

## **Climate change impacts on development. A note of Oxfam's experiences for the Stern Review.**

Climate change – in the sense of rapid, large-scale and noticeable climate change, unusual in people's experience – is happening already. This is having important economic and social effects. It is making life more precarious for many people, particularly those who are already the poorest. Yet people are not passive, but are changing their lives in various ways in order to adapt.

Climate change has been implicated in a growing number of disasters to which Oxfam has to respond, from hurricanes to droughts (for further information see the Red Cross/Red Crescent Climate Centre, [www.climatecentre.org](http://www.climatecentre.org)). However, this paper looks rather at some impacts of climate change on people's day-to-day lives in the "development" sphere. It is based on Oxfam experience or on cases brought to our attention.

In the main, climate change, rather than introducing radically new phenomena, exacerbates existing climatic variability, and exacerbates existing problems, notably of poor water management. Similarly, people's adaptive strategies are often based on doing more of the same as their ancestors, but some strategies are more radical or innovative.

In the future problems are likely to affect not only more "weather-dependent" and rural societies, but also a wider range of seemingly less susceptible ones, for example city-dwellers whose water supply is further reduced.

Some changes are sometimes beneficial to some groups, but the longer-term sustainability of these beneficial conditions is open to doubt. It is important to understand the unequal impacts of climate change on different groups in different places, as well as the particular ways different societies will try to cope or adapt.

### **Climate matters: Living with increasing climate variability and uncertainty in southern Africa**

The ADAPTIVE research project<sup>1</sup> has investigated farmers' perceptions of, and responses to, changes in the summer rainfall zone of South Africa.

Individuals, communities, and nations have, to varying degrees, had to cope with and adapt to climate variability and change for centuries. So, in order to better understand how societies may adapt to future climate change, it is necessary to understand human behaviour and decision making as well as having a firm grounding in climate science.

#### ***Understanding climate variability and uncertainty***

For farmers in South Africa, the concepts of "drought" or "extreme" rainfall are not necessarily sufficient to capture the dynamics of climate variability that are critical to decision making. Factors such as the *timing* of the onset of first rains (which affects

crop planting regimes), the *distribution* of rainfalls within the growing season, and the *effectiveness* of the rains, are all real criteria that affect the success of farming. Therefore better *drought* forecasting per se may not be enough to help people cope with climate uncertainty and change.

**Table 1 Climate parameter characteristics for the three study areas in South Africa**

Climate parameter	Limpopo Province (northern area)  Case study village: MANTSIE	NW Province (west of Mafikeng)  Case study village: KHOMELE	KwaZulu Natal (eastern area of the northwest of the province)  Case study village: eMCITSHENI
Long term mean annual rainfall	400-500mm	500-600mm	8000-900mm
Onset of season characteristics	Growing length of dry season, later start to wet season in October to early November	Early wet season rain days have been increasing (Sept-Oct)	Highly variable and increasingly uncertain. Increase in early season rains with parallel decline in late season rains (Feb-March) for some years.
Within season characteristics	Within wet season a trend towards fewer rain days in Nov and Dec and an increase in overall occurrence of dry spells	Variability in rainfall amounts and distribution with no specific wetting or drying trends identifiable	Higher rainfall in first half of growing season, characteristically heavier rainfall events with lower rainfall events later in the season.
Drought frequency	Frequent in the last two decades: 1982-3, 1987, 1990 and 1994	Regular over the last 50 years	No trend

Individual people in the case study areas showed an acute awareness of the changing climate trends around them. Where repeated exposure to an event has occurred, such as with drought in Mantsie, familiarity and experience mean it can be viewed very differently from other ‘surprise’ events (like flooding) which occur less often. As one farmer said:

*“Drought is easier to cope with because we are used to it, the heavy rains are not good because we need a little and often”.*

And climate matters: amongst all the disturbances that affect African societies today, including the impact of HIV-AIDS and political disturbances, local people say climate change is significant.

