

Deserts & Drylands

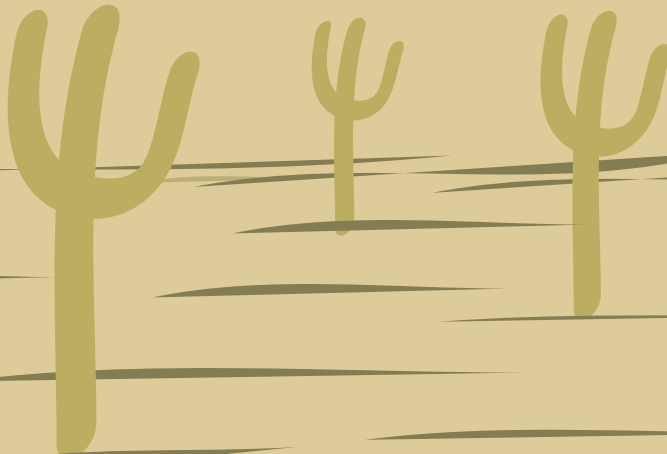
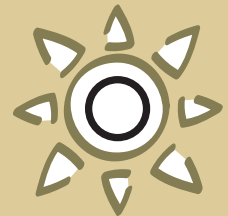
Gaining ground

Tree of life

Virtual water

Save our soil

Mali's music stars





TUNZA

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Partners for Youth and the Environment



**UNEP and Bayer, the German-based
international enterprise involved in
health care, crop science and materials
science, are working together to
strengthen young people's environmental
awareness and engage children and
youth in environmental issues
worldwide.**

A partnership agreement lays down a
basis for UNEP and Bayer, who have
collaborated on projects in the Asia and
Pacific region for nearly 10 years, to step

up current projects, transfer successful
initiatives to other countries and develop
new youth programmes. Projects include:
TUNZA Magazine, the International
Children's Painting Competition on
the Environment, the Bayer Young
Environmental Envoy in Partnership with
UNEP, the UNEP TUNZA International
Youth Conference, youth environmental
networks in Asia Pacific, the Asia-Pacific
Eco-Minds Forum and a photo
competition, 'Ecology in Focus', in
Eastern Europe.

‘Hispaniola is a marvel: hills and mountains; plains and meadows; land beautiful and fertile for cultivation and harvest, for all manner of livestock, and for dwellings and townships.’

Christopher Columbus

in a letter of 1492 describing the island now comprising Haiti and the Dominican Republic. Haiti, its hillsides stripped bare, has become the poorest country in the Americas.



Topfoto

Congratulations to Lau Tsun Ming from Hong Kong (China), global winner of the 15th International Children's Painting Competition on the Environment. The competition has been held every year since 1990 and has received more than 170,000 entries from children in over 100 countries.



Editorial

‘Forests precede civilization,’ it is said, ‘deserts follow’. It has been so since humanity first settled down from a nomadic life. More than 3,000 years ago, *Gilgamesh* – the world’s first ever written story – warned against the cutting down of the cedar forests of Mesopotamia. It went unheeded and the region is now desert, with Uruk – the great city where it was written – no more than a bump in the sand. Plato lamented how ancient Greece had been stripped of trees and soil, while the Mayan civilization of Latin America also partly owed its demise to desertification.

Now the same process threatens much of the world. Land degradation affects one third of the Earth’s land surface and endangers the health and livelihoods of over a billion people, more than one in every seven people on the planet. Over 100 countries – rich and poor – are affected. So is every continent apart from Antarctica. It is probably the world’s most widespread environmental crisis.

For the first time, however, the

world is at least recognizing the problem. An international treaty – the United Nations Convention to Combat Desertification – came into force 10 years ago. And 2006 has been designated by the United Nations as the International Year of Deserts and Desertification to try to call attention to the issue. This is also the theme of the worldwide celebrations of this year’s World Environment Day.

Sadly, progress in tackling the problem over the last decade has been painfully slow. Perhaps because it mainly affects marginalized and poor peoples – often from ethnic minorities – it has rarely been a top priority of most governments or of the international community. And yet the longer it is ignored, the worse it gets, putting all our futures at risk. It is a tall order to reverse the trend of thousands of years, to turn back the desertifying blight that has both doomed successive civilizations and been their legacy. But it has to be done – and done within the lifetime of our generation. We must seize the challenge.



Save Our Soil

Desertification – an ugly word for an ugly process, which is stripping away the very flesh of our planet.

All land-based life depends on the fragile crust of soil that coats the continents. Without it, there would be no crops, no plants, no forests, no animals – and no people. It is agonizingly slow to form, but can be destroyed frighteningly fast. Building up just a few centimetres of soil can take centuries. But misuse it, and it can be gone in a few seasons.

Once it is lost it is effectively gone forever. Air and water pollution can be cleaned up. Oxygen is replenished by natural processes. Water comes back with the rain. But soil that has been eroded away will not be restored in anything less than many generations.

And yet this is happening across a third of the entire landmass of the planet. Every year it makes 12 million hectares of land – an area about the same size as Liberia or the state of Mississippi – totally useless for cultivation, and much more is so impoverished that it is no longer economically worth farming or grazing. Every year, together with drought, it costs the world a massive estimated \$42 billion in lost production.

It blights most of the world's drylands, which make up two fifths of the Earth's land surface and contain roughly the same proportion of its cultivated land. And it threatens the health and livelihoods of more than half their people. 'Given the size of the population in drylands, the number of people affected by desertification is likely larger than for any other contemporary environmental problem,' says a report by the Millennium Ecosystem Assessment, a four-year global study by 1,300 experts from 95 countries.

Over 135 million people – equivalent to the populations of France, Italy, Switzerland and the Netherlands combined – face being driven from their homes and becoming environmental refugees. Desertification plays a part in political instability, social breakdown and the eruption of armed conflicts.

Africa, where nearly three quarters of the drylands are already seriously affected, is the worst hit: over half the land in 10 northern states of Nigeria is affected, as is four fifths of Kenya. Asia, which could lose a third of its arable land, has the most people at risk: desertification threatens the livelihoods of millions in China, for example, and costs the country a staggering \$6.5 billion a year. Much of Latin America is also badly hit.

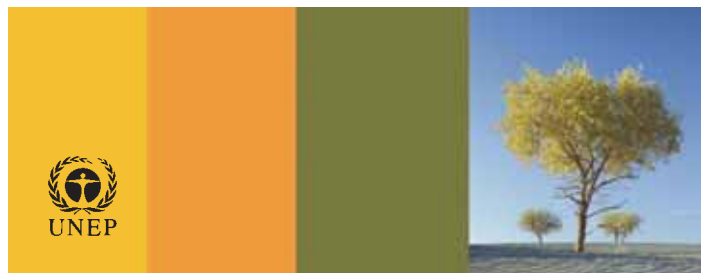
But this crisis affects rich countries as well as developing ones. Some 100 million hectares of Europe's farmland have been degraded, with Spain among the most affected countries. Australia has one of the world's worst land degradation problems, and the prairies of North America – which export food to over 100 countries – are also at risk. In all, some 110 countries, most of the nations on Earth, are affected by desertification to some degree.



J. Pintassilgo/UNEP/Topham



Carole Hodgson



DON'T DESERT DRYLANDS!

Sometimes the problem is one of expanding deserts. More often it erupts like a skin disease, with patches of severely degraded land developing sometimes thousands of kilometres away from the nearest desert: gradually these patches spread and merge, creating desert-like conditions.

There are four main causes. Overcultivation drains the soil of nutrients, starving crops. Overgrazing – by some 3 billion cattle, sheep and goats – strips the soil of its vegetation, and leaves it exposed to the winds and rain that erode it. Deforestation robs land of the trees whose roots hold the soil together and which channel rainwater down to the soil, again exposing it to erosion. And poor irrigation can cause soil to waterlog and grow too salty to use.

