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Desertification and climate

Staff members of the United Nations Convention to Combat Desertification Secretariat highlight critical problems in the fight against desertification

For years now, climate change has been recognized as a major environmental issue and one that involves several stakeholders. Consumers, private companies, politicians and researchers are actively engaged in studying the processes of how to reduce emissions and developing innovative policies and mitigation programmes.

The people who may be the most affected by the problem and the ones who will have to adapt are those in the South who live on less than one dollar a day. National Adaptation Programmes of Action are, therefore, being planned and developed in an effort to address this situation. Synergies and the mainstreaming of the issues of climate change with other programmes dealing with development and environment would considerably enhance the efficiency of planned activities.

One of the most alarming processes of global concern, meanwhile, is desertification

or land degradation. The recent major report of the Millennium Ecosystem Assessment entitled Ecosystems and Human Well-Being underlines the fact that desertification is one of the greatest environmental challenges and a major impediment to meeting basic human needs in drylands.

Desertification is due to direct and indirect human-induced factors, but it is also due to climatic variations, including increasing droughts or reduced freshwater availability linked to global warming.

MAIN POINTS

- **The authors describe** the main features of the desertification problem and the strong link with poverty.
- **They note that** land degradation is affected by, and in

turn affects, climate change.

- **Collective action** in responding to both desertification and global warming is, they argue, an appropriate response.

Desertification is a truly global phenomenon with serious economic and social implications. The urgent need to combat desertification was given recognition by the international community at the 1992 Earth Summit in Rio de Janeiro, Brazil. The United Nations Convention to Combat Desertification (UNCCD) was adopted two years later as an international legally binding instrument to address the issue. Entering into force in 1996, the Convention now counts 191 Parties, the largest membership of the Rio Conventions.

While the intervening years have seen progress in placing desertification on the international agenda, the issue still deserves more recognition. A fact that ought to shake people out of their inertia is the inextricable link between desertification and poverty.

In the Millennium Ecosystem Assessment, desertification was cited as “potentially the most threatening ecosystem change impact-

ing the livelihoods of the poor.” Among the two billion people living in drylands, 90 per cent are in developing countries.

Since it is clearly not a one-dimensional environmental issue, the fight against desertification requires a multi-layered approach, which integrates the environmental aspect into a broader socio-economic framework, primarily within the development sphere. The UNCCD stands at the helm of this process, having as its main tool the National Ac-

tion Programmes to combat desertification, which evaluate the nature and intensity of the desertification problem in the respective country and identify the necessary action to be taken.

The link between climate change and desertification is of major significance. According to the Millennium Ecosystem Assessment, dryland soils contain over a quarter of all of the organic carbon stores in the world as well as nearly all inorganic carbon. Due to

the increased emissions and reduced carbon sink caused by desertification and related loss of vegetation, it is estimated that about four per cent of total global emissions are generated in drylands. Therefore, restoration and improvement of dryland conditions could have a major impact on global climate change patterns.

Climate change in turn also affects desertification, although the exact links are not sufficiently understood and may vary significantly from one region to another. Due to the increase of energy in the atmosphere, however, it is expected that the number of extreme events such as droughts and heavy rains will increase slightly, potentially having a dramatic impact on already weakened soils. Freshwater availability may also be reduced, due to phenomena such as increased solubility and salt-water intrusions induced by the rise in sea levels.

Some studies go even further. Mike Wallace, co-author of a recently launched study on the shift in jets streams, said that, “if they move another two to three degrees poleward during this century, very dry areas such as the Sahara Desert could nudge further towards the poles, perhaps by a few hundred miles,” thereby forcing millions of people either to migrate or to adapt to the changing circumstances.

It is clear, therefore, that synergies between the UNCCD National Action Programmes, which are building bridges between development and environment policies, on the one



Western Sahara

Photo: © Nick Brooks/Western Sahara Project



Creating a contour ridge to trap water run-off, Cape Verde

Photo: © UNCCD

hand and the United Nations Framework Convention on Climate Change National Adaptation Programmes of Action on the

Deserts and Desertification (IYDD). The IYDD represents a unique opportunity to raise awareness amongst the broadest possible audience and to galvanize policy makers and the public at large into action.

The IYDD is a chance that must be seized, given the staggeringly sobering statistics that belie the complacency with which the issue of desertification is often treated. It is also a unique chance to develop synergies with other partners in the context of global change. In other words, collective action as an appropriate response to collective responsibility. This is the only way forward in seeking to put the world firmly on a path of development that is sustainable and to address two of the most important environmental challenges that we face in the 21st century - desertification and climate change.

“desertification is one of the greatest environmental challenges and a major impediment to meeting basic human needs in drylands”

other present a unique opportunity to take a new step towards comprehensive policy instruments. This would allow the development of innovative poverty reduction strategies, while strengthening the adaptation capacities of the poorest and fighting climate change through carbon sequestration and emission reductions.

The United Nations General Assembly designated 2006 the International Year of

The international workshop *Climate and Land Degradation* will be held December 11-15th 2006 in Arusha, Tanzania, as part of the IYDD celebrations. The meeting is organized by the World Meteorological Organisation in collaboration with the UNCCD and will be a great opportunity to move forward. ■

ABOUT THE AUTHORS

● The United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, is an agreement to combat desertification and mitigate the effects of drought through national action programmes that incorporate long-term strategies supported by international cooperation and partnership arrangements.

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FURTHER INFORMATION

● **In the Cyberlibrary:** A report on the International Year of Deserts and Desertification is available at www.tiempocyberclimate.org/newswatch/report060205.htm. The Cyberlibrary also maintains a selected list of websites covering drylands and desertification at www.tiempocyberclimate.org/portal/t26web.htm

● **On the Web:** Details of the Millenium Ecosystem Assessment can be found at www.maweb.org/en/index.aspx. For further information about the international workshop on Climate and Land Degradation, visit www.wmo.ch/web/wcp/agm/Meetings/wocald06/wocald-intro.pdf

Climate change and the Sahara

Guy Jacques and Hervé LeTreut describe the role of climate in shaping the Sahara and discuss future prospects for the region

In Arabic, “sahra” signifies a flat, waterless area. In fact, the Sahara, the biggest hot desert in the world, is a combination of immense flat sandy or stony regions scattered with mountain ranges with base rock protrusions or volcanic outcrops. Examples include the Emi Koussi, which culminates at an altitude of 3415 metres, the Toussidé at 3265 metres in the Tibesti Mountains, the Tahat at 2918 metres, the Ilaman at 2760 metres in the Hoggar, and the Greboun at 2000 metres in the Air. It also comprises depressions that are below sea level, such as the Qattara in Egypt at -133 metres and the Chott Melhrir in the southern part of the Aures range in northeast Algeria at -31 metres.

The 9.5 million square kilometres of the Sahara receives less than 100 millimetres of rainfall per year, with half of the Sahara receiving less than 20 millimetres. Indeed, the Mediterranean winter rains rarely cross the Atlas Mountains, and the monsoon rains

do not exceed farther north than 17 degrees North, the latitude of Timbuktu in Mali, and Khartoum in the Sudan, which mark the limits of present-day Sahara.

The drought in this region is a result of the atmospheric circulation. Around 30 degrees latitude, the rotation of the Earth causes the upper part of the atmospheric circulation (the Hadley Cell) to descend, bringing dry air to the ground from the upper layers of the atmosphere. However, another phenomenon partially opposes this seemingly unyielding mechanism: the monsoons that seasonally

MAIN POINTS

- **The authors describe** the climate processes that determine the dryland nature of the Sahara region.
- **They consider** the history of famine in

the Sahel zone over the past century.

- **Global warming will bring** increased fragility to semi-arid zones, models predict.

bring water evaporated from the oceans to the continents.

