunes. Local farmers, many of whom were once sceptical about whether forestation could work on a large scale, are now supportive and appreciate the efforts being made to restore their grasslands and oasis cropland.

Although there has been some success, the desertification situation remains very serious.



Map produced by ZOÏ Environment Network, August 2010
Source: Land Degradation Assessement in Drylands (LADA) (→ www.fao.org/nr/lada)

3 COMBATING DESERTIFICATION

What can we do?

Combating desertification and promoting sustainable development are closely linked due to the social and economic importance of natural resources and agriculture. As we know, when people live in poverty, they have little choice but to over-exploit the land. This is the circle that the UNCCD, through its work, seeks to break.

As with many other environmental challenges, it is less costly to stop the damage happening than to solve the problems it causes. Once desertification is a reality, repairing its impact is a long and costly process. Despite the severity of land degradation, it is not necessarily final. By employing good agricultural practice, the trend can be reversed, for example. To preserve soil productivity, sustainable long-term practices must be applied.

UNCCD Best Practice approaches focus on:

- Sustainable Land Management (SLM) technologies, including adaptation;
- capacity-building and awareness-raising at various levels;
- desertification, land degradation and drought, and SLM monitoring and assessment/research;
- knowledge management and decision support;
- the policy, legislative and institutional framework;
- funding and resource mobilization; and
- participation, collaboration and networking.

3.1 INCREASE POPULATION RESILIENCE

One valuable way of slowing the process of desertification is to reduce people's vulnerability by increasing the availability of alternative livelihoods and strengthening their resilience. This can be done in a variety of ways.

Preventing land degradation is obviously essential where it is possible, and where it is not recovery and rehabilitation are good options. Mainstreaming sustainable land management, drought-risk management and biodiversity considerations into the design, implementation and monitoring of adaptation action at local, national and regional levels is clearly central to any attempt to slow the progress of desertification. Climate change adaptation will need to find a concerted way to address poverty reduction and vulnerability to changing conditions.

Insurance schemes for small-holder agriculture can give farmers greater security, and Ethiopia and Kenya are piloting schemes which offer them insurance against crop failure. The ultimate goal is to provide a large-scale insurance scheme for the population. However, at the moment only very few benefit from such a scheme. Beyond that, land reform (in which Kenya again is making progress) can play a major part in improving people's ability to cope, including by making sure that they enjoy security of land tenure. A leasehold forestry project in Nepal is also achieving valuable results.

Supporting science-driven agriculture is clearly essential, as it is the way to enable farmers to take advantage of up-to-date developments and best practice which has worked elsewhere. Rainwater harvesting, drought-resistant crop varieties, agro-forestry and efficient energy use will all contribute to sustainable land management and improved ways of managing drought risk. Although it may sound too obvious to need mentioning, sharing research and information on the factors which contribute to desertification and on ways of combating it - the policies and practices which make the real difference - must not be neglected.

Improving resilience also means, of course, learning to be aware of and responsive to the needs of the natural world, adopting a holistic biodiversity and ecosystem approach, conducting and acting on environmental impact assessments, and observing the principles of sustainable use.

Further, it is well established that the dry areas and threatened areas are overpopulated, therefore unable to support human and livestock populations. One of the main keys is to reduce the dependence on these lands via creating jobs in other sectors note based on cultivation, or on range or forest lands.

Beyond these approaches, there is much more that can be done, for example partnership building for sustainable investments. This will involve:

- institutional strengthening at local level;
- governance empowerment and capacity development; and
- targeting women and youth.

3.2 IMPROVE LAND MANAGEMENT

To combat desertification it is necessary to restore and fertilize the land. Nutrients such as nitrogen, phosphorus, calcium, magnesium etc. must be in the soil for plants to grow. When the soil has lost all or part of its nutrients and may also have accumulated toxic elements such as salt, it is degraded and its productivity diminishes as a consequence.

Intensive agriculture is one of the main reasons for the soil to degrade, and once that has happened it is necessary to re-establish soil fertility by using either synthetic fertilizers or natural compost. The soil regenerated with organic matter in this way will produce more fruitful harvests. The restructuring of the soil is potentially a very effective and sustainable way to maintain soil fertility.

There is also a cultural aspect linked to land management and the challenge of overgrazing. It can be hard to convince local farmers to adopt the ideas of giving land time to recover and reducing herd numbers. In many countries the amount of livestock is a source of pride and honour for the owner, their family or clan. A possible solution can be to improve cropping techniques in cultivated areas, release land for cattle and hence reduce pastoral pressure and the degradation that results from it.

3.3 DIVERSIFY PRODUCTION

Diversifying crop and animal production allows better use of land resources and prevents over-production of a single species or crop. A plot can sustain different plants and animals over long periods, since their nutritional needs vary and the resources they remove from the land are complementary. Mixed farming reduces the loss of agricultural products in the case of a natural disaster, and certain production methods are obviously better adapted to counter drought than others.

Each plant species has specific nutritional needs, for example maize rapidly exhausts the soil much faster than other plants. In many cases prolonged monoculture should be avoided on the same plot of land and a system of rotational crop production should be established to restore soil fertility.

3.4 RESTORE LAND

Land degradation need not be permanent. To restore degraded lands, crop techniques should be improved by stabilizing the soil while enriching it with organic matter, and selecting different crop varieties. Even the slightest water levels can be used to irrigate and make unproductive soil productive. It is also important to combat marked soil salinity by employing the most effective system of irrigation. This involves removing any surplus water, monitoring the changes in groundwater reserves and soil salinity in the problem areas, draining, irrigating and planting trees whose roots will prevent the soil leaching away. Trees in turn act as a windbreak and provide supplementary resources like wood, leaves and fruit.

Experience shows that reforestation is a very effective approach to restoring land. It requires the creation of nurseries to nurture young plants from local species selected for their rapid growth and adaptation to the harsh climate. In rangelands, rehabilitation through shrub planting or seeding of appropriate species is also an effective means of land restoration. Reforestation is a long-term action since tree growth is slow. Fortunately, the trees' long life cycle means that the investment is generally viable.

Trees play several roles:

- they fix soil particles and prevent erosion by water and wind;
- act as obstacles to the wind and so protect crops;
- enhance soil fertility since many trees produce nitrogen that fertilizes and increases soil productivity;
- facilitate water penetration in the soil during rain and contribute to maintaining humidity for long periods;
- provide shade for animals and people;
- supply nutrients because fruit trees diversify food sources and provide fodder for livestock; and
- provide a source of firewood and construction materials.

3.5 CONTROL EROSION

To prevent desertification or to restore the productivity of damaged soil, erosion control is essential. A number of simple mechanical means alleviate the effects of wind and prevent the displacement of sand and dust. These include:

- the construction of fences or barriers from local plant species, woven palms, planted hedges or metal sheeting around villages and crops;
- planting vegetation whose roots protect and fix the soil;
- prohibiting livestock from grazing to protect the plantation areas.

3.6 USE NON-WOOD ENERGY SOURCES

All human societies use energy, which is vital for their proper functioning and development. Today, a large number of populations use wood as their major source of energy, which contributes to worsening desertification through deforestation and also increases the greenhouse effect by releasing carbon dioxide.

The non-sustainable use of forest resources as a source of energy is a factor in desertification. Identifying and employing alternative renewable energy sources are therefore important in the fight against desertification.

3.6.1 Solar energy

Given the right technology, the bright, sunny conditions characteristic of arid and semi-arid regions, can satisfy energy needs in these areas. However, this may be still too expensive for widespread use. Ideally solar energy would be the obvious choice, and could be used in many ways, for instance:

- greenhouses integrated into the dwelling structure with panels that store energy from the sun in batteries (to supply hot water);
- parabolic mirrors to help cook food and produce steam for running steam turbines;
- photo-voltaic panels to transform the sun's rays into electricity. The electric current is stored in batteries and can be used day or night; and
- the evaporation power of the sun can produce distilled, salt-free water by means of a solar distiller.

3.6.2 Wind

Wind turbines need to be set on open exposed areas with high average wind speeds (at least 20 km/h). However, wind energy is growing rapidly because it can provide more energy on a large scale than solar power. In drylands with frequent winds, this form of energy could be an important complement in the long term. For example, wind energy can facilitate irrigation and water supplies for livestock.

One of the greatest advantages of wind energy is that it is plentiful. It is also widely distributed, cheap, does not emit toxic gases, and avoids uncontrolled tree-felling or fuelwood collection.

3.6.3 Biogas

Natural gas and biogas are in essence the same fuel but from different origins. While natural gas is a fossil fuel, biogas is a renewable fuel produced through the fermentation of organic materials such as household or agricultural waste.

The high temperatures in the drylands are beneficial to biogas creation. Biogas has several advantages. For one thing it is cheap to produce and can be used for lighting, cooking or to drive motors. It can also be produced in small installations, especially in regions where agriculture and cattle rearing coexist.

In developing countries, over 500 million households still use traditional biomass for cooking and heating. Elsewhere 25 million households already cook and light their homes with biogas and a growing number of small industries, including agricultural processing, obtain process heat and motive power from small-scale biogas digesters. Biogas is an example of a stationary use application thought to have particularly good potential as a renewable energy source with good greenhouse gas savings, especially when waste is used. Nevertheless, when energy crops are used for biogas, ecological and land use concerns need to be considered.

3.7 FIND ALTERNATIVE SOLUTIONS

3.7.1 Biochar

Land has an unparalleled capacity to hold carbon and to act as a sink for greenhouse gases. It is therefore imperative to focus on activities that enhance the rehabilitation, protection and sustainable management of degraded lands. Conventional means to increase soil carbon stocks depend on climate, soil type and site-specific management.

Biochar is charcoal created by a process called biomass pyrolysis (the decomposition or transformation of a compound by heat), and differs from charcoal only in that its primary use is not for fuel but for but for improving agricultural soils. Biochar was added to soils in the Amazon basin several hundred years ago with the affect of improving agricultural production..

Biochar is of increasing interest because of concerns about climate change caused by carbon dioxide and other greenhouse gas emissions. The pyrolysis or carbonization process is well known and can be implemented on a small scale (e.g. a cooking stove) as well as on a large scale (e.g. a biorefinery). About 50 per cent of the carbon can be captured when biomass is converted to biochar.

Some types of biochar can improve soil texture, thereby increasing its ability to bind and retain fertilizers and release them gradually. It naturally contains many micronutrients needed by plants and is safer than other "natural" fertilizers such as manure or sewage, having undergone high-temperature disinfection. Because it releases nutrients slowly, it poses much less risk of water table contamination. Recent studies appear to show that soil biochar is capable of increasing soil fertility by improving its chemical, biological, and physical properties. It significantly increases plant growth and nutrition, and improves the efficiency of nitrogen fertilizers in fields containing biochar. The fact that many of the dryland soils have been degraded means that they are currently far from saturated with carbon and their potential to sequester carbon may be very high.