Ten years ago, the world started implementing a global agreement to tackle the problem – the United Nations Convention to Combat Desertification, the only internationally recognized, legally binding treaty addressing land degradation in the drylands. No fewer than 191 countries have joined it.

It obliges countries to adopt action plans, and – unusually – embraces a grassroots approach, insisting that local people should be fully involved in working out what to do. In the past they have often been ignored, or blamed for causing the crisis. But they have had little say in determining their fate; they have been among the most powerless people on the planet, often marginalized in their own countries, often from ethnic minorities, almost always with little political influence. And poverty usually gives them no choice but to try to get as much out of the land as they can to feed their families in the short term, even at the cost of their long-term futures.

But despite the Convention's universal support and revolutionary approach, not nearly enough has been done to put it into practice. Hama Arba Diallo, the Convention's Executive Secretary, says: 'The issue still fails to receive the recognition it deserves.'

So the United Nations has designated 2006 as the International Year of Deserts and Desertification to remind the world of the problem. UNEP is devoting its worldwide World Environment Day celebrations to the same cause. Conferences and summits are being held. A five-day film festival – called Desert Nights – is to take place in Rome. There will even be special football matches organized by Hristo Stoitchkov, the legendary Bulgarian football player, who is one of the official spokespeople for the Year.

It is a timely wake-up call. And it needs to work, for it is high time the world got serious about the loss of its soil, perhaps its most precious resource.



C. Uthaiyanumas/UNEP/Topham



S. Baker/UNEP/Topham

Gaining ground

Desertification is being tackled all over the globe. We are finally learning from the mistakes of the past – and from its successes, like the United States' response to the Dust Bowl crisis of the 1930s (see box). Here are just a few of the solutions now being applied.

Capturing moisture

Problem: Loss of moisture from the soil is the primary challenge. It arises from the disappearance of vegetation, whether through drought, deforestation, overcultivation or overgrazing.

Solutions: The ancient practice of terracing – planting in steps cut into slopes – allows water to soak into fields as it flows downhill, and prevents erosion. Variations on this theme



Dani-Jeske/Still Pictures

help farmers to retain moisture in degraded lands. Contour bunding – embankments built into the earth along the contours of a slope – holds onto rainwater in Niger. In Burkino Faso, the embankments – known as *diguettes* – are reinforced



Mark Edwards/Still Pictures

with lines of stones. And in the Philippines and Thailand, farmers strengthen bunds by planting them with deep-rooted vetiver grass.

Rangeland can be set aside to let it recover. Shepherds in Morocco, for example, were encouraged to form cooperatives and then compensated for allowing parcels of land to recuperate. The vegetation recovered very quickly, and is now grazed in controlled rotation.

Coping with salinization

Problem: Overirrigation causes salts to build up in the soil, reducing its fertility.

Solutions: Drip irrigation – where water is fed through perforated tubing drop by drop, directly to the roots of the plants – is highly effective. Less evaporation greatly reduces the build-up of salt and the waste of water. It can wash salt away from plant roots and can even be done with



Carole Hodgson

saline water, as the method prevents salt from touching the leaves of plants. The technique is used in the United States, Mexico and Australia, and is being encouraged in Egypt, Eritrea, Jordan and elsewhere.



Dan Porjes/Still Pictures

In Pakistan, farmers are adapting to saline land by growing salt-resistant plants such as pistachio trees and barley. Researchers in the region are also investigating salt-resistant plants which can bind the soil and provide cattle forage, and are also a source of cooking oil.

Israel is taking a high-tech approach, developing genetically modified melons, grapes and tomatoes that tolerate saline conditions.

Deserts and Drylands • How MUCH do YOU know?

1. What do all deserts have in common?
a. hot weather
b. sand
c. little rainfall
d. camels

2. Which continent is affected by desertification?
a. Asia
b. Africa
c. North America
d. all of them

3. What is the single largest cause worldwide of desertification?
a. wind
b. overgrazing
c. drought
d. farming

4. What is a camel's hump made of?
a. fat
b. water
c. bone
d. hair

Halting shifting sands

Problem: Topsoil and sand loosened by the loss of vegetation blow into arable areas and encroach on cities. This is particularly problematic when degradation on the fringes of deserts destroys the green belts that had held down the soil and sand and provided a buffer zone.

Solutions: One approach is to stabilize the sand – such as by using straw grids to hold it down, planting drought-tolerant shrubs in dunes, or even spraying with petroleum. Another is to slow the wind: trees make excellent windbreaks, which shield young plants, anchor soil and help to retain moisture.

China calls its blowing sands – the world's worst – 'yellow dragon', and is fighting them with the Green Great Wall,



Mark Lynas/Still Pictures
J.P. Delobelle/Still Pictures

planting more than 3.5 million hectares of forest in a 4,500-kilometre network of belts stretching from Beijing to Inner Mongolia. The project is now in its fifth year but is expected to take decades to complete.

Recovering degraded land

Problem: Land impoverished by overcultivation, erosion and drought needs to have its nutrients restored.

Solutions: The Zai technique of pit planting – which originated in Mali and has been adopted by farmers in Burkina Faso, captures rain and run-off, keeps seeds and mulch from being washed away, concentrates nutrients and helps improve depleted soil. Pits 20 to 40 centimetres wide and 10 to 20 centimetres deep are dug at 1-metre intervals during the dry season, and organic matter is gradually built up inside. After the first rain's fall, they are covered with a layer of soil, into which seeds are sown.

Legumes like pigeonpea – grown in India and Africa – add valuable nitrogen to soil. Agroforestry – planting trees



among crops and herds – can have many benefits. Trees drop nitrogen-rich leaves and so boost soil fertility, prevent erosion and provide shade, fuelwood, fruit, fodder and timber.

It can be done

The best example of the devastating effects of desertification is also the greatest lesson in how it can be defeated. For decades, farmers in the Great Plains of the United States ploughed up native grasses to plant wheat. In the 1930s, a prolonged drought killed the crops and exposed the topsoil. Windstorms swept it away in massive dust clouds, destroying 40.5 million hectares of land across five states, displacing millions of farmers and plunging the country deeper into economic depression.

When Franklin D. Roosevelt was inaugurated as President in 1933, he established the Soil Erosion Service to help rebuild agriculture and to prevent the disaster recurring. It taught farmers techniques still in use today, such as terracing, contour ploughing, strip cropping, leaving crop residue on land to increase nutrients, and planting trees surrounded by shrubs to create windbreaks.



Alex S. MacLean/Still Pictures

5. How many plants species are estimated to grow in the Sahara?
a. 80
b. 450
c. 750
d. 1,200

6. How long has the Atacama desert in Chile gone without rain?
a. 10 months
b. 14 years
c. 40 years
d. 90 years

7. How much of the Earth's land area is covered by deserts and drylands?
a. 5 per cent
b. 13 per cent
c. 20 per cent
d. 40 per cent

8. Can it snow in a desert?
a. yes
b. no

Answers a.e.b.d.7.c.6.5.d.4.a.3.b.2.c.1

Year of change

2006 is a special year for deserts and their peoples.

At UNEP's suggestion, the United Nations agreed to make it the International Year of Deserts and Desertification (IYDD).

The year sets out to celebrate the beauty and uniqueness of the world's drylands, which have been home to some of the world's oldest civilizations and provide vast and irreplaceable habitats for wildlife.

Public understanding of desertification – and its widespread, devastating effects – lags well behind the urgency of the issue, so the Year also sets out to change this, and to get across the need to protect the biodiversity and communities of deserts and drylands.

The year's events include the launch of a book, *365 Pictures for the IYDD*, photography exhibitions in France and Germany, and a National Conference on Wind Erosion in Iran. Commemorative stamps are being issued and a photography competition held.

