The environmental impact of mountaineering in the Mt. Everest region

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Introduction

Sixty years have passed since the Mount Everest was first conquered. The popularity of its scaling and the rapidly growing tourism in the Nepal Himalayas after 1970 are noticeably affecting natural, social, and cultural environments in the vicinity. This in turn, is creating serious environmental problems at the Everest Base Camp (5,300 m above mean sea level), the entry point for climbing the Mt. Everest. In this study, our research objective was to elucidate the relationship between mountaineering activities and associated environmental changes by applying GIS and remote sensing, so that further degradation of present environmental conditions could be stopped.

Method

The geographical area covered in this study is the Everest Base Camp in the Sagarmatha National Park, Solo Khumbu region which is located in northeast Nepal. In order to elucidate the actual usage of the Everest Base Camp, field survey was carried out four times in May, October 2003, May 2004 and May 2005 at and around the Everest Base Camp. We conducted the following investigations at the Everest Base Camp; survey of the Base Camp, questionnaires to all the mountaineering parties at the Base Camp, survey of the water quality at the Everest Base Camp. We monitored the actual usage of the Everest Base Camp in order to clarify the number of tents and their locations by photointerpretation using high resolution satellite images on two separate occasions (2003 and 2013).

Results

Survey of the Base Camp

A topographical survey of the Base Camp was conducted to pinpoint the location of each tent and to grasp the topographical features of the area. The Base Camp in the pre-monsoon season is shown separately in the EVEREST BASE CAMP TOPOGRAPHIC MAP 2003 MAY. We were probably the first in the world to create a topographical map of the Everest Base Camp that shows detailed positioning of each tent. There were 35 parties consisting of 665 tents in the pre-monsoon season. On the other hand, there were 44 tents of 4 parties in the post-monsoon season. As shown in

the photographs and the maps, there is a sizable difference in the usage of the Base Camp between the pre and post monsoon seasons. Notice the congestion occurring at the camp during the pre-monsoon season.

Questionnaires to all the mountaineering parties at the Base Camp

Inquiries were made to every party staying at the Base Camp. The questionnaires enquired about the following information:

Number of members in each party; amount of belongings brought in and out; number of yaks used to carry equipment; and environmental considerations taken by each party.

Results of the questionnaire show that during the pre-monsoon season, an astounding ll5 tons of equipment was brought into the Base Camp.

Furthermore, over 2,300 yaks were used for transportation during the pre-monsoon season. The enormous amount of excrement produced by these yaks is one of the main sources of resource contamination.

Many of the parties brought solar panels to the camp, which we believe, provided them with the power necessary for internet communication via satellites.

Survey of water quality at the Everest Base Camp

Water quality research was conducted at 3 locations of the Base Camp: water collection points; filtering drainage; and inflow points of contaminated water. COD at the collection points showed 10ppm, which indicated that the water was badly contaminated. There was improvement in the quality of the filtered water and desired results were obtained to a certain degree. However, at the last point, COD was a very high 100ppm, which indicates a very serious contamination level.

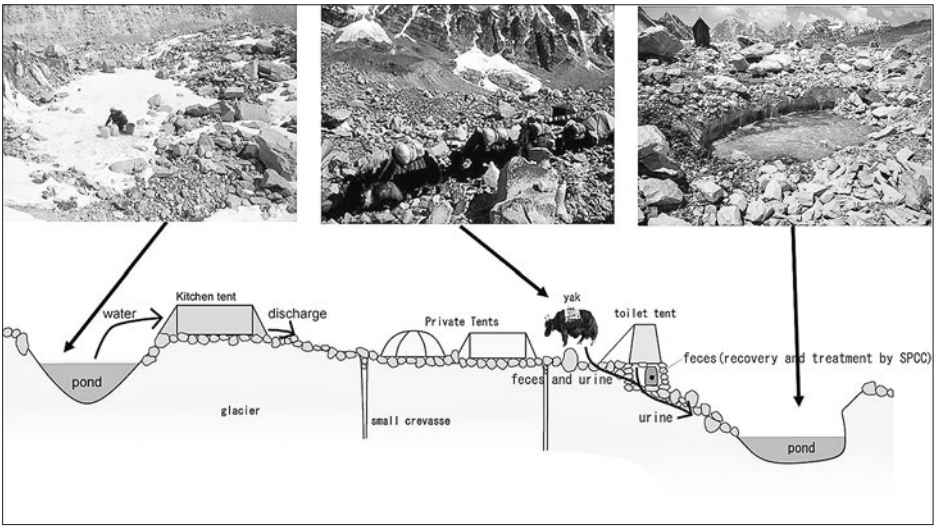

Figure 1. *Cross section of the Everest Base Camp on the Khumbu Glacier*

Drinking or cooking water is usually sterilized by boiling. However, it was revealed from the research this time that the headspring itself was contaminated. We can conclude that the sources of contamination were not only from the toilets used by people, but also from the enormous amount of waste generated by the yaks, and waste water from the kitchens, showers, and laundry areas of each party.

Conclusion

A few of the findings of this study after surveying thrice in May, October 2003, May 2004 and May 2005 at and around the Everest Base Camp are as follows. (1) A topographical map of Base Camp was prepared pinpointing the location of each and every tent of the area. We are probably the first in the world to prepare such topographical map of the Everest Base Camp. (2) Inquiries were conducted with each group staying at the Base Camp regarding the number of members in each party, quantity of goods brought in and out, and number of yaks used for transportation. The results of the questionnaires show that during the pre-monsoon period in 2003 an astounding 115 tons of goods were brought into the Base Camp. Furthermore, over 2300 yaks were used for transportation. (3) Water quality research was also conducted at water collection points of the Base Camp. The water was found to be badly contaminated because of urine and excrement of Yaks that were found scattered over the Base Camp.