

Charting change

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From the Himalaya to Male, there are clear signs that climate change is real.

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Namgye Chumbi was weeding his potato garden in the village of Phakding in Nepal's Khumbu region below Mount Everest on the morning of 4 August 1985. Because of the monsoon season, there were not too many trekkers hiking up the trail towards Namche Bazaar. It was a brilliantly clear day, unusual for the monsoon season, and he was working by the banks of the Dudh Kosi River. True to its name, the river was milky white and frothing, as the water tumbled noisily over boulders. Yet around two in the afternoon, the river suddenly became strangely silent. The water level went down, and Namgye sensed danger. Much in the same way as coastal dwellers saw the sea recede before the 2004 Indian Ocean tsunami, the Dudh Kosi was about to reveal its terrifying avatar. "I noticed that the white water had turned muddy brown, and in the distance I heard a thundering sound like an approaching helicopter," Namgye recalls. "I looked upstream and saw this huge wall of dark brown water approaching very fast." Namgye indicates the level of the river with his right hand, and raises his left hand high over his head like a cobra to show what he saw.

There was no time to think. Namgye dropped everything and began to run up the mountain. His wife, Sherkima, had more presence of mind, and picked up their two young children, Hira and Tsering, and followed her husband. They reached a ledge as the thunderous flood raced beneath them, lapping at their heels. The ground was shaking like an earthquake, and the sound was deafening. Namgye and Sherkima lost their house and everything in it. If they had been just a few seconds slower, they would have lost their lives as well. Their millet farm upstream was cut in half, as the river changed its course and started flowing through its terraces. Thereafter, the family built a hut, and other families helped them with food. "We only had the clothes we were wearing, but at least we were all alive," he says. Nearly 25 years later, Namgye has built a new house higher up the mountain, where his married children and four grandchildren today live together. The Dudh Kosi, meanwhile, is still frothing white as it flows past the farm. Namgye points out one boulder the size of his house that was brought down by that terrible flash flood.

No one died in the 1985 flood because there were no trekkers on the trails, and people were not asleep in their homes. But it did wash away a large section of the trail as well as all the bridges along this stretch of the river, and the Dudh Kosi deposited debris up to 15 metres high downstream. The water stayed muddy and high for two weeks until it finally started to recede. Villagers in Jorsale and Phakding were puzzled that there was a flood when there had been no rain; they only found out later that a glacial lake called Dig Tso had burst upstream in the Bhote Kosi Valley. A few years later, there was another flood caused by another lake below Mount Ama Dablam that overflowed because of an avalanche; it caused damage upstream but was not as high when it reached Phakding. Nepali glaciologists say there is a glacial-lake flash flood every two years or so on a river in the country, and many expect the floods to become more frequent and more serious as the lakes are

gorged by glacial melt. Namgye has heard there are even bigger, more dangerous lakes upstream in the Imja Khola. Is he worried? "I am," he says. "But where can I go?"

Water World

From the air, one can quickly understand why the Himalaya are referred to as the Third Pole. A jumble of ice, rock and snow stretches as far as the eye can see. The frozen flanks rise to breathtaking heights, the cornices on their summits translucent blue against the sunlight. Blocks of ice as massive as large buildings teeter at the edge of icefalls, looking as if their motion has been caught in a snapshot. And like the polar ice cap, all this is defrosting fast. Climatologists say that, like other mountain ranges in the warmer parts of the Earth, the Himalaya are warming three times faster than the rest of the planet. You do not have to be a geologist to spot the signs from up here.

The Khumbu glacier, which feeds off the southern side of Mt Everest, looks as though a gigantic bulldozer has pushed debris right down the valley below, and then retreated. The terminal moraine no longer has any ice - it is just a pile of boulders. On the north slope of Thamserku, down-valley, the snow has retreated to the knife-edged summit ridge, with just the tongue-shaped relic of a former glacier visible. Up here in the mountains of Nepal, global warming is not an abstract scientific theory; it has become a fact of everyday life. Its effects are visible everywhere: in snow-capped mountains that are turning into stark, exposed rock, and in new lakes that have made traditional yak-herding routes impassable. There is also less direct impact that is more difficult to measure: droughts and cloudbursts, delayed monsoons and huge forest fires.