The ADAPTIVE work has identified differing forms of responses to climate variability and change. These are outlined in Table 2. The strategies are either simply means of ‘getting by’, or *coping*, or represent real forms of *adaptation* to the changes in precipitation parameters. Some of these responses, such as diversifying livelihoods, are not unique to climate disturbances, but importantly have been clearly identified by rural people themselves here as *deliberate* responses to climate triggers. The

following definition as to what is “coping” and what is “adapting” also come from the people themselves.

**Table 2: Impacts of, and responses to, locally identified climate parameters in the study villages**

<b>MANTSIE</b>		
<b>Parameters identified by focus group</b>	<b>Perceived impact</b>	<b>Range of responses – rapid (coping) and longer-term (adaptation)</b>
Little rain Breaks in rainy season	<p><i>On welfare of household</i></p> <ul style="list-style-type: none"> <li>• Hunger</li> <li>• Demands from family and friends for food</li> <li>• Sickness and tiredness</li> </ul> <p><i>On natural resource- based livelihoods</i></p> <ul style="list-style-type: none"> <li>• Crops die</li> <li>• Loss of seeds</li> <li>• Less fodder for animals to eat</li> <li>• Debt (money owed from ploughing)</li> <li>• Young animals die</li> <li>• Less grass</li> </ul>	<p><i>Change a farming practice – coping</i></p> <ul style="list-style-type: none"> <li>• Buy salt</li> <li>• Store fodder</li> <li>• Go to town to buy more seeds</li> </ul> <p><i>Spatial/temporal diversity-adapting</i></p> <ul style="list-style-type: none"> <li>• Eat wild fruits</li> <li>• Look at plants and birds to decide what can be planted when and where</li> <li>• Buy short-maturing crop varieties</li> <li>• Take smallstock to river area or other villages</li> </ul> <p><i>Commercialising –adapting</i></p> <ul style="list-style-type: none"> <li>• Sell your animals</li> <li>• Try to start a business</li> <li>• Travel to town to find work</li> </ul> <p><i>Networks- coping and adapting</i></p> <ul style="list-style-type: none"> <li>• Send someone from the community to ask the government what they will do to help</li> <li>• Go to church</li> <li>• Ask family elsewhere to help</li> <li>• Collect your welfare payments/food</li> <li>• Steal</li> </ul>
<b>KHOMELE</b>		
<b>Parameter</b>	<b>Impact</b>	<b>Response</b>
Less rain Period of no rain Unpredictable rain Rain out of season Late rain	<p><i>On welfare of household</i></p> <ul style="list-style-type: none"> <li>• Tiredness and hunger</li> </ul> <p><i>On natural resource based livelihoods</i></p> <ul style="list-style-type: none"> <li>• Seeds do not germinate</li> <li>• Makes soil more unproductive</li> <li>• Affects planning – cannot tell the rainfall patterns by flowers on wild plants</li> <li>• Poor quality grass</li> <li>• Livestock die</li> <li>• Dryland crops die</li> <li>• Pests proliferate</li> <li>• Leaves change colour</li> </ul>	<p><i>Change a farming practice – coping</i></p> <ul style="list-style-type: none"> <li>• Grind maize stalks as feed</li> <li>• Use resistant yellow maize</li> <li>• Plant late maturing fruit trees</li> </ul> <p><i>Spatial/temp diversity-adapting</i></p> <ul style="list-style-type: none"> <li>• Use irrigated land</li> <li>• Eat wild fruits</li> <li>• Work land in other places</li> <li>• Cut fodder from ironwood trees and collect seeds from wild plants</li> </ul> <p><i>Commercialising –adapting</i></p> <ul style="list-style-type: none"> <li>• Gardening projects to improve food security</li> <li>• Form groups to start new business venture</li> <li>• Sell livestock, esp. at auction</li> </ul>