Neither the past climate nor scenarios of the future can be fully understood without first understanding the monsoon regime. The monsoon regime is largely controlled by the seasonal oscillation of the intertropical convergence zone (ITCZ) from one hemisphere to the other, a zone of intense rainfall which follows the Sun and can, thus, be found in summer in the Northern Hemisphere; and the thermal contrast between the oceans and the continents, which favours the advection of humid air over the warmer continents, also in summer.

The West African monsoon is a complex and fragile mechanism because of the multiple interactions amongst the atmosphere, the marine and the continental hydrosphere, the ground and the biosphere. Recent modelling studies underline the important role of the oceans, vegetation cover and topography

in the establishment of the monsoon circulation. In addition, human activities modify the rainfall. Thus, the over-exploitation of the land leads to an increase in the albedo, not only in the Sahel but also in the Sudan-Guinea climate zone, with a direct impact on the atmospheric circulation.

The start of the West African monsoon depends on the northward progression of the ITCZ during the spring and the northern summer. The ITCZ is defined by the line of demarcation between the northeasterly trade wind, the Harmattan, which removes the Saharan heat and dust, and the southwesterly monsoon which draws water over the equatorial forest and, above all, over the Atlantic. The migration of the ITCZ develops suddenly, passing from a near-stationary position at five degrees North in May-June to another equilibrium position at ten degrees North in July-August. The Sahel and the southern

The Sahara thousands of years ago

Recent research shows that the Sahara dried up quite suddenly about 5,500 years BP; four centuries were enough time to complete this desertification. The enormous changes that brought about this climate inversion 4,000 years ago were gradual. Why then was this desertification so sudden? Here we have an effect that is somewhat mysterious and which bears testimony to the non-linear character of the climate system. It is possible to surpass the thresholds allowing the system to evolve, sometimes in a major way, under the effect of relatively minor causes.

The most recent climate models show that one of the processes likely to have accelerated the climate inversion is the effect of the vegetation, whose role is crucial. A slight reduction in the vegetation would increase the reflective nature of the soil, thus diminishing the rainfall, which in turn reduces the vegeta-

desert' developed. For example, founded between the ninth and thirteenth centuries AD, the Mauritanian cities of Chinguetti, Ouadane, Tichitt and Oualata are the surviving witnesses to the prosperity of medieval Mauritania, crossroads of Andalusia, the Arab world and Sahelian Africa.

These cities are unavoidable stopovers on the major trans-Saharan trade routes, by which the products of the North are bartered for those of the South (salt, cloth, gold, fine glassware, and so on) and from which radiates an intense cultural and religious life, as well as numerous scientific and artistic activities. Long periods of drought, epidemics, sometimes even famines have brought irreparable damage to these cities. The advance of the desert reinforces their isolation, which is exacerbated by the appearance of new economic axes turning towards the Atlantic.

The past century

During the last decades, the most marked climate evolution has not affected the heart of the Sahara but its southern fringe, the Sahel. The inhabitants of the Sahel know that throughout their life they will suffer drought and malnutrition that accompany life in the region, and that only their ingenuity or escape can save them. This 'shore' (*sahel* in Arabic) of the sea of sand is subject to climate fluctuations depending on the more or less marked, more or less lengthy, advance in summer of the rainfall zone associated with the ITCZ.

“the inhabitants of the Sahel know that throughout their life they will suffer drought and malnutrition”

Sahara then receive the major part of their rainfall. Farther south, the annual amounts are greater and are distributed over two rainy seasons, one in the spring and the other in the autumn.

In this article, we look back over the recent history of climate and the Sahara, then consider what impact humanity may have in years to come.

tion, and so on. The heat would then become fiercely overpowering and the desert would spread. This scenario explains the observed evolution as it is presented without any need to resort to the historians' hypothesis according to which agriculture failed because the farmers over-exploited the soil.

As the desertification got worse, over the centuries and millennia, a 'civilization of the

For the Sudano-Sahel, the periods 1930-31, 1940-41 and 1947-49 had brief but intense droughts. Yet two long and intense episodes marked the twentieth century. The first lasted from 1898 to 1916 with peaks in 1911 and 1914-15. During these twenty years, Lake Chad, considered the 'climatometer' of the Sahel, lost half its quantity of water, during which the tides of the Nile were reduced by a third. When the rainy season arrived, many people no longer had the strength to work the land. As a result, nearly 5000 Fulani died in Nigeria, where the cattle herds dropped from 88,000 head in 1913 to 26,000 in the following year.

The second major period of drought was from 1968 to 1988, with minimal rainfall between 1971 and 1973, in 1981 and 1982, and again in 1987. This drought also affected the humid region of Africa. The drop in the rainfall south of the fourteenth parallel reached 20 per cent with marked regional inequalities. In the Niamey region in Niger, 490 millimetres of rain fell, on average, per year from 1970 to 1990 compared with 690 millimetres for the preceding twenty years. As a direct consequence, the River Niger's low water discharge, in the city of Niamey, dropped from 50 to three cubic metres per second.

The concurrent rise of ten centimetres per year in the water table was, at first glance, something of a paradox. For some researchers, this paradox was explained by landscape changes. In response to population growth, surfaces cultivated or in short-term fallow rose in the vicinity of Niamey from 10 per



Fezzan, Libya

Photo: © Nick Brooks/Western Sahara Project

cent to 60 per cent. This transformation of the vegetation cover accentuated the run-off of rainwater as a result of the impermeabilization of the ground surface, a reduction in the obstacles to the flow and in the activity of the soil fauna, which became concentrated in the hollows forming temporary stagnant pools that alimanted the water table by infiltration.

Although this drought period affected Guinea, Liberia, Sierra Leone, Mali and Burkina Faso, it spared much of the Côte d'Ivoire, Ghana, Nigeria and Cameroon up until the end of the 1970s. In contrast, in the 1980s, the decrease in rainfall was widespread, with a maximum intensity in those regions close to the Sahel as well as in the west near the Atlantic, in Côte d'Ivoire, Liberia and Guinea.

There is no way of knowing whether this climatic breakdown around 1970 is a response to the appearance of a long-term drier climate in the Sahel or to a transitory period of drought such as the region has experienced several times before. There was a rainfall deficit (on average, -180 mm of rain per year) almost continuously from the end of the 1960s to the mid-1990s; this deficit was not limited to the Sahel but extended right to the Gulf of Guinea.

This drought is only one of the indicators of climate variability in West Africa. The deficits in the discharge of the major drainage basins are greater than the rainfall deficit. Thus, the basin discharges in Senegal and Niger have decreased by 50 per cent to 60 per cent, whereas the annual rainfall on their drainage basins decreased by only 20 per cent to 30 per cent.

The Sahara of 'tomorrow'

Sub-Saharan Africa and, more generally, the whole of West Africa have experienced the greatest known decrease in rainfall in the world during the past fifty years, with sand and dunes invading about one million square kilometres since 1900. What would happen with global warming?

It might be tempting to extrapolate from thousands of years of history and conclude, somewhat hastily, that, in a warmer world due to the increase in greenhouse gases, the climate of the Sahara would be similar to that of the warm climatic optimum of the early

Holocene Epoch and, hence, more humid. Unfortunately, things are never so simple and the same climate modelling methods that describe very well the more humid conditions of the early Holocene Epoch indicate, on the contrary, a significant risk of drought for the coming centuries.

Even if climate models are imprecise on a local scale, they give a reliable indication of the geographical distribution of warming on the global scale. In all the future climate simulations, the warming by greenhouse gases is maximal towards the poles because it remains close to the surface, whereas in the tropical or inter-tropical regions it is mitigated by the effects of convection that mixes the air up to an altitude of more than ten kilometres. For the same reasons, warming is more marked in winter.

These conditions are very different from those of the early Holocene - we no longer find strong warming of the continental surfaces in summer at low latitudes which draw the monsoons northwards. They do not favour an extension of the rainfall regime but rather an amplification of the intensity of the existing regime. In other words, more rain in those regions where it rains already, and less rain in the arid regions.