What many here still do not know is what is causing this warming, and what to do about it. Some blame the gods for erratic weather - not the emission of greenhouse gases by rich countries and the bulging middle classes of India and China. The people in the mountains of Nepal do not know that the futures of their children and grandchildren are tied up with how the preparatory meetings for the international climate-change conference in Copenhagen in December turn out. Will the rich countries agree to cut back to 40 percent of 1990 emissions in the next ten years (which scientists warn is needed to keep the average rise of global temperature to within two degrees Celsius), or will they stall out at only the 13 percent that the Americans seem willing to go? The Copenhagen meet will also prove whether the rich countries are actually willing to help developing countries make the switch from fossil fuel to renewables, and whether they will help to fund adaptation measures in order that the world's poor can cope with rising sea levels and receding snowlines.

One month earlier, this writer was in the Maldives, at the other end of Southasia, in a country that is likewise on the frontline of global climate change. And just like Namgye Chumbi, who lives below Everest, the 400,000 people of the Maldives have to face problems that they had no responsibility in creating. Indeed, they are even more vulnerable, as sea-level rise caused by climate change threatens the very existence of their country. No part of this archipelago of 1200 islands, grouped around 25 atolls, is more than 1.5 metres above sea level. Storm surges have already brought sea water up to knee level in many of the islands, including in Male. The latest projections show that sea-level rise is likely to be even more dire than was predicted in the 2007 report of the UN's Intergovernmental Panel on Climate Change (IPCC) report, with sea levels worldwide likely rising one metre by the end of the century - even if countries start to drastically cut back on carbon emissions in the aftermath of the Copenhagen conference.

More than any other country in Southasia, it is in the Maldives that one detects a sense of urgency and the political will at the highest level to deal with the effects of climate change. The Maldivians are not given to speeches and moaning about the West's high per capita carbon footprint. Soon after

he was elected to power last year, President Mohamed Nasheed announced that his country would be carbon neutral by 2020. Setting an example, President Nasheed receives guests in the courtyard of his modest presidential house in Male, preferring the outdoors to his air-conditioned office. (All electricity in the Maldives is currently generated by thermal plants.) He has already decided not to live in the lavish, energy-intensive presidential palace built by his predecessor, which has instead been handed over to the Supreme Court. "Climate change isn't a vague and abstract danger but a real threat to our survival," says the president. "If the world can't save the Maldives today, it might be too late to save London, New York or Hong Kong tomorrow." (See full interview, "Frontline nation".)

All the same, President Nasheed's zero-carbon plan is not going to come cheap. It will cost more than USD 1 billion to switch to wind, solar and wave energy. Part of this money will come from a new green tax of USD 3 per day for every tourist, as well as from grants from the governments of rich countries with guilty consciences. The money will be spent on more than 150 large wind turbines, undersea transmission lines and 500 square metres of rooftop photovoltaic cells throughout the country, outfitted with batteries for night-time use. But even so, it may be impossible in the short term to replace carbon entirely, including the fuel that is burnt by Maldivian fishing vessels, ferries and aircraft that remain the mainstay of transportation in these atolls.

Other plans are also afoot to deal with the inevitable effects of climate change. As has been widely covered, the Maldivians are even looking into buying a new 'homeland' in India, Sri Lanka or Australia. For the time being, they are busy building dykes and raising the level of a new island that is being built near Male to accommodate its growth. From far away, one sees smoke rising from the Thilafushi garbage island, a 45-minute boat ride from Male. Coupled with tourism, the increasing affluence of the Maldivian capital has inevitably generated large amounts of trash; the government has decided that, instead of destroying coral islands, it will use the rubbish to create a whole new island, where there once was a lagoon. Today, there are nearly 200 Bangladeshi migrant workers toiling here, burning combustible garbage, compacting plastic, removing metal, disinfecting contaminated rubbish, and raising the level of the industrial island so that it is higher than the rising ocean. Manufacturing units and factories have already moved to parts of this newly formed territory.