UNEP's World Environment Day, 5 June 2006, is dedicated to desertification. An international film festival in Rome – including documentaries on dryland communities, fictional films and awards – will be held on the World Day to Combat Desertification on 17 June, 12 days later.

'Land – next to water and air – is the very base of all life,' said Klaus Toepfer, UNEP's retiring Executive Director.

'But unlike air and water, which can be cleaned up and rehabilitated, once soils are lost it can take millennia for nature to recreate them. Human-induced land degradation now affects all continents, and needs to be addressed urgently.'

It's not too late to get in on the action. Anyone can participate, and the IYDD encourages people to come up with local events and activities, from publishing editorials in the local paper to producing plays and organizing round-table discussions and art exhibitions.

There are also activities online. One group, for example, is posting images on the theme of deserts and desertification on the free photo-sharing website www.flickr.com, which is also serving as a forum for discussion.

For a list of events worldwide visit the IYDD website (www.iydd.org).



Desert joy

Alaa Tariq Ahmed, Tunza Youth Advisor for West Asia, is working with the Bahrain Women Society to reconnect young people with their desert heritage and promote the value of desert life.

For thousands of years the people of the Kingdom of Bahrain – a tiny island nation in the Persian Gulf – were very attached to the desert, a big part of their cultural identity. But rapid economic and industrial growth, and the accompanying changes in lifestyle, have undermined this: Bahrainis now only occasionally venture into the desert for recreation, like camping and hunting.

Yet desertification – caused by the harsh climate and overuse of the land – is the most challenging environmental issue facing the Kingdom. It degrades Bahrain's limited arable land, dries up fresh-water sources, and brings drought and dust storms.

Wildlife is already limited by the arid climate, and is made even more vulnerable by desertification and human abuse. In response, the Government has set up protected areas – gazelle and hares are not yet extinct, lizards and jerboas (desert rats) are common, and the mongoose, probably imported from India, lives in irrigated areas. Birds are sparse except in spring and autumn, when many migrant species rest here when travelling to and from temperate areas.

Sadly, most Bahrainis do not appreciate the country's natural beauty, let alone take responsibility for it. The Bahrain Women Society (BWS), to which I belong, is trying to influence environmental attitudes and reconnect people emotionally to

their desert, working hard to create awareness of desertification and to promote the value of desert life.

We aim to make learning about environmental issues easy and fun and – with our umbrella non-governmental organization, the Environment Citizenship

Programme – came up with the project 'Creativity in Environmental Culture'. Our mascot is a spiny-tailed lizard, known locally as *dabb*, which is closely linked to Bahraini culture but is now threatened by hunting and habitat destruction. We named our lizard Wanees, meaning 'joyfulness' in Arabic.

The Wanees team already has two projects on the go: a children's storytelling series, and a website (www.wanees.info) with educational material and links to activities. And this is just the beginning. BWS has high hopes that the programme will improve peoples' awareness of the environment, keep the focus on cultural identity when implementing environmental activities, create a sense of affinity with the desert's creatures, and encourage appropriate investment in environmental tourism, among other goals. With luck – and Wanees' help – we will succeed!



Heinz Stucke/www.bikefriday.com/bf/heinzstucke

Desert diversity

Stone plants



Martin Harvey/Still Pictures

By evening it looks like a pebble on the ground. But by day, that pebble – actually comprising pairs of fleshy leaves – blooms with a daisy-like flower. Stone plants, succulents found in the South African and Namibian deserts, are specially adapted to conserve water, including the ability to recycle their own moisture and nutrients.

Sandgrouse



Fred Bruemmer/Still Pictures

This ground-feeding bird from Africa, Asia and parts of Europe flies long distances at dawn and dusk to drink at watering holes. The male's belly feathers can hold up to 20 millilitres of water, which he carries over distances of more than 40 kilometres to his thirsty offspring, allowing the sandgrouse to nest far from water.

Dune beetle



Rosemary Calvert/Still Pictures

Though this dune beetle of the Namib desert lives underground most of the time, it climbs to the crest of its dune on foggy mornings and lets condensation collect on its body. It then stands head down, allowing the water to trickle towards its head and into its mouth.

TUNZA answers your questions

Q



J.L. Perret/UNEP/Topham

Q Is it true that several millennia ago the Sahara desert was a fertile savannah?

A The Sahara is 2.5 million years old, and people have lived on its edge for more than 100,000 years. During the last ice age it was a much wetter place, but by 2500 BC it was as dry as it is today.

Q Why would anyone want to live in deserts? What can we learn from the people who do?

A Most people do not choose where they live, and most of the world's poor have few, or no, options to improve their daily lives. Those living in drylands – 90 per cent of them in developing countries – lag far behind the rest of the world in well-being and development. But there is much to be learned from how they are coping with, and in some cases improving, their difficult environments.

Q Is desertification a global concern? Why should people living far from drylands care about it?

A All of the Earth's people should be concerned with desertification, which affects one third of its land and causes food insecurity, famine and poverty. Social, economic and political tensions arising from it can create conflicts, deepen poverty and intensify land degradation even more. As it increases, it threatens to deprive many millions of their homes and livelihoods.

Looking at the question from another angle, dust blown from the Sahara desert has been implicated in respiratory problems as far away as North America and has affected the Caribbean coral reefs. Storms in the Gobi desert affect much of China, Korea and Japan and cause fever, coughing and sore eyes.



Jian Ming Wang/UNEP/Topham

&

Q Is it technically, biologically, or scientifically possible to halt and reverse the spread of deserts?

A Various techniques for stabilizing the sands have proved effective. They include:

- ☐ Erecting sand fences in the path of the prevailing wind. This halts the movement of sand, and produces an artificial dune to protect the area from further movement.
- ☐ Placing large boulders works in a similar way, providing an 'anchor' for the sand to build up against.
- ☐ Spraying petroleum, or other material that can evenly cover the sand – a process often called the 'mulch' technique – can stop it moving.
- ☐ Planting trees can stabilize the land. But there is some concern that their demand for water could have a detrimental effect.

Q How will the International Year of Deserts and Desertification (IYDD) help the world to tackle the problem of desertification?

A The IYDD will help to raise awareness of deserts and of the problems of desertification. It will highlight both the causes of degradation and the measures that can be taken. Among other initiatives, this year's World Environment Day (WED 2006) will focus on the Year's priorities, with activities around the world. These efforts will help people not only to think about the issue but to take action, and we hope that you will do the same.

Q What can young people do to help tackle desertification?

A Young people all over the world can play a crucial role in the fight against desertification. They should join (or even form) an environmental organization, through which they can learn about deserts and desertification and raise awareness of them. Use the IYDD to organize discussions, exhibitions, public-awareness campaigns and other activities to increase knowledge and action on the issue – and take the lead.

Do you have any QUESTIONS on environmental issues that you would like the experts at UNEP to answer?

Please send them to uneppub@unep.org, and we will try to answer them in future issues.

A



Argan – tree of life

They call it the giver of life in southwestern Morocco, the only place where it grows. Little known elsewhere – even in the rest of the North African country – the argan tree survives heat, drought and poor soils to fight desertification and provide valuable products and employment for the local Berber people.

The only tree of its kind anywhere in the world, the argan grows in forests between the coastal towns of Agadir and Essaouira. Gnarled and thorny, it sends its roots deep into the ground in search of water, binding the soil and preventing erosion.

Its green fruits – which look like oversized round olives – smell sweet but taste horrible. But they contain a real treasure, an extremely hard nut with small oil-rich seeds.