If the models have got it right, the Sahara and the Sahel will not experience a decrease in their aridity, but on the contrary, an increased fragility of the semi-arid zones. ■

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EMISSIONS TRADE

British Prime Minister Tony Blair and Californian Governor Arnold Schwarzenegger have announced an agreement to work together to fight global warming that could lay the foundations for a trans-Atlantic emissions trading system.

They will collaborate on research into cleaner fuels and technologies. "The environmental and economic consequences of climate change and our dependency on fossil fuels compel both California and the United Kingdom to commit to urgent action to reduce greenhouse gas emissions and promote low carbon technologies," according to a joint statement.

Read more:
<http://www.tiempocyberclimate.org/newswatch/arnews06.htm#060813>

ARCTIC HEAT

An Inuit community in Canada is installing air conditioners after July temperatures topped 30°C.

Ten air conditioners are being installed for office workers in the village of Kuujuaq in Quebec, Canada. "These are the times when the far north has to have air conditioners now to function," said Sheila Watt-Cloutier, International Chair for the Inuit Circumpolar Conference. "Our Arctic homes are made to be airtight for the cold and do not 'breathe' well in the heat with this warming trend."

Read more:
<http://www.tiempocyberclimate.org/newswatch/arnews06.htm#060820>

PARTICIPATION

The Secretariat of the United Nations Framework Convention on Climate Change is encouraging indigenous peoples, particularly from Africa, to participate actively in the next Conference of the Parties to the climate treaty in Nairobi, Kenya, in November 2006.

Marking the International Day of the World's Indigenous Peoples, August 9th, Richard Kinley, acting head of the Secretariat, congratulated indigenous peoples on their "continued progress with strengthening international cooperation on issues of concern."

Read more:
<http://www.tiempocyberclimate.org/newswatch/arnews06.htm#060820>

CLIMATE TREATY

Switzerland and Kenya led a two-day meeting, September 14-15th, in Rüşchlikon, Switzerland, to discuss the future role of developing nations within the climate treaty. At least seventeen developing nations took part.

"We want to reinforce the dialogue launched last year in Montreal, by concentrating on reduction actions, which would be possible in all countries," Swiss environment minister Moritz Leuenberger said. Technical or financial support was also on the agenda. "This support has to take account of the priorities for Africa and other developing countries."

Read more:
<http://www.tiempocyberclimate.org/newswatch/arnews06.htm#060924>

AMAZON DROUGHT

The Amazonian forest cannot withstand more than two consecutive years of drought, according to research conducted by the Woods Hole Research Center, Falmouth, United States.

The project was led by Dan Nepstad, who is based in Belém, Brazil. "We started thinking about simulated drought experiments back in 1994, when the Amazon was coming out of a major drought caused by a severe El Niño, and the forest almost completely ran out of water," he explains. There is now increasing concern that global warming could lead to longer and/or more severe droughts in the Amazonian Basin.

Read more:
<http://www.tiempocyberclimate.org/newswatch/arnews06.htm#060806>

Food security for the Solomons

Louise Hunt reports on the successful efforts of a community group to teach capacity strengthening

The Solomon Islands is an archipelago made up of ten islands lying between the Pacific Ocean and the Solomon Sea. The Weather Coast, on the Pacific Ocean side of Guadalcanal Island, is only about 30 kilometres from the Solomon Islands' capital of Honiara, as the crow flies. But it's one of the poorest, most isolated regions in the South Pacific.

Behind its beaten coastline and sheer cliff faces lies a wall of rugged mountains matted in primary rainforest. It's a three-day arduous hike to the nearest truck road. By sea, the journey to town takes six hours in an outboard motor-boat amidst ocean swells easily reaching 20 feet on a fine day. Soaring fuel prices mean chartering a small boat costs as much as a flight from the United Kingdom to New Zealand. For most people, the cargo ship from Honiara is their only chance to sell crops at the central market and buy-in additional

food supplies. In October 2005, the ship had not returned in three months.

Then there's the weather. As its name suggests, there's a lot of it. Between the nine months of April and January, the Weather Coast is deluged. The region receives between 5000-8000mm of rainfall annually. Cyclones frequently visit and the broad rivers that lie between market, school and church, flood and detach already isolated communities.

MAIN POINTS

- **The author describes** a community project on the Solomon Islands aimed at strengthening the capacity of local people to improve food security.
- **The community group** has successfully established a

training centre, teaching unemployed youth skills and supporting food-processing enterprises.

- **The outcome is** that this Weather Coast community is no longer completely at the mercy of the elements.

During this time, the gardens, which are the main source of food and income, become so waterlogged that it's possible to canoe across them. This is also known as the hungry time, when many people exist only on bananas and coconuts.

Conflict increases food shortage problems

Added to its natural problems, the Weather Coast's already vulnerable food security situation became more tenuous during the ethnic tensions that brought five years of unprecedented violence from 1999. The conflict grew because of resentment of the people of Guadalcanal over the increasing population of non-indigenous settlers, coming mainly from the island of Malaita which lies to the east. The feeling was particularly vehement on the Weather Coast, where people were increasingly frustrated by lack of development services, while other parts of the Solomons

seemed to be benefiting from government and overseas support. In retaliation, Weather Coast leaders - including the notorious Harold Keke - formed the Guadalcanal Liberation Front, to forcibly remove the migrants.

During this time, the people of the Weather Coast not only lived in fear of attacks by Malaitan rebels and the government, they also feared the Guadalcanal Liberation Front, which turned on its own people, subjecting them to harassment, extortion, rape and murder. Many were forced to flee from their homes into the highlands, leaving behind their subsistence gardens.

A report by the Kastom Gaden Association, a Solomon Island community development non-governmental organization, published in October 2005, assessed the food security and livelihood situation on the Weather Coast. It found the conflict directly contributed to food shortages experienced over recent years. It also found that severe underdevelopment on the Weather Coast was as much a contributing factor to the tensions as resentment of other ethnic groups.

A fragile peace returned with the arrival of the Australasian and Pacific Islander police force, the Regional Assistance Mission to the Solomon Islands, in 2003 and the incarceration of most of the militia leaders, including Harold Keke. Communities are trying to put their traumatized past behind them, but many still have little confidence in seeing development similar to that occurring in other parts of the Solomon Islands.

Training centre educating on food security

But one Weather Coast community has chosen not to wait in vain for government funds and big international aid grants and has positively directed its fighting spirit to start up an independent training centre, teaching unemployed youths skills to develop their communities and their livelihood prospects. It is also single-handedly attempting to tackle endemic food shortage problems by re-educating communities on sustainable agriculture and supporting families in food processing enterprises, which have, for the first time, begun to generate regular and significant incomes.

The Turusuala Community Based Training Centre in Avuavu Ward instantly dispels any gloom-laden preconceptions of the Weather Coast. It is perched in luminous green foothills with a mesmerizing view over Lake Lauvi, the Solomons' second biggest lake. The centre is making good use of an abandoned government research station, now transformed into classrooms and dormitories. In the valley below, forests have been cleared for a model farm, where students are taught sustainable agriculture methods for indigenous crops such as sweet potato, cassava, taro and yam and a variety of cabbages that form the basis of diets. They also learn over a two-year course how to keep chickens and pigs and build with locally-available materials.

Jerry Anderson, deputy principal, explains how the school began its life in August 2003

with no outside financial assistance. "We started with ten students and worked together on small business activities to raise money to repair the buildings and buy tools," he says. "We harvested crops and made paddles for canoes and coconut scrapers, which we sold locally." They made SBD\$1,500 (approx. AUD\$270) from this enterprise, which was enough to expand the centre to accommodate another 30 students for the next intake. Student ages range from 17 to 27, and there is a near-equal gender mix.

