

## Climate change impacts on glaciers around the world

### Blomstrandbreen glacier, Svalbard – one example

Svalbard, a group of islands in the Arctic Circle coming under the jurisdiction of Norway, has more than 2100 glaciers that cover nearly 59% of the landscape. The Blomstrandbreen is a glacier that flows into the Kongsfjorden along the north west edge of Spitzbergen, Svalbard. The Blomstrandbreen has retreated nearly two kilometres since 1928, with an accelerated rate of 35 metres lost per year since 1960 and even higher in the past decade. Other glaciers of the area show similar retreat patterns, with some disappearing at a rate of up to 150m a year.

Researchers estimate that Svalbard's total glacier retreat of 512 square kilometres between 1961 and 1993 comprises 16% of Northern Hemisphere ice loss during that period - and a similar proportion to the sea level rise attributable to ice loss in the north.

The loss of Svalbard glaciers has implications not only for the region's bird and animal life, and on the growing tourism industry. It also will impact on the sea itself. Researchers have found that freshwater contributions from ice pack and land ice could significantly affect thermohaline, or heat and salt, circulation in the oceans as well as raise global sea levels.

Some scientists suggest that it may take only modest changes in the fresh water fluxes from the Arctic Ocean to change the convection intensity and pattern and thereby influence the global thermohaline circulation. Studies are currently underway to track the heat flow between the Atlantic Ocean and the Arctic Ocean through the Fram Strait to monitor global warming. Worryingly, recent studies warn that we may already have evidence of a slower thermohaline circulation over the Scotland-Greenland deep ocean ridge.

Global warming in the Arctic is expected to be two to four times that at lower latitudes, and United Nations scientists have warned, "... the Arctic is extremely vulnerable to projected climate change - major physical, ecological, sociological, and economic impacts are expected. Because of a variety of positive feedback mechanisms, the Arctic is likely to respond rapidly and more severely than any other area on Earth, with consequent effects on sea ice, permafrost, and hydrology." Already a 5°C increase in average temperature over the last century has stressed Arctic ecosystems in ways that we are only beginning to understand.

Unfortunately the fate of the Svalbard glaciers is not unique. Globally, the effects of climate change are being felt in a variety of ways and scientists predict more regular and more intense impacts. Climate change presents a threat to most natural systems. Those natural systems threatened include glaciers, coral reefs, mangroves, arctic ecosystems, alpine ecosystems, prairie wetlands, native grasslands, and biodiversity "hotspots". Climate change will increase existing risks of species extinction and biodiversity loss in ecosystems at every latitude and in each region. This is not only impacting nature – it has devastating implications for human lives as well.

## **What causes climate change**

Climate change is directly linked to our fossil energy consumption. Global warming of the earth is the result of increasing greenhouse gas emissions. The principal cause is carbon dioxide (CO<sub>2</sub>), which is released when fossil fuels such as coal, oil and gas are burned.

In 2001 a revised report was issued by the Intergovernmental Panel on Climate Change (IPCC), a body under the United Nations made up of more than 2500 scientists from around the globe. The IPCC found new and stronger evidence that most of the observed warming of the past 50 years is attributable to human activities, and that about three quarters of the anthropogenic (human created) emissions of CO<sub>2</sub> during the past 20 years are due to fossil fuel burning.

The IPCC also reported that the average global temperature was projected to rise to between 1.4 and 5.8 degrees Celsius in the next 100 years. This is a large increase on the projections in their previous report, made in 1995, which estimated the increase in temperature to be between 1 and 3.5 degrees. A 2 degree increase would produce substantial damage to or loss of many natural ecosystems, lead to a spread of diseases such as malaria and cause substantial damage to agriculture in developing countries.

According to the 2002 United States National Communication to the United Nations Framework Convention on Climate Change, "Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise... Human-induced warming and associated sea level rises are expected to continue through the 21st century."

## **Glacial impacts globally**

Throughout the entire world glaciers are disappearing through global warming, not only in the polar regions, but also in parts of the world with a milder climate. Below are examples of recent research and predictions. See the paired historical and current images on the Greenpeace website [www.greenpeace.org](http://www.greenpeace.org) for a visual display.

