

Climate change and tourism: Aggravating water issues in the Everest region

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ABSTRACT

This article reviews water issues in the Everest Region of Nepal. Climate change and tourism as two major aggravating water issues in this region are discussed, and the needs to address these issues are proposed. This paper analyzes the previous studies concerned with the specific water issues in the region. Initiatives in response to the management of water bodies in this region are also presented. Sustainable water resource management policies and programs are to be practiced from individual to global level initiatives for mountain development and immediate action should be taken to solve the critical issues of water pollution in the region. Some major ways forward are proposed for response from the individual to global level initiatives.

Background

Water remains one of the major issues in the Hindu Kush–Himalayan Region. Inadequacy and poor quality of water supply for domestic purposes is increasingly becoming a concern in rural catchments of the Mountains of Nepal. The degradation of the water resources in the mountain region is mainly due to impacts of uncontrolled tourism and the recently noticed issue of climate change. Water quality is subject to concern in the most of the water sources of the region. Microbiological contamination, in particular, poses a risk to human health. In view of the ongoing watershed degradation and its adverse impacts on the biophysical and socio-economic environment in the mountains of Nepal, there is an urgent need to take immediate action from individual to organizational level for its correction. The mountain watersheds are undergoing degradation caused primarily by the mounting population pressure on forest and land resources. Water bodies in the high value tourist destinations of the highlands of Nepal are being degraded day by day. The water quality of the Everest region is of major concern nowadays. To address such problems, some broad policy measures are outlined within the framework of an integrated watershed management strategy and there is immediate need of enforcing these strategies in action. As population size and competition over resources increase, efficient use and management of water quality in mountain watersheds are of growing concerns in the region.

Climate Change and the Himalaya

Studies have shown that over the last few decades, the rising temperature of earth surface has been causing changes in weather patterns, rise in sea level and melting of glaciers (UNEP 2001). Global climate change is causing a rapid melt down of snow and glaciers in the Himalayan region. Warming in the Himalayan region has been much greater than

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global average. Weather patterns are becoming more unpredictable and extreme – dry seasons become dryer and wet seasons wetter. This phenomenon is causing concern over the long term reduction in total water supply, affecting lives and livelihoods of the Himalayan people, especially in agriculture practices and long term food security. As up to 50 percent of the average annual flows are contributed by snow and glacial melting in the region, global warming is severely impacting on the amount of snow and ice and thereby on downstream water availability in short and long term (ICIMOD, 2008).

The warming of the climate system is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level. The Earth's average surface temperature has risen by 0.76 °C since 1850 (EUROPA 2008). Climate change is affecting people around the globe, and this is especially evident at the top of the world around Mount Everest and the high peaks of the Himalayan mountain range (ICIMOD, 2008). The summit of Everest (Hillary step) was completely snow and ice free last year. The Sherpas notice a change in the last 10 years (Himalaya Alert, 2009). It is seen that the Himalayan region, including the Tibetan Plateau, have consistent trends in overall warming during the past 100 years (Yao et al. 2006). Various studies suggest that warming in the Himalayas has been much greater than the global average of 0.74°C over the last 100 years (IPCC 2007; Du et al. 2004). As a result of global warming, the type, frequency and intensity of floods, droughts and heavy precipitation events, are expected to rise even with relatively small average temperature increases (Meehl *et al.* 2007 cited in UNFCCC 2007).

