Human Development Report **2007/2008**

Fighting climate change:
Human solidarity in a divided world

Human Development Report Office

OCCASIONAL PAPER

Climate Change and the Right to Development. Himalayan Glacial Melting and the Future of Development on the Tibetan Plateau

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2007/28

Climate Change and The Right to Development

Himalayan Glacial Melting and The Future of Development on the Tibetan Plateau

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Background Paper for 2007 UNDP Global Human Development Report
May 7 2007

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A) Global Climate Change: The tipping point

A.1. Current and future impacts of climate change

According to recent findings from the 2007 sessions of the UN Inter-Governmental Panel on Climate Change (IPCC), ten of the warmest years in recorded history have occurred since 1990, leading to more frequent and extreme storm events and higher rates of glacial melting on the world's mountains and polar icecaps.[1] The latest IPCC findings now show clear and convincing evidence (90% certainty) that our use of fossil fuels and emission of greenhouse gases are warming the Earth well beyond normal background levels, bringing far reaching consequences for the state of global ecosystems and the future of human development.

Even if more drastic measures were started today to greatly reduce global emissions, the impacts of current climate change trends would continue to pose serious risks to humanity for decades to come. With the impacts of climate change felt more frequently in various parts of the world in the form of severe droughts, water shortages and extreme weather events, the time for speculation over the causes and consequences of climate change is over. While stronger mitigation measures are critical, it is increasingly clear that we are now entering a period of hard consequences, requiring urgent adaptation measures.

Developing countries have made many hard-won development gains over the past decades, and will make many more in the lead up to the 2015 targets under the Millennium Development Goals (MDGs). However, the shifting nature of the world's climate poses serious risks to sustaining any such gains in the decades to come. Unless action is taken to greatly reduce emissions, and enact adaptation measures, many of these hard won development gains could start to be reversed in the decades to come. As with other global environmental trends, the impacts of climate change will be felt the hardest by the world's poor, communities that lack the capacities to adapt to this uncertain future.

The Asian region holds special challenges in this regard. With the largest concentration of people surviving on less than US$2 per day, and with carry capacities of land and water systems already being stressed owing to

[1] *See* UN Framework Convention on Climate Change (UNFCCC), "IPCC Fourth Assessment Report on the Science of Climate Change" and "IPCC Fourth Assessment Report on Impact, Vulnerability and Adaptation to Climate Change", UNFCCC, Bonn, 2007.

rapid growth and development, the future of development in Asia is closely tied to the ability of Governments and communities in the region to effectively adapt to the emerging consequences of global climate change. The frequency and severity of floods is increasing in coastal regions of Asia. Examples include the historic flood events in 2006 in China, India and Indonesia where tens of millions were affected, and historic droughts in 2005-2006 in semi-arid areas of China and India that experienced severe water-stress conditions. Urbanization is a major challenge with Asia expected to host most of the world's largest cities by 2020, most of which are currently located in low-lying coastal zones at risk from sea-level rises. Cities like Dhaka, Jakarta, Mumbai and Shanghai are all at risk from both sea-level rises and increased frequency of storm events.

The consequences of climate change will be critical for countries' ability to sustain progress towards and achievement of the Millennium Development Goals. Critical to achieving the overarching goal of poverty reduction are countries' ability to achieve adequate levels of food and water security; however the water and agriculture sectors are the very components of Asia's economies the most sensitive to climate change impacts.[2] Food output and sustainable water supplies in parts of Asia are projected to decrease because of rapidly rising temperatures, more frequent droughts, extreme floods, and continued land degradation. This is particularly important for vulnerable communities in high-altitude mountain systems in Asia where fragile ecosystems already face severe pressures from rapid development.[3]

A.2. Glacial melting in the Himalayas

One of the most pressing concerns in Asia relates to the ongoing melting of the Himalayan glaciers.[4] "Himalaya" is a Sanskrit word meaning 'abode of snow', known in the region as 'Asia's water tower' or the 'third pole'. The Himalayas host tens of thousands of glaciers covering an area of 33,000 km^2, the largest freshwater reserve outside the polar ice caps.[5] These glaciers feed seven of the great Asian rivers - the Ganges, Indus, Brahmaputra, Salween, Mekong, Yangtze and Huang He rivers – the source of food and

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[2] *See* Inter-governmental Panel on Climate Change (IPCC) *Special Report on the Regional Impacts of Climate Change: An Assessment of Vulnerability*, UNFCCC, Bonn (2001).

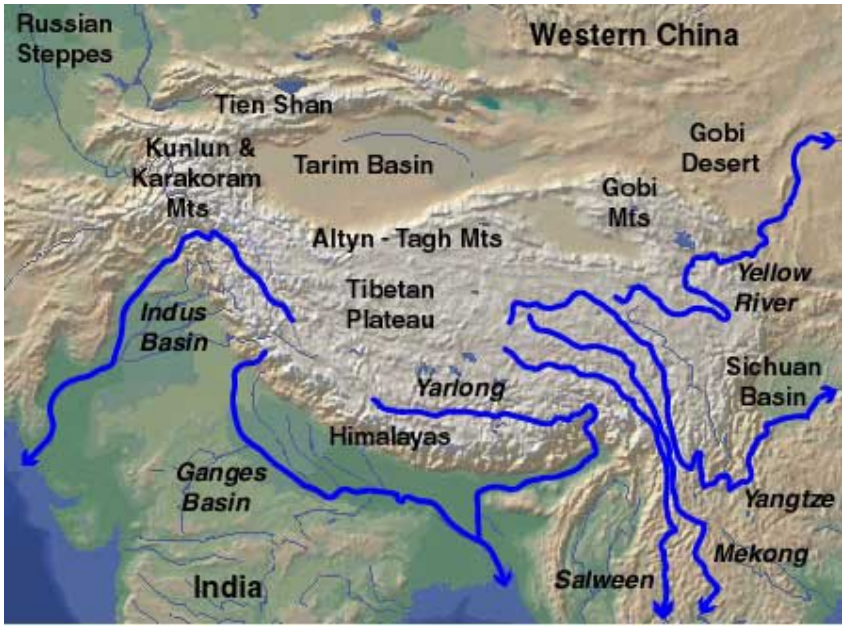
[3] *See* Pearce F. *Flooded out: retreating glaciers spell disaster for valley communities*. New Scientist 16-2 (2189): 18 (1999)

[4] *See* Bandyopadhyay J, Rodda JC, Kettelmann R, Kundzewicz ZW, Kraemer D. *Highland waters—a resource of global significance*. In *Mountains of the World—A Global Priority*, Messerli B, Ives JD (eds). Parthenon Publishing Group: New York; 131–155 (1997).

[5] *See* WWF, *An overview of glaciers, glacier retreat, and subsequent impacts in Nepal, India and China*. World Wildlife Fund, Nepal Program (2005).

water security for approximately 2 billion people.[6]

While the Himalayas have supported development along these rivers for millennia, their ability to sustain future development towards the 2015 targets of the MDGs is now called into question owing to rapid glacial melting from climate change.[7] The Intergovernmental Panel on Climate Change (IPCC) has found that up to 25% of the total global mountain glacier mass could disappear by 2050 and up to half by 2100.[8] Data published by UNEP and the World Glacier Monitoring Service (WGMS) shows that mountain glaciers around the world are continuing to melt as the global temperature rises. The average rate of ice loss from all glaciers around the world since 2000 is over half a meter per year, three times the annual rate during the 1980s.[9]



In the Himalayas, as much as two thirds of glaciers are retreating at an alarming rate. The International Commission for Snow and Ice (ICSI) in a recent study reported that Himalayan glaciers are shrinking quicker than anywhere else and that if current trends continue they could disappear altogether by 2035.[10] WWF reports that Himalayan glaciers are receding at

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[6] WWF, *An overview of glaciers, glacier retreat, and subsequent impacts in Nepal, India and China*. World Wildlife Fund, Nepal Program (2005) at 3.