Other courses added

In its second year, the Community Based Training Centre's resourcefulness and initiative convinced some non-governmental organizations to fund expansion projects to include new training courses in food processing and sewing machine repair and materials for new buildings. The centre is also beginning to produce enough revenue from its farm and furniture-making projects to pay staff a modest salary when possible. The school fees are SBD\$200 per student with help given to those who find it hard to meet the full payment. In contrast, the Weather Coast's only secondary school charges SBD\$1,200 a year and this is rising. Consequently, many children receive no formal education beyond primary level.

The experience of Tanasio Kechekado, a second year student at the training centre, is typical of a Weather Coast youth. He says prior to starting the course he had no practical skills or employment prospects, having

left school in primary form six. He spent his days gardening, helping his sister and sitting with other youths. He says he is very happy to have been given the opportunity to learn agriculture and building skills. His hope for the future is to run his own furniture-making business and a farm.

Many students say the full programme,

working 12 hours a day on lessons and farm duties, is instilling discipline and a strong sense of responsibility for their communities that had been missing. Jerry says he has witnessed a big change in their outlook. He says: "I can see positive results in the students who will graduate this November. A lot of the boys were ex-militants, involved with Harold

Keke. When they started the course they were aggressive and didn't communicate well. We tried to sit down and talk with them about how they could change their lives for the better. Now they have peaceful attitudes and meaningful work. We know we can leave them on the farm and they will continue to work hard, before, we had to watch over them all the time."

Some students will be invited back as teachers, others will be able to use their qualification to go on to higher education if they have the funds. It is hoped that those who cannot continue their education will use their skills to develop their villages.

The Turusuala school is receiving support from the Kastom Gaden Association as part of its Sustainable Livelihoods in Isolated Rural Areas Programme (SLIRAP). The scheme, funded by AusAID, is focused on improving the food security of vulnerable parts of the Solomon Islands, including the Weather Coast and areas of Malaita and Makira.

Climate change causing erosion, food shortages

School principal Celestine Aloatu says food shortages on the Weather Coast are getting worse due to a number of factors. "The rainy season now lasts nine months of the year and most people believe it's raining more than in the past," he says. This means farming, which mostly has to be on sloping land, is being affected by erosion that is stripping the nutrients from the soil.



Women selling banana chips

Photo: © Mike Webster

Over the decades, there has also been a transition in the types of root crops people are planting, which is leaving them more susceptible to climate problems. Celestine explains that, in the past, people mainly planted yam and taro, which is harvested at different times of the year and can be stored for the rainy season. Now people are more focused on introduced root crops, like sweet potato, pana and cassava. He says: “People like these crops because they require less labour as they grow in secondary forests and can be harvested after three months. But people are not spending enough time improving the soil. And sweet potato doesn’t withstand the rainy season.”

“People are experiencing food shortages year after year,” adds Celestine. “The weather is making life harder. There is a lot of malnutrition. Coconut is the only food that withstands any weather, it’s common practice to survive on coconuts and bananas. People understand about nutrition but the situation gets out of hand and hunger leads to bad management. Many people here are resigned to their fate. They don’t have a crusading attitude. We are trying to educate people about sustainable farming by encouraging them to concentrate on crops that give the best harvest.”

Another prong of the Sustainable Livelihoods in Isolated Rural Areas Programme is to train communities in how to make added-value products from home-grown produce to boost their virtually non-existent incomes.



Turusuala school principal, Celestine Aloatu, and his son

Photo: © Mike Webster

Food-processing workshops have been held in target regions, with Avuavu being the first, in March 2005, to receive training from Kastom Gaden’s consultant food scientist Richard Beyer, who is based in Fiji.

Banana chip project boosts incomes

The programme is currently focusing on pro-

ducing banana chips, as banana trees fare well under heavy rainfalls and processing is cheap and simple. There are now around 30 members of the food-processing groups in Avuavu ward, mainly women, who meet weekly to make the chips together in their villages. The Isolated Rural Areas Programme supports the groups by providing cooking and packaging equipment. The groups can buy oil, salt and flavourings from the training centre. To become a member, they each have to plant 100 banana trees to ensure the scheme is sustainable.

Interviews with women who have been processing banana chips for some months reveal they have been able to boost their incomes significantly since the groups started. Some women previously received virtually no income. Others said they were only able to make small profits of around SBD\$10 a week from selling produce such as bananas, sweet potato, pineapples and cabbage and fish at the local market. Now they also sell packets of banana chips that can make from SBD\$30 to SBD\$50 in one day. The women sell these packets at Avuavu market and at the secondary school, which has become their biggest customer base. They also sell to local villages.

The women say they keep the additional income, rather than give it to their husbands, and use it to pay for household items such as kerosene, soap and salt, which were difficult to afford before they joined the groups.

Rose Sai, a food processing member from

St Dominic's Community, said for the first time in her life she has been able to make SBD\$50 in one day by selling banana chips. She makes around 25 packets and sells every one for SBD\$2 per packet at market every Wednesday and Friday. She said: "Making banana chips is very easy work. It takes less time than making cassava pudding and you can sell more packets. It's a very helpful way of earning regular money because it doesn't depend on the seasons." She has ambitions to set up a small shop selling household items in her village with the money she is making from the banana chips. Others said they wanted to save towards paying for school fees.

Members say the scheme also gives them more food security during the nine-month rainy season, as they are able to buy in supplies of rice and flour to supplement their diets when subsistence gardens are flooded. It also brings money into an area which is seriously deprived of economic opportunities.

Selling the products in Honiara

The scheme has great potential for expansion if the products can be regularly shipped to Honiara. For a trade show in the capital, in July 2005, the groups were given a one-off opportunity to dispatch a thousand packets of banana chips by a Regional Assistance Mission to the Solomon Islands helicopter. This proved to be their most profitable venture yet, with most of the women making over SBD\$100 each.

The groups have also begun training to

produce jams, marmalades and chutneys that have a longer shelf life and are more portable. Kastom Gaden has begun to sell small loads whenever they can be sent via motor boat during visits. They hope this will become a weekly feature of its marketing service, Farmer Fresh, which provides a vegetable box delivery scheme for residents in Honiara.

Celestine hopes the scheme will become a small income generator for families across the Weather Coast. The programme will be expanded to neighbouring wards, Moli and Talise in the near future. "My vision is that each community will manage their own food processing project through our training and support. One day soon I hope we will have an agreement with retailers in Honiara to take produce from the Weather Coast."

Looking to the future

The weather may not change for the better, but such a development could mean these communities need no longer be completely at the mercy of the elements. It may also go some way towards addressing the inequity that has been and could potentially again be the catalyst for conflict. Celestine pointed out, however, that transport is the hardest problem to solve. This will take some serious investment in road or shipping infrastructure and a real acknowledgement by the Solomon Islands government and international aid agencies of the needs of the people of the Weather Coast. ■

ABOUT THE AUTHOR



● **Louise Hunt** is a freelance journalist. She spent six months in 2005 in the Solomon Islands working as a volunteer with the Turusuala Community Based Training Centre and the Kastom Gaden Association on Guadalcanal Island.

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Email: louise.hunt@gmail.com

FURTHER INFORMATION

● **In the Cyberlibrary:** The Tiempo Climate Cyberlibrary presents a listing of theme sites on Small Island States at www.tiempocyperclimate.org/portal/t3637web.htm

ACKNOWLEDGEMENTS

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Institutions for adaptation

Evans Kituyi describes how scientific institutions in Africa could better influence national policies and programmes to improve adaptation to climate change

The United Nations Framework Convention on Climate Change (UNFCCC) requires convention parties to take deliberate measures to enable ecosystems and socio-economic sectors to adapt to the adverse consequences of climate change. African countries are particularly vulnerable to climate change for a range of reasons, including a lack of adequate monitoring and early warning facilities, limited skilled human resources and few relevant science and technology applications.

According to Kofi Annan, Secretary-General of the United Nations, no nation can afford to be without its own independent scientific and technological capacity. New initiatives to strengthen national scientific capabilities worldwide and foster global cooperation may, therefore, be needed. Every nation should develop a science and technology strategy that reflects local priorities

(including support for basic science education and training) and allows nations to achieve local competence in selected areas of national priority.