The oil is very nutritious, and – even more important – rich in essential fatty acids and antioxidants. It is believed to lower cholesterol levels, stimulate circulation and boost the immune system – and

has also traditionally been used as a treatment for skin diseases. Long used locally for dipping bread and as a salad dressing, it is now becoming a fashionable food in Europe and North America. The cosmetics industry is also becoming increasingly interested in it.

Goats sometimes help to harvest the seeds. Kept out of the forests until the fruit is ripe, they brave the thorns and climb the trees, eating the fruits' unpalatable flesh. The discarded nuts are then cracked by hand between two stones – a laborious process – to get out the oil.

The nutshells are burned as a fuel. And the argan's wood – known as 'Moroccan ironwood' – is prized, and used in inlaid boxes. Nothing is wasted.

Women's cooperatives have begun harvesting the oil for export, providing much-needed jobs. But the life-giving tree is under threat. In less than a century, more than a third of the forest has been destroyed for farming, pastureland or making charcoal.



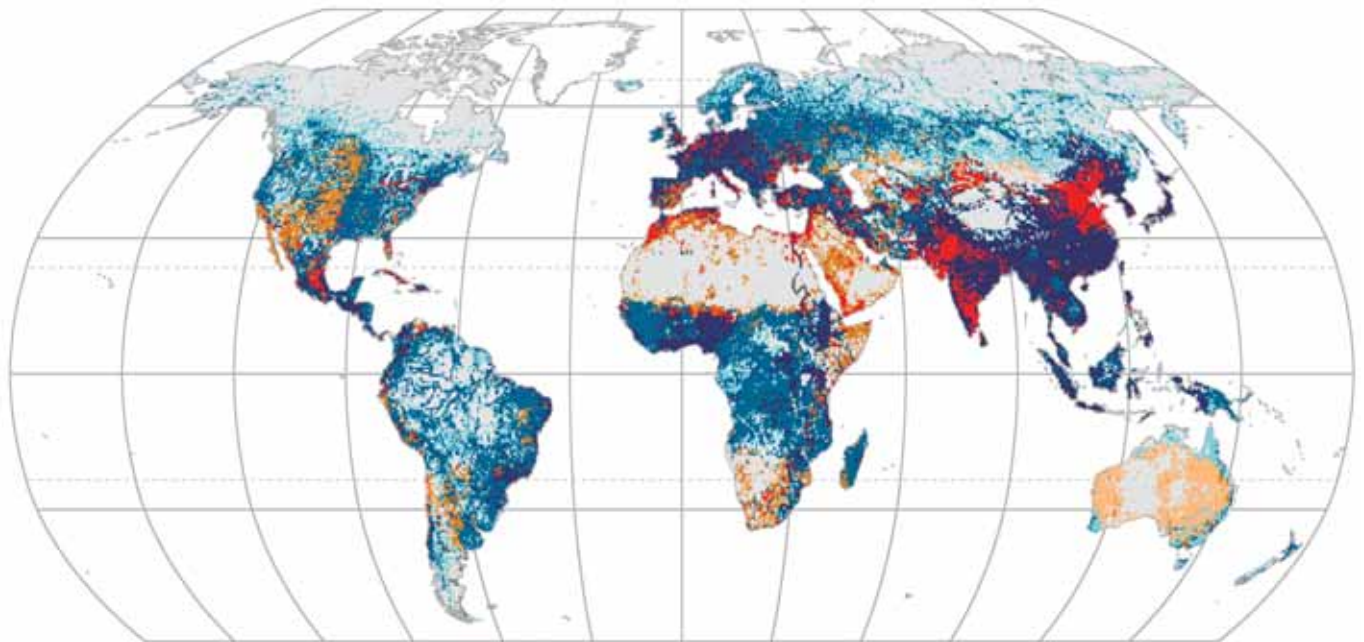
See the spectacular snow-coloured desert!

Tourists from around the world visit southwestern Bolivia to see the Uyuni Salt Flat, the largest salt lake worldwide. They are enchanted by the nearly 10,000 square kilometres of this salty desert located about 3,600 metres above sea level. It was formed between 10,000 and 15,000 years ago, after Lago Minchin slowly dried up, leaving billions of tonnes of salt and other minerals. Local people escort visitors on excursions by car to see the vast white plains lined by the unbroken chains of snowcapped mountains. Enjoy one of the driest and quietest places on Earth – but be sure to wear sunglasses and sunscreen and bring plenty of water!

Running dry

All life on Earth depends on water. Humans can survive only a few days without it, and the entire planet would be a barren wasteland without its life-giving power.

Population and water stress



Number of people in unstressed conditions (per 50 km²)

>100,000 10,000–100,000 0–10,000

Little or no population

Number of people in stressed conditions (per 50 km²)

0–10,000 10,000–100,000 >100,000

Source: Water Systems Analysis Group, University of New Hampshire.
Datasets available for download at wwdrii.sr.unh.edu/; UN/WWAP 2006, UN World Water Development Report 2

Demand for freshwater is soaring as populations grow and personal consumption rises, yet there is no more of it on Earth than there was 2,000 years ago, when there were only 3 per cent as many people to use it. Water is being withdrawn from rivers, lakes and underground sources – for irrigated agriculture, industry and domestic consumption – faster than it can be replenished.

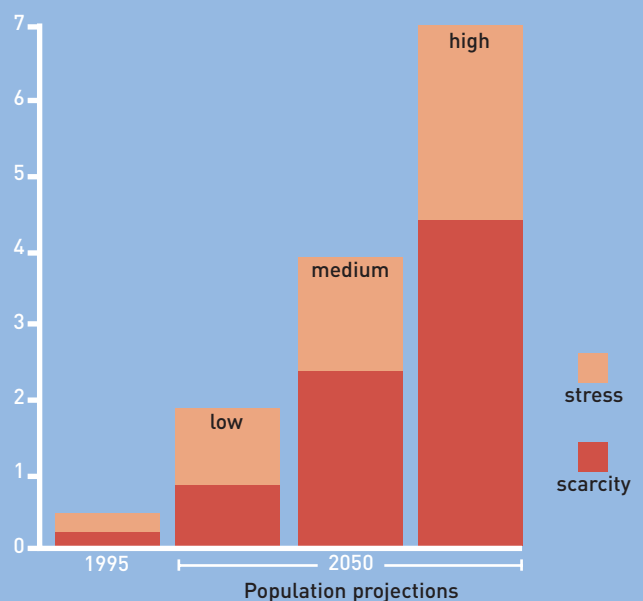
Just as seriously, freshwater supplies are threatened by pollution as sewage wastes, toxic industrial effluents, pesticides and fertilizers flow into lakes and rivers or leach into groundwater. Disease and death result; water-related diseases, like diarrhoea, kill millions of people every year. The environment is damaged, and wildlife species are endangered.

Thirty-one countries – mostly in Africa and the Middle East – are already chronically short of freshwater. This is expected to get very much worse. By 2025, it is forecast, more than 2.8 billion people in 48 countries will face water stress or scarcity. By 2050 this is expected to rise to 4 billion people in 54 countries – about 40 per cent of humanity. Ethiopia, India, Kenya, Nigeria and Peru are all likely to run short in the next quarter century. Parts of China already face chronic problems.

It may already be too late for some water-short countries with rapidly rising populations to avoid a crisis. But the world needs to conserve water, pollute less, manage supply and demand, and, where necessary, try to slow population growth and cut overconsumption.

People suffering from water stress and scarcity

Billions of people affected



An area officially suffers water stress when its annual supplies drop below 1,700 cubic metres per person. When supplies drop below 1,000 cubic metres per person, its people face water scarcity.

Virtual water - a reality

They call it 'virtual water'. This is not the stuff we drink and use directly in our homes, but what has been used to produce the food and other goods we consume. Take orange juice: 22 litres of water are used – to irrigate the groves and wash the fruit for example – to produce every litre of it.