	<ul style="list-style-type: none"> <li>• Less water for animals</li> <li>• More thorn bushes</li> </ul>	<ul style="list-style-type: none"> <li>• Look for piece work</li> <li>• Plant winter crops</li> <li>• Plant late maturing fruit trees</li> <li>• Breed indigenous species</li> </ul> <p><i>Networks- coping and adapting</i></p> <ul style="list-style-type: none"> <li>• Ask for money from relatives</li> <li>• Get help from government e.g. subsidised feed</li> <li>• Have village meeting</li> <li>• Local leasers decide what to do</li> <li>• Advice from church</li> <li>• Get medicines</li> </ul>
<b>EMCITSHENI</b>		
<b>Parameter</b>	<b>Impact</b>	<b>Response</b>
Changing seasons Hail Drought Frost Heavy rain Snow	<p><i>On natural resource based livelihoods</i></p> <ul style="list-style-type: none"> <li>• No feed for animals</li> <li>• Makes soil more unproductive</li> <li>• Animals die</li> <li>• Can't afford to buy good seeds</li> <li>• Can't sell crops</li> <li>• Lack money (no crop/livestock sales)</li> <li>• No money for transport</li> <li>• Crops die</li> </ul>	<p><i>Change a farming practice – coping</i></p> <ul style="list-style-type: none"> <li>• Store fodder</li> <li>• Build cattle shelter</li> </ul> <p><i>Spatial/temp diversity-adapting</i></p> <ul style="list-style-type: none"> <li>• Change type of vegetable or maize type</li> </ul> <p><i>Commercialising –adapting</i></p> <ul style="list-style-type: none"> <li>• Change type of vegetable or maize type (related to sale opportunities)</li> <li>• Plant vegetables</li> <li>• Sell livestock or goods</li> <li>• Start projects</li> <li>• Find work</li> </ul> <p><i>Networks- coping and adapting</i></p> <ul style="list-style-type: none"> <li>• Borrow from family</li> <li>• Apply for government grant</li> <li>• Have village meeting</li> <li>• Pray at church</li> <li>• Ask extension officer for information</li> </ul>

The ADAPTIVE project also found that some forms of response were occurring in all three areas. Commercialising small-scale agricultural production was important in all areas, creating a source of cash that can then be used flexibly to meet household needs.

The findings illustrate that concerns about the effects of climate change on rural societies are justified: climate change is happening, and it is affecting activities that depend on the natural environment. However, far from being passive victims, people recognise even subtle changes in climate parameters, and take steps to respond to them.

Some of these responses may be positively beneficial; some though, may be harmful, in the short or long-term. Either way, people are making significant changes in their lives. Inevitably, there will be winners and losers in the process. Some people will adapt more successfully than others, and it may be that climate change will result in a polarisation of wealth and well-being in ways we have not seen before.

Source: ADAPTIVE/Oxfam (published in “Africa – Up in Smoke?”, 2005)

**Perceptions of climate change in the Himalayas:**

A similar programme of research (in this case unconnected to Oxfam) has recently been reported on (see Tiempo magazine, published by the International Institute for Environment and Development, Issue 56, July 2005, [www.tiempocyberclimate.org](http://www.tiempocyberclimate.org))

Ngamindra Dahal, Energy and Climate Change Co-ordinator at the King Mahendra Trust for Nature Conservation, Nepal, interviewed communities in Mustang and Manang Districts. The results are summarised in the table below.

It should be noted that some changes are, at least in the short-term, beneficial, and have even been such as to engender an air of optimism among many people interviewed. These include being able to grow apples at higher altitudes, bigger, tastier fruit, and successful farming of new and more vegetables without need for greenhouses. Older people find their villages more comfortable due to higher winter temperatures. However, these benefits may be relatively short-lived, with water management the greatest looming problem, and other groups are suffering negative consequences from the changes. Growers of wheat and potatoes have done badly, as have cattle and sheep farmers because of the declining production of grass, due to reduced snow deposits. Roof leakage and wall-erosion due to the more intense rainfall particularly hurts low-income families who cannot afford repairs.