[7] *See* Singh P, Bengtsson L. *Impact of warmer climate on melt and evaporation for the rainfed, snowfed and glacier-fed basins in the Himalayan region*. Journal of Hydrology 300: 140–154. (2005)

[8] *See* Watson RT, Zinyowera MC, Moss RH (eds). *Climate Change 1995. Impacts, Adaptation and Mitigation of Climate Change: Scientific and Technical Analyses*. Cambridge U Press: Cambridge (1996).

[9] *See* www.wgms.org/mbb/mbb9/sum05.html

[10] *See* www.icsi.org. *See* Meghna Tare, *Himalayan Glaciers*, CSI Fellow, www.csi.org.

10-15 meters per year, and that climate change is accelerating this.[11] Glacial melt will result in increased water flows for several years, followed by water shortages as glaciers gradually disappear.[12]

At the center of this challenge lays the Qinghai-Tibet Plateau in western China, known as the 'Roof of the World'. The plateau covers more than 1.6 million km^2, about a quarter of China's landmass. About the size of Western Europe this forms the largest high-altitude landmass on earth. The plateau stretches across China's provinces of Tibet and Qinghai and contains more than 45,000 individual glaciers, covering about 90,000 square kilometers and extensive permafrost.

It is here where many of Asia's great rivers originate. China's Yangtze and Yellow rivers commence their flow on the plateau, flowing eastward to China's heavily populated rural and urban centers. The Mekong River also originates on the Tibetan Plateau as does the Yarlung Tsang Po River that travels eastwards from Tibet for 2,000 km before becoming the Brahmaputra River flowing south into India and Bangladesh. [13] Most of Nepal's rivers also originate in Himalayan melt waters, subsequently flowing south into India's

[11] WWF at 5

[12] *See* Singh P, Kumar N. *Impact assessment of climate change on the hydrological response of a snow and glacier melt runoff dominated Himalayan river*. *Journal of Hydrology* 193: 316–350 (1997).

[13] *See* WWF, *An overview of glaciers, glacier retreat, and subsequent impacts in Nepal, India and China*. World Wildlife Fund, Nepal Program (2005).

Ganges River, while Pakistan's Indus River also derives its original flows in Tibetan glaciers. [14]

In the decades to come, rapid melting trends could result in decreased water flows and shortages for over 500 hundred million of people directly reliant on these waters, unless actions are taken now to reduce the risk of rapid melting and water supply disruptions.[15] If glaciers continue to retreat at current rates, many of the afore-mentioned rivers systems will be altered, threatening food and water security and threatening by mid-century the reversal of hard won development gains in this part of the world.[16]

The impacts of global climate change on Himalayan glacial melting is far more than a scientific concern, it can have profound political, economic and social repercussions in the region unless urgent action is taken.[17] As one sign of the importance of the issue to countries in the region, institutions from China and India, China's Institute of Geology and Geophysics and the Indian Mountaineering Foundation, recently announced the first joint Indian-Chinese research survey to the Qinghai-Tibet plateau to take place in late-2007 to explore the process of glacial melting and jointly monitor the changing nature of these water sources.[18] In September 2007, the teams will commence research on glaciers at Mount Gang Rinpoche and Mount Loinbo Kangri in Tibet.

A.3. Trends and scenarios in China and the Tibetan Plateau

In early 2007, the Ministry of Science and Technology and six other national ministries jointly issued China's first-ever National Climate Change Assessment Report.[19] The report lays out the likely impacts of climate change

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[14] *See* Lal M. *Climatic change - implications for India's water resources*. Journal of Indian Water Resources Society 21(3): 101–119. (2001). *See* Young GJ, Hewitt K. *Hydrology research in the upper Indus basin, Karakoram Himalaya, Pakistan*. In *Hydrology of Mountainous Areas*, Moln´ar L (ed.). IAHS Publication No. 190. IAHS Press: Wallingford; 139–152 (1998).

[15] *See* Rees H. G. and Collins D. N. *Regional differences in response of flow in glacier-fed Himalayan rivers to climatic warming*, Hydrological Processes, 20, 2157–2169 (2006).

[16] *See* Wang Guo-qing, Zhang Jian-yun, Zhang Si-long, et al. *Impacts of climate change on water resources and its vulnerability in China.* Journal of Water Resources & Water Engineering, 16(2): 8-15 (2005).

[17] *See* ICIMOD. *Inventory of Glaciers, Glacial Lakes and Glacial Lake Outburst Floods—Monitoring and Early Warning Systems in the Hindu Kush–Himalayan Region–Nepal*, International Centre for Integrated Mountain Development: Kathmandu, Nepal (2000).

[18] Rabinowitz G, *Indian, Chinese team to map glacier melt: Two expeditions will take scientists into remote areas of Tibet,* Associated Press, December 21, 2006.

[19] Ministry of Science and Technology (MOST), *National Climate Assessment Report*, Beijing (2007)

on social and economic development over the next decades, showing few aspects of development will escape from the emerging trends.[20] According to the Government report, China's average annual temperature may increase between 1.3°-2.1° C by 2020, by as much as 3.3° C by 2050 and by as much as 6° C by 2100. The report also predicts rainfall to increase in some regions of China as much as 17% by 2100.[21] However, regional differences in precipitation patterns would become more extreme and increases in temperature could result in increased evaporation, resulting in net water reductions around some inland rivers.[22]

According to China's Initial National Communication to the UN Climate Change Convention, glaciers in Western China could decrease overall by 27% by 2050.[23] With one quarter of the world average per capita water availability, China already faces serious water pressures. The findings suggest that this could get worse in some regions owing to reduced glacial water flows and rising temperatures, with the risk of per capita water availability in certain regions decreasing by a further 20-40% by 2080.[24] By 2050, China's grain output could fall by as much as 10% unless crop varieties adapt to new temperature and water regimes, while by the latter half of the century, production of wheat and rice could drop by as much as 37% according the National Climate Change Assessment Report.

China is also expected to have more extreme weather. Typhoons, floods and droughts killed 2,704 people and caused a loss of $27.32 billion in 2006, China's warmest year on record since 1951.[25] Some coastal zones of China have already seen sea level rise of about 5cm/yr, among highest in the world. Major urban areas such as Shanghai are expected to face serious challenges from rising sea levels, including increased salinity of groundwater supplies.[26]

For Western China, recent UNEP/GEF projections show a major warming very likely to develop over Western China during the 21st century,

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[20] *See also* Qin Dahe,Ding Yihui,Su Jilan,*et al* .*Climate and Environment Changes in China,Volume I: Climate and environment changes in China and their projections*, Beijing: Science Press (2005).

[21] *MOST* at 12.

[22] WANG Shun, WANG Yan-guo, WANG Jing, et al. *Change of Climate and Hydrology in the Tarim River Basin during Past 40 Years and Their Impact.* Journal of Water Resources & Water Engineering, 2004, 12(3): 23-30

[23] National Climate Change Coordination Committee, *Initial National Communication to the UNFCCC,* 39-45, NCCC, Beijing (2002).

[24] Id.

[25] Chinese media

[26] *MOST* at 15

based on projections using IPCC assessment data and the results run by China's National Climate Center and the Institute of Atmospheric Physics. Western China could see temperature rise of 1.0-2.5° C by 2050 (relative to 1961-1990 figures), with Western China likely to see higher increases than the national average trends, and greatest increases seen in the northern reaches of the Tibetan Plateau. [27] At the same time, rainfall over Western China could increase by 5-25% by 2050 relative to 1961-1990 levels according to the study.