Food grown on irrigated land will, naturally, have a larger water footprint than what is cultivated in fields that just rely on the rain. Nations with warm climates tend to use more water, as do countries which consume a lot of meat: some 22,000 litres of water are used to produce just 1 kilogram of beef, compared with just 1,000 litres for each kilogram of grain.

Every time a country imports something, it also imports the

virtual water embedded in its production. Importing that kilogram of grain, for instance, means importing 1,000 litres of virtual water.

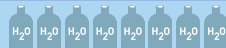
There is little trade in real water because it is heavy and expensive to carry long distances. But trade in virtual water happens all the time, and it is estimated that it accounts for about 15 per cent of the water people use. There are wide differences between countries. The United States, Canada, Australia, Argentina and Thailand are all big virtual water exporters, while Japan, Sri Lanka, Italy, the Republic of Korea and the Netherlands are large importers. Exporters place large demands on their own water resources; importers effectively shift part of their demand elsewhere.

HOW MUCH WATER IT TAKES TO MAKE...

1 cup of coffee needs 140 litres of water.



1 litre of milk needs 800 litres of water.



1 kilo of maize needs 900 litres of water.



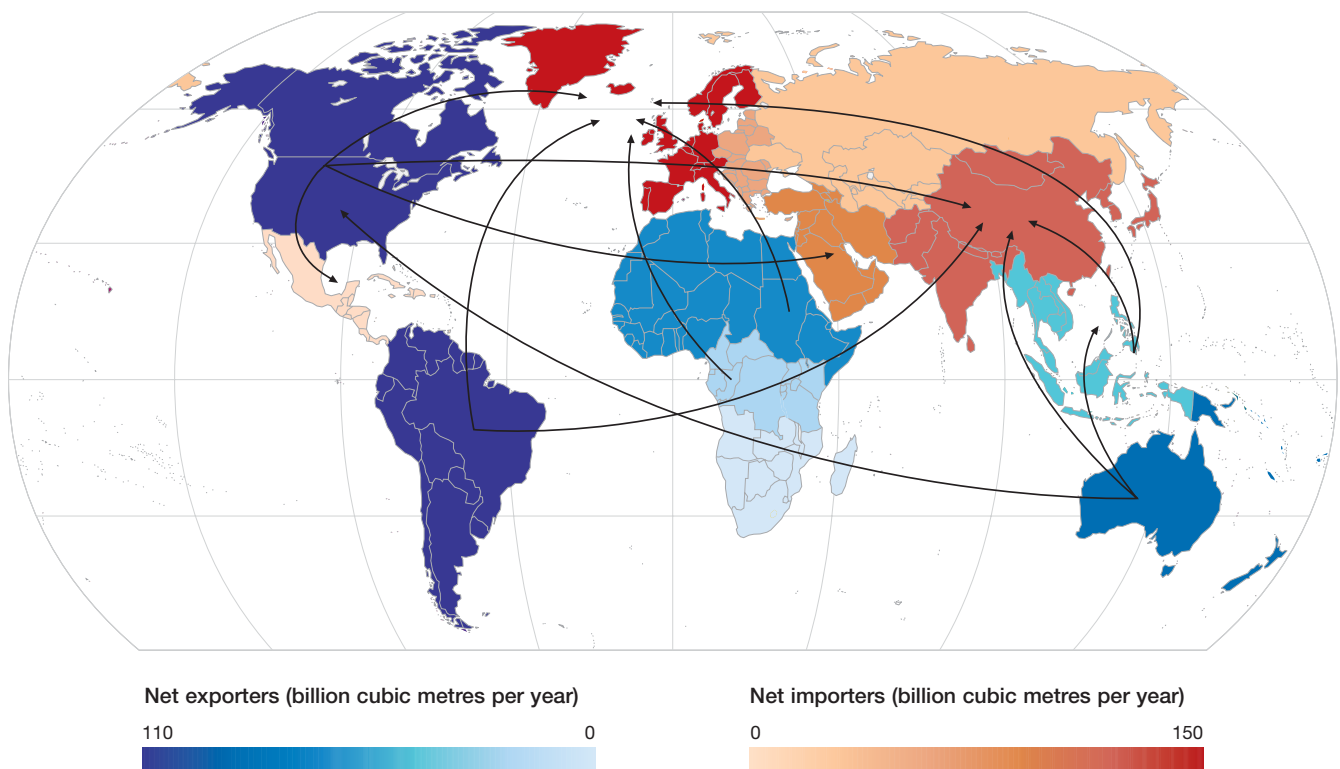
1 kilo of wheat needs 1,100 litres of water.



1 kilo of rice needs 2,300 litres of water.



Virtual water imports and exports around the world



Source: Chapagain and Hoekstra, 2004 Water Footprints of Nations; UN/WWAP 2006, UN World Water Development Report 2



B. Wiklund/UNEP/Topham



Pick up your pencil!

Maurice Odera, Tunza Youth Advisor for Africa, reports on the drought in Kenya and the efforts to alleviate associated human suffering.

In the past five months or so, Kenya has been caught up in a severe drought, the worst in its history. And I can't help wondering whether it's due to climate change. Is global warming finally beginning to take its toll? Increasingly irregular weather patterns are combining with rapid deforestation – for products ranging from charcoal to the pencil on your desk – to bring about desertification.

Droughts are a natural phenomenon in Eastern Africa, particularly the Horn of Africa, but their frequency and effects are on the rise. In the 1983-1984 season, drought affected 200,000 people. Now, in the 2005-2006 season, it has affected 3.5 million so far. The next one is expected in 2009 – only three years away. Given Kenya's current population growth, the increased frequency means the number of those affected will rise significantly. If drastic measures are not taken, the number of victims may double.

But there are things we could do to focus on the careful management of available resources. Rainwater harvesting during the wet season would mean water could be stored instead of going to waste, helping agriculture – on which Kenya's economy depends – to be less rain dependent and more irrigation dependent, giving us a measure of control over vital food production. During dry periods, hosepipe bans could prevent the misuse of water. And tree-planting campaigns could help reverse desertification.

The current drought is costly: we

have spent \$500 million to combat it, in a country where 60 per cent of the population still lives below the poverty line. The World Food Programme needs another \$250 million to ensure that no more Kenyans die of hunger, but so far it only has \$25 million. Kenya has also received \$5 million from corporations and other well-wishers. Perhaps we could invest some of this in infrastructure to minimize the effects of future droughts.

Though this is a time of great challenge, I believe that every problem has a solution. If we work together, I am sure we can come up with even more answers. As young people with the future in our hands, we must be determined not to be part of the problem, but part of the solution.

Every drop counts!

- Harvest rainwater in a bowl and use it.
- Turn off the tap while brushing your teeth or washing up.
- Wash vegetables and fruit in a basin, then use the water for plants.
- Fix leaky taps – inside and out.
- Use the minimal amount of water in the bath – or have a shower.
- Install a drip irrigation system in the garden.
- Start a compost heap and use it to help retain soil moisture.
- Choose native plants that require less water and provide a habitat for wildlife.



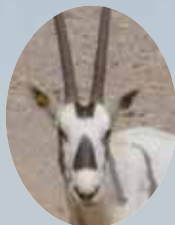
It seemed doomed, extinct in the wild. But a last-ditch rescue effort, by the Sultanate of Oman's Arabian Oryx Project, seems to have saved the Arabian oryx. TUNZA talks to Andrew Spalton who – first as chief biologist on the Project and now Adviser for Conservation of the Environment, Diwan of the Royal Court of Oman – oversaw this extraordinary operation.