Mountain Tourism and Its Impact on the Water Resources in the Everest Region

Verticality in the mountain regions is the cause of both aesthetic delight and backbreaking toil (Nepal Mountaineering Association, 2002). In recent years, the soaring number of tourists and mountaineers in nepal is damaging the ecology of the Himalays (Shrestha 1976; Shrestha 1989; Sharma 1989; Shah 1990; Bajracharya 1990 cited in Shrestha, 1994). These practices have led to pollution and deterioration of the Himalayan paradise. The heavy influx of mountaineers and trekkers along the upper slopes of the Himalays are depleting and degrading forest and water resources in ecologically fragile and sensitive areas of the region (Shrestha 1976: 89 cited in Shrestha, 1994). Increased deforestation in the region has speeded up the rate of soil erosion and landslides, loss of habitat for wildlife, and drying up of water resources, as well as degradation in scenic quality (Sherpa, 2008). In almost all the trekking routes, it is found that the camping sites are left unclean. Frequently used camping sites are becoming very unhygienic because of human and mule excrement, unburnt pieces of wood, ash and garbage (Shrestha, 1994).

Pollution of Water Bodies in the Everest Region

The first limnological study on lakes of Nepal was carried out in 24 lakes located at an altitude of 4500–5600 m above sea level in the Mount Everest region by some research teams. Palaeo-limnological analysis of four Himalayan lakes was carried out in the Everest region. Despite being characterized by very slightly polluted chemical conditions, the sedimentary record of phytoplankton and benthic algae in two lakes showed that there have been periods of high productivity (Sharma et. al 2005).

The large number of trekkers and climbers who visit Nepal and the Everest region contribute to the local economy but also cause serious environmental impact. Such impact includes the burning wood for fuel, pollution in the form of human waste and trash, and abandoned climbing gear. Although some climbing gear is recycled by local residents either for their own use or for resale, it is estimated that more than 50 tons of plastic, glass, and metal were dumped between 1953 and the mid-1990s in what has been called "the world's highest junkyard" (Pubblinet Switzerland, 2009).

In Gosainkunda and Gokyo lakes, thousands of pilgrims visit annually and the waste discharge from hotels and Dharmashalas reach the lake enhancing pollution (Karki et al. 2005; Bhutia, 2005; DNPWC and WWF NP, 2005 cited in Shrestha et. al 2008). In addition, bathing and washing in the Gokyo lake and wastes of camping have also added pollution to the lake where about 7000 tourists cater in the hotels annually (Karki et al. 2005 cited in Shrestha et. al 2008)).

A survey sponsored by the Hindukush Karakoram Himalaya Partnership Project EvK2 National Research Council of Italy in coordination with the Nepal Academy of Science and Technology carried out in 2007-08, states that contamination in water bodies in the Sagarmatha National Park and its Buffer Zone (SNPBZ) has accelerated in recent years due to the high influx of visitors and the increase in human waste. It has recorded bacterial contamination in 13 percent water samples and one sample of mineral water. *E. coli* and *Streptococcus faecalis* bacteria were found in the waters of Khumbu Valley, the major water bodies being Dudhkoshi, Bhotekoshi, Imja Khola and Gokyo lake. The major causes of water contamination in the area are unsafe toilet and use of manures and pesticides. A total of 2,197 tons of manure is produced annually and eight tons of manure is used in a hectare of arable land in the region. Six water samples collected in the area had iron content of 1.2 mg/litre in Dudhkoshi at Jorsalle and 0.64 mg/litre in Bhotekoshi near Thame, which is much higher than the acceptable limit i.e. 0.3 mg/litre, according to the WHO (THT, 2009).

Management Issues and Concerns

It is necessary to both preserve and develop the mountain environment, specifically its water and biomass resources, in a manner that recognizes their key role in the hydrosphere's cycle and in the lives of both mountain and plains people. Much of this can be assured through a system of governance that promotes local decision-making and regulation (Nepal Mountaineering Association, 2002).

The Sagarmatha Pollution Control Committee, set up in 1993 has been highly effective in improving waste management. Problems include abandoning dead bodies on mountaineering peaks and leaving waste on peaks and base camps. A number of strategies have been successful in making improvements including clean up campaigns at various base camps, constructing rubbish pits and distributing litter bins, employing litter collection staff, school environmental education lessons, giving out leaflets and booklets, and creating tourist information centres (RGS, 2009).