Recent research by the National Development and Reform Commission, the Ministry of Water, the Chinese Academy of Social Science, the National Natural Science Foundation and various local partners has found that by 2050, glaciers in Western China will experience a strong retreat, and the areas of marine-type, sub-continental-type, and continental-type glaciers will reduce by 30%, 12% and 5%by 2030, and by 50%, 24% and 15% by 2050, respectively.[28] The study predicts sudden flood and glacial outbursts will increase in Tibet and surrounding areas. Glacial runoff would increase 5%-30% across the plateau and increase as high as 50% in specific areas. Areas of unstable snow cover will increase precipitating more severe winter and spring droughts.

Meanwhile frozen soils overlaying the plateau, the permafrost, are expected to decrease by 5%-15% in the Tibetan Plateau, while the permafrost boundary on mountain slopes could rise by 300-400m. Permafrost melting in the plateau would also increase through higher soil temperatures over the next 30-50 years.[29] With increased temperatures of approximately 2C over the next 50 years in the area, permafrost with temperature above -0.42C will only exist seasonally. Permafrost melting would reduce water runoff into streams and groundwater supplies, with estimated water loss as much as 5-11 billion m3/yr in the Qinghai-Tibetan Plateau region.[30] Permafrost degradation is expected to lead to decline of natural forest areas, shifting habitat of vegetation species, and disappearance of grasslands.

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[27] *See* Yongyuan Yin, *Vulnerability and Adaptation to Climate Variability and Change in Western China*, Report Project No. AS 25 at 15, UNEP/GEF Assessments of Impacts and Adaptations to Climate Change (AIACC) Project, START Secretariat, Washington (2005). *Also See* Weihong Qian, Xiang Lin, *Regional trends in recent temperature indices in China*, Climate Research, 27:119-134 (2004) *and* Zhao Z.C., Ding Y., Xu Y. and Zhang Jin, *Detection and projection of climate change over Northwest China for the 20th and 21st centuries due to the human activity*, Climate and Environment Research, 8(1).26-34 (2003).

[28] Chen Yiyu, Ding Yongjian, She Zhixiang, *et al. Assessment of Climate and Environment Changes in China (II): Impacts, adaptation and mitigation of climate and environment changes*, at 3. Beijing: China Science Press (2005)

[29] Id

[30] Id

In the Tibetan Plateau, temperatures hit record highs in early 2007. January temperatures in the Qamdo area of the Tibet Autonomous Region hit 21.8° C, 1.7° C higher than the previous record set in 1996.[31] And in Dengqen County in Tibet, temperatures reached 16.6° C, 2.5° C higher than the previous record in 2001. Eight other spots across the plateau also recorded record-breaking temperatures in 2007. According to the recent National Climate Change Assessment Report, warming trends are shrinking the glaciers by 7% a year, and can threaten the Yangtze and Yellow Rivers, and trigger more frequent droughts, sandstorms and desertification in other regions of China. According to recent studies, ice core records from the Dasuopu Glacier in Tibet indicate that the last fifty years have been the warmest in the past 1,000 years.[32]

The report finds that China's glaciers declined by 21% since the 1950s, an average of 131.4 km^2 annually over the past thirty years. If climate change continues at its current rate, two thirds of the glaciers could disappear by 2050, and almost all could be gone by 2100.[33] According to research on the Tanggula Mountain Glacier in Tibet, 50% of the 2213 m^2 glacier could melt by 2050 if the temperature rises by just 2.4° C, and 90% will disappear if it rises by 5.8° C.[34] The report predicts that the shrinking of the glaciers would seriously impact livelihoods of Tibetan mountain communities and exacerbate water supply and land degradation challenges further downstream. Analysis of data by the Chinese Academy of Social Science (CASS) from 680 Chinese weather stations shows that average temperatures in the plateau region have risen 0.9° C since the 1980s resulting in an annual 7% reduction in glacier extent and the widespread melting of permafrost.

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[31] Zee News, *Tibet`s record temperatures spark climate change fears*, Beijing, January 8, 2007 (http://www.zeenews.com/znnew/articles.asp?aid=346544&ssid=26&sid=ENV)

[32] *See* www.climatehotmap.org/fingerprints

[33] MOST at 27

[34] *Glacier on Tibet-Qinghai Plateau Melting Fast,* Xinhua News Agency, Beijing, May 21, 2005.

In Lhaze County, in the western reaches of Tibet, increased levels of development has resulted in gradual deterioration of land and water resources over the past several years.[35] Given the fragile nature of the mountain ecosystems in the area, and the rapid loss of forest cover over the past decades and immature soils, the ability of the area to preserve moisture and soil fertility is already low. Trends of environmental degradation will become even more challenging with the emerging impacts of glacial melting and climate change in Tibet.[36]

Traditionally, summer precipitation accounted for more than 80% of the area's annual water and irrigation supply. Farmlands, grasslands, and other vegetation along the edges of local streams are now threatened. Climate change is already starting to alter this regime.[37] Increasing temperatures in the region are also changing the nature of wind patterns, bringing increased erosion and sandstorms. Data from local weather stations shows that sandstorms have increased in recent years.

In summary, three general consequences are foreseen from continued glacial melt in various regions in the plateau. First, continued melting trends will have serious implications for *upstream and downstream water supply*. As noted by the 2006 UNDP Global Human Development Report "Beyond Scarcity: Power, poverty and the global water crisis", recession of the Himalayan glaciers threatens to disrupt the water supply of over 100 cities and 300 million people across China.

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[35] Yan-Zhi Zhao, Xue-Yong Zou *et al*, *Assessing the ecological security of the Tibetan plateau: Methodology and a case study for Lhaze County,* Journal of Environmental Management 80 120–131 (2006).

[36] *See* Xu Y, Zhao Z-C, and Li D, *Simulations of climate change for the next 50 years over Tibetan Plateau and along the line of Qing-Zang Railway,* Plateau Meteorology, 24(5).698-707 (2005). *See* Sharma KP, Vorosmarty CJ, Moore B. *Sensitivity of the Himalayan hydrology to land-use and climatic changes*. Climatic Change 47: 117–139 (2000).

[37] Yan-Zhi Zhao, Xue-Yong Zou *et al*, at 128.

Second glacial melting will exacerbate *land degradation and desertification trends*. Climate change is exacerbating unsustainable land-use practices in Western China, increasing frequency and severity of dust storms and catalyzing conversion of grasslands into semi-desert conditions in this area home for centuries to local herders making their livelihoods from livestock management.[38] Official estimates show 2,330 km^2 of land going to desert each year while a much greater area seeing reductions in productivity as land faces the dual challenge of overuse and a changing climate.

Third, increasing temperatures in the Plateau are also associated with melting of the *permafrost,* frozen soils that underlay much of the region. Climate change is exacerbating the melting of these soils, threatening to further exacerbate the scale of potential future desertification in area.[39] Also of concern is the likely release of greenhouse gases such as methane and carbon dioxide from such soil as it thaws. With estimates of the amount of carbon locked up in permafrost ranging between 60 and 190 billion tons, thawing of the soil of the Tibetan plateau will produce a large-scale release of greenhouse gases, further adding to the climate change process. The melting of glaciers in the plateau is indeed a local, regional and global concern.

B) Vulnerability of Development in the Tibetan Plateau

B.1. The Western Development Strategy

It was 1992 when the Government of China formally announced its official policy to establish a 'socialist market economy with Chinese characteristics'. This served to be a historic event not just for China, but for the world. This dramatic shift unleashed a new era of globalization and

[38] *See* GAO Qingzhu, LI Yu'e, LIN Erda, et al. *Temporal and Spatial Distribution of Grassland Degradation in Northern Tibet*. Acta Geographica Sinica, 2005, 60(6): 965-973.