Distinctive white antelopes with long straight horns, oryx once freely roamed the Arabian Peninsula: 2,000 years ago, Aristotle mentioned them in his *History of Animals*, though he thought they had just one horn, like unicorns. But by the early 1970s, the Arabian oryx (*Oryx leucoryx*) had been hunted to extinction in the wild. Bedouins traditionally hunted them for their meat, hides and horns. But the arrival after World War II of trophy hunters, with automatic weapons and motorized vehicles, sealed their fate.

Yet today, says Andrew Spalton, their story is 'a model of what can be done to conserve wildlife when a concerted multinational effort is made'.

It began in the early 1960s when Fauna and Flora International (FFI), recognizing the animal's plight, launched Operation Oryx. It took some from the wild in Yemen and from collections elsewhere in the region to protect them in a zoo in Phoenix, Arizona. There they were bred, ready to be reintroduced into the wild when the time was right.





OUT OF THE ASHES



Carole Hodgson/Kerstin Howard

In 1979, H.M. Sultan Qaboos bin Said of Oman established the Arabian Oryx Project, arranging for a small group of the captive-bred oryx to be brought to the Jidda', a flat limestone plateau in Oman's central desert where their last wild relative had been killed.

The animals initially lived in a small

were more than 400 oryx in the wild, and all but about 20 had been born in the desert.

The oryx, says Spalton, is extremely well adapted to the harsh life of the desert, where summer temperatures can reach nearly 50°C, where there is no surface water, and where rainfall is minimal and sporadic. 'Its short, brilliantly white fur

reflects sunlight to prevent absorbing heat, but stands up in the winter to reveal heat-absorbing black skin,' he says. 'And its large, splayed hooves allow it to dig depressions in the sand in which it lies, transferring excess body heat to the ground and minimizing exposure to drying winds.' Its hooves are also designed for migrating distances of up to about 400 kilometres across sandy terrain, as the animals follow the vegetation that quickly springs up after rain.



Kerstin Howard

enclosure to acclimatize to their new environment, but the first group was released in 1982, and thrived. In 1994 the Government of Oman established the Arabian Oryx Sanctuary – about 25,000 square kilometers of the Jidda' – which was promptly declared a UNESCO World Natural Heritage site, the region's first. By 1996 there

Most remarkably, says Spalton, the oryx doesn't need to drink to survive – fortunate, since it has been seven years since it last rained in the Jidda'. The plants it eats contain most of the moisture it needs. But, like the 250 species of plants that thrive in the sanctuary, the oryx also relies on fog. On about 54 days a year the fog forms from

cool, humid air drawn in over the desert from the Arabian Sea: vegetation drips with condensation, providing moisture for animals and plants alike.

In the late 1990s, a new spate of poaching drastically reduced the herd, threatening to wipe it out again, as oryx were caught alive and sold to private collectors abroad. The Project responded by removing 39 of the remaining wild oryx to enclosures, and strengthened anti-poaching operations and legislation.

Despite this setback, Spalton and his colleagues in Oman remain positive. 'We have now experienced poaching that is common to many similar projects around the world and we hope to come through with many lessons learnt,' he says. 'The herd is now more than 100 strong in the enclosure, and we are reintroducing young bulls to the wild to join an estimated surviving population of 120. And we plan to release some more females once all signs of poaching have disappeared.'

While the population is recovering in Oman, two herds have been released into the wild in Saudi Arabia, one in the Uruq Bani Ma'arid protected area, the other into a fenced zone within the Mahazat as-Sayd reserve. The Omani sanctuary, meanwhile, continues to carry out its mission, and is putting increasing emphasis on benefiting the local community by encouraging eco-tourists to come to learn about what Spalton calls 'this remarkable animal, and the fragile but fascinatingly rich ecosystem that supports it'.

Kerstin Howard



There is no life without water. Yet people have made their homes in arid lands since ancient times, long before modern technology found ways of delivering water quickly and easily.

Ironically these modern methods often help cause desertification. Overpumping water from wells depletes aquifers, taking the water from them faster than rain – and time – can replenish it. Tapping prehistoric water from fossil aquifers – such as the massive Nubian Sandstone Aquifer System in Libya – is unsustainable because their waters, trapped underground for thousands of years, are not replaced. As the water fails, vegetation dies, and precious topsoil erodes away.

Similarly, overirrigating land causes salinization. As the water evaporates it causes a dangerous buildup of salts, making the soil infertile.

So perhaps it's time to revisit some of the ancient, well-tried – but often overlooked – ways of harvesting water. One of the oldest is named the *qanat* in Iran, the *falaj* in Oman, the *foggara* in Algeria and the *madjirat* in Andalusia. It originated some 3,000 years ago in ancient Persia, and is still employed throughout the Middle East and beyond.

Qanats bring underground water from hills and moun-

tains down a gently sloping tunnel, often many kilometres long; frequent vertical shafts allow ventilation and maintenance.

The method spread east along the Silk Road to China and west to Spain – probably thanks to the Moors – and onwards to Mexico, Peru and northern Chile. It's a durable technology: a 2,700-year-old system still provides water to almost 40,000 people in the Iranian city of Gonabad. In all, the country retains over 160,000 kilometres of *qanats*.

Capturing and storing rainwater – often by households collecting it from their roofs – has also, of course, gone on for thousands of years. But people in the Thar desert in Rajasthan have been gathering it on a community level since the 1600s. Their groundwater supplies are too salty to drink, so they began collecting rainwater on special saucer-shaped catchments, measuring anything from 20 square metres to 2 hectares, built into the land. These are cleared of vegetation, graded into a gentle slope, and packed down with pond silt or gravel. Rain runs down the slope, through a mesh that filters out debris and into a *kund*, a covered, underground tank usually made of cement and covered with a dome-shaped lid.

Harvesting snow makes even cold deserts inhabitable. A centuries-old system in the Spiti valley, deep in the Indian Himalayas, uses diversion channels to tap glaciers up to 10 kilometres away. The water runs down the stone-lined channels, called *kuls*, to a circular tank in the village and is then used for irrigation. This allows the region to make its living from agriculture, even though the harsh climate supports little vegetation.

A circular system

A pioneering irrigation system is transforming the lives of 60 small farmers in Acauã, in the semi-arid region of northeastern Brazil, where water is short and temperatures rise to over 35°C. The centrepiece of each farmer's *mandala* (mini-plantation) is a water basin which irrigates nine beds arranged in concentric circles around it. The inner three circles provide the family with fruit and vegetables, five further beds supply produce for the market, and the outer environmental buffer zone, which includes a cacti fence, forms a natural barrier against animals. Trees and palms provide both fruit and shade for the beds, while the basin is also used to raise fish and waterfowl.



Centre for Science and Environment, New Delhi

X. Echarri/IST/Alamy Pictures

Bayer

Water for thirsty lands

A *kul* tank, India.



Desert fog, Saudi Arabia.



A *falaj* in Oman.

Carole Hodgson

A *kund* in the Thar desert.



Centre for Science and Environment, New Delhi

Fog collectors, Chile.



Gill Mott-Smith Pictures

In the Spiti village of Poh, farmers are now also experimenting by filling a shaded reservoir with snow at the beginning of December. As spring arrives, the snow thaws at the ideal rate for irrigation. On a smaller scale, people in the Takhar province of Afghanistan get drinking water by collecting snow in pit reservoirs insulated with a layer of earth. Bamboo pipes channel out the water as the snow melts.

Regions with neither rain nor snow have long harvested fog and dew. People in South America's Atacama desert use piles of stones arranged to minimize evaporation. In parts of the Middle East, low walls built around vines ensure that the condensation falls right onto the plants. And Bedouins put out rugs and cloths to catch moisture from morning fog.