People should promote integrated river basin and water management schemes, strengthen policies which enable the storage of surplus water during the monsoon and improve the availability of water during dry season. People should also promote the exchange of scientific data thus reduce uncertainty, and clarify the relation between economic growth, pollution and the receding cryosphere in the Himalayas (Schild, 2008 in press release).

In such highlands, sustainable outcomes can be achieved by managing water and watersheds more efficiently to provide sufficient water, preventing deforestation and land degradation to secure agro-economic sectors. Mountain tourism in Everest region is under the threat of many adverse situations. To overcome these threats and to address the sustainability of the Everest tourism there are some primary needs of implementing appropriate watershed and river basin management program to ensure the continued supply of essential services, especially water supply and soil conservation to be addressed very soon (Sharma, 2009).

Efforts have been made to reduce the negative environmental impact on Mount Everest. The Nepalese government has been using a portion of climbing fees to clean up the area. In 1976, with aid from Sir Edmund Hillary's Himalayan Trust and the Nepalese government, the Sagarmatha National Park was established to preserve the remaining soil and forest around Mount Everest. By the mid-1990s the park comprised 1240 sq km (480 sq mi). Trekking and climbing groups must bring their own fuel to the park (usually butane and kerosene), and the cutting of wood is now prohibited (Pubblinet Switzerland, 2009).

Additionally, the Sagarmatha Pollution Control, funded by the World Wildlife Fund and the Himalayan Trust, was established in 1991 to help preserve Everest's environment. Climbing activity continues to increase, however, and the environmental future of the Mount Everest area remains uncertain (Pubblinet Switzerland, 2009).

In many mountain regions, the quantity, variability, and timing of runoff from snow and glaciers can directly and indirectly affect the incidence and prevalence of water-related diseases. Mosquitoes have recently been observed at higher altitudes. Other vulnerabilities are the loss of life from flash floods, glacier lake floods, and landslides. Decreasing safe drinking water sources may increase the incidence of water-borne diseases (CEPF, 2006). Hence, there is immediate need to take corrective actions to manage the indispensable resources of the region.

In changing climatic conditions the study of weather in Himalayan Mountainous region can form the basis of effective water management (ICIMOD, 2008). Since mountain regions are rich in all four major sources of renewable energy (hydropower, wind, solar energy and biomass), development policy must be better informed about the diversity of demand for water and energy in Specific Mountain niches (Nepal Mountaineering Association, 2002).

Results and Discussion

Natural resources in the Everest region are not free from depletion and degradation. Human interventions in the natural settings have played pivotal roles in creating such unpleasant environments. The Water resources in the region are mainly degraded due to uncontrolled influx of tourists. If the region is to attract more tourists towards it, it should welcome quality eco-friendly tourists. Only huge influx of tourists based on economic criterion should not be developed for collapsing own economy in the future. Lack of sustainable watershed management practices in the region may be another reason behind this issue. Another cause of water depletion in the region is due to the effects of climate change. As mountain ecosystems are fragile and vulnerable even to tiny climatic variations, they may show significant impacts. Melting of snow and ice in the mountains of the region draws considerable attention and immediate actions to be taken for their future existence. Improper use of pesticides and fertilizers in agricultural fields also has caused the pollution of water bodies in the region. It shows that there are no any preventive mechanisms developed for barring the entrance of pesticides and fertilizers in the water bodies. Similarly, improper management of garbage, either produced by tourists or by the locals, has caused to pollute water. The overall reason behind the degradation and depletion of water resources in the region is the lack of provision of sustainable mountain development policies.