[39] *See* Cheng, Guodong (ed.) *Assessing Climate Change Impacts on Snow pack, Glaciers, and Permafrost in China.* Gansu Culture Press, Lanzhou (1997).

development in China, opening-up an expanded role for the private sector to drive China's growth and setting the stage for China's re-emergence at the center of the world economy.[40]

Just fifteen years on, China is now the world's fourth largest economy with per capita GDP over US$ 1,000 and foreign exchange reserves over US$ 1 trillion. China's growth rate now accounts for about 17% of world GDP growth, second only to the US contribution.[41] Currently just 35% of China's population survives on less than US$2 per day, with relatively large gaps in economic growth and development results between urban and rural areas, and between coastal regions in the east and landlocked regions in the west. While overall growth continues at a rapid pace, concern has shifted to making future growth more socially equitable with special concern to extend the benefit of global markets and rapid growth to less developed landlocked regions in Western China.

Towards this end, China enacted a 'Western Development Strategy' in 2000 to support achievement of a set of core socio-economic development goals by the year 2015. This is in line with China's national Xiaokang Goals for a 'Well-Off, Balanced Society' and the Millennium Development Goals (MDGs). Western China covers nine provinces and autonomous regions, and dozens of municipalities, altogether covering 60% of the country with a population over 370 million (25% of the national total). The region is also vital to continued growth in the east, hosting 80% of China's total water supplies, 50% of China's mineral reserves and 36%, 12% and 53% of China's coal, oil and natural gas reserves.[42]

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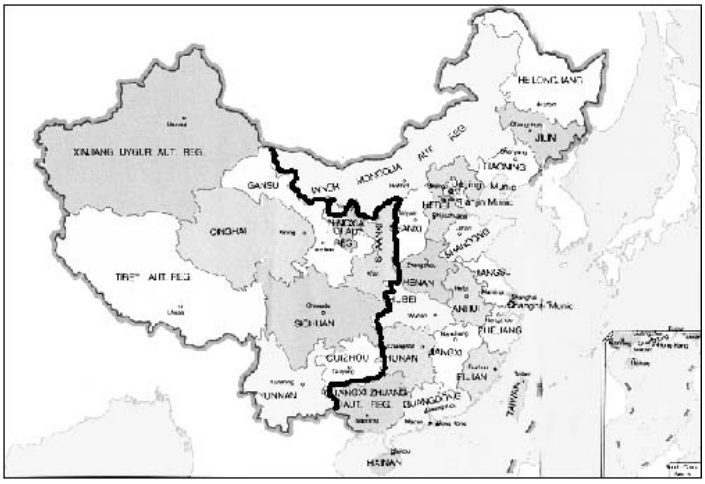
[40] Hart-Lansberg M and Burkett P, *China and Socialism: Market reforms and class struggle*. Monthly Review Press, New York (2005) at 5.

[41] Id at 87

[42] PRC, *Development Strategy of Western China*, Permanent Representation of the People´s Republic of China to the United Nations Agencies for Food and Agriculture in Rome (2000)



During its *first phase* (2000-2005), the Western Development Strategy focused on developing basic infrastructure - roads, highways, airports, urban centers, to connect landlocked areas to more economically developed regions in the East. According to official figures, during this period the Government invested RMB 1 trillion (approximately US$125 billion) to develop over sixty projects in transport, water, energy and telecommunications. According to official figures, during this period the West reported an annual average GDP growth rate over 10%, with the region's combined GDP reaching 3.33 trillion Yuan (US$416.25 billion) by 2006, from 1.66 trillion Yuan at the start of the strategy in 2000. Fixed asset investment grew by 23% annually and local revenue grew by an average of 15.5%.[43]

Based on a foundation of improved infrastructure and increased access to domestic and international finance, the *second phase* (2005-2015) is expected to see an expansion of inter-provincial and international investment and trade with the West, increased local GDP and translation into an increase in human development indicators.[44] While increased investment and trade in natural resources and commodities is central to the strategy, emphasis is also placed on translating local growth into public health, education and social services for rural communities towards achievement of social development goals. The *third phase* (2015-2050) is meant to see a consolidation of growth and development trends by mid-century.

Apart from its landlocked nature, a number of other factors have also inhibited the regions achievement of faster increases in development indicators. Western China is home to expansive drylands; fragile ecosystems where expanded development will exacerbate pressures on land degradation

[43] *W. China Development Strategy Bears Fruit,* Xinhua News Agency, Beijing, August 31, 2006

[44] PRC at 5

and water scarcity and threatened sustainability, unless preventive measures are taken. Indeed, the Western Development Strategy calls on development agents to integrate ecological sustainability into investment activities.[45] This brings to the fore concerns over a 'race to the bottom', incentives for provinces in the West to compete for new investment opportunities by easing environmental requirements. It also raises issues of 'environmental justice', the special plight of vulnerable groups and segments of society within provinces whose health and well-being could be disproportionately impacted by future increases in pollution.

As noted above, also of top concern now are the emerging consequences of climate change following China's 2007 National Climate Change Assessment. At the center of the debate over the environmental risks in the Western Development Strategy are the risks that glacial melting in the Tibetan Plateau pose for achievements of regional development goals and the MDGs. While the science of climate change and the nature of future impacts are increasingly understood, an urgent need exists to effectively integrate responses - 'Adaptation Policy Frameworks' - into local development plans and programmes – to 'climate proof' future human development gains.

Vulnerability of MDGs to Climate Change in Western China[46]

MDG 1: Poverty reduction and food security

- Impacts of glacial melting on land and water ecosystems in Western China, and to local economies and poverty reduction efforts,
- Impacts of glacial melting on the national economy and poverty reduction efforts from altered water flows in the Yangtze and Yellow Rivers and impacts on national agriculture, industry and urban users,
- Impacts of glacial melting on food security given uncertainties in weather patterns changes to land and water regimes and crop yields

MDG 2: Education

- Impact of altered water regimes on time it takes for rural communities to seek water and earn farm related incomes, reducing time for education

Goal 3: Gender Equity

- Impacts of glacial melting on poverty reduction efforts have gender elements, as women have disproportionately less income in Western China
- Impacts on agriculture and rural economy impact disproportionately on women who have greater reliance on natural resources incomes

[45] Id at 10

[46] *Adapted from* Friends of the Earth Australia, *Changing the Future of the World's Poor*, Canberra (2003).

Goal 4: Health

- Risk that rising temperatures in Western China poses for prevalence of infectious disease.
- Risks from reduced water flows on environmental health

Goal 7: Water and Environment

- Risk of water shortages as a result of increased temperature, changes in rainfall and glacial melting patterns
- Ecosystem change leading to loss of arable land and extension of drylands

Goal 8: Trade and Investment

- Glacial melting poses risks to sustainability of increased inter-provincial and international investment and trade links to Western China.

At stake is the future of human development in Western China itself, and the sustainability of ecosystems and natural resources in the West which China as a whole is now dependent on to sustain national growth. As noted further below, rapid changes to the climate and the Himalayan glaciers, combined with changes to land and water ecosystems, present serious risks to the ability of current and future generations to achieve human development goals – to achieve their right to development as enshrined in China's Constitution and international policy.

B.2. Development trends in the Tibetan Plateau

During Phase I of the strategy, a team of geological survey experts conducted the first-ever large-scale Qinghai-Tibet Plateau Geological Survey. The results show vast metal reserves deep beneath the surface of the Plateau, identifying 600 potential sites for new mines with estimated reserves of 30-40 million tons of copper, 40 million tons of lead and zinc and several billion tons of iron ore.[47] Official figures show that Tibet generated fiscal revenue of 5.25 billion Yuan (about US$656 million) during the first phase of the Western Development Strategy (2000-2005) and inward investment of 72 billion Yuan (about US$9 billion).[48] This included investment in over one hundred infrastructure projects, including a new Qinghai-Tibet Railway, now the world's highest elevation railway.

