

Gharats (watermills): Indigenous device for sustainable development of renewable hydro-energy in Uttarakhand Himalayas

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Abstract

The Himalaya has a rich ancient tradition for tapping hydro-energy from the hill streams and rivers through the device of *gharats* (watermills). The present contribution encompasses the study on the energy consumption pattern of hill communities living in buffer zone of the Nanda Devi Biosphere Reserve, a world heritage site located in Garhwal Himalayas, India. The current status of *gharats*, the factors responsible for the neglect of this renewable energy device, initiatives taken for upgrading for their revival have been highlighted. Field and policy level opportunities and constraints associated with promotion of such hydro-energy in the study area by upgrading of traditional watermills are analysed and suitable options for removing impediments are suggested.

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1. Introduction

Energy is one of the basic requirements to sustain life on Earth. Energy availability and its appropriate consumption play a vital role in the economic development of any nation. World energy demand has been increasing very rapidly with the increase in population. The conventional sources of energy resources are limited on Earth and excessive use of these resources is adversely affecting its environment. Rural communities in the Himalayan region have always relied on biomass energy for domestic uses, hydropower, animate energy and human muscle power for mechanical works such as milling grain, ploughing fields, and transporting goods. However, various studies [1,2] have shown that the present pattern of energy supply is not sustainable to meet the increasing energy requirements due to the rapid increase in the population and the growing aspiration of mountain communities for better living standards.

The mountain people are acquainted with mountain specificities (e.g., inaccessibility, marginality, diversity,

fragility) and through trials and errors over the generations have evolved several practices and measures to promote and enhance the range of survival and growth options [3]. Since ages, the Himalayan people have developed indigenous device in the form of watermills, locally known as *gharats* to harness renewable hydro-energy. There are believed to be about 2,00,000 *gharats* in Indian Himalayas, of which about 60,000 *gharats* alone has been estimated in Uttarakhand. Of these, 65% are in operation annually, 25% are run seasonally, and 10% are reported to be defunct [4]. However, in recent years, many of these were being abandoned by the *gharats* owners because of very low income and tough competition from more effective diesel powered mills in nearby towns [5].

The Nanda Devi Biosphere Reserve (NDBR), which represents, the Trans-Himalayan region of the bio-geographic classification of India [6] possess an immense hydropower potential because of presence of number of rivers and streams criss-crossing its mountainous terrain. The sustainable harnessing of hydro-resources of the area can be ensured through upgrading and revival of *gharats*, a traditional device of renewable energy with community implementation and management. Development of renewable energy sources such as *gharats* can contribute to create

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jobs in small and medium sized community enterprises, brings socio-economic cohesion within the community and has positive implications for balance of trade, security of supply and protection of environment [7].

The present contribution is an attempt to analyse energy use pattern, use of traditional renewable hydropower in NDBR and to put-forth a strategy elements for upgrading of *gharats* in the buffer zone of NDBR, so that it could play a lead role in diversifying rural economies, and reducing existing environmental damages to the NDBR ecosystem

2. Study area

The NDBR (30°06′–31°04′N and 79°13′–80°0′E) is situated in Chamoli district of the state of Uttarakhand, India. It came into existence on 1 January 1988 under the Man and Biosphere (MAB) programme of Government of

India (Fig. 1) and is named after the famous Nanda Devi peak (7816 m above m.s.l). The total area under NDBR is 5860.69 km² and it has two core zones: Nanda Devi National Park (624.62 km²) and Valley of Flowers National Park (87.50 km²), surrounded by a buffer area (5148.57 km²) consisting of four zones (Kagbhushundi, Malari-Lapthal, Old-NDBR and Sundardhunga).

The NDBR has a distinctive microclimate because of wide variations in altitude, climate, and geological conditions. This has given rise to an enormous diversity of ecosystems, which supports nearly 800 plant species, 18 mammal species, and 200 birds. Many of these species are endangered and listed in the Red Data Book. The entire Biosphere Reserve is also the catchment of the river Ganges. About 81% of the area of core zone and 60% of the area of buffer zone of NDBR remains permanently snow bound or covered by glaciers. The major glaciers (i.e., Kosha, Ramni, Changbang, North Rishi, North Nanda

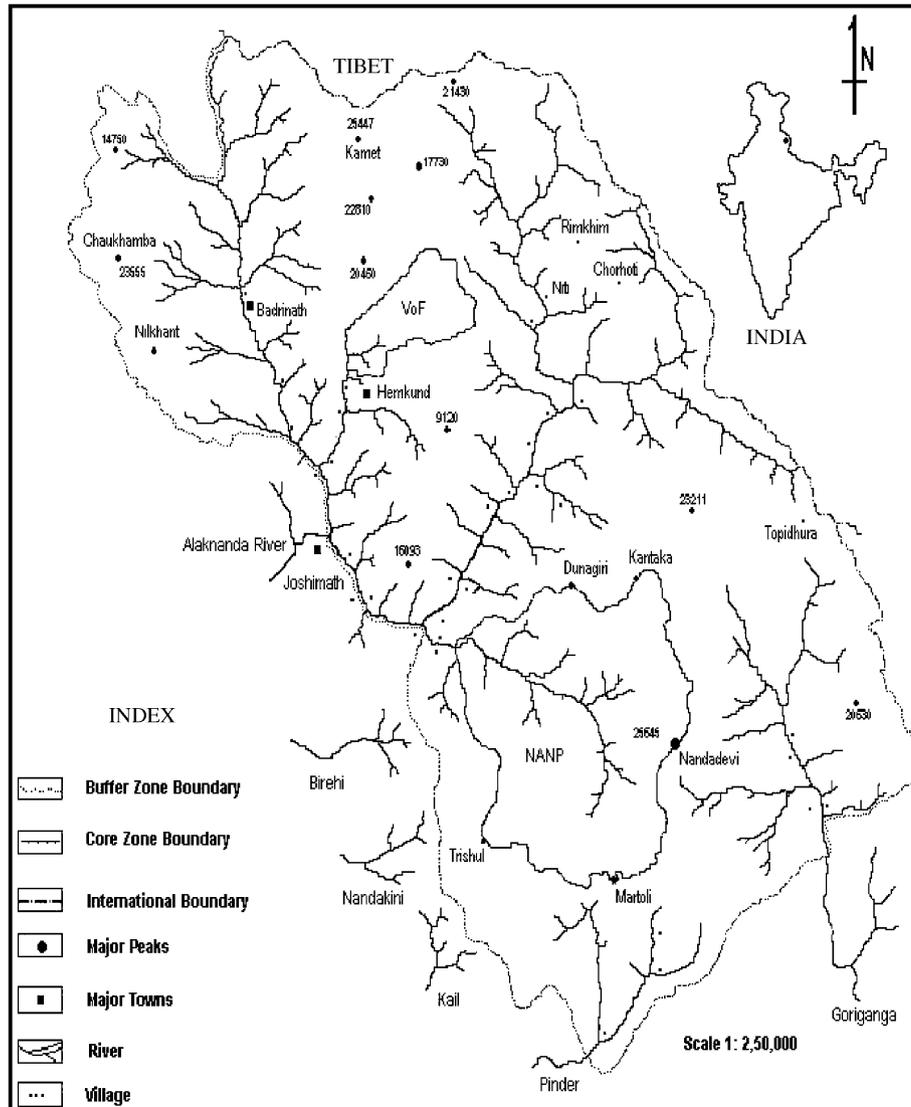


Fig. 1. Location map of Nanda Devi Biosphere Reserve, Uttarakhand.

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