

**Dawa Dorje**

**Environmental impact assessment of tourism in Ladakh, India**

**Abstract**

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Mountain tourism has become an important source of income, contributing in a major way to economic development in many Himalayan states and region. This poses a threat to fragile mountain environment. Furthermore, one of the characteristics of mountain tourism is the high degree of seasonality, causing human pressures to concentrate in a relatively short period. This is particularly true for high altitude ecosystems, where tourist access is essentially restricted to the summer months, which are also the peak period of biological processes. This study aims at describing and assessing the impact of tourism and its related activities in Ladakh Trans-Himalayan ecosystem, India.

Tourism industry has been growing steeply in the region for last seven years. This is due to political crisis in other Himalayan states, tourism promotion agencies in several European countries and easier access to the region by increasing the number of flights. Main tourism-related activities carried out in the region are trekking and jeep safaris. Trekking impact has been in the limelight because the trek trails in the region lacks proper infrastructure assets e.g., waste disposal bins, accommodation and toilets. Thus all the trekking related activities are intervened with the environmental components at a high cost. Therefore the main objective of this study is to map and assess the main interferences between trekking-related activities and environmental components, and in particular natural ecosystems, wildlife, water and soil. A secondary objective is to understand and represent tourism-driven urbanization processes that affected Leh, the capital city of Ladakh.

The first objective was achieved following a stepwise approach:

1. Scoping. Scoping is defined as the preliminary process to identify the environmental stressors (trek related activities), the environmental receptors (environmental components), and consequently the potential impacts. Among the main stressors are: trail usage, grazing, dumping sites, camping sites, off-road driving. Their main impacts relate to animal habitat fragmentation, habitat disturbances, vegetation damage and overgrazing, point source pollution, soil trampling, soil erosion and loss of soil fertility.
2. Setting-up an environmental database. Land cover mapping was processed with integration of DEM (Digital elevation model). Vegetation mapping was processed and calibrated with the help of NDVI (Normalized difference in vegetation index), habitat composite index was developed through IUCN (International Union for Conservation of Nature and Natural Resource, Water was extracted out through DEM hydro process in GIS (Geographical Information System) environment and at last soil mapping was classified according to USDA and collected from Wildlife institute of India.
3. Collecting tourism data. Tourism data were collected through field survey in 2006. GPS field data were located for all the Camp sites, dump sites, sinuosity sites and trails. In addition the tourism inflow data were collected for the last 33 years. Beside pack animal inflow and people accompanied inflow were collected through questionnaires and interview for one year.
4. Impact modeling. Mapping soil erosion susceptibility, assessing soil fertility, estimating overgrazing prone areas.
5. Impact assessment. Using Spatial Multi-criteria evaluation (SMCE) techniques, the impact models were integrated into concise maps in order to identify most critical areas, as well as most affected environmental components. The overall purpose is to generate a tourism impact map for whole Ladakh region. GIS helps in extracting and analyzing spatial data, whereas MCE helps to describe, assess the impact of proposed tourism activities according to several environmental criteria.