During Phase II of the strategy (2006-2010), China seeks to build on this initial infrastructure and research investment by supporting increased levels of inter-provincial and international trade. An example is the Yulong copper mine in Tibet, a joint venture between Chinese and international

[47] *Metal Reserves Found on the Roof of World,* China Daily, Beijing, February 13, 2007.

[48] *State Aid Promotes Tibet's Development,* Xinhua News Agency, Beijing, April 14, 2006.

investors with registered capital of 625 million Yuan (approximately US$78.1 million). With construction to commence in 2007, Yulong will soon become China's largest copper mine with 6.5 million tons of reserves.[49]

Despite the prospects that increased investment and trade holds for local revenues and increased funds for social development goals, the Qinghai-Tibet Plateau Geological Survey calls for a 'gradual development' of mining in the region, warning that rapid exploitation could permanently damage the plateau's fragile ecosystem.[50] It calls for natural restoration plans as a pre-condition to industrial development. This serves as one example where climate risks can be factored into general development trends so as to sustain local ecosystems and prevent damage to local human development prospects.

Unless such considerations are taken seriously, Tibet could face serious consequences as environmental impacts of rapid development combine with the underlying risks from climate change and glacial melting. The development of resources such as hydropower, mineral extraction, timber, wildlife and livestock and the associated increase in human populations has significant correlations with ecosystem sustainability of the region, and with climate change impacts in particular.

Several development activities planned for the plateau under Phase II of the Western Development Strategy stand vulnerable to glacial melting trends. An example is the landmark Qinghai-Tibet Railway, one of the most symbolic projects under the Western Development Strategy. Opened on October 15, 2005, the new railway is expected to reduce the cost of transporting goods between West and East, catalyze increased trade of goods and services, and reduce the cost of basic commodities for local consumption in Tibet. However, part of the railway is built on permafrost, and trends of

[49] *Largest Copper Mine to Start Construction in Tibet,* Xinhua News Agency, Beijing, April 7, 2006

[50] *Id*

climate change and permafrost melting over the next decades have caused concern.[51] Permafrost melting seriously threatens transport services of Qinghai-Tibet railway and highway and other infrastructure projects in the region.[52] Further plans for investments in airports, roads, and ecotourism will also face such risks.

China also plans to develop hydropower facilities in the region to fuel rising energy demands. According to recent surveys of potential hydropower resources across China, Tibet could produce more than 100 million KW of hydropower. With a 1.34 billion Yuan (about US$165 million) investment from the Chinese government, the first unit of a new 100,000-kw hydropower scheme is planned to commence operation on the Lhasa River in 2007.[53] The Lhasa River flows through Lhasa City, capital of Tibet, before joining the Yarlung Tsangpo River further east, also known as the Brahmaputra as it flows out of China into India and Bangladesh. Apart from power generation, the hydropower project is also expected to play a role in flood control and irrigation.

Over the next 50 years, geological hazards in mountain areas are also expected to increase owing to glacial melting and climate change. Debris flow, landslides etc will increasingly threaten towns and industrial activities in the Tibetan Plateau.[54] As glacial melting increases over the next decades, water tables will fall, springs and streams will dry up and rivers will have reduced flows.

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[51] *See* Xu Y., Zhao Z-C., and Li D., *Simulations of climate change for the next 50 years over Tibetan Plateau and along the line of Qing-Zang Railway*, Plateau Meteorology, 24(5).698-707 (2005).

[52] Chen Yiyu, Ding Yongjian, She Zhixiang, *et al. Assessment of Climate and Environment Changes in China (II): Impacts, adaptation and mitigation of climate and environment changes*, at 3. Beijing: China Science Press (2005)

[53] *Tibet's Largest Hydropower Project to be Operational***,** Xinhua News Agency, Beijing, March 27, 2006

[54] *Chen et al* at 5

Adequate consideration of climate risks can help investors and local communities buffer investments from the future impact of climate change. Lack of integration of climate risks into such investments could undermine the local ecology and economy, and threaten the sustainability of any gains made by the Western Development Strategy as a whole.

B.3. The Case of the Yangtze River headwaters

The Yangtze River Headwaters are situated in the interior of the plateau, lying between the Kunlun and Tanggula Mountains in southern reaches of Qinghai Province and northern reaches of Tibet.[55] The Yangtze River is China's largest, and provides crucial water supply to industry, agriculture and 500 million domestic users along its course. In its downstream reaches, the Yangtze is home to the Three Gorges Dam, now the world's largest hydroelectric dam, slated to commence electricity provision in 2009.

The year 2006 was China's warmest year in almost half a century, and the upper reaches of the Yangtze saw their lowest levels since the 1920s. Many now worry of the consequences for the Yangtze from long-term decreases in water flows owing to glacial melting. According to recent studies by NDRC and the Ministry of Water, climate change will also bring sudden melting events in the Tibetan Plateau that could cause an increase of sudden flood events in the middle reaches of the Yangtze. [56]

The source of the Yangtze is in the semi-arid alpine zone of the plateau in Tibet and Qinghai Provinces. At about 4000m above sea level, the area has low population, extensive permafrost and annual average temperatures

[55] WANG Xin, XIE Zi-chu, FENG Qing-hua, et al. *Response of Glaciers to Climate Change in the Source Region of the Yangtze River.* Journal of Glaciology and Geocryology, 2005, 27(4): 498-502

[56] *See* Chen Yiyu, Ding Yongjian, She Zhixiang, *et al. Assessment of Climate and Environment Changes in China (II): Impacts, adaptation and mitigation of climate and environment changes*, at 3. Beijing: China Science Press (2005)

between 2-4C. However, according to recent studies, climate change has brought increases in average annual temperature by as much as 2C in the last 50 years, bringing about accelerated permafrost melting.[57] Over the next 50 years, the temperature is expected to increase even faster, altering the ecological nature of the area and eventually reducing glacial melt flows into the Yangtze.

With a naturally dry and cold climate with sparse vegetation, the area is already characterized as a fragile mountain ecosystem. Adding to this are the current and future impacts of climate change, with land degradation and reduction of permafrost already seen throughout the area.[58] Indeed the area can now officially designated as 'desertified land'.[59] Recent field research and remote sensing data have confirmed the area of land degradation and soil erosion to have now passed over the 100,000 km^2 mark by 2006, over two-thirds 67% of the total area.[60]

Such trends pose serious risks not only for local communities in Western China dependent on the waters for agriculture, livestock and domestic use, but also for the hundreds of million of downstream users. Sediment deposition in past years has already raised the riverbed and reduced the capacity for flood discharge. Rapid changes owing to climate change are expected to exacerbate this process unless preventive and adaptive measures are taken.

Changing climates and glacial melt will make future watershed conservation efforts increasingly difficult, and will aggravate sand deposits into the Yangtze silting up its middle and downstream reaches and further reducing its flood discharge capacity.[61] Such changes being risks to related to water supply and disaster prevalence in the entire Yangtze River basin. Future impacts will come from glacial melting and reduced water flows, permafrost-melting exacerbating land degradation, and increased wind erosion resulting from changing local climates. Permafrost melting is of particular concern given the local and national threats from rapid desertification.

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[57] *See* FAN Qi-shun, SHA Zhan-jiang, CAO Guang-chao, et al. *Assessment of the Influence of Glacial Resources on Climatic Changes in Qinghai Plateau*. Journal of Arid Land Resources and Environment, 2005, 19(5):56-60.

[58] *See* GAO Qingzhu, LI Yu'e, LIN Erda, et al. *Temporal and Spatial Distribution of Grassland Degradation in Northern Tibet*. ACTA GEOGRAPHICA SINICA, 2005, 60(6):965-973.