The avoided emissions of greenhouse gases are between 2 and 5 times greater when biochar is applied to agricultural land than used solely for fossil energy offsets. As such, this approach of soil organic carbon restoration could contribute a significant adaptation tool to climate change, in addition to sequestering carbon. Having said that, research on biochar is still underway and many critically important issues have yet to be understood. Thus far there has been little public awareness or debate about the wide-scale application of biochar. Further, the pyrolysis conditions and the biomass feedstock will affect the suitability of biochar for improving the productivity of agricultural soils, with some types of biochar having the potential to seriously reduce soil fertility and agricultural productivity. It is therefore vitally important that only suitable biochars are added to agricultural soils. It is imperative that errors as they have been made in other areas are avoided, such as further land conversion.

3.7.2 Zero-tillage farming

Zero-tillage farming (also called no-till or no-tillage) is a method of plowing or tilling a field in which the soil is disturbed as little as possible by, essentially, not plowing the field. The crop is planted directly into a seedbed which has not been tilled since the harvest of the previous crop. This way farmers can increase the amount of water in the soil and decrease erosion. It may also increase the amount and variety of life in and on the soil, but may require increased herbicide usage. Zero-tillage also improves the structure of the soil by maintaining soil cover. It implies leaving the residues of the previous season's crops on the farmland, which can increase water infiltration while reducing evaporation as well as wind and water erosion. The additional use of other soil fertilization techniques is also promising, at the same time increasing moisture capture, which is associated with carbon sequestration. Less soil tillage reduces labour, fuel, irrigation and machinery costs. Zero-tillage can increase yield because of higher water infiltration and storage capacity, and less erosion. Another benefit of zero-tillage is that because of the higher water content, it can make economic sense to plant another crop instead of leaving a field fallow.

- Conservation of soil moisture;
- Reduction of soil erosion by the wind since the crop residue cover isn't plowed under the soil;
- Reduction of farm labour (i.e. time actually spent tilling the field, fuel consumption) thereby reducing farm expenses;
- Increased planting and harvesting timelines, since time spent tilling and preparing the field required;
- Earthworms, and other biological organisms, are left alone to live and manipulate the soil by creating tunnels, which otherwise would be created by tilling. This allows for good movement of water and air throughout the soil for good plant growth;
- Reduced soil compaction. Many years of tilling lead to a very hard, densely packed soil; and
- Increased soil organic means better soil structure and more available nutrients for plant growth. Tilling 'burns' organic matter away.Increasing soil organic helps to sequin the soil.

While these aspects make zero-tillage a promising tool to reverse soil degradation, one should remain alert to potential negative impacts it might entail, such as increased pesticide use. It is recommended to consider advanced research and local conditions before adopting new techniques to achieve the greatest benefits.

3.8 FORGE A GLOBAL PARTNERSHIP

Millennium Development Goals

One conclusion of the landmark survey of global ecosystems, the Millennium Ecosystem Assessment (MA), was that people living in drylands on average lag far behind the rest of the world in terms of their human well-being and other Millennium Development Goal (MDG) indicators. Some of the contrasts highlighted were stark. For instance, the average infant mortality rate (MDG 4: Reduce child mortality) for all dryland developing countries was at least 23 per cent higher than that in non-dryland countries.

But this is not to say that no MDG achievements have occurred in drylands. Remarkable progress has been made towards universal primary education (MDG 2) in many countries, not least in sub-Saharan Africa where the gross intake rate rose by 25 per cent between 2000 and 2007. Abolishing school fees at primary level in several countries with significant proportions of their territories in the drylands – including Burkina Faso, Ethiopia, Ghana, Kenya, Malawi, Mozambique and Tanzania – resulted in enrolment surges. One of the largest increases in the net enrolment ratio was in Tanzania, where the 1991 figure (just over 50 per cent) had risen to more than 96 per cent by 2006.

Other proven measures widely introduced include investment in school infrastructure, improvement in teacher recruitment, and the distribution of free or subsidized textbooks. In Burkina Faso, for instance, a focus on public-private partnerships has helped to increase the country's available classroom space by almost 8 per cent per year between 2000 and 2007.

UN Commission on Sustainable Development

The sixteenth session of the Commission on Sustainable Development (CSD 16), held in May 2008, highlighted the link between climate change and land degradation, underlining how agricultural systems needed to adapt to climate change conditions to ensure food security. It also identified several obstacles to addressing land issues, such as growing pressure on scarce land resources due to population growth, the increasing need for food, energy, water and raw materials, and the expansion of urban areas. Other factors contributing to land degradation include the loss of arable land to urbanization, erosion, or mechanisms that make the soil sterile. Drought threatens the livelihoods of affected rural communities leading to food shortages and food insecurity, and contributes to the decline in agricultural production, famine and population movements. Projected climate change is likely to increase the frequency, severity and duration of drought in many arid and semi-arid regions, with even greater and prolonged impact. The increasing frequency of the El Niño/La Niña phenomenon has led to a new climate pattern called seasonal aridity or periodic drought, in addition to local droughts.

Other obstacles include the lack of both financial and technical resources as well as the capacity-building support needed for effective drought management; a weak legislative framework for promoting sustainable agricultural practices; and a lack of institutional capacity for implementation, which further weaken local communities' capacity to deal with the impact of drought; a lack of reliable forecasts and information for local communities; and a lack of drought-monitoring systems and early-warning capability, particularly in Africa.

The CSD meeting was told that desertification is the most serious form of land degradation, posing a threat to progress in sustainable development, and to the eradication of poverty and hunger, thus setting back the efforts of developing countries to achieve internationally agreed development goals, including the Millennium Development Goals. Constraints also included the slow process of transfer, acquisition and adaptation of appropriate and affordable technologies, including for water and soil conservation, for growing climate-resilient and less water-intensive crops, for improving land productivity and increasing agricultural production. Also cited were the

lack of financial incentives; inadequate scientific research, education, data collection and monitoring; and limited decision-making participation by local communities, indigenous peoples and other civil society groups, in policies to combat desertification.

Many delegations stressed the important role of UNCCD and highlighted the need for its full implementation. UNCCD was deemed "the only legally binding, universal agreement on land issues that systematically addresses land degradation and desertification, offers a platform for adaptation, mitigation and resilience and can therefore reinforce the measures intended to address the adverse impacts of climate change and the loss of biodiversity".

At the seventeenth session of the CSD in May 2009, the actions identified to combat desertification included:

- calling upon governments, where appropriate, in collaboration with relevant multilateral organizations, including the GEF implementation agencies, to integrate desertification and land degradation into their plans and strategies for sustainable development;

- integrating National Action Plans (NAPs) for drought and desertification into national development strategies;

- supporting the implementation of the UNCCD as well as its Ten-year Strategic Plan (2008-2018), through regional and international cooperation, the provision of adequate and predictable financing, technology transfer and capacity-building; and

- taking measures and providing international assistance, promoting national action and encouraging sub-regional, regional and international cooperation to prevent sand dune movement and reduce the frequency and severity of sandstorms.

LAND FOR LIFE 3

Best practice: Knowledge management and decision support

Rotation grazing: resting, reseeding and planting in Syria

The Syrian steppe (Badia) covers 10 million hectares of central and eastern Syria. Characterized by poor soils and low rainfall, it is suitable only for grazing by small ruminants, equines and camels. The Bedouin communities herd about 12 million animals here. After years of severe drought and intensive grazing, the Badia has become badly degraded.

With support from the International Fund for Agricultural Development, the local communities have restored vegetation in about one third of the Badia rangelands (nearly three million hectares). The key to success was involving local people in decision-making and encouraging them to take full ownership of the rehabilitation and management of the rangelands.

Using their extensive local knowledge, the Bedouin herders worked with experts in the drafting and implementation of the management plans. They determined how many animals should graze in a given area at a given time, taking seasonal conditions into account. Various approaches were used, including films, meetings with communities, field days and workshops, to bring communities on board and communicate the new rangeland management techniques. Once communities had agreed to collaborate, they and the experts established the boundaries together and selected the sites suitable for rehabilitation.

Three key approaches pursued in the rehabilitation were land resting, reseeding and planting. Where possible, the land was simply rested for up to two years. As a result, native plants that had long disappeared sprouted and flourished, and the full range of vegetative cover re-emerged. Where degradation was advanced, the focus was on reseeding using native rangeland forage plants or plants suited to the local conditions. Soil was first furrowed to enhance rainwater infiltration. As a result, the seed production units now generate 160 tonnes of seed per year.

Rotation grazing has regenerated more than 930 000 hectares of the Badia. About 225 000 hectares were reseeded and about 94 000 hectares have had nursery shrubs planted. Regular browsing by livestock keeps the shrubs from becoming woody and prolongs shrub life. Eventually, they reseed themselves.

As a result, breeders have reported up to a tenfold increase in the average productivity of the land, from 50 to 500 feed units per hectare. This rehabilitation has not only provided fodder but also led to a healthier ecosystem to which birds, insects and animals are returning.

(Source: IFAD)

4 DESERTIFICATION IN CONTEXT

4.1 CLIMATE CHANGE

Desertification is exacerbated by climate change and vice versa. As severe weather events increase in frequency and severity due to climate change, dryland degradation tends to increase. Worse still, desertification and climate can form a 'feedback loop' with the loss of vegetation caused by desertification reducing carbon sinks and increasing emissions from rotting plants. The result is more greenhouse gases in the atmosphere, and a continuation of the vicious cycle involving climate change and desertification.

In Africa alone, a total of more than 650 million people are dependent on rain-fed agriculture in environments that are already affected by water scarcity and land degradation, which will be further exacerbated by climate change. If this trend continues, two-thirds of the region's arable land could be lost by 2025 (FAO 2009), and the livelihoods of millions of small farmers along with it.

On the other hand, drylands can also play an important role in mitigation, for example through carbon sequestration in soils. While drylands have relatively low sequestration potential per unit area, their large expanse makes them important. This creates both risks and opportunities for mitigating climate change. While soil degradation emits greenhouse gases, soil restoration prevents such emissions and even creates storage capacities for greenhouse gases already in the atmosphere.

Carbon sequestration is the process by which carbon sinks (both natural and artificial) remove CO_2 from the atmosphere, primarily as plant organic matter in soils. Organically managed soils can convert CO_2 from a greenhouse gas into a food-producing asset. Combined with sequestration in non-agricultural soil, the potential for land to hold carbon and act as a sink for greenhouse gases is unparalleled.