### **Ka Roimato, (Franz Josef glacier) New Zealand**

The glacier known to the Maori as Ka Roimato is also called the Franz Josef Glacier. It reaches to 250 metres above sea level out of the Southern Alps on New Zealand's South Island. Ka Roimato means "Frozen Tears" and it gets this name from a legend of doomed lovers Hinehukatere and Tawe. This is a very dynamic glacier and since 1860, when scientific observations began, it has retreated 1500 metres. However, within that span it has advanced four or five times. The most recent advance, a very strong thrust lasting from 1983 to 1999, has now been reversed and a retreating phase has once again taken hold.

### **Grinnell Glacier, USA**

The Grinnell Glacier sits just to the east of the continental divide in the Rocky Mountains of northern Montana State. It is in the middle of the United States of America's famous Glacier National Park. In 1850, Grinnell covered 2.33 square kilometres, by 1993 its remnants totaled only 1.11 square kilometre. From 1850 to 1920, Grinnell retreat averaged six metres annually. Between 1920 and 1946, retreat averaged 15 metres per year and it had lost 51% of its 1850 area. Between 1946 and 1979, the retreat slowed to four metres per year but the glacier reduced in area another 41% from the 1946 total. Its volume has decreased at even faster rates during this same time span.

### **Pasterze Glacier, Austria**

The impressive Pasterze Glacier lies in the Hohe Tauern mountain range of the Alps, along the northeastern slope of Austria's tallest mountain, Grossglockner and flows into the Moell River. The 9 kilometre-long Pasterze is currently losing 5 metres in height and 20 metres in length every year. According to the 2001 Third Assessment Report of the Intergovernmental Panel on Climate Change, the European Alps have lost half of the original ice volume since 1850. Scientists from the World Glacier Monitoring Service predict that 95% of the existing Alpine glacier mass could vanish over the next 100 years and many of the small glaciers will disappear altogether within decades—due to global warming.

### **Qori Kalis Glacier, Peru**

The Qori Kalis Glacier is the largest ice outlet from the Quelccaya Ice Cap which tops the Cordillera Vilcanota in Peru's south-east corner. The ice cap itself has shrunk by at least 20 percent since 1963. But the Qori Kalis is disappearing at an accelerating rate: between 1998 and 2001 the terminus retreated an average of 155 metres per times faster than average annual year--three retreat from 1995 to 1998 but an alarming 32 times faster than the average annual retreat from 1963 to 1978.

### **Orubare Glacier, Uganda/Democratic Republic of Congo**

The Orubare Glacier covers a face of Uganda's Mount Rwenzori (Bantu for 'Rainmaker') standing on the border with the Democratic Republic of Congo, marked by the Rwenzori Range. Mount Rwenzori, also called Mount Stanley, reaches 5109 metres and is the third highest point in Africa. In 1906 there was one large glacier on Mount Rwenzori, as evidenced in photographs. By 1994 it had broken into four significantly smaller glacial pieces. In 1987's "Glaciers of Africa", the scientific judgement stated, "There has been substantial and virtually continuous wastage of the glacier ice for more than 100 years". But the moisture surrounding Orubare and the other Rwenzori glaciers gives them a longer life span than their sisters on Mount Kenya and Kilimanjaro—those glaciers are simply evaporating faster than they can accumulate.

### **Imja Glacier, Nepal**

The Imja Glacier skirts the southern slope of Island Peak, Imja Tse, in the Himalayan Khumbu Range of Eastern Nepal, just southeast of Mount Everest. As it retreats a proglacial lake, Imja Tsho, grown bigger. The proglacial lake was born in the 1960s and continues to grow, filling the area left as the glacier front retreats, currently at the rate of nearly 10 metres per year. In Nepal, the average temperature has increased by 1.5 ° C since 1975. "Glaciers in the Himalayas are receding faster than in any other part of the world," according to Syed Iqbal Hasnain from the International Commission for Snow and Ice (ICSI) and the School of Environmental Studies of India's Jawaharlal Nehru University in New Delhi . "If the present rate continues, the likelihood of them disappearing by the year 2035 is very high."