## IMPACTS ON LIFE AND LIVELIHOOD SOURCES

<b>Changes in temperature, wind and precipitation</b>	<ul style="list-style-type: none"> <li>• Winters are less cold and frosty</li> <li>• The river valleys of Kali Gandaki are getting windier</li> <li>• Less snowfall in winter</li> <li>• Increased rain and snowfall after winter</li> <li>• Unusually intense summer rainfall</li> </ul>
<b>Weather hazards</b>	<ul style="list-style-type: none"> <li>• Increased frequency of avalanches, flash floods, windstorms and hailstorms</li> <li>• Rainfall patterns are getting more erratic; there are long droughts and sudden heavy rains</li> <li>• More loss of life and property from harsh weather incidents</li> </ul>
<b>Vegetation</b>	<ul style="list-style-type: none"> <li>• The altitude of the tree line is rising</li> <li>• Grasslands are less green because reduced snowfall results in moisture deficiencies and less grass production</li> </ul>
<b>Water supply and housing</b>	<ul style="list-style-type: none"> <li>• Reduced water flow in local streams and springs</li> <li>• Unpredictable fluctuation in flow levels and timing of seasonal spring recharging</li> <li>• More roof leakage and wall erosion in traditional mud houses</li> <li>• Water supply is a major problem leading to the abandonment of some old settlements in Mustang</li> </ul>
<b>Agriculture</b>	<ul style="list-style-type: none"> <li>• Bigger tasty apples at higher altitudes where it used to be too cold for apple farming; apple orchards and nursery farms are emerging</li> <li>• Successful farming of cabbage, cauliflower, cucumber, chili and tomatoes in open gardens (without a greenhouse)</li> </ul>
<b>Lifestyle/business</b>	<ul style="list-style-type: none"> <li>• Older people find their villages more comfortable due to warmer winters</li> <li>• Tourism businesses are more profitable due to longer drought periods in the post monsoon months</li> <li>• Agricultural businesses suffer due to reduced irrigation and variable precipitation patterns</li> </ul>

Source: Based on personal observations and communications with local residents and development workers in Mustang and Manang between October 2003 and March 2005.

### **Renewing livelihoods in the face of climate change and disruption in rural Mozambique**

A second ADAPTIVE case study is from Mozambique. Despite civil war and major floods and drought, Mozambique has emerged in the 21<sup>st</sup> century as a country of progress and possibilities, a flagship of renewal in Africa. The ADAPTIVE research project<sup>1</sup> set out to investigate how rural people have adapted to these disturbances so that rural communities can be better supported in the face of future changes, especially climate change.

Research focused on the community of Nwadjahane in Gaza Province in southern Mozambique. The village was established in the 1980s following displacement from surrounding areas during the civil war. Over the years, villagers have had to live with political and economic instability, drought and major flood and storm damage. Despite these difficult circumstances villagers have developed creative and innovative ways of coping and adapting to this uncertainty and change.

#### **Reorganising social networks to maintain resilient livelihoods**

Social networks are the links and connections that individuals and households have with family, neighbours and friends. Within Nwadjahane these have evolved and

changed over the last 20 years. A fundamental shift is from paying people with cash in exchange for help with tasks on the farm, to “traditional” forms of non-cash bartering such as exchanging labour. Villagers explain that this is due to the combined drivers of less cash within the local economy (linked to wider economic processes) and the perceived increase in the number of weather-related disturbances. Increasingly frequent and severe droughts, floods and storms have led to either less cash being available from crop sales, or simply the need for more labour to replant or repair damaged crops or farm infrastructure. One of the recognised positive outcomes from this shift is an increased sense of solidarity with neighbours.