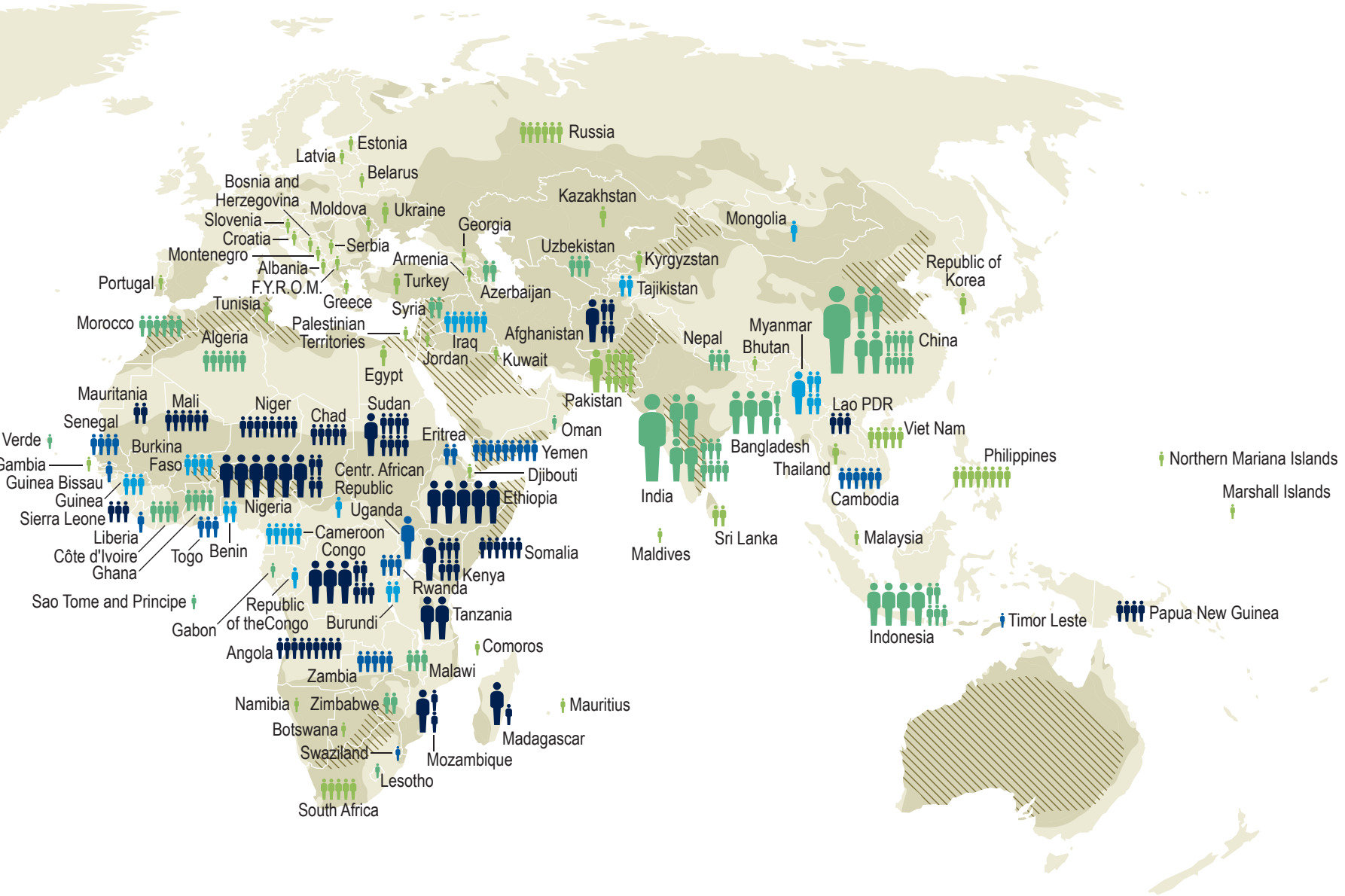
This should help confer new value on land, because of its ability to sequester and literally "breathe in" the excess blanket of CO_2. In turn, CO_2 enriches the soil, giving life to trees and vegetation, which then can generate more carbon sinks. In areas where the soil is depleted, this process of carbon sequestration is literally switched off.

4.2 WATER SCARCITY

Water availability affects domestic life as well as the development of certain agricultural techniques. In drylands more than anywhere else, water availability is often critical. These areas are characterized by a high evaporation rate and surface waters such as rivers and lakes tend to disappear relatively quickly. Water scarcity and poor water quality threaten public health, food and energy production, and regional economies. It is estimated that 40 per cent of the world's population suffers from water shortages. In the drylands, practically all water reserves are utilized and are often threatened with pollution, which may help to spread numerous diseases.

While irrigation could improve food production, its inefficient application can also be a risk, especially in terms of salinization. For example, about 10 per cent of the world's irrigated land has been damaged by salt, compounding the threats to food security. The build-up of salts in the soil lowers yields and can damage the land beyond economic repair. Salinization is reducing the world's irrigated area by 1-2 per cent every year, hitting the arid and semi-arid regions the hardest (FAO 2002).

Land degradation in the drylands can have direct consequences on the water cycle. If there is low rainfall, drought ensues: groundwater reserves do not refill, water sources become depleted, wells run dry, plants and animals die and humans have to migrate to more hospitable regions. Conversely, during periods of high rainfall, the ensuing floods kill people and animals, notably in regions where the vegetation cover is reduced or totally destroyed. The torrential rain flow causes a substantial loss of soil, which is flushed out by the rains and when the land dries again, a hard crust forms on the surface making it impermeable, and reducing water infiltration.



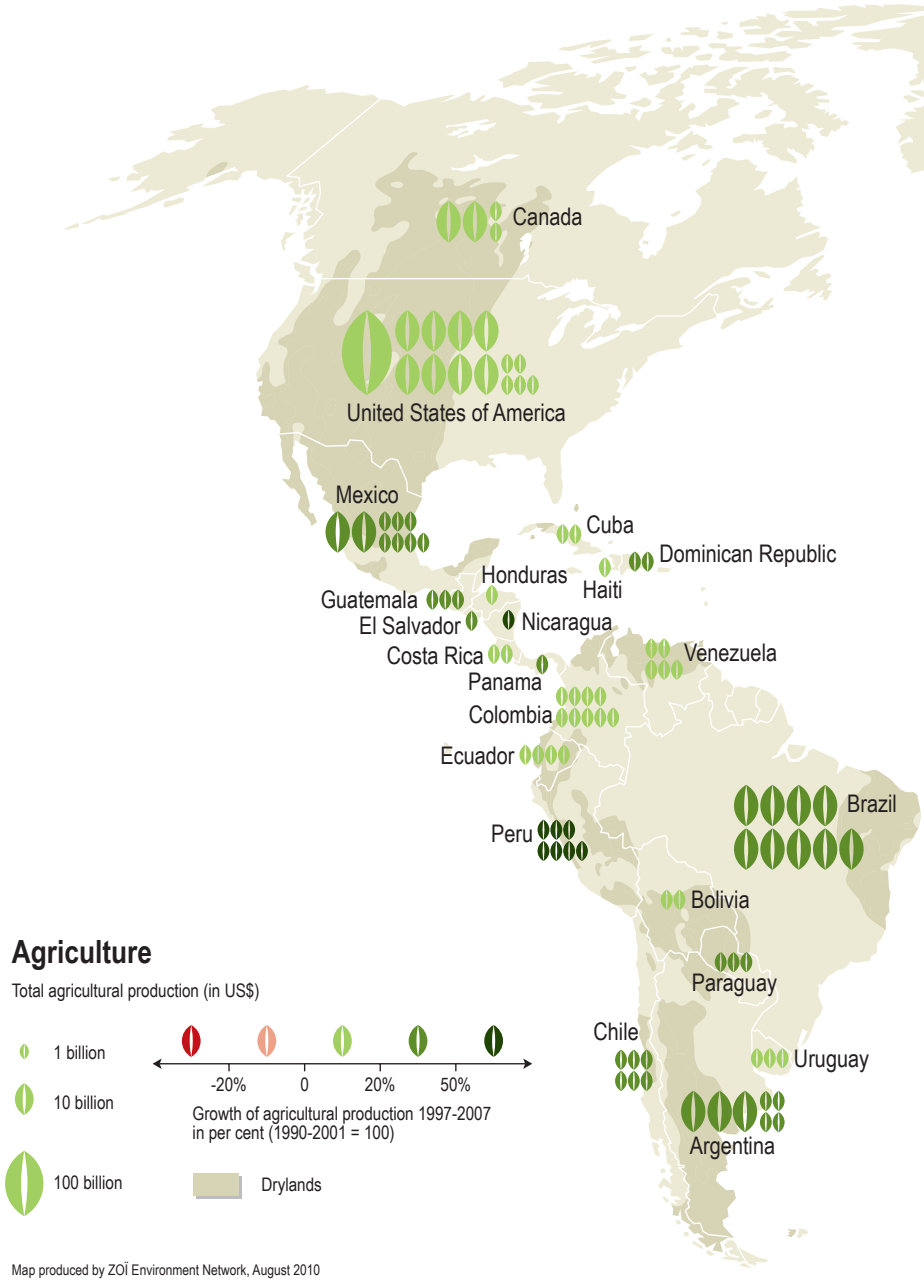
Map produced by ZOÏ Environment Network, August 2010
Source: WHO / UNICEF - Joint Monitoring Programme for Water Supply and Sanitation (JMP) (→ www.wssinfo.org);
UNESCO - World Water Development Report Indicators, water stress index (→ www.unesco.org/water/wwap/wwdr/indicators
Note: Data not available for every country

4.3 ENVIRONMENTAL MIGRATION

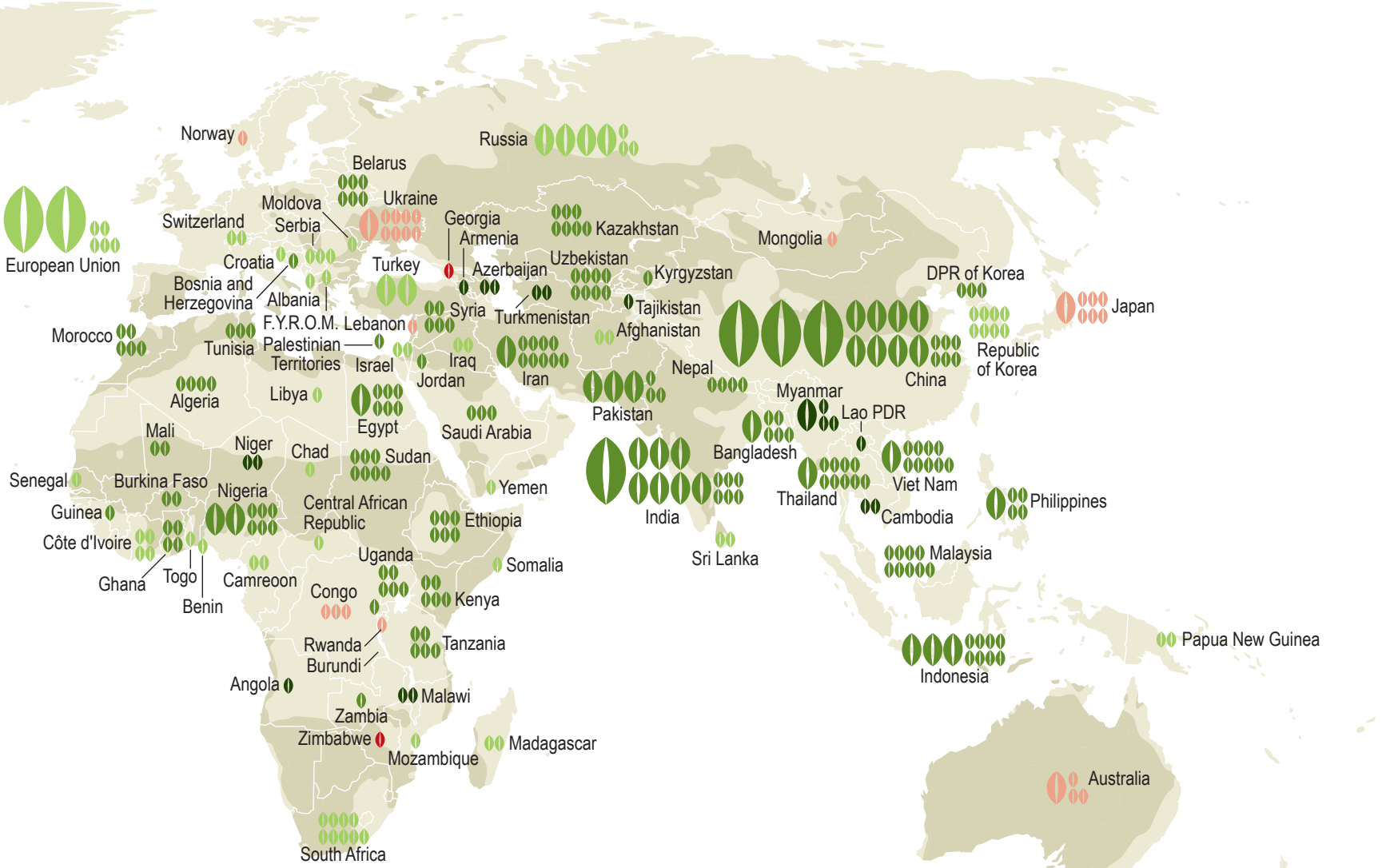
Desertification is a global issue, which threatens development, sparking an exodus from the affected regions because when land becomes uneconomic to farm, people are often forced into internal or cross-border migration. This can further strain the environment and cause social and political tensions and conflicts. Because of its link with migration, desertification is a truly global problem, in the same way as climate change or biodiversity loss.