But to achieve this, true science and technology partnerships between developed and developing countries are necessary. Kofi Annan has also observed that cooperation

MAIN POINTS

- **Evans Kituyi asserts** that all nations require a science and technology strategy. African nations in particular need stronger scientific and technological capacities to support climate change adaptation.
- **He explains** why African scientific and

science policy research outputs have not enhanced regional sectoral and community adaptive capacities.

- **He proposes** a framework, which stresses partnerships, to help African institutions influence the process of adaptation.

among the science and technology communities of different countries and regions yields a large collective reservoir of knowledge and expertise.

There is a clear need for African nations to build stronger scientific and technological capacities able to support development programmes, particularly those linked to climate change adaptation. Although past studies have made recommendations on how adoption of scientific and technological innovations could realize adaptive capacities in various sectors (for example, mosquito repellants to prevent malaria in the health sector), none have provided meaningful advice on how scientific institutions could be organized within a broader institutional framework to ensure effective communication and implementation of adaptation proposals.

Many recommended interventions operate in a 'stand alone' manner in their own sectoral cocoons, lacking the clear inter-sectoral

linkages needed to deal with the inherent complexities that characterize the impacts of a challenge such as climate change.

The article is based on a study that analysed institutions and available literature on adaptation in Africa. The study used focused consultations with experts and built on outcomes from the World Summit for Sustainable Development preparatory meetings. This discussion assesses the role of various institutions in generating and integrating scientific knowledge in national development policies and programmes that favour adaptation to climate change impacts. Specifically, it assesses why outputs from scientific and science policy research communities in Africa have not enhanced the adaptive capacities of communities and sectors in the region, particularly in the Least Developed Countries. This article proposes an innovative framework, which African institutions could adopt to effectively influence the process of adaptation to climate change. It also lists a set of requirements for this strategy to be effective.

Identifying institutions and their roles in adaptation

Adaptation activities have two main purposes: to reduce climate change damage; and to increase social and ecosystem resilience in response to the impacts that cannot be avoided. The table on this page gives examples of Kenyan institutions whose mandates address vulnerability and adaptation concerns.

SCIENCE AND TECHNOLOGY INSTITUTIONS AND THEIR ROLES

Key Roles	Institutional examples
Prediction of extreme events	Drought Monitoring Centre; meteorological department; universities
Technology development and dissemination	National research and development institutions; private sector; community organizations
Policy analysis/development	Science and technology policy institutions
Awareness raising	Non-government organizations such as Climate Network Africa; meteorological department
Capacity building	Drought Monitoring Centre; universities; non-government organizations

Numerous research projects and assessments have helped to greatly enhance scientific knowledge of climate change impacts in Africa. Similarly, various studies have elaborated priority sectors for adaptation studies and implementation in many African countries and regions such as East Africa. Given the urgency with which new approaches are needed to address adaptation more prominently than before, it is ironic that knowledge from these past assessments has not been integrated into national development policies and programmes. One key challenge involves developing alternative, innovative institutional arrangements in which local scientific institutions play a stronger role.

Challenges confronting institutional performance

Under current organizational structures, ef-

orts by African scientific and science policy research institutions are unlikely to be able to influence meaningfully community and sectoral adaptive capacities in African countries. This failure can be attributed to a range of challenges that have not been addressed over time.

Institutional programmes, strategic directions and planning processes are not necessarily informed by the need to contribute to and support national programmes linked to climate change adaptation.

Institutions are not sufficiently networked to exploit synergies and share knowledge and human, technological and material resources, hence cutting costs. As a result, the wealth of knowledge among community-based organizations and other non-government organizations has not been harnessed for national decision-making.

There are no organized mechanisms of collecting, collating, appropriately packaging and distributing information to decision-makers. Specifically, there are no systems to:

- regularly collect grassroots data;
- survey indigenous knowledge on coping-with the impacts of climate variability and integrate this knowledge into sectoral policies and programmes;
- learn lessons from experiences in other countries; and,
- track international debates on adaptation and participate in national, regional and international fora, where national positions would be lobbied for.

There is limited formal interaction with political leaders making it difficult to get adaptation high on the local political agenda. Key science and technology policy research findings are poorly communicated making it difficult to get policies and legislation which favour adaptation passed in parliament or incorporated into national programmes. Furthermore, it is difficult to attract funding for adaptation projects.

There are no formal organized mechanisms to coordinate activities by various stakeholders. This makes it difficult to measure the combined impact of existing piecemeal stakeholder activities.

Lessons from successful adaptation projects elsewhere

Many successful developing country adaptation projects have been reported in recent

climate change and development meetings. Such meetings include the workshop on community-based adaptation in Dhaka, Bangladesh, in February 2005, and the regular Development and Adaptation Days events at the annual UNFCCC Conference of Parties meetings.

For example, there has been a water security project for communities in Kenyan marginal lands. As part of this project a national non-governmental organization called the Sahelian Solutions Foundation (SASOL) works with the local Ministry of Water Resources and the Geology Department of the University of Nairobi. This local partnership collaborates with the Institute of Environmental

ing, this project demonstrates the importance of working with local partnerships.

In Nigeria, several adaptation strategies are in operation. These are based on a range of local projects that could alleviate climate change impacts and ensure food production and people's livelihoods are sustained. Feedback into national policy-making is proposed.

All these case studies have mechanisms for institutional interaction and providing feedback into the development of policy and programmes. Integrating these mechanisms with the basic elements that constitute good institutional arrangements for realizing sustainable development (see box on page 19),

“there is a clear need for African nations to build stronger scientific and technological capabilities”

Management (IVM) at the Free University of Amsterdam. SASOL coordinates information exchange with communities while the Ministry ensures government policy priorities are targeted. IVM mobilizes financial resources and ensures information is fed into international climate change policy debates.

In Bangladesh, CARE Canada coordinates a project where community-based organizations interact with local micro-finance institutions and local government to ensure food security in vulnerable communities. While CARE Canada facilitates international knowledge exchange and provision of fund-

yields a model that may be adopted for scaling up adaptation activities in vulnerable communities and sectors.

Basic features of this model include:

- multistakeholder project coordination;
- strong local partnerships among two or more institutions representing academia, civil society, government and social entrepreneurs or business; and,
- the critical role of international partnerships.

Projects fitting this model have managed to integrate indigenous knowledge into processes and programmes, build capacity

INSTITUTIONAL ARRANGEMENTS FOR SUSTAINABLE DEVELOPMENT

- Capture local complexities and realities - avoid global prescriptions for local situations.
- Involve local consultants, groups and institutions in design and implementation to harness local knowledge and lower overall transaction costs.
- Promote regular dialogue among researchers and policy/decision-makers.
- Promote engagement in local, regional or international knowledge networks.
- Promote tripartite partnerships involving government, civil society and business.
- Respond to national development priorities, and regional and international policy processes and agreements (such as National Strategies for Sustainable Development, the New Partnership for African Development, Multilateral Environment Agreements, the Millennium Development Goals, World Trade Organization processes).
- Ensure programmes help build local capacities, for example, by engaging masters and doctoral students.
- Use multidisciplinary approaches.
- Appropriately package and communicate research outcomes, and monitor impacts.

to handle technologies, increase national political awareness and continue to function after international partners have departed. Applying recently developed decision support tools could further strengthen the implementation of this model.