To overcome the existing problems in the Everest region, some significant initiatives are required for saving mountain environment such as:

1. Awareness on Climate Change and necessary Adaptation Measures for protecting water resources and quality in the region
2. Intervention of responsible tourism policies, programs and practices
3. Implementation of Integrated Natural Resources Management Approaches
4. Enhanced participation of local people and improved use of local knowledge to mitigate the unintended consequences.
5. Environmental Education and Awareness
6. Sustainable Watershed Management Policies and Practices

Ways forward

- Scientific and research community should be responsible for the real findings concerned to the impacts of the development interventions and its consequences e.g. tourism, climate change.
- Local community should be responsible for the conservation and management activities
- Tourism products and services provided and tourists (international and domestic) visiting such places themselves should be eco-friendly and be responsible for nature conservation.
- Regional community should focus on the protection and conservation of water resources in the region.
- National policies are to be guided through the principles of sustainable and responsible development mechanisms.

- Global mountain communities should be bridged for the common goal of conserving the natural assets 'the sacred mountains'.
- Advocacy organizations should raise the marginalized social and environmental issues for mountain development.
- Development programs and projects should target on the conservation of the environment for the sustainability of the human being in such places. Such programs should provide enough space for promoting indigenous people of the region and their knowledge.

Conclusion

There lies complexity of the causes and consequences of water resources degradation in Everest region because of tourism development and recently noticed effects of climate change. Tourism in the Everest region has grown rapidly in recent years and at the same time the water quality has deteriorated sharply. Meanwhile, the effect of global warming is higher in this vulnerable and fragile structure. Present modes of water utilization and management in this region are not sustainable, and some of the research evidences have already quoted the seriousness of water quality degradation. Increasing numbers of tourists, relative increase in population and service infrastructures, such as, shops, restaurants, and hotels, and in addition, insufficient management measures, result in the decline of water quality. Countermeasures on sustainable water management approaches and mitigation measures to the effects of climate change are to be practiced immediately to deal with the current water resources degradation issues, and assure long term sustainability of the indispensable resources like water and make tourism development sustainable in the region. Multi-tier Initiatives should be taken from individuals, local communities, national organizations, and regional and global mountain development forums to tackle such problems. **‘Mountain to Mountain Cooperation throughout the Globe’** should be regarded as an ideal notion to be practiced better as this region is globally linked by many ways.

References

- Bajracharya, Samjwal R., Pradeep K. Mool, and Basanta R. Shrestha, 2007. *Impact of Climate Change on Himalayan Glaciers and Glacial Lakes. Case Studies on GLOF and Associated Hazards in Nepal and Bhutan*. ICIMOD, Kathmandu, Nepal: Quality Printers (Pvt) Ltd.
- CEPF, 2006, Critical Ecosystem Partnership Fund, Ecosystem Profile, Eastern Himalayas Region [online], [cited 14th April 2009]. Retrieved from: <<http://www.cepf.net/Documents/final.ehimalayas.ep.pdf>>
- Du et al., 2004. Mutual Influence between Human Activities and Climate Change in the Tibetan Plateau during Recent Years. In *Global and Planetary Change*, 41: 241-249.
- EUROPA, 2008. Climate Change [online], [cited 3 April 2008]. Available from: <http://ec.europa.eu/environment/climate/home_en.htm>.
- Himalaya Alert, 2009. Himalaya Alert Mission [online], [cited 10th April 2009]. Retrieved from: <http://www.arcticalert.com/himalaya_alert_mission.php>
- Himalaya Press, 2008. Himalaya – Changing Landscapes photo exhibition draws attention to the impacts of climate change in the Himalayan region. Press Release, Kathmandu, 2 December 2008 [online], [cited 12th April 2009]. Retrieved from: <<http://www.changing-landscapes.com/press/>>
- ICIMOD, 2008. Press Release. Stockholm World Water Week
- IPCC, 2007. *Climate Change 2007: The Physical Sciences Basis*. In Summary for Policy Makers, IPCC: 21. Geneva: IPCC.
- Jianchu et al., 2007. *The Melting Himalayas Regional Challenges and Local Impacts of climate Change on Mountain Ecosystems and Livelihoods*. ICIMOD, Kathmandu.
- Meehl et al., 2007. *Global Climate Projections*. In: UNFCCC 2007. United Nations Framework Convention on Climate Change. *CLIMATE CHANGE: IMPACTS, VULNERABILITIES AND ADAPTATION IN DEVELOPING COUNTRIES* [online], [cited 8 Sep 2008]. Retrieved from: <unfccc.int/files/essential_background/background_publications_htmlpdf/application/txt/pub_07_impacts.pdf>
- Nepal Mountaineering Association, 2002. Mountain Resource Management: Kathmandu Declaration on Mountains IYM 2002, Kathmandu. Retrieved from: <www.nepalmountaineering.org/index.php?>
- Pubblinet Switzerland, 2009. Everest, Mount, mountain peak in the Himalayas of southern Asia, considered the highest mountain in the world [online], [cited 10th April 2009]. Retrieved from: <<http://www.italysoft.com/curios/everest/index.php>>
- RGS, 2009. Tourism in Everest Region [online], [cited 10th April 2009]. Retrieved from: <[www.unlockingthearchives.rgs.org/resources/documents/tourism%20fact sheet.pdf](http://www.unlockingthearchives.rgs.org/resources/documents/tourism%20fact%20sheet.pdf)>
- Sharma, S. 2009. Sustainable tourism Development in Everest Region: Analyzing the Linkages (Rural-Urban; Local-Global), Interactions (High Land-Low