Still, there is very little money available to adapt to climate change. The Maldives used to receive some 800,000 tourists a year, but last year that figure dropped by nearly half due to the global recession. The Maldivian economy was hit hard. Ecologically minded Europeans are becoming even more reluctant about burning all that fuel to fly the long distances required to get to the Maldives. For a country so dependent on tourism, this could be devastating. As such, President Nasheed has an argument ready to convince tourists to keep coming to the Maldives: spending two weeks in a carbon-neutral resort in the Maldives, he says, will mean that Europeans will not just offset the carbon they burn to fly there, but will also be less of a burden on the planet than if they were to spend those two weeks back home during the winter, burning lots of fossil fuels.

Yet this seems to be a hard sell. At the Male airport, European charter flights have indeed started arriving at the start of the tourist season. Parallel to the runway is Male's lagoon airport for sea planes, where Canadian-built Twin Otter aircraft with pontoons fly in and out every five minutes, ferrying tourists to outlying resorts. It is hard to see how the Maldivians will achieve carbon neutrality.

Himalayan meltdown

Up in the mountains of Nepal, it is the morning rush hour at Lukla Airport, the access point to the

Everest region. Here, too, Twin Otters bringing trekkers from Kathmandu are landing every few minutes. It looks like a Formula One pit stop: there are only four parking slots on an apron carved out of a mountainside, so the planes leave one of their propellers turning as passengers line up to board even as others disembark. Within minutes of landing, the planes are taxiing out for the return flight to Kathmandu. In the peak trekking season, in October, there are up to 40 flights every morning in this busy little airstrip.

Boarding a six-seater Pilatus Porter plane, we roll down Lukla's inclined runway and begin to fly up the Dudh Kosi. Far below, Namgye Chumbi's house is a tiny speck next to the shining white ribbon of the river. Incredibly high on the northern horizon is Mt Everest (Sagarmatha), which the river drains. The scars of the 1985 Dig Tso flood on either banks of the narrow river valley are still visible. As we fly past the monastery of Tengboche, there are signs of global warming all around. The mountains look like melting ice-cream cones, and the water flowing out of the shrinking icefall makes the rounded rock slopes below them glisten in the sun. One can easily see how far down the valleys the glaciers once extended, by the remnants of their moraine walls. The seracs now cling precariously to the edge of cliffs, and piles of rock and debris indicate where the glaciers once were.

Then we see it: the dirty green water of Imja Tso, the lake that has emerged out of nowhere in the past 40 years. Maps of the Everest region from the 1960s show no lake here, but today Imja Tso has grown dramatically to a body of water two km long, 500 metres across and about 100 metres deep. The Imja glacier is blocked by another that comes down steeply from the Lhotse face, and this has dammed the lake. It is fed by falling rain, melting snow as well as the permafrost that is thawing due to global warming. The Himalaya are warming three times faster than the rest of the world, and scientists say Imja Tso could grow another kilometre in the next five years. Flying at 20,000 feet with oxygen masks in the un-pressurised plane, we are still below the summits of these colossal peaks. And looking around at evidence of the great Himalayan meltdown, it is easy to see why all the focus in the climate-change debate is on the cryosphere.

This icebound landscape is the most dramatic visible proof of global warming, as well as the dangers caused by the Third Pole's depleting 'water tower' and subsequent glacial lakes. The correlation is also easier to grasp when one flies past peaks sculpted over millions of years by ice and wind. Water in its vapour form is pushed up these mountains during the monsoon, and it falls as liquid water along the lower reaches of the mountains. Higher up, it falls as snow and is stored in its solid form as ice. Below the snowline, the snow melts in the summer and feeds water into rivers in the dry season. This water is vital for irrigation and drinking downstream, but global warming is pushing the snowline higher and increasingly melting the permanent ice, too. Accelerating the process is the pollution caused by the burning of coal and diesel in the Indo-Gangetic plain. The fine particles of soot are carried by prevailing winds and are deposited on snowfields and glaciers. The dirty snow is less reflective, absorbs more sunlight and melts faster.

