Environmental quality of Upper Mustang
Population, water and tourism *

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Abstract

In order to give a clear view of the environmental quality in Upper Mustang (Nepal), an evaluation has been made of socio-economic, water quality conditions, and tourism characteristics using a combination of biophysical parameters, demographic and human considerations and the Index of Touristic Positioning. River water quality, springs water quality, state of human ecology and carrying capacity are considered for the ecosystem health of area.

INTRODUCTION

Upper Mustang, a Nepalese Valley of high environmental, social and historical interest, is part of Mustang District, bordering Tibet to the North, East and West, and from the South the admittance is along the Kali-Gandaky Valley. In order to evaluate the sustainability and the quality of tourism in Upper Mustang, our field unit carried out a specific trekking mission in June of 2000. The primary purpose of our research is to define some essential components of ecosystem health based on biophysical, socioeconomic and human health elements examined in this study. A secondary purpose is to assess and provide an analysis of the impacts of tourism on the valley's ecosystem health, with particular attention to water quality.

METHODS

To monitor and assess the state and the condition of Upper Mustang ecosystem health, we used a combination of demographic and biophysical parameters. The integration of these two sets of indicators provides some indications of tourism impact on ecosystem health, comprising both the ecological and human components of the Upper Mustang.

The cultural aspect of tourism impact was examined through the investigation of the local socioeconomic situation, observation of the demographic profile, population distribution and tourist presence.

The environmental impact of tourism is assessed primarily through the analysis of water quality, comprised of river water quality and drinkable water quality, because they are excellent indicators of man's use of the ecosystem.

For water quality analysis, various analytical methods were used, including site monitoring and laboratory analysis, interviews and personal observations. The possible pollution of water was assayed by different kinds of indicators: microbiological analysis and biotic indices used in Europe, also for extreme Alpine environments, Extended Biotic Index (EBI), Biological Monitoring Working Party (BMWP').

It is obvious that no index with different country of origin can be used satisfactorily to identify the pollution level of country with different fauna. So, we used also a method developed for Nepal, the Nepalese Biotic Score (NEPBIOS).

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The EBI, the BMWP' and the NEPBIOS are freshwater pollution bio-monitoring indices based on benthic macroinvertebrate communities inhabiting rivers, streams and creeks and also based on the different sensitivity to pollution of some taxa. (Ghetti, 1986; O.Moog and S. Sharma, 2001). The microbiological analysis is based on Enteromicrobial presence (Aerobic count plate, Escherichia coli count plate, Enterobacteriacae count plate and Yeast and Mould count plate by 3M Petrifilm).

RESULTS

Population

According to the Central Bureau of Statistics, there are 1171 households, with average size of 4.6 people, for a total population of 5,395 inhabitants in Upper Mustang. The gender breakdown is 2,730 males and 2,665 females (Central Bureau of Statistics, 2001). The population is young, with high birth and death rates; in fact the 0-14 age group represents 29.60% of total population while those over 50 represent 18.57% (Fig.1). The 0-4-age group shows that, in all probability, birth control has been used in last few years (family planning campaign). According to the census 2001, the literacy rate is 42.05% for male and 23.16% for female.

Tourist Presence and Impacts

Opened to tourism only in 1992, Upper Mustang area has controlled tourism. Not more than one thousand trekkers are allowed to visit this area annually. Local communities were involved in all aspects of conservation and development processes: without increasing the level of awareness of both, villagers and visitors, lasting environmental protection and cultural diversity cannot be achieved. His Majesty's Government, the Ministry of Tourism, has proposed that 60 percent of the revenue, generated from trekking royalties to Upper Mustang, be earmarked for use in the Upper Mustang Conservation and Development Project (UMCDP), and has delegated the responsibility of managing to the King Mahendrea Trust for Nature Conservation (KMTNC, 1997). By applying the methodology of the list of characteristics we noted that, at present, Upper Mustang tourism could be classified as low impact (IPT=71%), (Boselli et al., 2003) (Fig.2)