[59] P. YAN, G. R. DONG et al, *Desertification Problems in the Yangtze River Source Area, China,* Land Degrad. Develop. 15: 177–182 at 177 (2004).

[60] Id at 179

[61] WANG Xin, XIE Zi-chu, FENG Qing-hua, et al. *Response of Glaciers to Climate Change in the Source Region of the Yangtze River.* Journal of Glaciology and Geocryology, 2005, 27(4): 498-502

Reduced water flows resulting from glacial melting will also exacerbate the process of dryland expansion and siltation into the Yangtze.[62]

As highlighted in recent studies, local adaptation measures must consider factors unique to this area: (1) infrastructure solutions are unlikely to be stable due to permafrost melting and resulting land instability, (2) afforestation to support soil stability will be difficult given challenges of increasing water scarcity, and (3) the area lacks capacities for local environmental governance to take aggressive measures. As the Western Development Strategy moves forward, adaptation measures must be incorporated into investment and development plans to take into account the changing nature of the environment and the implications for local human development goals.

Adaptation measures in such cases also need to be integrated into national actions; land degradation and water supply are now top national priorities. This includes the need for integration of climate change risks into environmental assessments for domestic and foreign investments directly or indirectly linked to the glacial melting issues in the region. It should also include capacity building for local agencies in the source areas in Qinghai and Tibet to improve indicator and monitoring system to track the emerging vulnerabilities from rising temperatures, and permafrost and glacial melting.

C. Adaptation in the Tibetan Plateau

C.1. A Human Development Approach

Climate change poses risks not only to physical infrastructure and ecosystem change, but also to the sustainability of human development in the region.[63] Climate change is increasingly seen as a fundamental threat to human security with risks for reversal of hard won development gains over the next decades.[64] While China has experienced the fastest reductions of human poverty in history, as noted by the Stern Report on "The Economics of Climate Change" human development itself could face a major 'U-turn' by

[62] Yin, Y., Miao, Q. and Tian G. (eds.) *Climate Change Impact Assessment and Sustainable Regional Development in the Yangtze Delta.* Special Issue of Journal of Meteorology, Nanjing Institute of Meteorology, China (1999).

[63] See Goldstein MC, Jiao B *et al*, *Development and Change in Rural Tibet: Problems and Adaptations,* Asian Survey, Vol. 43, No. 5. 758-779 (2003).

[64] *See* Ribot, J.C., Magalhães, A.R, Panagides, S. *Climate variability, climate change, and social vulnerability in the semi-arid tropics*, Cambridge, Cambridge University Press (1996).

mid-century.[65]

If current trends continue, climate change will jeopardize China's Western Development Strategy and local achievement of the Millennium Development Goals in the Tibetan Plateau, unless urgent measures are now taken to 'climate proof' development results. There has been growing awareness within the region itself of the impact of climate factors on local livelihoods - particularly for rural communities whose livelihoods are dependent on natural resources but lack the capacities to respond to changing land and water dynamics.[66] Local communities have traditionally been effective in adapting to changing environments and conditions, but the projected magnitude of climate change from rising temperatures and glacial melting in the plateau could stretch this adaptive ability to its outer limits, with serious consequences for local development. Given the unprecedented scale and consequences of impacts in the area, environmental changes often render the customary knowledge and traditions in the plateau ineffective.

Current strategies for infrastructure investments and increasing trade and growth are no longer a guarantee for improved social development results, once the far-reaching implications of climate change are factored in. Indeed rapid developments that fail to take climate change into account will likely exacerbate risks to human development if they add to ecological challenges in the fragile environment of the Tibetan Plateau.

Climate change calls for a shift in the development paradigm, in which policy decisions regarding the Western Development Strategy fully integrate the vulnerabilities local communities will face from climate change. Using a Human Development Approach to climate adaptation would go beyond the reorientation of policies to climate proof infrastructure and investments projects. A focus on human capabilities in Tibet and surrounding areas would ensure communities are able to act as agents of change, taking proactive measures to adapt to climate risks to ensure local development, ways of life and livelihoods.

In the 1990's, Nobel economist Professor Amartya Sen articulated the foundation of the Human Development Approach.[67] In his classic work

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[65] Stern N *The Economics of Climate Change*, London (2006)

[66] *See* Yongyuan Yin, *Evaluation Tools to Identify Implications of Climate Change and Economic Development for Sustainability in Lijiang and Yulong Mountain Region of China,* Environment Canada, (2003). *See* Brogaard S and Seaquist J, *An assessment of rural livelihood vulnerability in relation to climate - a case study in agro-pastoral northern China,* paper presented at International Workshop on Human Security and Climate Change, Oslo (2005).

[67] Sen A, *Development as Freedom*, (2000).

"*Development as Freedom"* Professor Sen argued that development is "not the mere accumulation of goods but the enhanced freedom to choose, to lead the kind of life one values".[68] Beyond being beneficiaries of economic and social development, climate-affected communities need to be active agents of change to ensure that any local development gains can be sustained by future generations. By focusing on Sen's human capability approach, the attention of climate impacts in the region shifts from climate proofing infrastructure and investments, to aspects of community life beyond income, to better understand the aspects of local life and culture climate change poses its greatest risks.[69]

Two principles have historically been applied under the capability approach – (i) that the chosen capability be *universally valued* by people across the world and (ii) that the capability be *basic so that without it, many other capabilities would be foreclosed.*[70] A capability approach allows measures to adapt and accommodate to new challenges in a world of rapid change. Global environmental issues now stand at the center of that change. Beyond being a mere 'market externality', climate change is now shifting the very foundations of life on earth, with implications for our concept of human development itself.

The ability to achieve and sustain a certain quality of life for current and future generations is now under threat for communities around the world, including those affected by climate change and glacial melting in the Tibetan plateau. Indeed one could say that the capacity to deal with climate change is quickly becoming a universal value held by people across the planet, and that without this capacity many other human development goals are in jeopardy.

The purpose of adaptation measures under a human development approach is to improve human capabilities and lives, to ensure communities' abilities to achieve and sustain their development goals in a rapidly changing environment. From this point of view, adaptation should be about removing vulnerabilities to climate change as obstacles to achievement of future development goals. A human development approach to Western Development would focus adaptation measures on the capability of future generations in

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[68] Marks SP**,** *The Human Rights Framework for Development: Five Approaches*, at 4, Submission to the 2nd Global Forum on World Development, UNDP, Rio de Janeiro (2000). *See also* Alston, P *Making Space for New Human Rights: The Case of the Right to Development*, 1 Harvard Human Rights Yearly Bulletin 3, 20 (1988).

[69] *See* Cantrell T, Holthaus E, and King A, *China and Its Climate: The Impacts on Culture*, in Using the Science of Weather in Business and Public Policy, London (2005). *Also see* Cheng-Bang An and Lingyu Tang et al *Climate change and cultural response around 4000 cal yr B.P. in the western part of Chinese Loess Plateau,* Quaternary Research 63, 347– 352 (2005).

[70] Fukuda-Parr, *Operationalising Amartya Sen's ideas on capabilities*, UNDP Working Paper 6-7, New York (2002).

Tibet and surrounding areas to achieve a standard of living and way of life as good as those of the present generation and on the right of future generations to live in a healthy and productive environment.

C.2. A Rights Based Approach

For communities in the Tibetan Plateau, climate change poses fundamental threats to their ability to sustain standards of living, local ways of life and the exercise of their basic 'Right to Development'. The UN Declaration on the Right to Development was adopted by the United Nations General Assembly in 1986 by an overwhelming majority. The first article in the Declaration puts forward the concept of the right to development as "an inalienable human right by virtue of which every human person and all peoples are entitled to participate in, contribute to and enjoy economic, social, cultural, and political development in which all human rights and fundamental freedoms can be fully realized."[71] China's Constitution also places emphasis on the fundamental right of communities to achieve social and economic development goals.