In some countries, land degradation has led to massive internal migrations, forcing whole villages to flee their farms for already overcrowded cities. Fifty million people are at risk of displacement in the next ten years if desertification is not checked (UNU 2007). Implementing sustainable land and water management policies would help to overcome these increasingly extreme challenges.

Problems occur in the urban environment as well as in rural areas still unaffected by land degradation, but which receive new migrants. Desertification can drive whole communities to migrate towards cities or regions where survival conditions are initially more promising but grow increasingly difficult and threaten social stability and cultural identities. The makeshift dwellings, which are insanitary and illegal, are sometimes sources of ethnic or religious conflict. Desertification also causes political instability and has played a part in sparking off some of the armed conflicts currently underway in the drylands.



Map produced by ZOÏ Environment Network, August 2010
Source: FAO Statistical Yearbook 2009 (→ www.fao.org); FAOSTAT (→ http://faostat.fao.org)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Kyrgyzstan
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Papua New Guinea
Burundi
Indonesia
Angola
Malawi
Zambia
Zimbabwe
Madagascar
Mozambique
Australia
South Africa
New Zealand

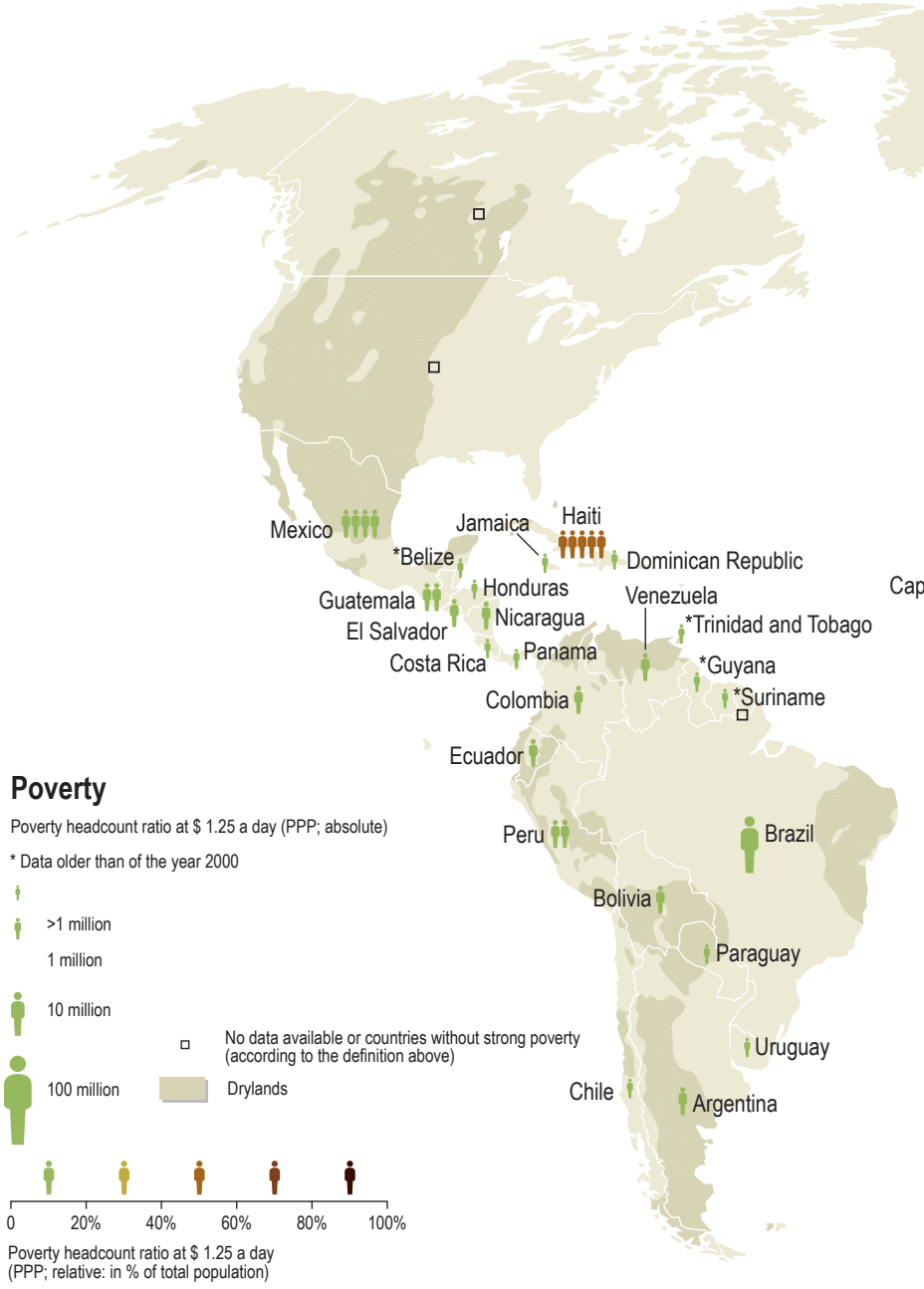
4.4 POVERTY ERADICATION

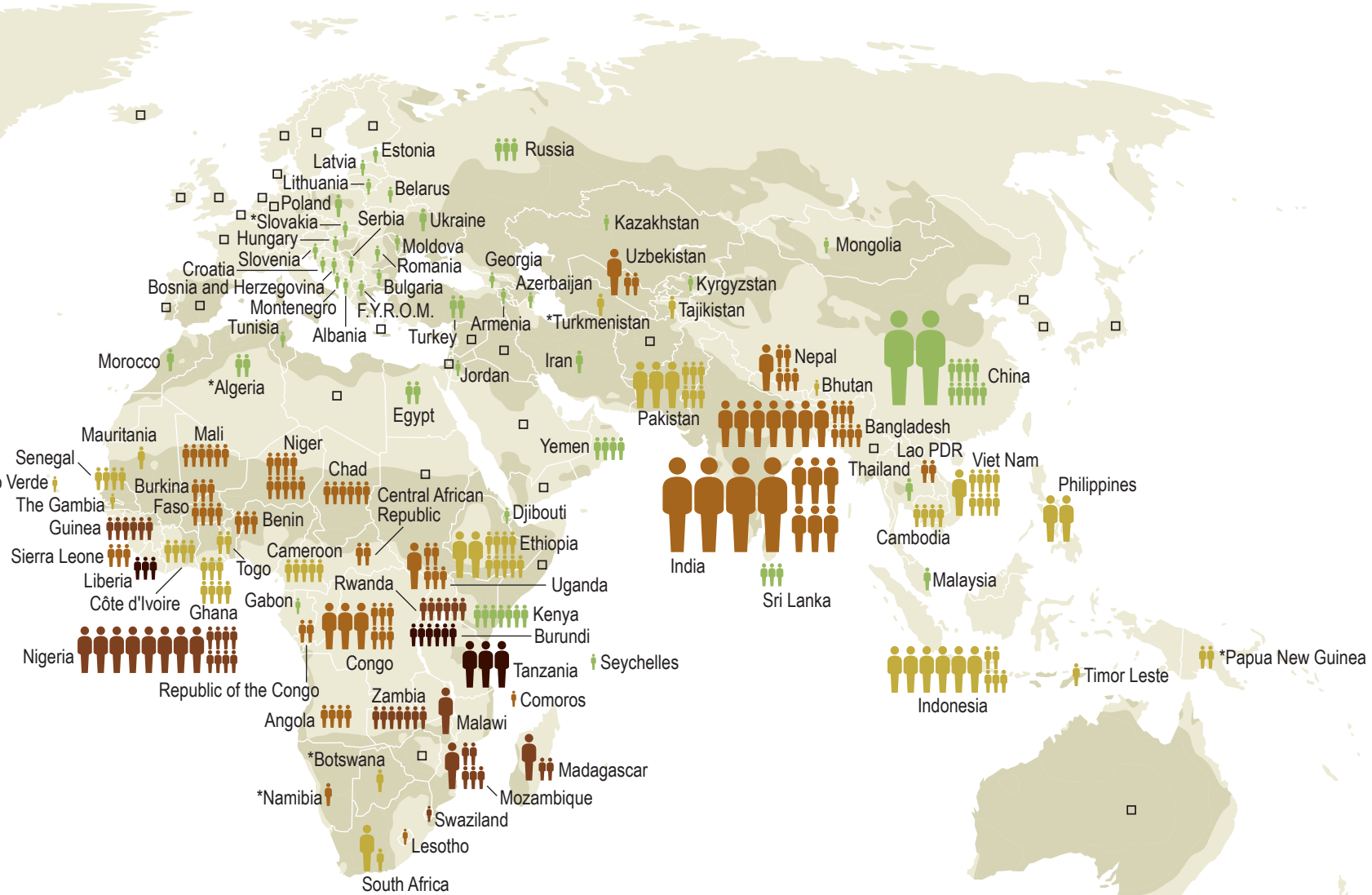
The majority of people who are directly affected by desertification live below poverty line and without adequate access to fresh water.

Poverty drives populations to over-exploit the remaining natural resources, triggering a vicious cycle of accelerating land degradation and greater poverty. Poverty is thus both a cause and a consequence of desertification. Land degradation also weakens populations and institutions rendering them more vulnerable to global economic factors. For example, the shortfall in tax receipts as a result of low productivity impacts governments' capacity to repay their foreign debt and develop national socio-economic programmes.

The occurrence of desertification and prolonged drought reduces national food production and increases the need to turn to foreign products. Moreover, food aid can eventually lead to a reduction in local agricultural production, especially if it becomes more costly to produce locally than to resort to imports that are distributed for free by the international community.

Although both rich and poor are affected when disasters occur from desertification, land degradation and drought, the poor are hardest hit because their ability to cope with, and recover from, these events depends on their access to assets such as land, and their ability to mobilize resources. For example, when drought strikes, rich individuals, groups or communities can invest their assets elsewhere to meet short-term needs, whereas that is not an option for the poor.