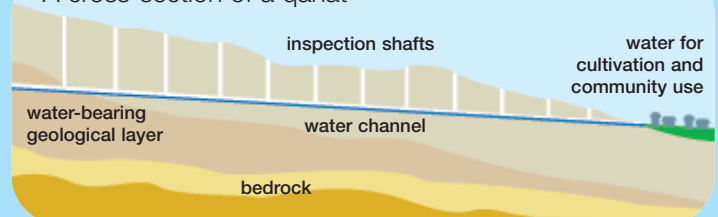
Water from dew is used to grow melons in China's arid Gansu province, where the cultivated area is covered by large pieces of gravel which capture condensation, deliver it to the soil and keep moisture from evaporating. And Professor Girija Sharan, a researcher designing greenhouses for the water-deprived village of Kothara, in Kutch, recently discovered that morning dew provided up to 9 litres a day from a 124-square-metre roof: he is now researching the best

material for collecting the moisture, with the help of the World Bank.

Until 1987, the remote fishing village of Chungungo, in Chile, relied on trucked-in water. Then polypropylene nets were hung up to condense water as fog blows through them: the droplets run down into gutters and reservoirs, to be piped into homes. This has provided not just an independent and reliable drinking water source, but irrigation for crops. Its success has prompted similar schemes in Peru, Namibia and South Africa.

New technologies inspired by old ones can both solve immediate water crises and take the pressure off overstressed water sources. Importantly, they are sustainable – because they simply do not permit the use of more water than can be naturally replenished. So hope for the future may lie in the past.

A cross-section of a *qanat*



When a water source has been located – in an underground lake or a water-bearing geological layer – a channel is built at a carefully calculated angle to ensure the correct flow. Once near its destination, the *qanat*, which often becomes an open ditch, can be divided into several channels.

The art of survival

Desert peoples, more than any others – except perhaps the Inuit of the Arctic – have mastered the art of surviving in extreme conditions. And they have done so by living in harmony with their environment.

Often derided as ‘primitive’ by ‘modern’ affluent people, desert cultures actually have much to teach the modern world. And, as the stresses on the planet get ever more severe, their lessons will become ever more urgent and important.

The Bedouin of the Middle East and Northern Africa, for example, migrate from oasis to oasis to pasture their livestock, allowing each grazed area to recover, and using their acute understanding of weather patterns to go where new rain has fallen. Their animals provide food, clothing and even shelter: water-resistant tents are woven from goats’ hair. Their traditional clothes – usually a long white tunic, sleeveless cloak and head cloth – both protect their skin from the sun and prevent dehydration from evaporating sweat.

Aborigines in the dry heart of Australia, similarly, have to be expert in their harsh environment to survive. They know the roots and trees that yield water, how to harvest dew, and even get refreshment from water-holding frogs. In the same way, they can hunt by following the faintest tracks, imitating animal movements and camouflaging themselves. The Bushmen of the Kalahari desert – who mainly eat fruits, nuts and roots – also get water from tree trunks and wring it from plants.

On the other side of the world, the Hopi people of the southwestern United States live in durable and cool specially constructed houses made from stone and sun-dried mud bricks.

But desert peoples are increasingly threatened, as ‘civilization’ encroaches on their lands and modern development and lifestyles overtake traditional cultures. We could be losing their priceless lessons before we can learn them.

Photos: UNEP Collection



Their name – **Tinariwen** – means ‘empty spaces’, drawn from the desert that the members of the band call home. Nomadic Touaregs of northeastern Mali, they met in the early 1980s during a period of exile and social upheaval, and began to perform while in a refugee camp. They evolved their own sound – a rhythmic, mesmerizing blend of their own musical tradition, with its choruses and percussive handclaps, mixed with rock, reggae and blues stylings. The conflict has subsided, but the music still evokes a longing and a call for justice that has found an eager audience worldwide. TUNZA caught up with the band in Mali, where they were recording their third album, due out in 2006.

Q Clearly the desert landscape influences the songs you write. Now that the band often travels worldwide to perform, do you find you must reconnect with the desert in order to compose?

A Our music has always been about the desert, our experience of the desert, and our people’s experience of the desert. When we were young, living in Tamanrasset in Algeria, we used to go off with our mates, a guitar and some tea and spend time out in the bush, just talking, playing music and hanging out. That’s why people kept calling



Eric Mulet

us 'Kel Tinariwen' – the desert boys. But yes, we need to have plenty of experience of the desert in order to create our music. We like travelling, but the desert is our home and always will be.

Q *What would you say is the essence of the desert?*

A For us the desert is about our family, our friends, our people, our customs and our way of life. But it's also about freedom. There's so much space, so much sky. No one bothers you. You can drive where you want, and just sit under the sky drinking tea, playing music, cooking food. It's a calm existence, and we can't do without it.

Q *Tell us a bit about some of the traditional instruments you use.*

A We don't really play traditional instruments. The point about Tinariwen is that we made the leap from traditional to modern instruments. The guitar has always been our main instrument, and in the desert, there are plenty of people who just call our music 'guitar'. Sometimes one of us –

Ibrahim – does play the shepherd's flute, which has a lovely sound, like the desert wind. And on the new album we have experimented a bit with using the traditional lute, which we call *teherdent*. Maybe in the future we will go back to our roots more and start using other traditional instruments like the *imzad* or the *tindé* drum. Those instruments are the basis of all our music, and we haven't forgotten them.

Q *You have always used music to transmit messages as well as inspire and entertain. What aspect of your music do you think people connect with the most?*

A Yes, it's true that we have used music to transmit messages. But our songs have always been about our own experiences and those of people we know. In that sense, they're all personal. It's just that at times, we were living through very hard situations influenced by – and influencing – politics. We were singing about our destiny, and about the lessons we had to learn in order to face up to the reality of what was going on around us. When we tour internationally, people don't understand our language,

Tamashek. But if they enjoy our melodies, rhythms and sounds, that's a good start! We also hope our audiences learn something about the desert and our culture, and see that we're people just like everybody else, trying to do the best we can in difficult circumstances.

Q *As people of the Sahara, you have a unique perspective on its rich and vulnerable ecosystem. What do you think is the most important thing for young people to know about the desert environment?*

A When people talk about 'ecosystem' it often seems like something exotic, apart from them, something they can do without. In the desert, the nomad understands that his environment is his life. There's no separating the two. We were all born nomads, and even if we now live in houses and towns, we still respect the desert, because we know that it makes us who we are, and in the end, it is what we will return to. It's also very important for youth to appreciate that all the things modern life offers, like electricity, cars, CD players and the Internet, are very fragile. Who knows how long they will last?

Music... from empty spaces



Droughts in the driest places

*The links between
global warming
and desertification
are not obvious and
work both ways*

Human civilization may owe much to the interplay between climate change and desertification. Some experts believe that the great cultures of Egypt and Mesopotamia began because the Arabian Peninsula and the Sahara rapidly turned to desert thousands of years ago, forcing people to settle along the rivers Nile, Tigris and Euphrates. The desertification is believed to have been brought about by a complex series of changes caused by alterations in the Earth's tilt and orbit.

Nothing as dramatic is happening today. But the world's top group of experts on global warming, the Intergovernmental Panel on Climate Change, says that 'climate change and desertification remain inextricably linked'. The trouble is that, although we know that the two inter-react, we do not know enough about how – except that it is complicated and subtle.

Everyone expects global warming to bring more droughts to most of the world's driest places, but these don't cause desertification in themselves. Overexploiting the land and cutting down trees are the main causes. But when these are already happening, declining rainfall can be the trigger that sets off desertification.

This is what has happened over the last decades in Africa's Sahel, on the fringes of the Sahara, where rainfall has diminished by up to 40 per cent, and the land has been severely degraded. Climatologists have linked the drier weather to global warming, and projections suggest that rainfall may diminish to the same degree in North Africa and southern Spain.