Climate change and the environment are critical to achieving basic rights.[72] The process of integrating environmental concerns into a broader rights framework started in 1972 with the Stockholm Declaration on the Human Environment stating; "man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being". This was taken forward in Principle 1 of the 1992 Rio Declaration on Environment and Development that stated "human beings are at the center of concern for sustainable development" and that they are "entitled to a healthy and productive life in harmony with nature". [73]

Since then, climate change has accelerated and has now become a much larger global concern. Climate change stands to transform the landscape of development and the ability of communities' to achieve a minimum level of socio-economic rights. Many in China, and in Western China itself, argue that urgent problems of survival are more crucial than long-term human security in less economically developed areas such as those in the plateau. However, this reflects a traditional 'need-based approach' to development, which the

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[71] Sengupta A, *The Right to Development as a Human Right,* Working Paper*,* Harvard School of Public Health (1999) at 2.

[72] *See* UNEP, *Human Rights and the Environment ,* Proceedings of UNEP Geneva Environment Network Roundtable, Geneva (2004). *See also* Watt-Cloutier S, *Climate Change and Human Rights*, Human Rights Dialogue, Series 2 No.11 pp 10-12, Carnegie Council, New York (2004)

[73] Dias A, *Human Rights, Environment and Development* at 3*,* UNDP Human Development Report 2000 Background Paper, New York (2000)

capability approach includes but goes well beyond.

The UN Special Rapporteur on Human Rights & the Environment further elaborated the link between the right to development and global environmental change, arguing that the right to development would be violated if trends of climate change and other environmental harms continue. The UN Special Rapporteur encapsulated this in the idea of a 'right to prevention of ecological harm' as part and parcel of the right to development, particularly given the clear impacts of global environmental change on poor and vulnerable communities.[74]

Given the stark changes expected in the future, a stable climate is quickly evolving to become an essential element of the Right to Development, as part of the 'enabling environment' in which communities - current and future generations - can lead secure and healthy lives. Making this connection lifts ecosystem services from being a subset of other rights, such as water or land related aspects of economic and social rights, and endows the 'emergent', more complex elements of ecosystems, such as climate change, to a higher moral, policy and legal plane for communities and policy makers to better balance against the dominant economic drivers of change.

Applying a rights-based approach in the Tibetan plateau construes adaptation as a way of protecting and achieving socio-economic rights in vulnerable communities, emphasizing equity between upstream and downstream communities, between urban and rural communities and between current and future generations. Sustainable human development is "development which meets the needs of the present generation without compromising the ability of future generations to meet their own needs." By integrating climate change into the right to development, the long-term nature of climate change consequences calls for solutions tailored for today and for future generations.

The human security aspects of climate change are becoming central to the basic concept of human development, and as such a new paradigm is needed, one which takes us from Sen's original 'Development as Freedom' model to a new 'Sustainable Development as Freedom' model with climate and ecological security as a core freedom within broader human development and right to development frameworks. In addition to the 'five freedoms' outlined in Sen's 'Development as Freedom' concept, there is a growing view to climate and ecological security as a 'sixth freedom'. As noted by Professor Sen in 2004,

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[74] Dias A, *Human Rights, Environment and Development* at 18-20, UNDP Human Development Report 2000 Background Paper, New York (2000)

> *"To use a medieval distinction, we are not only patients, whose needs demand attention, but also agents, whose freedom to decide what to value and how to pursue it can extend far beyond the fulfillment of our needs. The question can thus be asked whether environmental priorities should be seen in terms also of sustaining our freedoms. Should we not be concerned with preserving - and when possible expanding - the substantive freedoms of people today without compromising the ability of future generations to have similar, or more, freedoms? Focusing on 'sustainable freedoms' may not only be conceptually important (as a part of a general approach of 'development as freedom'), it can also have tangible implications of immediate relevance."*[75]

Analyzing adaptation measures in this context would recognize the fundamental value of a stable climate as a basic condition of life, indispensable to human welfare and to the fulfillment of social and economic rights. Given the gravity of the situation, actions to address climate change are more than an academic exercise; they are quickly becoming issues of 'common concern for humanity', a growing ethical concern for people across the world.

In the Tibetan Plateau, concerns over climate align with cultural norms and traditions regarding our duty to protect the environment. In the sacred *Sutta Nipata*, the Buddha argued that since humanity is far more powerful than other species, we have special responsibilities to the environment linked to this asymmetry of influence. A common sense of urgency among humanity to the growing crisis of climate change brings forth an opportunity to engage this responsibility to support community-based capacities for adaptation, based on a sense of their right to a healthy environment, and our moral duty to address climate change as a 'common concern of humanity'.

C.3. Conclusion: Options for local adaptation measures

Based on the recent findings of China's 1st National Climate Change Assessment, and the realization of the long-term and serious consequences of glacial melting in the Tibetan Plateau, UNDP, Norway and China's National Climate Change Coordination Committee (NCCCC) of the National Development and Reform Commission (NDRC) are now launching a new Programme entitled "Provincial Strategies and Actions for Climate Change Mitigation and Adaptation". While national policies have been enacted to set the vision and overarching direction for climate change mitigation and adaptation, much work is needed to have such policies translate into on-the-ground action.

UNDP's new programme in China includes a major emphasis on building local capacities for taking adaptation measures in the Tibetan Plateau,

[75] Sen, A, *Why We Should Preserve the Spotted Owl*, LRB, Vol 26, No 3 at 2, London, (2004)

and addressing the challenges on integrating Adaptation Policy Frameworks (APF's) into policies related to the Western Development Strategy and achievement of the MDGs.[76] It will use global best practices in adaptation analysis and processes for designing local measures. [77]

It will also build on the successful models developed through the *UNEP/GEF Global Assessments of Impacts of and Adaptation to Climate Change Project* integrated assessment (IA) approach, which provides a robust framework to integrate climate change scenarios, socio-economic scenarios, climate vulnerability identification, climate change impact assessment, sustainability indicator specification, adaptation option evaluation, and multi-stakeholder participation.[78] The IA approach provides an effective means for the synthetic assessment of climate vulnerabilities and evaluation of the general performance levels of a set of adaptation options through a multi-criteria and multi-stakeholder decision making process.

By focusing on the connections between climate risks and human security, the programme provides an opportunity to bring synergies between natural and socio-economic spheres to reduce vulnerabilities to glacial melting. This will draw on best practices developed by the Global Environment Facility (GEF) and frameworks developed by other partner organizations.[79] The programme will focus on marginalized communities, those who will suffer the largest consequences since they have the fewest resources and the least capacity to manage change. Those at the forefront of glacial melting – the communities in the plateau – require new adaptive capacities if future risks of falling back into poverty are to be managed.

The programme will also address national aspects of the challenge. After the historic 1998 floods along the Yangtze, the Government recognizes

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[76] Lim Bo, *Policy Frameworks for Adapting to Climate Change*, UNDP, New York (2005).

[77] *See* Benioff, R., Guill, S. and Lee, J. (eds.). Vulnerability and Adaptation Assessments: An International Guidebook. Dordrecht, The Netherlands: Kluwer Academic Publishers (1996). *See* Carter, T.R., Parry, M.L., Harasawa, H. and Nishioka, S. (eds.). IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations. Department of Geography, University College, London (1994). *See* Feenstra, J., Burton, I., Smith, J. and Tol, R. (eds.). Handbook on Methods for Climate Change Impact Assessment and Adaptation Strategies, Version 2.0, UNEP, Nairobi (1998).

[78] *See* Yongyuan Yin, *Vulnerability and Adaptation to Climate Variability and Change in Western China*, Report Project No. AS 25, UNEP/GEF Assessments of Impacts and Adaptations to Climate Change (AIACC) Project, START Secretariat, Washington (2005).