Map produced by ZOÏ Environment Network, August 2010
Source: World Bank (→ http://databank.worldbank.org)

4.5 LOSS OF BIODIVERSITY

Drylands are often seen as being devoid of life, but in fact they contain an incredible diversity of species that are well adapted to the difficult climatic conditions. The biodiversity we see today is the result of thousands of millions of years of evolution, shaped by natural processes and, increasingly, the influence of humans. It forms the very web of life of which we are an integral part and upon which we so fully depend.

More than anywhere else, societies in the drylands depend on the use of biodiversity for their daily needs and their economic and spiritual development. Since dryland biodiversity is fragile and specialized, and adapted to a very specific set of physical conditions, land degradation and climate change can have significant and irreversible negative impacts on drylands species.

Biodiversity underpins many livelihoods in drylands, including pastoralism, agriculture and tourism. Nature-based tourism is a particularly important source of income for people living in sub-Saharan Africa where community management of biodiversity yields positive benefits both for biodiversity conservation and sustainable use, as well as for sustainable livelihoods. For generations, traditional pastoral and agricultural practices have evolved in harmony with biodiversity in such a way that people rely on indigenous biodiversity, such as traditional livestock varieties that are more resilient to drought and disease than imported varieties. At the same time, the structure and composition of grasslands, including the variety of species, is reliant on sustainable grazing.

As a consequence of land degradation, animal species that are dependent on vegetation have to migrate to other areas to find sufficient resources or they risk disappearing altogether. Their loss is significant because animal and plant species from the drylands are particularly well adapted to this extreme environment. They act as indicators of environmental conditions and their disappearance is a sign of significant habitat degradation. In addition, local species constitute important resources for the population, so their disappearance increases food insecurity and the impoverishment of the world's most fragile populations.

Taking all these factors into account, desertification reduces the natural capital available to drylands species and people, making them more vulnerable to change. The loss of dryland biodiversity also limits the extent to which drylands can recover from temporary reductions in productivity.

4.6 AVOIDED DEFORESTATION

Deforestation and desertification adversely affect agricultural productivity, the health of humans as well as of livestock, and economic activities such as ecotourism. Forests and tree cover combat land degradation and desertification by stabilizing soils, reducing water and wind erosion and maintaining nutrient cycling in soils. The sustainable use of goods and services from forest ecosystems and the development of agroforestry systems can, therefore, contribute to poverty reduction, making the rural poor less vulnerable to the impacts of land degradation. Desertification and the associated loss of vegetation cause biodiversity loss and contribute to climate change through reducing carbon sequestration.

A key factor on how deforestation triggers desertification is linked to a drastic change in microclimates where vegetation is removed. For instance, if shrubs and trees are felled, the noonday sun will fall directly on formerly shaded soil; the soil will become warmer and drier, and organisms living on or in it will move away to avoid the unaccustomed heat. The organic litter on the surface - dead leaves and branches, for example - will be oxidized rapidly and the carbon dioxide carried away. So too, will the small store of humus in the soil.

The problem of developing arid lands and improving the well-being of the people dependent on them, is vast and complex. Forestry has a major role to play in any strategy to tackle it:

- it plays a fundamental role in the maintenance of the soil and water base for food production through shelterbelts, windbreaks, and scattered trees, and soil enrichment;
- contributes to livestock production through forest pastoral systems, particularly by the creation of fodder reserves or banks in the form of fodder trees or shrubs to cushion droughts;
- produces fuelwood, charcoal, and other forest products through village and farm woodlots;
- contributes to rural employment and development through cottage industries based on raw materials derived from wild plants and animals and the development of wildlife-based tourism; and
- provides food from wildlife as well as from plants in the form of fruits, leaves, roots, and fungi.

LAND FOR LIFE 4

Best practice: Capacity-building and awareness-raising at various levels

Senegal: Acacia Operation Project

Tree species producing gums generally belong to Acacia genus, which is largely spread in Africa and particularly in arid and semi-arid areas. In addition to producing gums, fodder and firewood, Acacia species ensure the maintenance of agriculture favorable conditions by protecting crops against heavy rain and wind erosion, by buffering extreme climatic conditions and especially, by restoring soil fertility.

FAO in collaboration with its partners in 6 sub-Saharan Countries (Burkina Faso, Chad, Niger, Kenya, Senegal and Sudan) has implemented successfully the "Acacia Operation Project – Support to food Security, Poverty alleviation, and soil degradation control in the Gums and Resins Producer countries". A mechanized water harvesting technology (Vallerani system) was tested and a total of 13,240 ha were restored. Local people were trained in an intensive capacity building programme on use and application of the technology, nursery establishment and plants production, agriculture production and gums and resins harvesting and processing. The project focused particularly on the poorest and most vulnerable groups of rural society: women and children, most often assigned to harvest and process gums and resins.

The technique adopted consisted in working plots with the water harvesting plough, leaving a distance of about 6/8 meters between the rows. Trees were planted along the rows in the excavated half-moon-shaped basins. The space between the rows was normally used for sowing other herbaceous plants such as cotton, millet, peanut and watermelon. 600 hectares were replanted with Acacia trees at a later stage. Nurseries were established and producers trained to relevant techniques, the nurseries produced more than 700 000 seedlings. Additionally, the project purchased and provided seeds. For instance, 250 kg of Acacia senegal seeds and 50 kg of Acacia mellifera seeds were bought and 3 200 kg of vegetable seeds were distributed to different communities along with tools to fight bush fires.

In Senegal 44 sites and 3 390 hectares of land were treated as agro-forestry plots. Planted plots had very variable surfaces going from 2 to 500 hectares.

(Source: FAO)

UN-REDD

Deforestation and forest degradation, through agricultural expansion, conversion to pastureland, infrastructure development, destructive logging, fires etc., account for nearly 20 per cent of global greenhouse gas emissions, more than the entire global transport sector and second only to the energy sector. It is now clear that in order to limit the impacts of climate change to a tolerable level, the global average temperature rise should not exceed 2°C over pre-industrial levels. This will be practically impossible to achieve without reducing emissions from the forest sector, as well as other forms of mitigation.

Reducing Emissions from Deforestation and Forest Degradation (REDD) is an effort by the UN to create a financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and to invest in low-carbon paths to sustainable development. "REDD+" goes further, including the role of conservation, the sustainable management of forests, and the enhancement of forest carbon stocks.

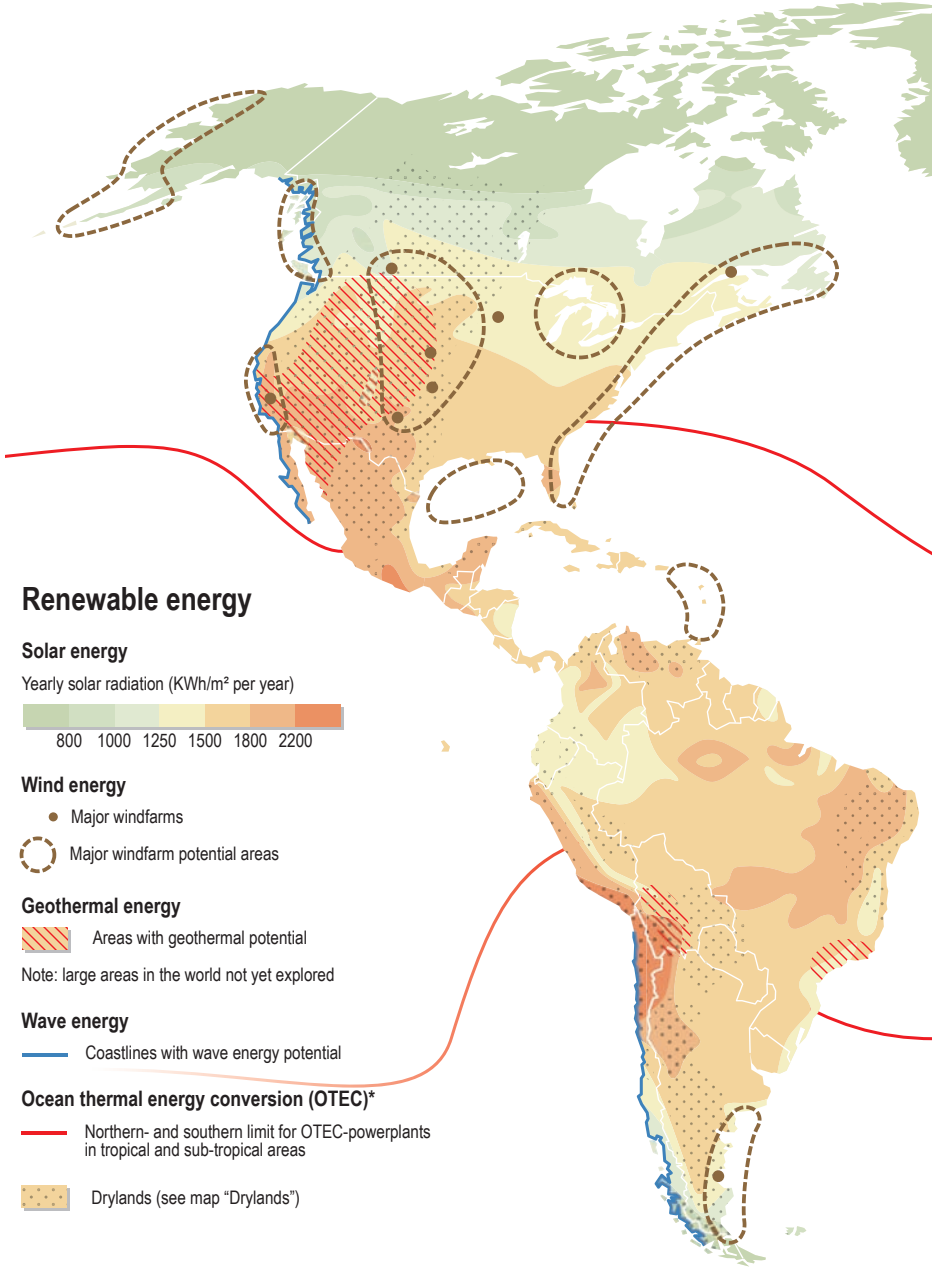
4.7 ENERGY CHALLENGES

Drylands provide energy resources to local populations as well as to global markets. These resources include woodfuels, a variety of fuel minerals as well as a large potential for solar energy. Energy is essential to poverty reduction and economic transformation, yet the world's hunger for energy is also one of the main drivers of desertification. The availability and use of energy will, to a large extent, determine how and if countries increase agricultural productivity, provide safe water, achieve higher levels of industrialization, and efficiently use information and communications technologies to become integrated into the global economy.

