

The Impact of Human Activities on Plant diversity in Nanda Devi Biosphere Reserve, West Himalaya, India

1. INTRODUCTION

Biosphere Reserves are the areas having rich ecosystem which are nominated by National governments to conserve the biodiversity of that area. The conservation is based on scientific approach by establishing social and ecological understanding of the area to achieve social development without harming nature. Nanda Devi Biosphere Reserve (NDBR) is one of the ten biosphere reserves of India which are recognised by UNESCO under Man and Biosphere (MAB) Programme.

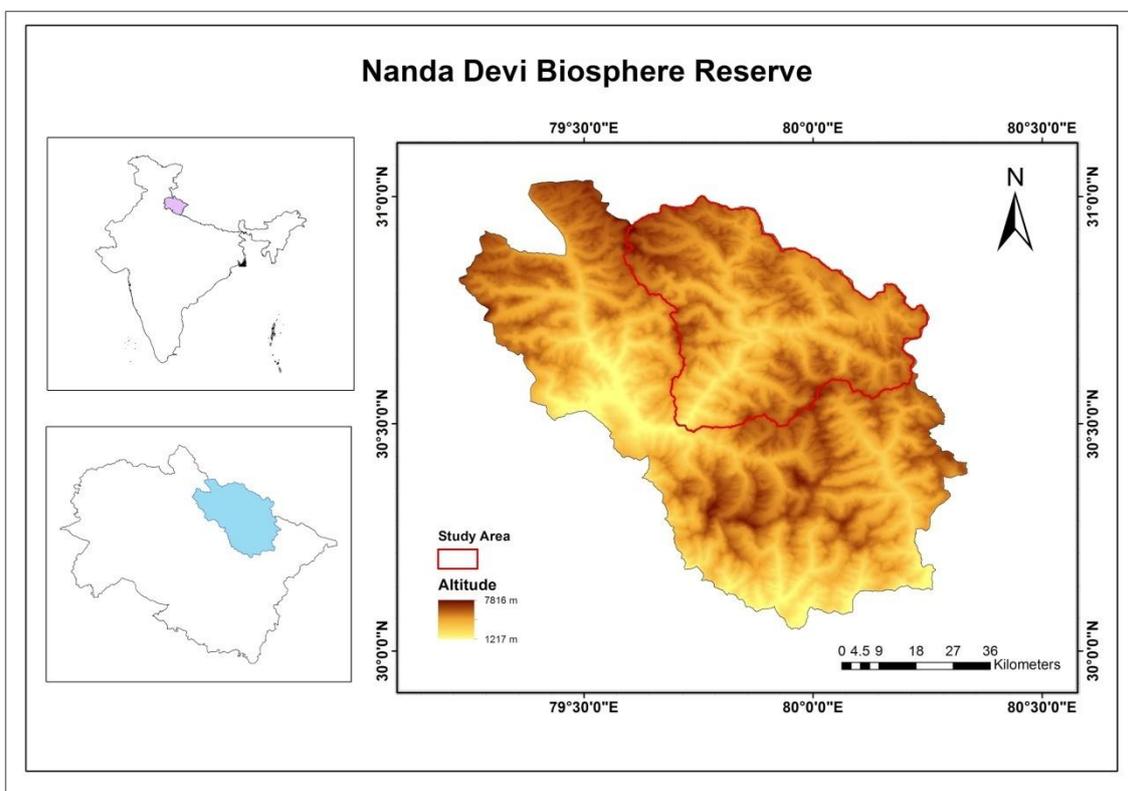


Figure 1: Map of Nanda Devi Biosphere Reserve

It is located in the state of Uttarakhand at the north-west border ($30^{\circ}08'$ to $31^{\circ}02'$ N Lat, $79^{\circ}12'$ to $80^{\circ}19'$ E Long) (Figure 1). It has two core zones, Valley of Flower and the Nanda Devi National Park. The reserve is spread over an area of 6407.03 km^2 covering three districts viz., Chamoli, Bageshwar and Pithoragarh of Uttarakhand. It has an elevation ranging from 1217 to 7816 m above mean sea level. The reserve has second highest peak of India named Nanda Devi situated at the core zone of Biosphere Reserve.

2. THREATENED SPECIES OF NANDA DEVI BIOSPHERE RESERVE

The present study was conducted in the Dhauli valley of Chamoli District. The diversity assessment above treeline was conducted and checklist of 160 plants was prepared during the study which includes *Nardostachys jatamansi*, *Aconitum violaceum*, *Arnebia benthamii*, *Dactylorhiza hatagirea*, *Picrorhiza kurroa*, *Saussurea obvallata* etc.