### **Using the diversity of the landscape to spread risk**

In Nwadjahane villagers farm both the fertile lowlands through irrigation and the higher sandy dryland fields. Increasingly severe floods and droughts over the last two decades have increased demand from households for plots of land in *both* areas. While the lowland can produce good crops of rice, vegetables and potatoes, these can be destroyed during floods. Highland areas can produce good crops of maize and cassava during flood years. However, during drought years the highlands are less productive and thus the family will rely on the lowland production. Households with land in just one area have started to form informal farming associations to lobby those responsible for land allocation and have successfully managed to gain access to new areas to farm. This is especially important for very poor households as it enables them to share some of the production costs, and risks, and thus increase their overall resilience to both droughts and floods. A lesson for development agencies is that external support to these farming systems needs to be careful not to favour one type of farming over another as it is the *combination* that provides resilience to climatic disruptions.

### **Innovations in farming practices**

These farming associations have become the focus of innovative and experimental farming practices. Through working in groups, villagers are able to spread the risk of new practices and technologies and learn for themselves through trial, error and experimentation. When successful, farmers have been able to take the lessons learnt back to their own individual farms. For example, 45% of those interviewed had changed to more drought resistant species of rice, maize, cassava and sweet potato at some point during the last 6 years as a direct result of the information exchange within and beyond the farming associations. The farming associations act as a buffer against initial risk with both poor and wealthy households able to experiment. The associations have also been particularly popular with groups of women, leading to a strengthening of their position within the farming community. With the support of extension officers these types of initiatives can strengthen livelihoods in the face of climate change and make livelihood activities more profitable and secure.

### **How can livelihoods be better supported in the context of change?**

Within the Nwadjahane community, individuals, households and formal and informal groupings of people are all looking for ways in which they can reduce their vulnerability to disturbances and increase the resiliency of their livelihoods. Some

adaptations are driven specifically by experience of extreme climatic events, but many come from a combination of climatic, environmental, economic, political and cultural issues. The study shows that we need to take climate change seriously but that it *must* be viewed within the everyday context of people's lives.

The Mozambique government has recognised this. It sees the need to support local level attempts to build resilience, and national planning strategies are deliberately addressing these issues. Some sectors of agriculture are being encouraged to commercialise at a large scale, while smallholders are being encouraged to participate in local level planning to build the human capacity for livelihood renewal. Thus climate change in Mozambique is not being viewed in isolation; it is being dealt with within the context of wider development issues.

<sup>1</sup> The ADAPTIVE project is based at the Universities of Oxford and Sheffield, UK. The project is funded by the Tyndall Centre for Climate Change and has received support from Oxfam and Save the Children and others. In Southern Africa it works with the Climate System Analysis Group at the University of Cape Town. For more information contact Prof David Thomas ([david.thomas@ouce.ox.ac.uk](mailto:david.thomas@ouce.ox.ac.uk)) or Dr Chasca Twyman ([C.Twyman@shef.ac.uk](mailto:C.Twyman@shef.ac.uk)).

### **Oxfam case study: climate change and conflict in Northwest Kenya**

The following case-study originated in the Oxfam GB programme in Kenya. The way of life of the Turkana people - nomadic pastoralists who graze huge herds of cattle and other animals on the dry savannah of North West Kenya - has long been made more precarious by political pressures from outside. Their ability to roam was restricted by arbitrarily imposed colonial borders, and modern governments have not done much to help them.

Now powerful forces outside their control increasingly threaten the very survival of the Turkana. The climate seems to be drying out and this has become a trigger for conflict between the Turkana and their neighbours, even as armed groups from outside, and a flood of automatic weapons, spill over from the long-running conflicts in neighbouring South Sudan and Northern Uganda.

Very much in line with models of climate change in sub-Saharan Africa, droughts in northwest Kenya appear to be becoming longer and more frequent. The Turkana have names for them. The latest is *Kichutanak*, which started in 1999. This drought has continued, with only poor and sporadic rains, right through until today (March, 2005). *Kichutanak* means "it has swept away everything, even animals". The Turkana had barely recovered from the previous prolonged four-year drought of 1992-95 called *Longuensil*, meaning "when the man with no legs from Oxfam came", a reference to an Oxfam member of staff with a disability. In 1979-80 came *Lopiar* or "sweeping everything away", which spread over two years. The previous severe droughts had been in 1970 - *Kimududu*, meaning "the plague that killed humans and livestock" – and in 1960, the year called *Namotor*, meaning "bones exposed".