This model demonstrates that without support from an international partner institution, the local research and development institutions on their own are unlikely to attract any funding for adaptation programmes from abroad. This calls for increased efforts to find funding from local sources to support adaptation initiatives. Greater political awareness is also critical. Parliamentary committees on the environment are common in Africa and should be targeted for sensitization on adaptation with a view to influ-

encing policies and funding allocation for adaptation response programmes. Greater regional integration could be encouraged. For example, these committees could influence drought management programmes in the annual work plans of institutions such as the African Union, East African Community, Intergovernmental Authority for Development, and the Southern African Development Community. Successful international knowledge networking and partnerships require connectivity to modern information technology systems, particularly the Internet. Finally, such partnerships are bound to create challenges surrounding intellectual property rights if these are not foreseen and tackled during the project planning stage. ■

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FURTHER INFORMATION

● **On the Web:** The author has contributed a Ring Alliance Think Piece on African perspectives on European Union sustainable development policies, available at www.ring-alliance.org/documents/EU_think_piece--Africa1.pdf

CONFERENCES

Death by a Thousand Coasts: The Ethics of Climate Change

**Washington DC, USA
24-11-2006 to 27-11-2006**

Sponsored by the Inter-Research Science Center. Technical session themes include: earth systems and climate change; climate change and human history; ecology and biodiversity; economics and climate change; political responses to climate change; and, coastal disaster response, risk assessment and reconstruction. Key-note speakers will focus on climate change and the fate of civilizations, climate change and biodiversity, and the economic challenges of climate change.

Details: Ethics Symposium Organizer, Eco-Ethics International Union, Nord-buente 28, 21385 Oldendorf/Luhe, Germany. Fax: +49-41328883.

*Email: eei@eeiu.org
On the Web: www.eei.org*

International Conference: The Humboldt Current System

**Lima, Peru
27-11-2006 to 01-12-2006**

Working theme of the conference is "Climate, Ocean Dynamics, Ecosystem Processes, and Fisheries". Intended to advance present understanding of the Humboldt Current System. Aims to initiate new regional integration and synthesis and foster exchanges among regional and international experts. Challenges include synthesis of available data, application of improved numerical models

and integration across disciplines and habitats.

*Details: HCS International Conference, c/o Representacion IRD en el Peru, Casilla 18-1209, Lima 18, Peru.
Email: hcsconference@amauta.net.pe
On the Web: <http://irdal.ird.fr/hcs-conference.imparpe.fao.ird.php3>*

1st International Conference on the Management of Natural Resources, Sustainable Development & Ecological Hazards

**Bariloche, Argentina
12-12-2006 to 14-12-2006**

Subtitle of the conference is "The Ravage of the Planet 2006". Organized by Wessex Institute of Technology and the University of Siena, Italy. Participants will come from a broad, diverse range of fields for dialogue on: water resources; ecology; energy; planning and development; learning from nature; and, new technologies.

Details: Zoey Bluff, Conference Secretariat, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, UK. Fax: +44-238-0292853.

*Email: zbluff@wessex.ac.uk
On the Web: www.wessex.ac.uk/conferences/2006/planet06/index.html*

3rd Future Environmental Trends Conference

**Bangalore, India
14-12-2006 to 16-12-2006**

Working theme is "Energy, environment and development: analysing opportunities for reducing poverty". Intended that the conference will focus

on the challenges that arise from the nexus between energy, environment and poverty. Will identify an agenda for action and research for Asia.

Details: Conference Organizer, Institut Veolia Environnement, 15, rue Sablons, 75016 Paris, France.

Fax: +33-1-53432286.

Email: eed@teri.res.in

On the Web: www.teriin.org/events_inside.php_id_17298

International Workshop on Community Based Adaptation to Climate Change

**Dhaka, Bangladesh
11-01-2007 to 16-01-2007**

Workshop follows on from the first which was held two years ago. Will consist of two days field visits to see community-based adaptation activities and three days interactive discussions on different thematic areas in Dhaka. Aims to share latest developments in adaptation programmes and discuss priorities and solutions.

*Details: Workshop Secretariat, Bangladesh Centre for Advanced Studies, House 10, Road 16A, Gulshan-1, Dhaka 1212, Bangladesh. Fax: +880-2-8851417.
Email: ccadaptation.workshop@bcas.net*

On the Web: www.bcas.net

International Dialogue on Science & Practice in Sustainable Development

**Chiang Mai, Thailand
23-01-2007 to 27-01-2007**

Subtheme of the conference is "Link-

ing Knowledge with Action". Aims to foster effective collaborations between scientists and practitioners to advance the practice of sustainable development, through knowledge sharing and promoting national, regional and international actions and implementation.

Details: Jill Jaeger, IDSP Executive Director, c/o Sustainable Europe Research Institute, Garnisongasse 7/27, A-1090 Vienna, Austria.

Fax: +43-1-2632104.

Email: jill.jaeger@seri.at

On the Web: www.sustdialogue.org

2007 European Renewable Energy Policy Conference

**Brussels, Belgium
29-01-2007 to 31-01-2007**

Supported by the European Solar Thermal Industry Federation. Expected that over 650 participants will attend. Main background fields of attendees include: EU institutions and representations; national and local governments and administrations; energy agencies; energy regulators and power companies; renewable energy industries; environmental NGOs and consumer groups; and, consultancies.

Details: Kathrin Braun, European Renewable Energy Council, Renewable Energy House, Rue d'Arlon 63-65, B-1040 Brussels, Belgium.

Fax: +32-2-5461934.

Email: braun@erec-renewables.org

On the Web: www.erec-renewables.org

4th International Biofuels Conference

**New Delhi, India
01-02-2007 to 02-02-2007**

Conference participants will come from a broad range of fields including policy and decision makers, R&D specialists, entrepreneurs, and financial and venture capitalists. Main themes for discussion will cover policy, finance, technology, regulatory and other issues on biofuels. There will be a number of keynote addresses made by international experts in this field.

Details: Anil Kumar, Program Manager - Outreach, Winrock International India, 1 Navjeevan Vihar, New Delhi 110017, India. Fax: +91-11-26693881. Email: anil@winrockindia.org On the Web: www.winrockindia.org/4rdintbioconf.htm

European Energy Efficiency Conference

**Wels, Austria
01-03-2007 to 03-03-2007**

The one-day conference will be held within the framework of World Sustainable Energy Days 2007. Other conferences alongside this event will be the "World Sustainable Energy Days", the "Energy Future 2030 Conference", the "Rural Development and Sustainable Energy Seminar" and the "European Pellets Forum". Other events will include an exhibition and trade show dedicated to renewable energy sources as well as site visits to energy efficiency projects.

Details: Christiane Egger, Conference

Director, O.Oe. Energiesparverband, Landstrasse 45, A-4020 Linz, Austria. Fax: +43-732-772014383. Email: office@esv.or.at On the Web: www.esv.or.at | www.wsed.at

5th Session of the Committee for the Review of the UN Convention to Combat Desertification (CRIC-5)

**Buenos Aires, Argentina
07-03-2007 to 22-03-2007**

Exact dates have not yet been determined. Participants will review the implementation of the Convention and its institutional arrangements. Preparation documents to assist country Parties are available for delegates and observers through the UNCCD Secretariat. Consideration of necessary adjustments to the elaboration process and the implementation of action programmes will also be discussed.

Details: UNCCD Secretariat, PO Box 260 129, Haus Carstanjen, D-53153 Bonn, Germany. Fax: +49-228-8152898. Email: secretariat@unccd.int On the Web: www.unccd.int

Secure & Sustainable Living: Social & Economic Benefits of Weather, Climate & Water Services

**Madrid, Spain
19-03-2007 to 23-03-2007**

Organized by WMO, the conference will focus on the social and economic benefits to society of the products and

services provided by the meteorological and hydrological community, especially the National Meteorological and Hydrological Services and WMO member states. Intended to be an opportunity for dialogue amongst various sectors of society to make more effective weather information.

Details: Madrid Event Organizer, WMO, Case Postale 2300, CH-1211 Geneva 2, Switzerland. Fax: +41-22-7308181. Email: madrid07@wmo.int On the Web: www.wmo.int

2nd International European Water Association Conference: Water in Protected Areas

**Dubrovnik, Croatia
25-04-2007 to 27-04-2007**

Co-organized by UNESCO and the International Water Association. Conference aims to discuss important issues, challenges and strategies together with threats to the conservation and rational use of protected water ecosystems. Topics will cover: water management in national parks; protected resources; threats to islands and coastal zones; and, water infrastructure in ancient cities.