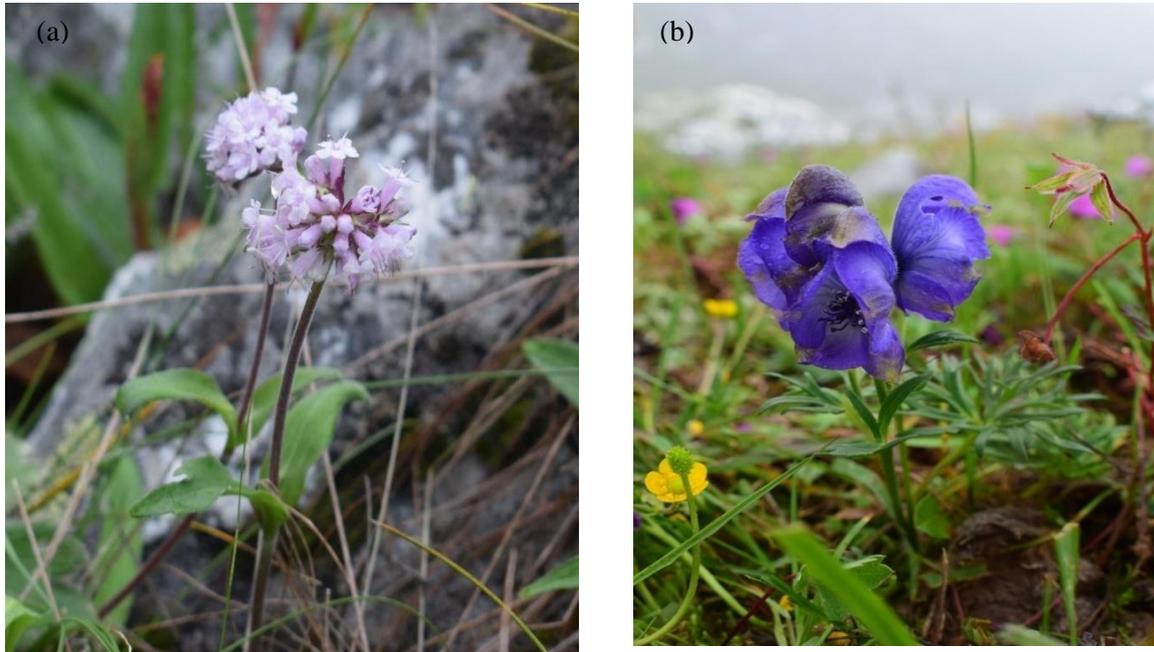


Figure 2: (a) *Nardostachys jatamansi*, (b) *Aconitum violaceum*

3. HUMAN ACTIVITIES IN THE STUDY AREA

Humans are the only beings on earth that have the potential to exploit resources beyond limits and affect ecosystem that cannot be restored. There is no place on earth which is untouched by its direct impact. The present study was conducted above treeline in one of the ecologically fragile areas of India and harmful human activities are observed that are a potential threat to ecosystem. In order to protect the area it is essential to observe the nature of human activities that are needed to be regulated and minimized.

During the field observation it was found that increasing tourism in the area is leading to more waste generation. It was found that the waste was buried near camping sites and the wild animals e.g. Himalayan Marmot, Royle's Pika are making it worse by digging the buried waste (Figure 3).



Figure 3: The waste dug up by wild animals near camping sites.

Research is one of the important tool which helps in better understanding of the area. But improper research management can lead to negative impact over ecosystem (Figure 4).



Figure 4: Remains of fence used for research observations.

In Nanda Devi Biosphere Reserve, the pastoralism is very old practice but decrement in the pastoral areas in the region is leading to more pressure over limited area. In summers, the local inhabitants graze their animals (Figure 5) and in the month of september-october they used to move towards lower regions.



Figure 5: Herds of sheep and Horse.

In the high altitude areas a rare Tibetan medicine (entopathogenic fungi) named *Cordyceps sinensis* or KEEDA JADI is getting famous since last 10 years due to its high money value.

Its high market prices are encouraging people to hunt for it in conserved forest area of NDBR. During social survey it was found that around 30 percent of local people including men, women and children move towards high altitude areas and stay there for an average of 30 days in the month of May, June and July. Although it became a very good income option which is good for local society but at the same it is affecting sensitive ecosystem which cannot be neglected. It was found that the areas having *Cordyceps* occurrence had a large number of tiny holes all around, which was dug by humans to get it and after that they were left open (Figure 6). It was found that, these areas had lesser plant diversity than the nearby protected areas.



Figure 6: The tip of *Cordyceps sinensis* and the hole left after digging it.

The long duration of grazing and herb extraction is leading to an increasing demand of good grass for animals and more fuel wood for people. It was found that the high altitude areas had man-made fire to regenerate good grass for animals and shrubs e.g. *Juniperus communis* were damaged for fuel wood (Figure 7).



Figure 7: The damaged forest vegetation due to man-made fire.

It was found that the conserved area had a number of invasive species e.g. *Persicaria wallichii*, *Rumex nepalensis* near camping sites and in the grazing lands (Figure 8). These plants have the potential to destroy the diverse vegetation of the ecosystem. Even the protected site near Lata Kharak where limited people are allowed since 1982 (after

declaration of site as National Park) which was also the first camping site of Nanda Devi Expedition was found to be completely disturbed due to invasive species *Persicaria wallichii* (Figure 8.(a)).



Figure 8: The invasive species (a) *Persicaria wallichii*, (b) *Rumex nepalensis*.

In this study it was found that the diverse flora of the area is not only having aesthetic beauty but also used by local people as medicines since old times. But the growing popularity and market demand of these medicinal herbs is creating competition in local people which is responsible for extraction of these herbs more than sustainable limits. Some medicinal plants are shown in Figure 9, which were found during social survey and extracted from conserved forest areas.



Figure 9: (a) *Picrorhiza kurroa* (b) *Juniperus communis* (c) *Dactylorhiza hatagirea* (d) *Pleurospermum brunonis* (e) *Arnebia benthamii* (f) *Aconitum violaceum*

It is possible in the near future that some of the plants will extinct form the area as the purpose of extraction is not limited to local use. The high market prices and low education and awareness level among local people is leading to destruction of flora in the study area.

4. CONCLUSION

The present study indicates that there is a need for improvement in present conservation measures. The lack of awareness and ignorance of laws by tourists, researchers and local people is worsening the conditions. The nature and extent of damage is so serious that immediate steps are required to be taken otherwise there are chances of extinction of some vulnerable plant species from the area. To sustain the area economically and maintain the existing plant-diversity the present conditions are needed to be examined scientifically and discussed for improvement in management of biosphere reserve.