The Turkana are used to dealing with drought and with food shortages. But because the droughts are more frequent and more prolonged, they have less opportunity to recover from a poor rainy season before the next is upon them. Also, rain is less



predictable than it used to be. Even in the longest drought, rains come to some places at some times. They could tell, from natural signs, when rains would come and where they would fall. Now rain, when it comes, may be sudden, violent and unpredictable.

There have always been tensions between the Turkana and other pastoralist groups for access to water and pasture. But these have increased as water sources have dried up and pastures been lost. Because the water table is not being recharged, the wetland areas that the Turkana could traditionally fall back on in times of drought have dwindled. Even the huge Lake Turkana has receded.

Territorial disputes have become more common as the lake recedes, taking with it the landscape features that formed traditional boundaries between groups. Many such disputes are settled peacefully, but each time one party or the other is perceived to have broken an agreement, the willingness to trust the next time, and to respect borders, is eroded.

Cattle raiding is also linked to drought. Raiding has always been used as a strategy to restock herds during or after a drought. Not surprisingly, prolonged drought and more cattle deaths leads to more raids. Last year (2004) a particularly big raid saw a coalition of the Toposa from Sudan and the Dodoth from Uganda take away large numbers of Turkana cattle. And raids lead, in turn, to new cycles of retaliation.

The marked increase in violence and killings, however, is associated with changes in the nature of conflict. Guns and bullets are cheap and plentiful and wars in neighbouring countries have led to a brutal form of predation replacing the “traditional” form of raiding. The Turkana face raids from a motley variety of well-armed gangs and rebel groups whose motives are often to seize cattle to sell for profit. These raids, unlike those undertaken in order to re-stock cattle, are carried out on a large scale and are extremely violent. They obey none of the traditional rules that tended to limit violence.

As a result of the droughts and growing insecurity, the Turkana have moved from a state in which they are able to cope most of the time, to one in which destitution and vulnerability to famine is a constant danger. International aid agencies like Oxfam have been providing relief food and still continue to do so, because the latest rains at the end of 2004 were patchy and poor. Oxfam’s approach is not just to give out food, but to link human and animal health, relief and development, and to help Turkana institutions that are trying to tackle the problems of cross-border raiding using conflict reduction and peace-building techniques.

(Source: Oxfam, published in “Africa- Up in Smoke?”, 2005)

<sup>1</sup> The ADAPTIVE project is based at the Universities of Oxford and Sheffield, UK. The project is funded by the Tyndall Centre for Climate Change and has received support from Oxfam and Save the Children and others. In Southern Africa it works with the Climate System Analysis Group at the University of Cape Town. For more information contact Prof David Thomas ([david.thomas@ouce.ox.ac.uk](mailto:david.thomas@ouce.ox.ac.uk)) or Dr Chasca Twyman ([C.Twyman@shef.ac.uk](mailto:C.Twyman@shef.ac.uk)).

## **CLIMATE CHANGE AND THE WATER CRISIS IN CENTRAL ASIA**

The following case-study is based on Oxfam's work in Tajikistan.

Oxfam began working in Tajikistan, the poorest of the five new Central Asian nations once part of the Soviet Union, in 2000/2001. It was in response to the worst drought there in 74 years. In the most affected area 200 hand pumps were installed to alleviate water shortages for some 9,000 people. But the background to the drought is a general increase in average annual temperatures of between 0.7 – 1.2 degrees C. Partly because of the associated increasing aridity, Oxfam is extending its development programme, including introducing farmers to new drought-resistant and less water-thirsty plants. Yet paradoxically, because Tajikistan has a complex, mountainous landscape, floods and landslides have also become more frequent and more severe in other areas. In 1998 such a flood swept away a pumping station on the Qizil Soo (Red) river, depriving some 7,000 people in six villages of clean water. Oxfam engineers are helping local people to renovate the pumping station, and are strengthening the riverbanks to guard against another flood. In summer 2004 Tajikistan was hit by serious floods and landslides. Half the capital, Dushanbe, was without water, and the only road between Dushanbe and Khujand, the second city, was cut along 25 kms, with many bridges also swept away. Economic damage was severe.

