

GLACIER MELT: WHY IT MATTERS FOR POOR PEOPLE

A note by John Magrath, Programme Researcher

Introduction:

The effects of global warming will be varied. Many are already being felt and rich nations are taking measures to adapt¹. Perhaps the first, and the worst, effects upon poor people will come about as a result of the rapid melting of mountain glaciers. These effects are highly geo-specific and may be more predictable than other effects of global warming - and are already under way.

The regions and places most at risk:

Oxfam has been particularly aware of these developments since beginning to work in the Central Asian state of Tajikistan. Tajikistan generates 55 per cent of all the water in the Aral Sea Basin, shared with four other countries – and Tajikistan's mountain glaciers provide 25-50 per cent of that (depending on melt)². Those glaciers are melting at an alarming rate. Water in Central Asia is already a highly contentious issue and the source of considerable hostility between Tajikistan and downstream Uzbekistan. The Aral Sea itself continues to shrink and has become a toxic wasteland for the people living on what used to be its shores.

Tajikistan generates around 64 million cubic metres of water each year – approximately 55 per cent of all the water in the Aral Sea Basin. Glaciers and underground water sources (8 per cent of the area of the country) provide around 25-50 per cent 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 per cent 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 one square kilometre) will probably disappear. Medium-sized glaciers will decrease by 20-50 per cent. Only the largest glaciers will lose less than 20 per cent. It is likely that a similar situation pertains in the neighbouring countries of Kyrgyzstan and Afghanistan.

Dr Stephan Harrison of Oxford 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 per cent of fresh water supplies there.

¹ For example, seven new reservoirs are planned to be built in the UK including a huge £600 million reservoir in Oxfordshire.

² Source: Tapping the Potential, UNDP 2003 Tajikistan National Human Development Report

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"³.

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). 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"⁴. Many glaciers feed the Ganges and Indus River Basins and glacial water forms a large proportion of the river waters. Perhaps only 1 or 2 per cent of annual flow to the great rivers comes from glacier *shrinkage* per se (i.e. 1 or 2 per cent more than if the glaciers were *not* shrinking). So downstream effects may not be so noticeable. However, this seemingly tiny proportion hides a major problem – seasonality of run-off. 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"⁵.

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 (estimated to be 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

³ Jeff Kargel communication with Mark Lynas, 5 November, 2003.

⁴ 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".

⁵ Correspondence with Mark Lynas, *ibid*.

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). He notes that Quito (Ecuador) and La Paz (Bolivia) are also heavily dependent on glacial runoff for their drinking water.

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 per cent)).

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

The science of glacier melting:

Like other aspects of climate change, some authorities deny that it is happening. They point to the lack of historical scientific records (few go back more than 100 years). They say some glaciers are getting larger (in Scandinavia), and that others are advancing rather than retreating. Dr Harrison and others however have no doubt that glacial retreat is real and widespread. The Scandinavian glaciers are actually increasing but this seems to be due to increased local precipitation, which may itself be related to global warming. Glaciers may seem to “advance” but actually be getting thinner and more spread out. And finally, although systematic observation of glaciers in the developing world has been relatively recent and patchy, it all matches up and there is a particularly solid body of historical evidence from the European Alps, the classic mountain glacier system, and from the North American Rocky Mountains.

What we are talking about here are not the polar ice caps or large ice fields. Their melting may raise sea levels, but they are so massive that even if parts melt, it is hard to predict the effects. The degree of melting is contentious and harder to define. They may have the capacity to weather the “thermal storm”. But the glaciers that supply water to people in Central Asia, Peru, and Nepal are technically nearly all “alpine” or mountain glaciers – much smaller. It is much easier to chart their movements and they are highly sensitive to changes in temperature.

The glaciers have been shrinking for the last 150 years and that seems to have begun as a result of natural warming. The end of the Nineteenth Century marked the end of a distinct cool geological period known as “the Little Ice Age” which had started in the 14th century. There was a warming of 0.3 degrees C in the first half of the 20th century in the northern hemisphere.

What is different is that in the last 20 – 30 years, and even more in the last 10 years, the melting has accelerated greatly – and continues to speed up. It is this accelerated melting which is considered by many scientists to be evidence of greater global warming brought on by humans. In the last 25 years a second 0.3 degrees C “warming pulse” caused northern hemisphere temperatures to rise to levels

unprecedented in the last 1000 years (and probably the last 2000), with the 1990s representing the warmest decade of the millennium⁶.

What does this mean for poor people?

A decrease in water supply due to glacier melt is likely to exacerbate droughts, increase competition and possible conflict, and make it less likely that the 2015 Millennium Development Goals (MDGs) for water and sanitation can be met*. 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). This will be a massive task.

More broadly, if global warming which started as a natural phenomenon is indeed exacerbated by human activities, then humans have a responsibility to act to slow down the rate of warming, rather than continually accelerating it.

*Goal 7 of the MDGs is to ensure environmental sustainability. One of its targets is to: "Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation."

⁶ Glacier Retreat in Alpine Areas by Shawn Marshall, Mountain Science Highlights.