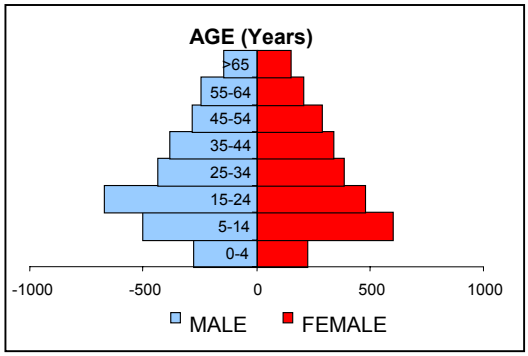

Fig.1: Population by age and gender (2001)

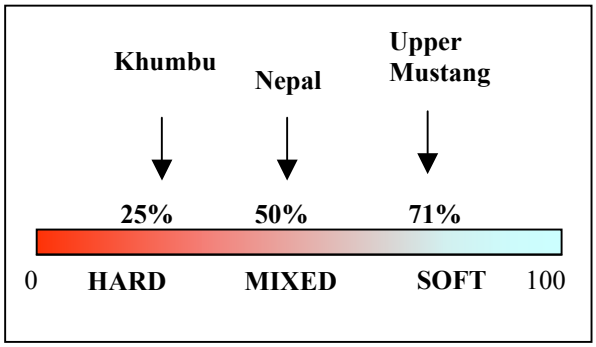

Fig. 2:Value of Tourist Position Index (TPT)

River water quality

The evaluation of surface quality of Kaligandaki river, in the section between Tsarang and Kagbeni, is estimated by two kinds of indicators: microbiological analysis and biocenotic indices (EBI, BMWP' and NEPBIOS). The evaluation using the microbiological fecal pollution analysis gives us a deterioration of water quality in the section between Tangbe and Chele. This is probably due to anthropic and animal impact (Tab 1). The European standards were used. This situation is confirmed by the biological results using the Extended Biotic Index (E.B.I.) and BMWPI' (Class II.III, IV). The evaluation of surface water quality using the Nepalese Biotic Score (NEPBIOS) indicates a similar situation, except for the section between Kagbeni and Chele, where the Nepalese results shows better water quality (Class II, III) (Fig.3)

Table1- Rivers' water samples: physical and bacteriological data-Upper Mustang, 2000

n°	Sampling point	Altitude	Latitude	Longitude	Date	time	Air °C	H_2O °C	pH	Condu c.	CT	EC	EB	Moulds Yeasts
											UFC /100	UFC /100	UFC /100	
1	Kagbeni	2843	28°50.370	83°47.083'	30.05.00	16,45	18	14,4	9	0,53	1260	445	28	32
2	Chele (Bridge)	2974	28°55.583'	83°49.686'	31.05.00	14,55	24	20,7	12	4,59	1470	22	44	84
3	Ghemi	3498	29°03.639'	83°52.555'	2.06.00	13,8				1,88	4440	>300	2220	420
4	Tsarang	3520	29°06.210'	83°55.748	3.06.00	10,27	23	11,6	8,12	1,71	n.d.	n.d.	n.d.	n.d.