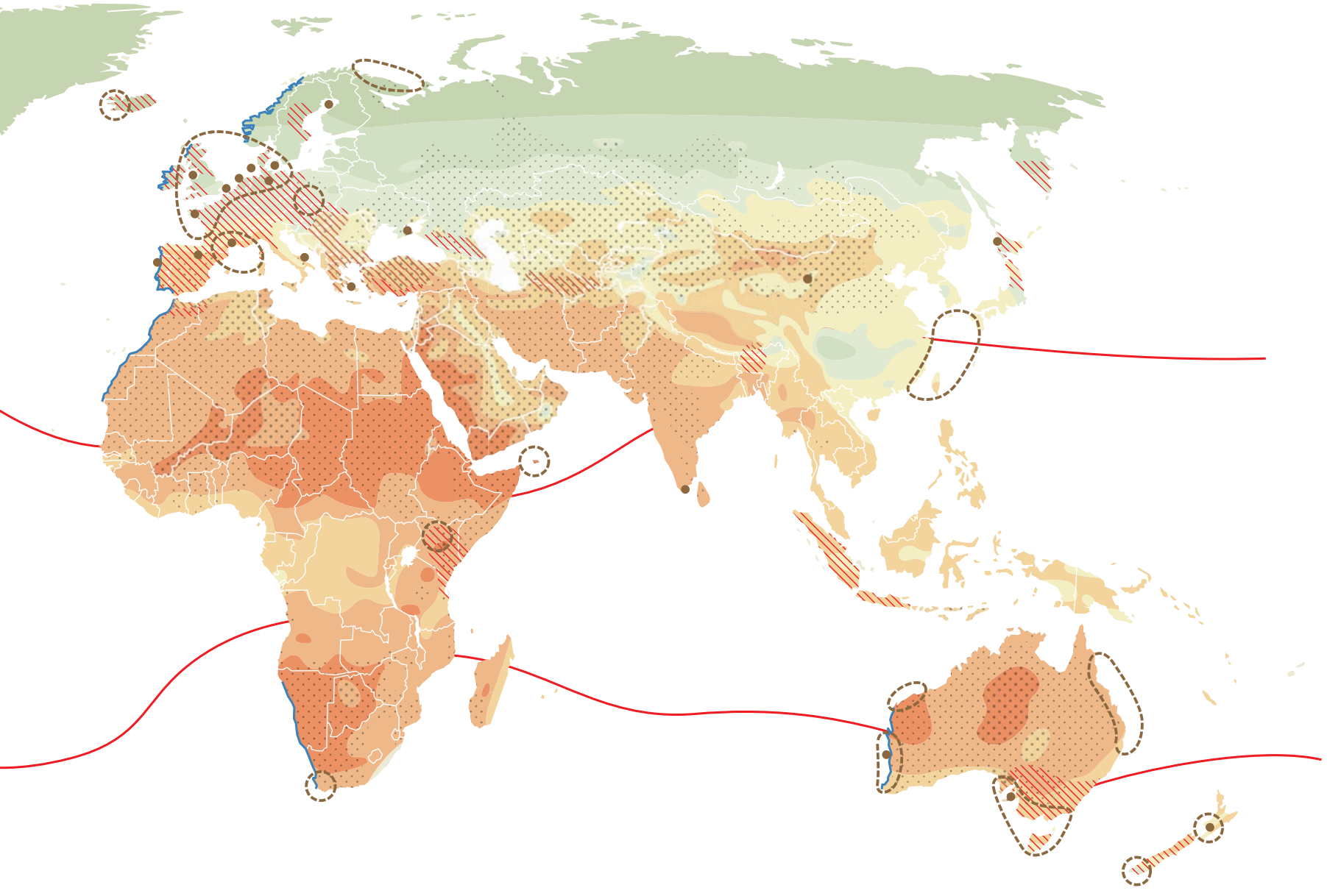
The use of firewood is one of the principal causes of desertification. In tropical arid areas, wood is the principal source of domestic energy for cooking and lighting both in rural and urban populations. Wood energy data tend to be scarce, with a high degree of uncertainty and many gaps. However, several organizations have attempted to present consistent statistics from the best national knowledge or field surveys. These organizations include the Food and Agriculture Organization of the United Nations (FAO) and the International Energy Agency (IEA).

FAO reported that woodfuel consumption in Africa reached 623 million cubic metres in 1994 — the highest per capita woodfuel consumption of any continent. Many African countries depend heavily on wood for energy, with fuelwood often representing more than 50 per cent of primary energy consumption. Due to the lack of water in the drylands, forest regeneration is very slow, reducing the growth of vegetation. However, practices such as allowing for rest periods from grazing and increasing fallow periods, generally have spectacular regenerating effects on the forest.

Energy crops can offer an alternative to wood and non-renewable energy sources if managed responsibly. The jatropha plant is one such crop that grows in low-rainfall regions on wasteland, does not compete with food crops on cultivated land and can contribute to sand fixation. In drylands therefore, careful selection of non-food crops could not only significantly reduce competition between food and energy security, but could also provide income-generating possibilities, as well as opportunities to reduce soil degradation. Furthermore, agrofuel crops could have the potential to increase soil organic carbon stocks while simultaneously curbing the amount of carbon released into the atmosphere through soil degradation. This in turn would contribute to climate change mitigation. Several developing countries such as India and Mali are implementing a number of jatropha projects.



*Ocean Thermal Energy Conversion (OTEC) is a means of converting into useful energy the temperature difference between the surface water of the oceans in tropical and sub-tropical areas, and water at a depth of approximately 1 000 metres, which comes from the polar regions. For OTEC a temperature difference of 20° C is adequate, which embraces very large ocean areas, and favours islands and many developing countries.



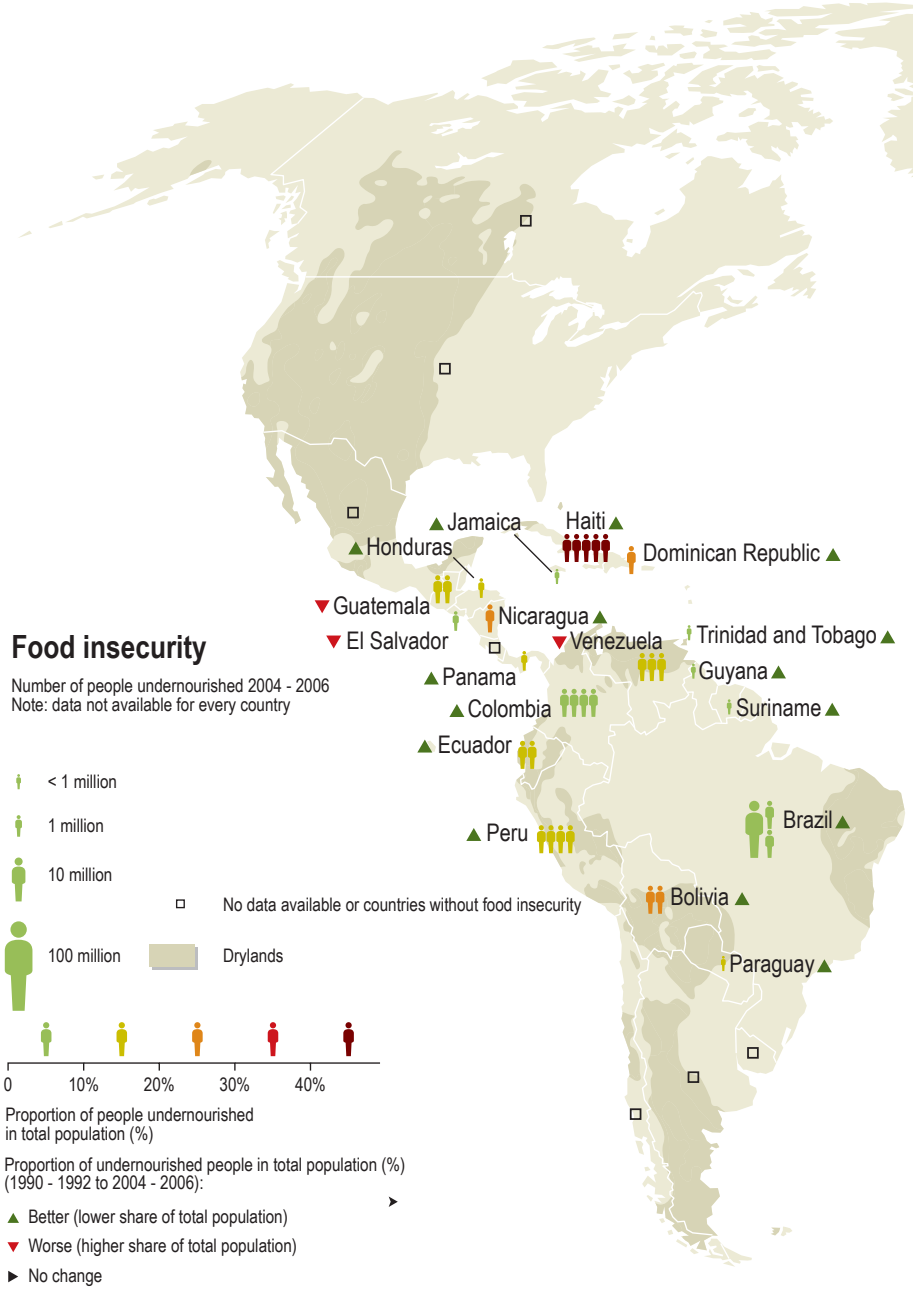
Map produced by ZOÏ Environment Network, August 2010
Source: The windpower (→ www.thewindpower.net); Cristina L. Archer, Mark Z. Jacobson, Evaluation of global wind power, Stanford University, 2005 (→ www.stanford.edu/group/efmh/winds/global_winds); Energie Atlas GmbH, 2008 (→ www.energie-atlas.ch)