The link works the other way too. Desertification can help change the climate – though, again, this is a complicated process and far from the main cause. As grass and trees disappear the soil dries out and this may increase air temperatures. And the loss of vegetation removes one of the main buffers against climate change since, as plants grow, they remove carbon dioxide – the main cause of global warming – from the air. But burning coal, gas and oil – and cutting down and burning rainforests – are much bigger causes of the rising levels of the gas in the atmosphere.

It is not straightforward. Global warming, as its name implies, is a worldwide phenomenon; desertification, essentially, is a collection of local processes. But when they work together they can create havoc for people and societies, whatever may have happened thousands of years ago.

Shifting sands

T. Dressler/UNEP/Topham

Africa's Kalahari desert – already much larger than California or Pakistan – is expected to double in size as global warming takes hold, covering hundreds of thousands of square kilometres of farmland with shifting sands.

Scientists say that climate change will stir up the desert's giant dune fields, and send them marching over much of South Africa, Botswana, Namibia, Angola, Zimbabwe and Zambia.

Around 10,000 to 20,000 years ago the dunes – made of sand created by the crumbling of soft rock in the area – stopped roaming around Southern Africa and settled down. They stabilized, and plant life grew on them, anchoring them in one place. But this, it seems, is about to change. Researchers at Oxford University in the United Kingdom have found that as wind speeds in the area accelerate, the sands will start moving again. At present the winds are relatively light, but climate change is expected to increase them.

As they get stronger they will start picking up sand and blowing it over the landscape. Sand drifts will bury vegetation – already weakened by lower rainfall – killing it and making the dunes even more unstable. The desert will start to expand.

Professor David Thomas – who has been studying the desert for 20 years – says that the effects will be 'drastic'. He adds: 'These landscapes are potentially very dynamic and they can kick in with a form of activity that is rather hostile to farming. The Kalahari is a large area supporting a reasonably big rural population that lives by farming. It is these people who are vulnerable to their environment becoming a rather more hostile, active, dune landscape than it is today.'

He urges local governments and aid donors not to make things worse. But present policies and projects are enormously boosting the number of cattle in the area, threatening to turn already arid land into yet more desert.

Desert diversity

Gila woodpecker

John Cancabasi/Still Pictures



This native of the Sonoran desert in the southwestern United States chisels a nest into the cool, moist saguaro – a distinctive, slow-growing, tree-size cactus – to protect its young. The woodpeckers only use these nests for a year, but the abandoned holes provide useful habitats for creatures such as lizards, insects and other birds.

Wild Bactrian camel

Fritz Polking/Still Pictures



At over 2 metres tall, the wild Bactrian camel of northwest China and Mongolia can drink up to 135 litres of water daily, allowing it to walk up to 160 kilometres without a drink as it migrates among feeding areas. Though the Bactrian camel has been domesticated for millennia, its wild cousin is critically endangered, and fewer than 1,000 survive.

Triops

Tim B. Graham/USGS



Magically appearing in post-rainfall puddles, these tiny crustaceans live in the deserts of nearly every continent on Earth. Their lifespan typically lasts 20 to 40 days, during which they hatch, feed, and lay eggs that stay dehydrated in suspended animation – for years, if necessary – until the next rain starts the process all over again.

Middle East

Deep in the desert of Jordan, the lost city of Petra has been carved into the living rock. Homes, banqueting halls and great temples were chiselled by hand into sandstone cliffs by the Nabataeans, one of the most civilized peoples of antiquity. They harnessed natural springs to grow crops, tend lush gardens and sustain a population of 20,000 people. But the trade routes that supported the city changed, and Petra became deserted and forgotten, only to be rediscovered in the early 19th century by Johann Ludwig Burckhardt, a Swiss explorer who was the first outsider to see it for 500 years.



Ulstein-Klar/Still Pictures



Fritz Polking/Still Pictures

North America

Once they were an ocean reef; now the Guadalupe Mountains rise out of the Texas and New Mexico regions of the Chihuahuan desert. The limestone range bears witness to marine life from an inland sea 240 to 280 million years old. The reef was buried for tens of millions of years before being pushed up by movement of the Earth's crust. As it rose, sulphuric acid in the water table dissolved the limestone from the bottom up, creating some of the world's longest caves. Scientists believe that the caves – the summer home for the migratory Mexican free-tailed bat – contain microbes with medicinal qualities.

Asia

For most of the year the Rann of Kutch in India is a searingly hot, inhospitable lowland desert. But for four months this part of the Thar desert – spanning over 20,000 square kilometres of the Arabian Sea coast along the Indo-Pakistan border – floods about half a metre deep, thanks to the summer monsoon rains and the sea-water driven into the area by wind and high tides. Then it teems with wildlife, serving as an important habitat for over 200 species of birds, including large migrating flocks of the greater and lesser flamingo, and 50 species of mammal, such as the endangered Indian wild ass – the last in Asia.



Ashok Jain/naturepl.com



Klein/Still Pictures

Oceania

It is quite an achievement to earn a nasty name in both a living and a dead language, but the thorny devil has achieved it; its Latin name, *Moloch horridus*, comes from a malevolent god or king. But its dragon-like appearance is offset by its size – only 15 centimetres long – and its behaviour. This lizard only attacks ants, eating them one at a time at a rate of up to 45 a minute. It has adapted to the desert by developing thousands of tiny grooves in its skin that collect dew and rainwater and channel the moisture to the corners of its mouth.

Antarctica

There could hardly be a less promising place to find life: for 25 million years Lake Vostok has been buried under 4 kilometres of ice at the coldest recorded spot in the white desert of Antarctica. The size of Lake Ontario – and thus one of the world's largest freshwater lakes – it is thought to be kept liquid by geothermal heat. Biologists believe prehistoric microbes 500,000 to 1 million years old, left over from the time when the frozen continent's climate was temperate, may still be living in its waters. Studying them could shed light on the evolution of life on Earth.



V. Chistyakov/TopFoto

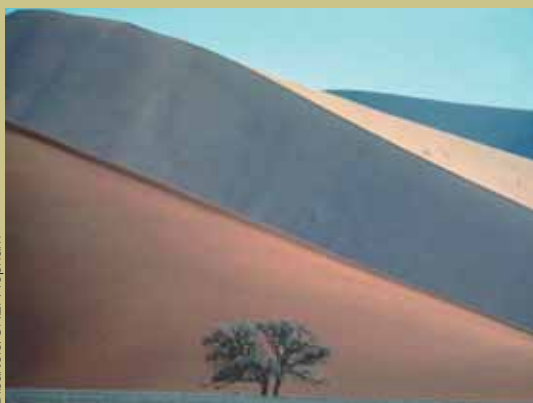


Martin Harvey/Still Pictures

Africa

Crocodiles and the Sahara don't seem to go together – but they do. Tara Shine, a student at the University of Ulster, was told about them by local people while studying in Mauritania. She investigated, and there they were. The area can go without rainfall for eight months of the year, and so the crocodiles survive by crawling into burrows and caves and entering a dormant state called estivation – the warm-weather equivalent to hibernation – until rain creates wetlands for them. Scientists think they are remnants from when the Sahara was greener and wetter, thousands of years ago.

7 regions



Dibartolo/UNEP/Topham

7 deserts



N. Vignola/UNEP/Topham

South America

Where the world's driest desert meets its longest mountain range lies one of the most extraordinary places on Earth. The Valle de la Luna, squeezed between the Atacama desert and 6,000-metre Andean peaks, really does look like a piece of the moon. Created 22 million years ago by the folding of the Earth's crust, it is absolutely lifeless, so arid that not even insects can live there. Ancient volcanoes deposited rock and ash on the folds, and wind has carved the sedimentary rock – containing salt, gypsum, chlorate, borate and clay – into strange shapes, including gnarled and twisted sculptures, small sharply crested hills and massive dunes.



Don't **Desert** Drylands!