[79] *See* Fankhauser, S. *The costs of adapting to climate change*. GEF Working Paper, No.13. Global Environmental Facility, Washington, DC (1997). *See* Callaway, J.M. Chapter 4: The benefits and costs of adapting to climate variability and change", In *The benefits and costs of climate change policies: analytical and framework issues.* OECD, Paris (2004).

that upstream dynamics can have serious consequences on communities and industries far downstream. Urbanization and infrastructure plans should be reviewed for water and food security impacts, as well as for adequate flood and disaster risk management systems. In local and national areas where impacts of glacial melting are likely to be felt, there is a need to develop incremental adaptation strategies to manage climate risks. In stressing the importance of climate in planning, designing and implementing Western Development strategies and investment activities, two overarching issues will be reviewed in the new UNDP programme.

The first is a *macro strategy* and involves rapid integration of climate risks into the Western Development Strategy and efforts to increase investments, socio-economic levels, local technical skills, improved water and food security, and disaster preparedness systems so that future generations can sustain results of such activities against trends of rising temperatures and glacial melting. This should be undertaken in line with a new Strategic Environmental Assessment (SEA) law recently launched in China, Asia's first SEA legislation, meant to integrate environmental concerns into 'upstream' policy and planning decisions. A rights-based approach brings attention the impacts that climate change will have on the ability of the Western Development Strategy to achieve human development goals and social and economic rights for current and future generations.

The second strategy is *a micro strategy* and involves a focus on key sectors and geographic areas within the plateau most sensitive to the climate change. This involves developing new institutional and individual capacities or modifying existing ones to promote links between climate and human development, and address rights based approaches through improving community access to information, participation and remedy related to climate change impacts within project review processes. It also involves modifying climate-sensitive development projects already planned in line with Environmental Impact Assessment (EIA) regulations, meant to integrate climate risks into individual projects.

The programme will also tailor its support to various areas within the plateau. The scale of future impacts, livelihood risks and vulnerabilities all vary both between and within provinces. If measures are to have real effect in coming years, an urgent need exists to develop the local policies, partnerships and implementation capacities to take action. In particular, the programme will focus on ways to strengthen capacity of local partners to integrate Adaptation Policy Frameworks (APF's) into local action.

Through the new programme, the impact on China's Xiaokang Goals and the MDGs will be explored; the changing vulnerabilities faced by poor and

vulnerable communities. A participatory process will identify climate risks facing specific regions in the plateau, detail how these risks will intensify and change, assess changing vulnerabilities at the community level, and how this impacts on social and economic rights.

A need also exists to increase synergy among national and local agencies involved in climate adaptation, and to enable a common framework among local agencies for planning, monitoring and responses given that impacts from glacial melting will reach across districts and provinces. In order to support such efforts, the programme will establish a new National Climate Change Forum, a platform for strategic planning and dialogue bringing the seventeen agency members of the National Climate Change Coordinating Committee together with UN agencies and partners in China.

UN Agencies will unite through a new UN Theme Group on Energy and Environment (UNTGEE), bringing together ten UN agencies for joint analysis and programming. The new forum will meet regularly to monitor government and NGO reports on emerging impacts of climate change, review strategic issues and policy directions internationally emerging from the IPCC and UNFCCC, and China's own national policies, and engage broader donor, NGO and private sector communities involved in the climate change area.

Since climate change impacts a broad spectrum of sectors - water, agriculture, ecosystems, industry, etc - UNTGEE will bring together expertise from various UN agencies. Specifically, the UN will provide support to China on strengthening the link between climate change and the MDGs by mobilizing support from the newly established UN "MDG Achievement Fund" a global fund with Spanish contribution of US$700million that has adaptation as one of its key areas of support. Joint UN programming helps achieve the "UN Coherence" agenda elaborated by UN Secretary General Ban Ki Moon, and brings the entire force of the UN to bear on what has become one of the most pressing concerns for the entire planet. Eight (8) key activities under UNDP's new programme include:

(1) In-depth research on the local effects of climate change and glacial melting around key glaciers in the Tibetan Plateau through collection and collation of data and new studies including links to new research initiatives such as the joint India-China climate research in the plateau to commence in late-2007. The results can be used to develop models to predict the future behavior of the glaciers under future climate scenarios and map out possible scenarios of local, national and regional development impacts.

(2) Climate Risk Assessments to examine the effects of glacier melting and rising temperatures on key elements of the Western Development Strategy.

This will use Human Development and Right to Development frameworks to analyze changes to freshwater and land regimes, and the implications of these changes for social and economic development in upstream and downstream communities. This includes consequences for irrigation systems, hydroelectric power systems, water quality and vulnerable ecosystems. Such assessments would be participatory, including community self-assessment methods, and could in the future serve as a model for use under Strategic Environmental Assessments of key development policies in China. Climate Risk Assessment will also be applied to select investment and development projects, as models for future use under Environmental Impact Assessment processes.

(3) Elaboration of Future Scenarios and Local Adaptation Strategies. Climate Risk Assessments will serve as a basis for analyzing forward-looking scenarios of change linked to 2050 and 2100 climate models, and designing Local Adaptation Strategies which chart how Adaptation Policy Frameworks (AFP's) can be integrated into Western Development policies and programmes. Adaptation measures will be selected that are most cost-effective and have the greatest value for achieving and sustainable human development goals and socio-economic rights.

(4) Community-Based Actions to implement Local Adaptation Strategies and APF's with relevance for key economic sectors and social development challenges. Such actions would be implemented with participation of relevant local stakeholders. Reliance on local community opinions and interests support a rights based approach and alignment of decisions and policy directions with local development choices within the Tibetan plateau area.

(5) Increasing access to citizen information, participation and remedy in decision-making. Looking to the longer-term issues related to climate risk, it will be critical to support local capacities for making informed decisions on ways to adapt development to emerging climate shifts. This includes increasing access of communities to information on the scientific trends of glacial melting and climate change, and on development projects with a high likelihood of being impacted by climate risks. Increased participation in designing response measures and implementing them ensures greater correlation with local adaptive capacities and definition of local needs. Finally, creating mechanisms to address remedy and compensation for impacts will become increasing important as communities deal with primary impacts from climate change trends, and secondary impacts from inadequately adapted development projects.

(6) Increasing awareness and communications on local climate change adaptation among government and corporate policy makers at the local, regional and national levels to ensure that local planners understand the

consequences of climate impacts on social and economic development, the management of which should be integrated within existing planning frameworks and institutions. Such activities may include production of films and public service announcements and activities related to major events such as the 2008 Beijing Olympics and the 2010 Shanghai World Expo.

(7) Enhancing conservation in upstream areas. Examples of actions taken by the Government to date include establishment of large nature reserves in northwestern Tibet (Chang Tang) and in the central and eastern Himalayas (Everest and Namchibarwa). Such efforts have limited or eliminated logging in many parts of these mountain ranges, and they are slowly reducing the loss of soil from overgrazing in headwater areas. UNDP support could go towards broadening conservation in productive grasslands areas to address land degradation issues and minimize impacts from permafrost melting. UNDP support will also go to establishment of a new Tibet Environmental Action Plan to integrate new threats to ecosystems from climate change and create ways to monitor and respond to biodiversity impacts of climate change. It will also go towards establishing a new Tibet Environment Fund to increase levels of financing towards ecosystem conservation.

(8) Regional cooperation to address transboundary issues is needed. The year 2007 will see the first-ever China-India climate change research mission to the Tibetan plateau, a historic opportunity to engage regional aspects of the climate change challenge in the region. UNDP support could go to supporting this south-south cooperation and helping to upscale the findings and lessons to address policy issues and coordinated strategies for the broader regional aspects of the Himalayan melting trends.