Details: Croatian Water Pollution Control Society, Ulica grada Vukovara 220, 10000 Zagreb, Croatia. Fax: +385-1-6118570. Email: hdzv@voda.hr On the Web: www.hdzv.hr

World Environmental & Water Resources Congress Tampa, USA

15-05-2007 to 19-05-2007

Intended that participants will share insights from research and case studies to generate best practices for the future with focus on habitat restoration. Topics include: environmental process; irrigation and drainage; planning and management; river restoration; international issues; eco-hydraulics and eco-hydrology; and, groundwater hydrology, quality and management.

Details: Diane Pane, Conference Coordinator, ASCE World Headquarters, 1801 Alexander Bell Drive, Reston, Virginia 20191-4400, USA. Fax: +1-703-2956222. Email: dpane@asce.org On the Web: www.asce.org

International Wind Energy Workshop: Wind Energy in the Energy Revolution in Cuba

**Havana, Cuba
22-05-2007 to 25-05-2007**

Workshop will provide a forum for discussion of updates in topics related to renewable energy technology, business, market and policies in renewable energy, energy efficiency and energy education. Aimed at energy professionals as well as those working in the field from academia.

Details: Antonio Sarmiento Sera Centro de Estudios de Tecnologías Energy Renewable, ISPJAE, Calle 127 s/n Marianao, CP 19 390, Havana, Cuba. Fax: + 53-7-2671644.

Email: cier_2007@ceter.cujae.edu.cu On the Web: www.cujae.edu.cu/eventos/cier

The story of the Yellow River

Li Moxuan describes her journey up the Yellow River, documenting the impacts of climate change on the environment and local people

Suobao is Tibetan. He is 35 years old, his family moved here in 1985 and he now lives with his mother, wife and three brothers at the foot of Anemaqing Mountain. This mountain harbours nearly 96 per cent of the glacier that feeds into the Yellow River. Each summer melted snow provides seasonal water flow to the river, which starts at over 5000 metres high on the Qinghai-Tibetan plateau and imperially winds its way down through China's land and history. The river, known as the 'cradle of the Chinese civilization', has fed the Chinese people since time immemorial.

Suobao describes changes in the main glacier of Anemaqing Mountain - the Halong Glacier - over the last 25 years. "The ice has retreated hugely. The end of white ice used to run nearly parallel with that of the black ice, but now, you should go and see it for yourself. The black ice is way ahead of the white ice, both are turning back to the mountain."

In front of the glacier, Professor Lu interpreted Suobao's message. Rocks and rubble carried by the movement of the glacier pile up at the end of the ice and are known as a moraine. As the glacier retreats, the moraine piles up, changing the landscape. The 'black ice', like the 'white ice', is actually the ice tongue, indicating the end of glacier. The difference is that the black ice is covered by

MAIN POINTS

- **Li Moxuan explains** that climate change induced glacier retreat and melting permafrost have significantly reduced water volumes in the Yellow River source region.
- **Melting permafrost** also destroys houses and road in-

frastructure, drinking water is scarce and reduced water quantities contribute to poor pastures.

- **Poverty is increasing**, particularly amongst herdsman, and people are at risk from ice avalanches and glacial lake outburst.

the moraine and thus melts much slower than the white ice. The discrepancy between their melting speeds is another indicator of drastic climate change. Glaciers are sensitive and react to even the slightest change in temperature. They provide reliable information on historical temperature changes. Professor Lu's remote sensing maps show that during the past 30 years, the Halong Glaciers have shrunk in area by 17 per cent. Since 1966, the Yellow River has lost 23.9 billion cubic metres of water from its source region due to glacier retreat.

The Hadley Center in the United Kingdom predicts that by 2100 the Tibetan Plateau will have undergone a temperature rise of 2.0 to 3.6 degrees Celsius. Roughly 50 per cent of China's glaciers in the northwest will be gone by 2050. This is a time bomb for the great rivers of China as diminishing glaciers drain their source regions.

In the short-term, glacier retreat causes



Headwaters of the Yellow River - Tibetan Plateau

Photo: ©Hugh Turral

other climate calamities. Local people described an incident on March 18th, 2004, when Anemaqing Mountain had the biggest 'snow avalanche' in its history. The avalanche was 5000 metres long, 3000 metres wide and 300 metres deep at its deepest point. Over 2640 hectares of autumn pasture were destroyed. Today, the green grassland looks like it has been erased by a colossal coal mine

or a volcanic eruption. Black rocks and rubble are everywhere you look. Scientists suggest that this was an 'ice avalanche' instead of a snow avalanche. Some 5500 metres up the western side of the Anemaqing Mountain, a large dark area shows where the avalanche started. This area used to be covered by ancient glacier ice. Rapid temperature rises melted the glacier's ice tongue, and the vari-

able velocity of different parts of the glacier created tremendous uneven pressure within the glacier. Steep slopes aggravated the situation and eventually the glacier explosively broke off. Together with the bulky snow pack on top and the dark moraine, the glacier and a large part of the mountain itself flew downward with brutal force. The blast spread over 15km². Fourteen months later, the impact of that moment is still palpatingly alive to any visitor.

The fallen glacier together with the moraine blocked the watercourse where three rivers - Qingshui, Damaqu and Quanlong - joined. A lake was formed, which continues to grow every day. The moraine dam, however, is increasingly unstable, with large visible, and even audible, cracks. Small rocks and ice pieces continue to fall into the lake from the dam, which now rises only five to ten metres above the water. A rise in water level due to torrential rain or fast glacier melt will cause the moraine dam to collapse. Some 40 kilometres downstream from this glacial lake, Xiadawu Township with its 175 households is located. What will happen to this township when the lake outbursts?

The journey to Hua Shixia Township is over permafrost, known as 'Dong Tu' in Chinese, which literally means frozen land. In the past 20 years, perennial permafrost in the Yellow River source region has retreated on a vast scale. As the mean land temperature has increased, the limit of the perennial permafrost has moved. In the north region of the Yellow

River source area, seasonal permafrost has seen a temperature rise of 0.4 to 0.6 degrees Celsius, and has moved 50 to 70 metres up the mountain.

Abandoned houses characterize the region. The thawing permafrost affects house foundations and causes house walls to tilt and crack. Highways are also disrupted. Roads, though scrupulously constructed to cope with various climate situations, cannot cope with climate change. The permafrost underneath has melted so rapidly and unexpectedly that the tar above, once flat and smooth, now rises and falls in dramatic waves. The yellow line in the road centre curves so much it is known as 'dancing road'. Every year the Chinese government revamps the highway on the Tibetan plateau and every three years it completely rebuilds it because the 'dancing roads' kill many drivers.

Melting permafrost has also led to the gradual loss of a natural barrier to water infiltration through the soil. This has reduced underground water quantities. Lower groundwater levels have reduced vegetation cover and led to desertification and soil salinization. In time, these will cause general land degradation and desertification of the Yellow River source region. Permafrost plays a vital role in shaping the hydrological cycle in the Yellow River source region, and the increasingly severe disruption of the permafrost by rising temperatures is responsible for widespread general environmental devastation in the area.



Halong Glacier, Qinghai-Tibet Plateau.

Top photo 1981 © Matthias Kühle

Bottom photo 2005 © John Novis/Greenpeace

Although the first trickle of water forming the Yellow River comes from Bayankala Mountain, the twin lakes of Zha Ling and E Ling are acknowledged as the official origin of the Yellow River. E Ling Lake is the world's largest high plateau lake. Twenty kilometres

away in the E Ling Township, Cai Jiarang described the suffering of local people. He is 38 years old and grew up here. He remembered his youth when the water in the Yellow River was high, grass was nearly at waist height (now it barely reaches the toe), and springs

abounded in the region. But now the Yellow River runs lower each year, and cattle and herdsmen have difficulty accessing drinking water. During low water season - in September to March - village people rely on their wells, but nomads have to eat snow and melt ice to drink.