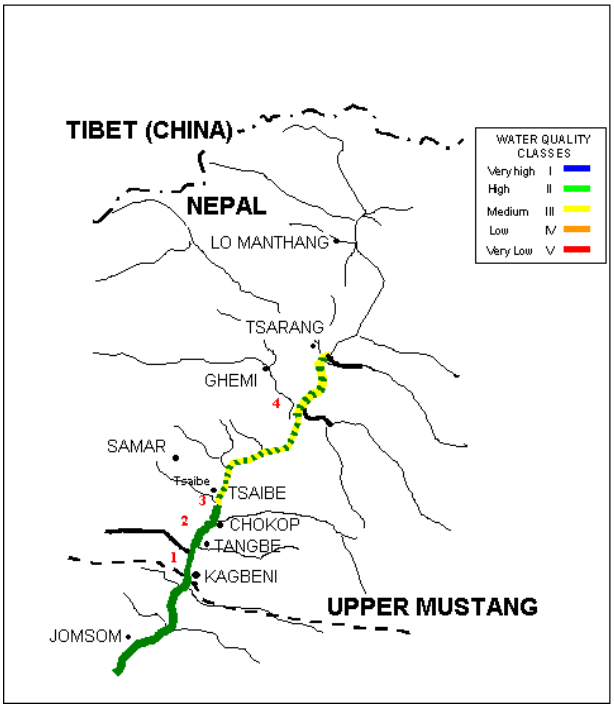

Fig. 3: Nephbios River Water Quality

Table 2- Springs and fountains' water samples: physical and bacteriological data-Upper Mustang, 2000

n°	Sampling point	Altitude	Latitude	Longitude	date	time	Air °C	H2O °C	pH	Conduc.	CT	EC	EB	Moulds
											UFC /100	UFC /100	UFC /100	Yeasts
1	Kagbeni	2866	28°50.294'	83°47.294'	30.05.00	17,15	18°	17,9	9,3	0,96	170	32	28	50
2	Tangbe	3040	28°53.414'	83°48.323'	31.05.00	10,45	30			1,57	>300	20	12	24
3	Chusang	2980	28°54.871'	83°49.184'	31.05.00	14	27	19,5	11,5	3,48	>300	18	3	135
4	Chele	3100	28°55.860'	83°49.615'	31.05.00	15,45	24	19,42	8,75	3,11	189	34	28	15
5	Samar	3575	28°57.695'	83°48.055	1.06.00	9,58	28	13,2	8,76	2,48	410	6	2	18
6	Syangmochen	3805	28°59.482'	83°50.304'	1.06.00	15,1	23	16,9	8,04	3,58	>300	120	14	10
7	ghemi 1	3582	29°03.639'	83°52.555'	2.06.00	13,13		13	8,8	2,8	30	6	10	10
8	Ghemi 2	3582	29°03.639	83°52.555	2.06.00	13,25		13	8,8	2,8	>300	37	31	10
9	Tsarang	3583	29°05.535	83°55.946	3.06.00	8,51	27	14,1	8,15	1,31	>300	11	>300	52

Drinking water

Drinking water was analyzed using sampling points (public taps) in 8 villages: Kagbeni, Tangbe, Chusang, Chele, Samar, Syangmochen, Ghemi and Tsarang.

In order to maintain high levels of human health and well being of the population, the bacteriological values suggested by World Health Organization (1998) and European Union (1998) are 0 ufc.

Our results show a widespread contamination in all samplings with different concentration (Tab. 2). The results varied according to the villages and the taps.

CONCLUSION

In considering the data and subsequent analysis of socioeconomic conditions and water quality, some conclusions have been drawn. The population is young but on the way of demographic transition: in fact the analysis of the population structure shows a decrease of class 0-4 age compared to that of 1991, probably due to the more widespread use of birth control, and a stabilization of old class. Regarding the environmental tourism impact, the Index of Tourist Positioning shows a low impact. In Upper Mustang the approach to tourism management is responsible. The Upper Mustang Conservation and Development Project has undertaken an innovative approach to promote nature conservation through sustainable development of tourism, to maximize benefits to local communities, and to conduct awareness programs to both host communities and visitors for minimal negative impacts.

Concerning water quality, the observations from our study show a vulnerability of water resources due to fecal pollution. In the villages drinkable waters are exposed to human and animal fecal pollution because the villages are also totally devoid any sewage system for the effective disposal of wastewater and human wastes. So, the human health of both, local and tourist population could be affected.

Our research will be completed with further analyses of different parameters. In conclusion, our study shows the Upper Mustang ecosystem vulnerability.

PROPOSAL

In order to protect this ecosystem, it is necessary to keep restricted tourism and to develop sustainable tourism that does not damage the ecosystems, that promotes the value of "awareness" instead of "consumerism", and that which sustains both the development and well being of the country and not just its economic growth.

It is necessary also to carry out drainage system in the villages and to protect the taps with “respect areas” from the animal and human fecal wastes.

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