Global warming is by no means the main cause of the region's water problems, which are man-made in another way. In theory, there should be plenty of water for all. The central Asian countries are "locked into" water-intensive cotton farming, and have inherited what were already hopelessly inefficient and wasteful irrigation systems. Now that Soviet subsidies have dried up, there is no longer the money to maintain what was already dilapidated infrastructure. Deforestation adds to flooding problems, and Tajikistan suffered a civil war, which further damaged infrastructure. Now nearly a quarter of the population uses irrigation channels – contaminated by farm chemicals – as its main source of drinking water. Meanwhile, far downstream the Aral Sea continues to shrink, exposing the fertiliser and pesticide dust washed into it from Soviet cotton fields and creating a toxic wasteland for people living on its shores.

But global warming could be what precipitates a crisis, tipping people over the edge just as it threatens to in other places around the world. In particular, melting glaciers are causing grave concern. Tajikistan generates 55 percent of all the water in the Aral Sea Basin, which it shares with four other countries, and much of that water comes from glaciers. Neighbouring Kyrgystan contributes another 25 percent. Yet the country's glaciers have shrunk by 35 percent in the last 50 years. In neighbouring Kazakhstan the capital, Almaty, depends on water from the fast-shrinking Tien Shan mountain glaciers.

The effects of melting glaciers are highly geo-specific and may be more predictable than other effects of global warming - and are already under way. In mountain valleys melting increases the risk of floods and landslides. Downstream, it is likely to increase competition for water. Many experts have pointed out how the regional water-sharing systems once closely woven together by Soviet design and

management have unravelled, and must be managed by five fractious and poverty-stricken new countries that have shown relatively little willingness to co-operate, and each of which wants more water for national development.

Oxfam has encouraged local civil society to begin to debate how Tajikistan can manage its water resources fairly and efficiently, so that ordinary people obtain the safe water they are entitled to and the country develops. At the same time, dialogue will need to encompass Tajikistan's neighbours so that water becomes a source of peace and not of conflict.<sup>1</sup>

(Source: Oxfam, published in "Up in Smoke?", 2004)

### **Further notes on glacier melt:**

Tajikistan generates around 64 million cubic metres of water each year – approximately 55% of all the water in the Aral Sea Basin. Glaciers and underground water sources (8% of the area of the country) provide around 25-50% of yearly flow (depending on glacier melt). Glaciers hold a massive 845 cubic kilometres of water, equivalent to seven times the total annual flow in the Aral Sea Basin. However, the glaciers are retreating at an alarming rate, due in large part to rising annual average temperatures and decreased precipitation over the past 20 years. In 1949 glaciers covered 18,000 square kilometres of Tajikistan. Satellite images from 2000 indicate this area has shrunk to just 11,863 square kilometres – a 35% decrease in the space of just 50 years. Although the rate of retreat must decrease as glaciers at higher altitudes begin to melt, if the current trend continues, Tajikistan's glaciers will have disappeared within 120 years. Tajik scientists say all small glaciers (less than 1 square kilometre) will probably disappear. Medium sized glaciers will decrease by 20-50%. Only the largest glaciers will lose less than 20%. It is likely that a similar situation pertains in neighbouring countries, Kyrgystan and Afghanistan.

Dr Stephan Harrison of Oxford University (now based at Exeter University), one of the world's foremost experts in glaciers, has been studying the glaciers in Kazakhstan. Glacially fed rivers supply irrigation schemes essential to agriculture and also drinking water to towns like Almaty. He warns that glaciers there are melting so fast that the livelihoods of millions of people will be affected with "profound political, economic and social repercussions". The arid region of northwest China is also affected, as glaciers account for over 10% of fresh water supplies there.