land; Development -Environment) and Potential Impacts of Mountain tourism [online], [cited 9th April 2009]. Retrieved from: <https://www.mtnforum.org/rs/ol/counter_docdown.cfm?fID=3708.pdf>

- Sharma, Subodh, Bajracharya, R. M., Sitaula, B. K., Merz, J. 2005. Water Quality in Central Himalaya. *CURRENT SCIENCE*, 89(5).
- Sherpa, A. 2008. Tourism: Threats and Opportunities in Sagarmatha National Park and Buffer Zone [online], [cited 22nd April 2009]. Retrieved from: <<http://www.angritasherpa.com/?p=6>>
- Shrestha et al., 1999. Maximum Temperature Trends in the Himalaya and Its Vicinity: An Analysis Based on Temperature Records from Nepal for the Period 1971-94. In *Journal of Climate*, 12: 2775-2787.
- Shrestha et. al, 2008. Ramsar Sites Of Nepal: Challenges And Opportunities For Conservation [online], [cited 19th April 2009]. Retrieved from: <<http://hkhbenso.com.np/papers/BENSO%20paper%20Final%201.pdf>>
- Shrestha, V.P. 1994. Environmental Problems in The Nepal Himalaya. *CNAS Journal*, Vol. 21, No. 2 (July 1994)
- THT, 2009. Water bodies in Everest Region Contaminated: Survey [online], [cited 16th April 2009]. Retrieved from: <http://epaper.thehimalayantimes.com/ht/ht/2009/04/21/index.shtml?ArtId=005_007&Search=Y>
- UNEP, 2008. *Climate Change* [online], [cited 3 April 2008]. Available from: <<http://www.unep.org/Themes/climatechange/about/index.asp>>.
- UNFCCC, 2007. United Nations Framework Convention on Climate Change. *CLIMATE CHANGE: IMPACTS, VULNERABILITIES AND ADAPTATION IN DEVELOPING COUNTRIES* [online], [cited 8 Sep 2008]. Retrieved from: <unfccc.int/files/essential_background/background_publications_htmlpdf/application/txt/pub_07_impacts.pdf>
- WWF, 2009. First field piloting of National Water Plan in Nepal [online], [cited 15th April 2009]. Retrieved from: <http://www.panda.org/who_we_are/wwf_offices/nepal/news/?154681/First-field-piloting-of-National-Water-Plan-in-Nepal>
- Yao et al., 2006. $\delta^{18}\text{O}$ Record and Temperature Change over the Past 100 years in Ice Cores on the Tibetan Plateau. In *Science in China: Series D Earth Science*, 49(1): 1-9.