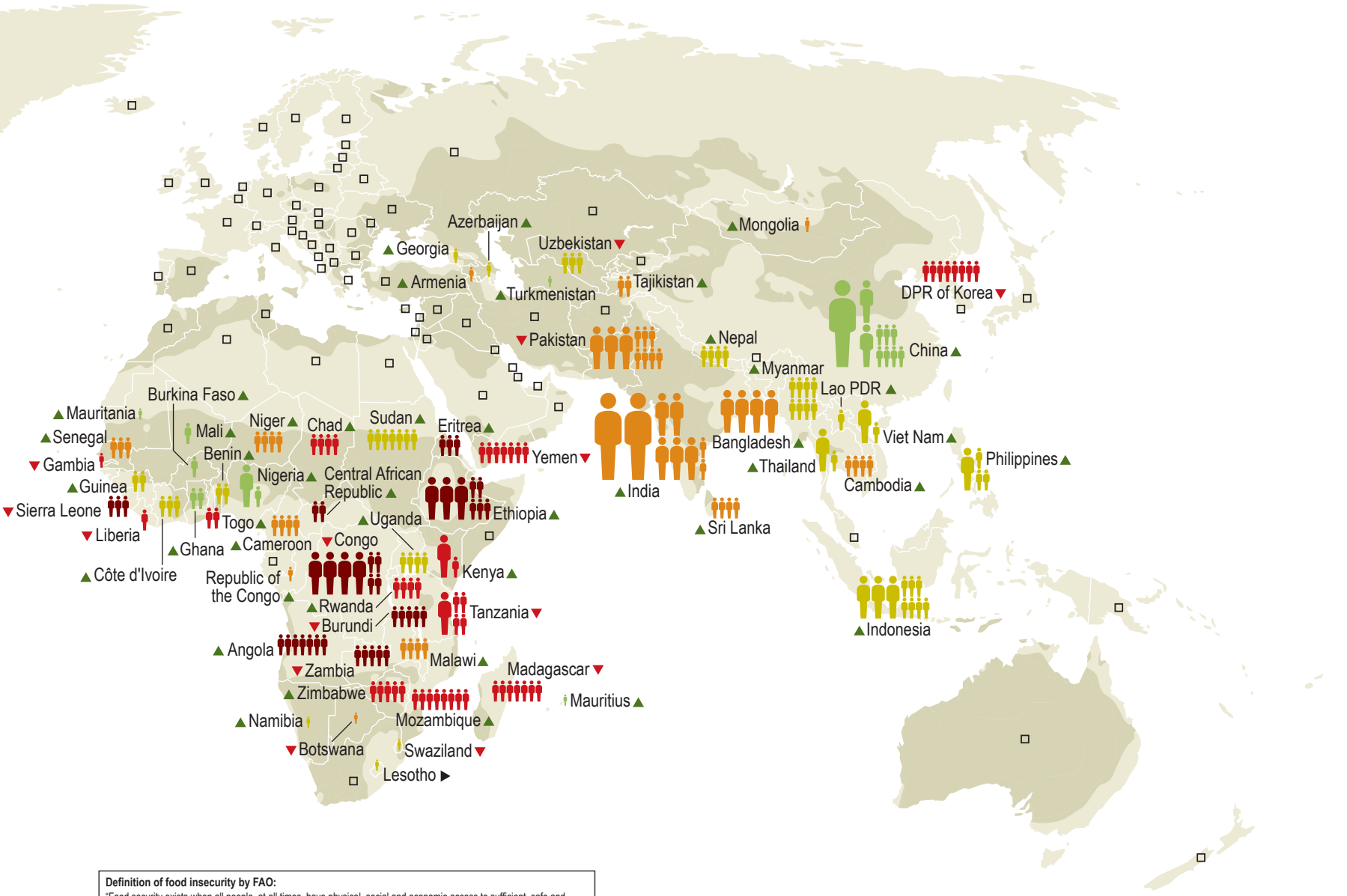
4.8 FOOD SECURITY

One of the reasons why desertification is considered a major global environmental issue is the link between dryland degradation and food production. Meeting the food demand for the projected population increase by 2050 (which will be mostly urban and richer) will be difficult to achieve even under favourable circumstances. If desertification is not stopped and reversed, food yields in many affected areas will decline. Malnutrition, starvation, and ultimately famine may result.

Meeting global food targets and sustaining a breakthrough in terms of yields will require more land and therefore more water, or at least more production per unit area or volume of water. Farmers will need to adapt, possibly by using new technologies and crops to be more frugal in their water use. A movement towards an increased utilization of drought- and heat-tolerant crops could be extremely important.

Food security can ultimately be put at risk when people already living precariously face severe droughts and other environmental disasters. Famine typically occurs in areas that also suffer from poverty, civil unrest, or war. Drought and land degradation often help to trigger a crisis, which is then made worse by poor food distribution and inability to buy what is available. The relationship between soil degradation and crop yields, however, is seldom straightforward. Productivity is affected by many different factors, such as the weather, disease and pests, farming methods, external markets and other economic forces.





Definition of food insecurity by FAO:
"Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Household food security is the application of this concept to the family level, with individuals within households as the focus of concern.

Food insecurity exists when people do not have adequate physical, social or economic access to food as defined above."

Map produced by ZOÏ Environment Network, September 2010
Source: FAO - The state of food insecurity in the World 2009 (→ www.fao.org)

4.9 GENDER

Many people living in the drylands engage in agricultural and pastoral activities. However, communities engaged in these activities display different patterns of asset ownership and access. For example, in agricultural communities men own the land and produce cash crops, and thus obtain credit and other facilities. Women, on the other hand, rarely own land and are often confined to the production of subsistence foods. In Uganda, for example, although 97 per cent of women have access to land, 8 per cent have leaseholds, but only 7 per cent actually own land and have access to credit. In such communities, women's access to critical resources is mediated by relationships with men.

Therefore female-headed households are at an even greater disadvantage, which makes them more vulnerable to the environmental and economic crises caused by land degradation. They suffer from the effects of male migration since the men leave for the cities in search of alternative lifestyles and to support their families.

Conversely, women are the primary natural resource managers, providers of food security, and repositories of knowledge and expertise on indigenous plants, medicines, food and water. As key players in both agricultural and pastoral production their role in dealing with soil fertility and crop failure in degraded and drought-prone areas is crucial. One problem is that women, especially the most impoverished among them, often lack organizational and environmental management strategies, due to limited access to information and education compared to men. As the most disadvantaged in asset access and ownership, women in drylands encounter great difficulty in adjusting to the extreme effects of desertification. Support and training in sustainable practices to reverse land degradation could be targeted towards women to maximize their impact.

LAND FOR LIFE 5

Best practice: Policy, legislative and institutional framework

Integrating environmental protection and natural resource management in Poverty Eradication Action Plan (PEAP) in Uganda

Approximately 90 per cent of Uganda's population lives in rural areas and relies on land and forestry resources for cultivation and grazing. Land degradation has been estimated to cause losses of 4-12 per cent of GDP (among the highest estimated costs in Africa) with soil erosion and nutrient loss accounting for the bulk of this. As a response, Uganda integrated policies on combating desertification in overarching frameworks for poverty eradication and sustainable development.

In Uganda, policy making and the budget process have been firmly based on the framework provided by the Poverty Eradication Action Plan (PEAP). The Action Plan incorporates environmental protection and natural resource management, which includes mainstreaming the UNCCD National Action Plan (NAP) into PEAP processes. The goal is to enable a more strategic use of major financing instruments for the sustained mobilization of financial resources for implementing the NAP activities.

Environmental management is a major component of the second pillar of the 2004 PEAP. In particular, elements such as the modernization of agriculture and preservation of the natural resource base such as soil and forests have a direct impact on the implementation of the sustainable land management agenda in Uganda. The PEAP also observed that problems of soil degradation and forestry have been underestimated in the past. It discussed farming practices that have contributed to soil degradation, and identified a number of ways to address these issues. The government aims to transform environmental concerns such as soil degradation, into advice, policy and action through the National Agricultural Advisory Services (NAADS).

As part of the PEAP process, "Analytical work has been done on the economic importance of environment and natural resources in Uganda. Problems of soil degradation, deforestation, depletion of wildlife resources and encroachment on wetlands give examples where public action is needed".

Specific strategies identified by the PEAP on sustainable land management (SLM) initiatives include:

- developing a sector-wide approach for the environment and natural resources sector;
- undertaking meaningful land reform by clarifying land rights and strengthening the rights of the poor, especially women;
- improving land registration in the short term and strengthening the land rights of the poor through systematic demarcation in the long run, including specific initiatives for urban land reform;
- regulating provision of housing to ensure minimum standards and avoid overcrowding;
- reducing deforestation caused by increasing demand for fuel wood;
- encouraging private sector participation in forestry sector while protecting central forest reserves;
- providing more support to district and community forests; and
- establishing beach management units to ensure sustainable management at community level, implementing programmes to protect wetlands and wildlife, and improving the weather-forecasting service to provide farmers with accurate information.

(Source: Global Mechanism, The finance action box)

LAND FOR LIFE 6

Best practice: Funding and resource mobilization

Afforestation Romania

Rural communities in Romania are usually highly dependent on agricultural production such as crops and livestock, and consequently those whose lands are significantly degraded by soil erosion, salinization, etc. suffer from serious economic losses. To counter these developments, Romania has established a national afforestation programme in which degraded lands are eligible for financing. Funds are also available for public lands belonging to the central government or to communes/municipalities.

To start the process, a local committee identifies degraded lands that could be used for afforestation and approves the project. Once a decision is made, the National Fund for Land Reclamation finances feasibility studies and/or technical projects and subsequent afforestation works. Specially earmarked budgetary allocations are also available for such activities. Local forestry agencies (inspectorates) then proceed with the procurement of public works and verifying financing claims.

The plantations are established in accordance with the applicable forestry norms (i.e., Norms for afforestation of degraded lands) following, as far as practicable, the natural type of forest for the specified area. After a five-year period the success of the plantation is reviewed and, if approved, afforested areas are officially assigned under the 'forest' land use category. As such they are subject to forest management plans and the Forestry Regime – the agency under the umbrella of the Ministry of Environment and Forests.

Under this programme more than 5 000 hectares of degraded lands were afforested in 2005 and 2006 respectively. The cost (including plantation maintenance) is around €5 000 per hectare. Unfortunately the amount of funding and the corresponding afforested areas decreased seriously in 2008-9 (from 2 500 ha in 2008 to 1 000 ha in 2009), in line with the economic recession. However this is expected to increase again from 2010 onwards, due to the launch of new afforestation programmes. The afforested areas developed under these mechanisms are also included as Afforestation/ Reforestation (AR) activities reported under the Kyoto Protocol (LULUCF).

(Source: PRAIS 4th UNCCD reporting and review process. Romania)

5 THE UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION (UNCCD)

THE UN CONVENTION TO COMBAT DESERTIFICATION (UNCCD)

The United Nations Convention to Combat Desertification (UNCCD) is a universal international agreement aimed at promoting a global response to desertifi-cation. The Earth Summit in Rio de Janeiro in 1992 was the genesis of this Convention, which entered into force in 1994. Today, the UNCCD has 194 member Parties. It has evolved to be the corner-stone instrument in the battle for sustainable development, applying an integrated approach which is consistent with Agenda 21, while promoting the participation of civil society and the transfer of science and technology and their effective combination with traditional knowledge. While the convention is an agreement between developed and developing countries to ensure global action to combat desertification, it also includes specific national commitments for concrete action.

The Parties to the Convention implement their obligations individually or jointly. Developed country Parties and affected country Parties are expected to consult on their respective roles in supporting these programmes, which can result in more holistic, integrated and participatory management of natural resources in dryland ecosystems. Once significant effort has been made to design a framework programme, international solidarity might facilitate the launching of specific projects and activities under the agreed policies, in an effective manner and without creating excessive transactional burden. Because programmes need to be adapted to particular regional circumstances, most of the specific requirements are described in the five regional implementation annexes for Africa, Asia, Latin America and the Caribbean, the northern Mediterranean and Central and Eastern Europe.

Now with the adoption of the UNCCD's 10-year strategic plan and framework to enhance the implementation of the Convention (The Strategy) between 2008-2018, affected Parties are expected to align their NAPS and other relevant implementation activities relating to the Convention with The Strategy. The Strategy was adopted at COP8, held in Madrid in September 2007, aiming to forge a global partnership to reverse and prevent desertification/land degradation and to mitigate the effects of drought in order to support poverty reduction and environmental sustainability. The Strategy heralds the UNCCD's mission as "to provide a global framework to support the development and implementation of national and regional policies, programmes and measures to prevent, control and reverse desertification/land degradation and mitigate the effects of drought through scientific and technological excellence, raising public awareness, standard setting, advocacy and resource mobilization, thereby contributing to poverty reduction"

The Strategy provides a unique opportunity to address some of the Convention's key challenges, to capitalize on its strengths, to seize opportunities provided by the new policy and financing environment, and to create a new and revitalized common ground for all UNCCD stakeholders. It supports the development and implementation of national and regional policies, programmes and measures to prevent, control and reverse desertification/land degradation and mitigate the effects of drought through scientific and technological excellence, raising public awareness, standard-setting, advocacy and resource mobilisation.