Jeff Kargel of the US Geological Survey says: "It's fair to say that Uzbekistan's economy and urban zones will suffer devastating collapse in the future or the people will have to adopt different ways of surviving on little water"<sup>1</sup>.

Himalayan glaciers form the largest body of ice outside the Polar caps. The population density of people living near glaciers in this area – particularly Nepal - is the highest in the world. In the short term, glacier retreat may have some benefits. For local people, more land will be opened up for cultivation at the heads of valleys (research into the pros and cons is being carried out by the University of Bergen).

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<sup>1</sup> Jeff Kargel communication with Mark Lynas, 5<sup>th</sup> November, 2003.

The melt may temporarily increase the amount of water in rivers downstream. But in the longer-term, “as the glacier gets smaller...summer flows will no longer be supported and will decline” (Intergovernmental Panel on Climate Change). There will also be increased erosion and less stability, including the formation of sudden and unstable mountain lakes. Glaciers in the Himalayas generally “are wasting at alarming and accelerating rates”<sup>2</sup>. For people in particular areas (mountain valleys) the proportion of water from “negative mass balance glaciers” may be much higher, and it may be very much higher – and even form the majority of the water available - during the dry season. Melt the glaciers entirely - and dry season flows stop.

Kargel says: “The long-term loss of glaciers presents striking political and economic risks for people in western China and all of the “Stans” [including Pakistan]. India is less affected, but it is a significant issue for them, too”<sup>3</sup>.

Another hazard is that of Glacial Lake Outburst Floods (GLOFs), when glacial lakes form or increase in size and the natural dams burst that hold them in check. This is a growing danger to communities in upland valleys in India, Nepal, Bhutan, Tajikistan and other countries.

Mark Lynas, environmental activist and author of the book “High Tide: News from a Warming World” (March 2004), warns that Peru’s coastal strip is another area at risk. This strip includes Lima, home to 8 million people (10m by 2015) and the largest desert city in the world after Cairo. No rain falls in this strip in most years, yet it produces half of Peru’s national agricultural product in 52 irrigated alluvial valleys.

The rivers flow all year but during the dry season in the mountains the runoff is almost exclusively due to glacier melt. The crucial glaciers are melting so fast that within about 20 years there will be no glacial runoff and many of Peru’s rivers will cease to flow for six months of the year. “It is difficult to see quite how a massive Third World city might cope with a crisis on this scale” (Lynas). The Peruvian water authorities are well aware of this looming problem. They envisage a massive programme of construction works – dams and trans-Andean tunnels. Some have been built. But the programme is hampered by cost and political problems. The authorities have also invested heavily in measures to stop avalanches set off as glaciers melt (an avalanche in 1970 killed 23,000 people). In Central Asia, however, the money is not there to create such alternatives or protective measures (or to stop the horrendously high level of water wastage (over 50%)).

In other cases – e.g. Africa, whose glaciers will probably disappear within 15 years, relatively few people live in affected areas.

The rise in temperatures and consequent rate of mountain glacier melt is such that it is extremely unlikely that anything can be done to stop it in the short term (100 years). Therefore humans have to adapt politically, economically and scientifically i.e. target regions being affected by glacial melt, anticipate water shortages and create the physical and political infrastructure to compensate (bringing water from elsewhere, storing water, saving water, sharing water).

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<sup>2</sup> Jeff Kargel, United States Geological Survey, international co-ordinator of GLIMS (Global Land Ice Measurements from Space), May 2002. See his map “Towns and Cities Affected by Melting Glaciers”.

<sup>3</sup> Correspondence with Mark Lynas, *ibid.*

<sup>1</sup> See: *Tapping the Potential, improving water management in Tajikistan*, UNDP National Human Development Report 2003, and *Central Asia: Water and Conflict*, 30 May 2002, ICG Asia Report 34, International Crisis Group, [www.crisisweb.org](http://www.crisisweb.org).

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