Government spokespersons of Southasia, in a reiteration of anti-colonial rhetoric, tend to blame only the rich countries, and defend their right to burn fossil fuel for economic growth. Given the low per capita carbon production of countries such as Nepal (one tonne per person per year, compared to 30 tonnes per capita in European countries), it does look unjust and hypocritical not to allow Southasians to burn more carbon in order to develop. And no matter what Nepal does, it will not make that much of a dent in saving the world from climate change. But countries such as Nepal need to switch to renewables not just to do their part to save the planet, but also to save their economies. Today, Nepal imports all of its petroleum products from refineries in India. The economic reliance on India is going to deepen as the world's oil reserves peak, and crude becomes more expensive and hard to get - thus increasing the country's political dependence. For Nepal, it is also a political imperative to switch to a hydro economy. And if that helps reduce the melting of its glaciers, even in a small way, that is a bonus.

Drying sponge

Nepalis and other Southasians also have a moral duty to do more. The Himalaya, along with the Tibetan plateau, constitute a gigantic storage system that feeds into rivers that provide water to nearly 1.2 billion people in China, Southeast Asia and the Indus-Gangetic basin – the Yangtze, Mekong, Irrawaddy, Brahmaputra, Ganga, Indus and most of their tributaries. Simulations show that the melting of Himalayan ice will significantly impact the flow of these rivers, causing them to flood during the springtime over the next three decades or so, drying up in the pre-monsoon when the water is needed the most. And all this will be happening as populations expand and the rising middle class in downstream Asian countries increases its water consumption.

Dramatic as all this is, scientists estimate that only nine percent of the annual water flow in the overall Ganga, for instance, comes from melting snow and ice in the Himalaya. Of this, seven percent is from snow and only two percent from glacial melt. So, even if global warming reduces the amount of ice in the mountains, it will not make a big difference on the flow in the Ganga. The important thing would be to develop the capacity to store monsoon runoff such that water flow is spread more evenly throughout the year. The proportion of snow melt in the dry season in rivers such as the Indus is much higher (40 percent), which makes it much more important to prepare for the impact of climate change in the Himalaya on dry-season irrigation downstream in Pakistan.

The focus on snow and ice has diverted attention from the real reason that the Himalaya should be considered a water tower: because of the gigantic storage system for ground water. Even below the snowline, monsoon rains recharge the aquifers so that the 4000-km-long mountain range acts as a gigantic sponge, storing water and releasing it year-round. Due to climate change, these rains have already become erratic. Climate variability, recurring droughts and extreme rainfall events have always existed, but there are signs they are getting both more frequent and more severe. Over the past two years, Nepal, North India and the western Himalaya have suffered two years of winter drought, as well as a delayed monsoon this year, devastating rice planting and rain-fed agriculture. Perennial springs went dry for the first time in living memory across Nepal's midhills, and snow-fed rivers had very little water in the spring because there was no snow to melt. In the past decade, monsoons have been consistently late, while the rains have then persisted till October. As winter rains have failed repeatedly across the Himalaya, some of the worst wildfires in living memory have broken out in India and Nepal. Glacial-lake floods and the impact of melting Himalayan permafrost are important, but many more people are being affected by erratic monsoons, weather variability and extremes of drought and floods.

For farmers across the mountains of Nepal and India, for plains dwellers in the Indus-Ganga plain and coastal villagers in the Bangladesh delta or the Maldives, climate change is just another hardship they have to face. It is a crisis that exacerbates all the others that such communities already face on a daily basis. While international delegations and government officials speak about 'adaptation' in the run-up to Copenhagen, villagers are already adapting. They are switching from rice to potato, to drought-resistant crops, moving higher up the coastline or building houses on stilts. But weather science is uncertain, and it is difficult to find the correlation with climate change in a way that can be helpful. The evidence is anecdotal. But by the time we convince ourselves to satisfaction as to why the monsoons are erratic and the cloudbursts are more frequent, it will be too late to do anything about them. It will be much more prudent to treat increased climate variability as an effect of climate change, and start strengthening local capacity to adapt – at the level of potato farmers such as Namgye Chumbi in Nepal, as at the level of national leaders such as President Mohamed Nasheed in the Maldives.

P.S.

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