Four strategic objectives with their own long-term impacts will guide the actions of all UNCCD stakeholders and partners in seeking to achieve the global vision. These four strategic objectives are:

1) To improve the living conditions of affected populations;

2) To improve the condition of affected ecosystems;

3) To generate global benefits through effective implementation of the UNCCD; and

4) To mobilize resources to support the implementation of the Convention through building effective partnerships between national and international actors.

The UNCCD is a unique instrument that focuses attention on land degradation and the social and economic problems it causes. It has helped to focus global attention on arid and semi-arid lands where some of the most vulnerable ecosystems and peoples can be found. This Convention is increasingly being recognized as an important instrument in global, regional and national efforts to achieve sustainable development and poverty reduction.

The UNCCD is particularly committed to actively encouraging the participation of local populations in combating desertification and land degradation. It seeks to facilitate co-operation between the countries of the North and the South, paying particular attention to the needs of developing countries in the areas of technology transfer and knowledge. In this sense building partnership lies at the heart of the UNCCD.

Additionally, as the dynamics of land, climate and biodiversity are so intimately connected, the UNCCD works closely with the other two 'Rio Conventions', the Convention on Biodiversity (CBD) and the United Nations Framework Convention on Climate Change (UNFCCC) (each of the three conventions derives from the 1992 Earth Summit in Rio de Janeiro), to meet these complex challenges with an integrated approach and the best possible use of natural resources.

5.1 STRENGTHS OF THE CONVENTION

Bottom-up approach

Traditional development planning has too often been "top-down", with experts defining the objectives, activities and expected outputs. The UNCCD, in a determined effort to ensure popular participation and ownership, demands that the National Action Programmes (NAP) originate at the local level with the full input of local communities - a "bottom-up" approach. Communities are encouraged to play a very active role in the design, development and implementation of NAPs. This approach embraces the full involvement, on an equal footing, of non-governmental organizations, women, farmers, youths and all other stakeholders living with the consequences of desertification and land degradation.

Partnership building

Addressing the problems and consequences of desertification and land degradation is an immense task in every sense. The UNCCD, in an effort to meet the challenge of implementing the Convention, is designed around the principle of partnership-building. It therefore encourages partnerships at all levels, local, national, sub-regional, regional and global. Synergetic implementation with the Convention on Biological Diversity and the United Nations Framework Convention on Climate Change is promoted. At the global level the Convention promotes support by the developed-country members to affected developing countries. It also seeks to engage and encourage donor agencies to support affected countries. The aim is to ensure that the implementation process has the economic, technical, technological, human, institutional and other resources it needs to work properly.

Financing the Convention

Sustained financing for SLM requires a strategic approach that is both long-term in its perspective and integrated with various relevant development processes at the national level. How do countries affected by land degradation and desertification find the money to support SLM? They raise most of it domestically, but bilateral assistance programmes and international agencies also provide large sums. According to the text of the Convention, developed countries are to provide "substantial financial resources and other forms of support", including grants and concessional loans, through both bilateral and multilateral channels.

The Global Environment Facility is the only multilateral fund specifically mandated to finance implementation activities elaborated by the affected countries in their National Action Programmes. Also at the disposal of the affected countries is the Global Mechanism, which was established by the Convention to promote actions leading to the mobilization of resources.

Science and technology

Land degradation can be minimized by means of both new and traditional technologies, ranging from satellite monitoring to the terracing of steep hill slopes. Science and technology must respond to people's real needs, and the Convention encourages researchers around the world to combine their talents for this purpose. Research can also help to uncover commercial investment possibilities, which in turn can foster further sustainable development.

Modern communications, satellite imagery and genetic engineering are just a few examples of tools that can help in combating desertification. Better weather forecasts and alerts can help to maintain or increase the land's productivity while improving food security and local living conditions. So too can new plant and animal varieties that are resistant to pests, diseases, and other dryland stresses. Photovoltaic cells and wind energy may reduce the consumption of scarce fuel wood and thus deforestation. For all these reasons, the Convention commits members to encourage technological cooperation. It calls for the promotion and financing of the transfer, acquisition, adaptation, and development of technologies that help to combat desertification or cope with its effects. These technologies should also be environmentally sound, economically viable, and socially acceptable.

5.2 PROCEDURES AND EXECUTIVE INSTITUTIONS OF THE CONVENTION

5.2.1 Conference of the Parties (COP)

The COP was established by the Convention as the supreme decision-making body. The main function of the COP is to take decisions on the effective and efficient implementation of the Convention. It also has the power to make amendments to the Convention.

5.2.2 Committee on Science and Technology (CST)

The Committee on Science and Technology, established under the Convention, promotes technological and scientific cooperation among national, sub regional and regional institutions through data collection, analysis and review, as well as the provision of up-to-date scientific knowledge.

The CST is a subsidiary body of the COP and provides it with information and advice on scientific and technological matters relating to combating desertification and mitigating the effects of drought, using the most up-to-date scientific knowledge. The CST is multi-disciplinary, open to the participation of member states, and composed of government representatives with relevant expertise. It reports on its work at each session of the COP.

5.2.3 Committee for the Review of the Implementation of the Convention (CRIC)

The Committee for the Review of the Implementation of the Convention (CRIC) was established in 2001 at the Fifth Session of the Conference of the Parties (COP 5) in Geneva, as a subsidiary body of the COP, to assist it in regularly reviewing the implementation of the Convention. The first session of the CRIC was held in Rome, from 11 to 22 November 2002. Since then the CRIC has been convened both in conjunction with and between ordinary sessions of the COP.

Under The Strategy, the CRIC's core functions are:

(a) Determining and disseminating best practices on implementation of the UNCCD;

(b) Reviewing implementation of The Strategy;

(c) Reviewing Parties' contributions to the implementation of the Convention;

(d) Assessing and monitoring CRIC performance and effectiveness.

National reporting forms the basis on which the review of the implementation of the Convention is done. These reports allow for informed decision-making by Convention bodies aimed at enhancing the implementation process. The CRIC assists the COP in the review of the implementation of the Convention under the authority and guidance of the COP.

The Strategy envisages a new approach towards planning, monitoring and reporting within the UNCCD, based on two complementary sets of indicators: the performance indicators to monitor achievement of the operational objectives of the Strategy; and the impact indicators to monitor achievement of the strategic objectives of The Strategy. Parties at the Ninth Session of the Conference of the Parties (COP 9) decided on a new performance review and assessment of implementation system, called PRAIS. This consists of two main elements: a.) Performance Review and b.) Assessment of Implementation. The performance review of the Convention's institutions and bodies is done using a results-based management (RBM) approach. The assessment of the implementation of the Convention and The Strategy is done using the impact indicators for the strategic objectives, which are reported on every four years, while the performance indicators for the operational objectives of The Strategy are reported upon every two years.

There is also reporting on financial flows in accordance with the Standardized Financial Annex and Programme and Project Sheets. And there is also a template to collect best practices.

The fourth reporting cycle of 2010 signals for the first time that all seven reporting bodies[1] of the Convention have reported using the online PRAIS portal. These reports have been done against the performance indicators as well as on financial flows in accordance with the Standardized Financial Annex and Programme and Project Sheets. In addition, all reporting bodies and CSOs will report on best practices. In 2012 member states will begin reporting against impact indicators.

The ease, effectiveness, user-friendliness and robustness of this new reporting process is being monitored through an iterative process where all reporting bodies and stakeholders are encouraged to highlight and discuss difficulties encountered in applying the new process and to make suggestions for its improvement. It is hoped that this process can be continuously refined and improved through this iterative process.

5.2.4 UNCCD secretariat

The main task of the secretariat is the facilitation of the implementation of the Convention. In doing so it provides services to the COP by arranging its meetings, preparing documents, coordinating with other relevant bodies, compiling and transmitting information, and facilitating consultations and other actions. The secretariat also provides, on request, assistance to affected countries, in the compilation and communication of information as stipulated by the Convention. Affected developing countries can also request the secretariat for information or advice on any matter concerning the UNCCD process.

5.2.5 Global Mechanism (GM)

In order to increase the effectiveness and efficiency of existing financial mechanisms, the Convention has established the Global Mechanism, a body mandated to "promote actions leading to the mobilization and channelling of substantial financial resources to affected developing-country Parties".

The GM advises member states on how to identify, access and mobilize financial resources for national projects and programmes promoting sustainable land management.

The GM has designed a specialized approach, called the "Integrated Financing Strategy", which pools finance from various sources: bilateral and multilateral cooperation, private sector and other innovative financing sources, such as climate change-related finance, market access and trade, market-based mechanisms and others. It encourages donors, recipients, development banks, NGOs, and others to mobilize funds and to channel them to where they are most needed.

The GM is under the authority of the COP, which periodically reviews its policies, operational modalities and activities.

LAND FOR LIFE 7

Best practice: Participation, collaboration and networking

Farmer-managed natural regeneration in the Sahel

Niger is the scene of an unprecedented farmer-led "re-greening" movement that has reversed desertification and brought increased crop production, income, food security and self-reliance to impoverished rural producers.

Between 1975 and 2003 more than five million hectares of land were re-greened by locals who planted 200 million trees in the Sahel. In the beginning farmers began protecting the trees in their fields by encouraging and managing spontaneous natural regeneration in several regions in Niger and Burkina Faso. Local populations used technical innovations (e.g. improved traditional planting pits, and contour stone bunds), which not only allowed them to rehabilitate tens of thousands of hectares of seriously degraded land but also led to groundwater recharge in many places, and spectacular rises in water tables. These developments are taking place where grazing is increasingly controlled and livestock management has been intensified. This positive feedback helps families to secure their livelihoods and has positive effects on food security, levels of nutrition and reduced vulnerability to desertification.

The increase in on-farm tree density has led to an increase in crop yields and in fodder production. More fodder means more animals, which in turn generate more manure to fertilize the soil. Nitrogen-fixing trees, like Faidherbia albida, help to improve soil fertility at no cost to the farmers. Twenty years ago farmers had to plant twice or even three or four times before the crops succeeded since strong winds early in the rainy season destroyed the plants or covered them with sand. The on-farm trees have reduced wind speeds and now the farmers often plant only once, which increases the length of the growing season.

Farmers in this region also report that they suffer less from dust storms compared with 20 years ago and that early in the rainy season the current tree densities protect their crops better against the impact of strong winds. Research in the Maradi region of Niger showed that one village reintroduced 35 different tree and shrub species that had disappeared in the 1970s. During the 2005 famine in the area, the reforested villages fared better because they could sell firewood and fodder. And when the rains in Niger arrived late and stopped early in the 2007 season, the farmers in the Maradi and Zinder regions with many trees in their fields had a better harvest than those with fewer trees.

It should be stressed that the farmers led the impressive examples of large-scale restoration of drylands in an autonomous process, showing that promoting tree and biodiversity regeneration and managing natural resources are social processes.

[1] The seven reporting entities of the Convention comprise affected country parties, developed country parties, SRAPs and RAPs, the UN and IGOs, GEF, Secretariat and the GM.

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