In the past 50 years, the water level in the twin lakes has dropped by an average of three to four metres. In 2001, the Yellow River stopped flowing between the twin lakes for the first time in recorded history. In the year 2000 alone, the water area in the Yellow River source region (rivers, lakes and reservoirs) has decreased by more than 15 per cent. Professor Lu believes that dwindling rainfall and high evaporation rates have reduced water resources on the ground and in lakes, and caused salinization, wetland deterioration and lake disappearance.

East of the twin lakes are a group of 4077 lakes known as the Star Sea Lakes. Over the past 20 years, more than 2000 have completely dried up and there are only 261 left with an area larger than 0.06 square kilometres. New roads are now built across dry lake beds and some lake banks have receded 30 to 40 metres.

A comparison of remote sensing maps for the area for 1986 and 2000 reveals significant lake shrinkage. The Star Sea Lakes are now nearly disconnected from the Yellow River, which has experienced reduced river runoff as a result. Hydrological records for the Yellow River source region show that since 1995

evaporation rates have drastically increased each year at a rate far exceeding rainfall rates. The effects of climate change are clear. Lake shrinkage has reduced the replenishment of underground water resources causing the aquifer level to drop. Since the 1980s, the Yellow River source region has seen a drop

“this is a time bomb for the great rivers of China as diminishing glaciers drain their source regions”

of seven to ten metres in underground water levels. Lakeside wetlands which serve as a buffer zone to protect the lake are quickly drying out.

Tibetan people have an uninhibited passion and respect for life, despite all its difficulties. Many have golden teeth, which adds to the effect of their broad grins. They are proud and honest and Tibetan women wear their precious jewellery and best clothes even for daily work. Families invest all their money in yaks, cattle and sheep. They stubbornly cling to their habits, culture and way of life. They do, however, suffer from resistance to change.

During the past 20 years, permafrost deterioration and lake shrinkage has caused dramatic grassland deterioration, aggravated by overgrazing. Loss of water and grassland has meant loss of cattle and impoverishment. Luo Wa from Yellow River Township is 80 years old. He owns only his dark house and bright yellow robes, and lives on govern-

ment rations with his wife. They used to own many cattle but can no longer even afford salt. Ben Luo is 79 years old. She used to have 140 sheep and 140 yaks but now lives with her granddaughter and has no income at all. Another woman once had 20 cattle and 30 sheep, which her husband enjoyed as a

dowry when they married 15 years ago. Now they have none left and her husband is barely home as he travels around to find odd jobs to support his family.

Yellow River Township is full of environmental refugees who live on government rations and reminisce about the waist-high green grass and abundant streams and springs. As the environment rapidly worsens, herdsmen are becoming particularly impoverished. Plans for the latter half of the year involve 105 households from Huanghe Township moving to Tongde County, Hainan Prefecture, as part of the government's 'returning pasture to grassland' project. There they will live in new houses and receive money to start a new life.

Yellow River Township is in Maduo County, known as the 'first county of the Yellow River'. In 1964, Maduo County began becoming rich, and, from 1979 to 1982, it boasted the best pasture in China and became the richest county in the country. At that time, Maduo

had 670,000 sheep and 6000 people. In the early 1990s, drought, water problems and vegetation degeneration struck the county grasslands. The green grass which people used to cut and store each year as winter fodder shrank to ground level. Nearly all the springs dried up. Today, Maduo County has 260,000 sheep and over 10,000 people. It has become the nation's poorest county.

La Bao, director of Maduo County from 1966 to 1984, states "it is getting warmer and warmer. We used to wear cotton padded coats in winter, now only fleece will do." La Bao's 36 year old son-in-law, Ni Qie, said recent dry years include 1996, 1997 and 2000, but that last year was very hard and, in general, things are getting worse. In winter there is difficulty accessing drinking water in grazing areas. In Hua Shixia County, people have no drinking water and all the wells have dried up. Selling water is a lucrative business in winter. Ni Qie works for the local public security bureau and part of his job involves persuading herdsmen to participate in the government's 'returning pasture to grassland' project. He reports that initially there was resistance amongst herdsmen who were unwilling to completely change their lifestyle and felt reluctant to leave their homeland. But increasingly people realize that the only way to save their homeland is to leave it.

In 2002, China invested over 100,000,000 yuan in a hydropower station so that Maduo County could be powered with electricity. The two generators have a total capacity of

2400kW, but only one is currently working. The current reservoir water level is 4268 metres, which is only marginally higher than the lowest operating water level of 4260 metres. In 2005 the power station only started working on April 14. In 2004 it did not generate any electricity at all due to the extremely low water levels of the Yellow River, and all the station workers went to find work elsewhere. Rainfall is better this year, but prospects look bleak with diminishing water resources and glacier retreat in the Yellow River source region.

Maduo County, which moved to its current site in 1976 to avoid frequent flooding, will be moved again to improve living conditions and protect the environment. This time, ironically, the move is due to lack of water. La Bao says that as long as there is a bit of water in the well he will not move, but Ni Qie feels the whole county should be displaced to protect the Yellow River source region and invest in everyone's future.

During the past ten years, climate change and ecological deterioration have reduced water volumes in the Yellow River source region by 23 per cent. Scientists predict that the Tibetan plateau will see temperature rises of 1.4 degrees in the next 25 years, and in just half that time the Yellow River source region will lose 50 per cent more water. What is at stake then will not be one hydro station or some herdsmen, it will be the plight of a whole river and a challenge to the whole nation. ■

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FURTHER INFORMATION

● **On the Web:** A longer version of this article is available at http://activism.greenpeace.org/yellowriver/YRS_Feature.pdf



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Capturing the synergies

It makes particular sense to link the climate change and the desertification conventions for three main reasons. First, many of those most vulnerable to climate change are poor people living in dryland areas. Climate adaptation measures, as implemented through the National Adaptation Programmes of Action, will necessarily have to focus on drylands, and dryland concerns will have to play a major role in such measures.

Second, the desertification convention focuses attention on particular development issues, such as strengthening alternative livelihoods, that in themselves constitute critical forms of climate adaptation. Existing action plans related to the desertification convention may provide an entry point to addressing climate adaptation in a way that is more focused on livelihoods than has so far been the case.

Third, linking the two conventions rather than designing, implementing and managing climate policy separately from ongoing activities to manage desertification makes

sense from an efficiency and mainstreaming perspective, particularly in countries with scarce financial and human resources.

There are, however, several challenges in realizing the undoubted synergies. Desertification measures focused on improving the drought resistance of agriculture can be

THE FINAL WORD

Siri Eriksen links action on climate change and desertification

integrated in a fairly uncontroversial manner to reduce sensitivity to future climatic change. Other types of desertification measures may, however, prove problematic. For example, drylands populations often rely on

access to indigenous plant resources to carry out their drought coping strategies, including grazing, food supply and handicrafts. These practices can be considered inappropriate, a tool long used by governments to legitimize control over dryland populations and resources, and some desertification measures focus, unwisely, on the absolute protection of vegetation from human activity. Climate adaptation, though, demands support for drought livelihoods through continued, sustainable access to indigenous

resources during times of climate stress. We may need to re-think measures designed in response to drylands degradation alone.

A further challenge is institutional and financial. Financial mechanisms related to the climate convention provide new and more promising sources of funding than those related to the desertification convention. The types of activities that can be paid for through the climate convention are, however, subject to close scrutiny and this may limit the opportunities to implement measures that focus specifically on strengthening livelihoods. Notwithstanding the relevance to climate adaptation, official development assistance may well become the most appropriate source of funding for actions targeting livelihood security. Coordination of such actions with those funded through the climate convention is critical.



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