WATER-FLOW PROTECTION TO PROTECTED AREAS IN NEPAL

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ABSTRACT

Water bodies within the protected areas are very important flow resources. Nepal has more than 6000 stream and rivers and more than 5000 ha. of land is covered by lake water. Northern high Himalaya is the source of these water resources. The biodiversity of the country is directly associated with water flow. A 13.9 percent of the total area of the country is under protected area. However, National Parks and Wildlife Conservation Act mentions the protection of water bodies within the protected areas, the national parks are badly affected by the activities done out side the park boundary. Therefore, water flow protection of protected areas is very necessary to incorporate within protected areas management plan and it should cover whole basin area within and outside the park boundary.

INTRODUCTION

Water-flow system is a major component of the bio-diversities. In Nepal, water ecosystem is following a cascading process fro the high Himalaya to low-land Terai in association with relief structure. Because of the topographic control factor water ecosystem is on extreme delicate position in the country. Construction of development and economic projects over running water course are obstructing self

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regulatory process and providing negative impact on the water ecosystem specifically on aquatic environment.

However, Nepal has considerable area under National Park (NP) and Protected Areas (PAs). Basically NP and PAs are playing a substantial role to protect natural resources and bio-diversities in the country. Besides the management policy and legislative measures, water-flow protection even inside the NP and PAs territory seems still on delicate situation. The man goal of this paper is to point out the major problems behind the water-flow protection to protected areas in Nepal.

BIOGEOGRAPHICAL SETTING

Nepal is a small country with an area of 14,718,100 ha, roughly rectangular in shape running parallel to the Himalayan arcs. Less than 200 km width has an elevation extended from less than 100 m to 8848 m. Within this narrow North-south stretch Nepal has clearly defined three east-west ecological belts. The upper part along the Tibetan boarder has high Himalayan strip. Perpetual ice covered peaks, glacier valley, narrow and steep bare rock slope with Alpine climate and biogeography are the distinct characteristics. The relatively small Trans Himalayan zone lies to the north of the main Himalayan chain in western Nepal. It is situated within the rain shadow of the Himalayas with an annual rainfall less than 500 mm. The middle belt is confined immediately south of high mountain belt just below the approximate elevation of 3600 m. This belt also has complex terrain. Many perennial rivers and their tributaries originated in high Himalayan region flowing via this belt to south. This region has warm to temperate climate according to its elevation. From the very beginning of the human history of the country this middle belt was taken as one of the best for human habitat due to its mild and healthy climatic condition. South of this middle belt with an elevation approximately lower than 1500 m. lies the Terai belt, including the lower part of Mahavhart, Siwalik, Inner Terai and terai all along the Indian boarder from east to west. This is the only more or less homogeneous physiographic region of the country. Numerous perennial rivers and their tributaries come down to this belt. This belt has warm to hot climate.

Because of this heterogeneous bio-physical situation of the country, there is significant biological diversities. Most species of animal and plants occurring at high altitudes in the Himalayas are characteristic of the Palearctic Realm, while the fauna

and flora of the southern lowlands are typically Indomalayan species. Nearly 100 species of mammals and 250 species of birds have been recorded and it is estimated that there are some 10,000 indigenous spècies of plants (Shrestha and Nepali: 1987). Large Asian mammals e.g. Greater One Horned Asian Rhinoceros (Rhinoceros unicorns); Wild Elephant; Gangetic Dolphin (Plantanista gangetica); Gharial crocodile (Gavialis gangeticus); Tiger are the major wet land endangered mammal species found in the Terai. Numerous Alpine endangered mammal species e.g. Musk deer (Moschus moschifems); Blue sheep (Pseudois nayaur); Red panda (Ailums fulgens); Snow leopard (Panthera unicia) are found in Himalayan belt. Several floristic plants as well as valuable herbal plants are also confined in different parts of the country.

PROTECTED AREAS IN NEPAL; AN OVERVIEW

To preserve these various endangered species from the rapid invasion of human population the initial exercise on National Park and Protected Areas was started in 1958. The first step to this direction was taken from the Chitwan for the protection specially endangered species. But an effective conservation movement was started after when the His Majesty Government (HMG/N) enforced the legal provision in 1973 by the National Park and Wildlife Conservation Act 1973. Up to now, Nepal has eight National Parks, four wildlife Reserves, one Hunting Reserve and two Conservation Area Projects. All of these covers 20,423 km 2 or 13.88 percent of the total land of the country. Out of these, Sagarmatha, Makalu, Langtang, Shey-Phoksundo, Rara National parks; Annapurna Conservation area Project and Dhorpatan Hunting Reserve are in High Himalayan belt. RCNP and Royal Bardia, Suklaphant, Parsa and Koshi Tappu Wildlife Reserves are in Terai belt. Whereas the Middle belt has only Khaptad National Park and Shivapuri Wildlife Reserves. These all national parks and reserves are equivalent to protected areas (IUCN; 1992).

WATER-FLOW AND BIODIVERSITIES; CONCEPTUAL FRAMEWORK

Rivers and streams are bodies of water continuously moving in one direction form upper part to lower part. The rivers and valley systems which they drain are the fundamental components of landscape. The present character of river system can

best be understood if they are examined in the context of a catchment ecosystem,

which consists of a river or lake together with its associated drainage area (Petts and Foster; 1985). The river ecology focuses on energy transformation, nutrient turnover and the storage, and processing of organic substrate. The biological communities of rivers and streams are dynamic, changing significantly form the source to mouth. Water volume, gradient, depth, temperature are the major physical factors affect the constituent of biological community, structure and pattern. The river continuum concept emphasized the species diversity on the basis of physical character of river (Vannote et al; 1980) .

Headwater streams and large rivers both have less species diversity than the middle order streams. In the headwater streams the invertebrate community will be dominated by two functional feeding groups; namely shredders and collectors. Strong links between streams and the terrestrial systems are reflected by the marked influence of riparian vegetation which reduces autotrophic production by shading and contributes large amounts of allochthonous detritus. The stable channel, the balanced sediment input, a coarse substratum, broad seasonal temperature regime, wide maximum diurnal temperature regime and variable discharge favors a diverse fauna in the middle order streams. The predictable variable physical characteristics of many middle order rivers encompass optimum condition for a large numbur of species, therefore, that system may have high species diversity. In the large river high sediment deposition, relatively stable discharge and low maximum diurnal temperature range due to buffering effect of the large volume of water is associated with the low biotic diversity.

Rivers and streams are also formed a corridor in the ecosystems, which help to transfer nutrient flow, energy supply and species diversity in the surrounding landscapes. Any obstruction of natural flow of water may hinder the ecological processes. Specially the stream and river regulation and damming activities directly affect the ecosystem.

In Nepal most of rivers when they come down to accessible low land they bc ome the middle order. In this stage they may have maximum species diversity st ge. Big hydropower dams in the Terai region directly reduces the biodiversity of th aquatic life. The Gandak dam and Koshi dam near the RCNP and Koshi Tappu

wildlife Reserve are the major construction. But, the situation is complicated because the areas are leased to the Government of India (Jaakko and Madecor; 1987).

WATER-FLOW AND BIODIVERSITES IN NEPAL

Snow covered highly elevated mountain in northern part ot the country is the main source of hydrological net-work. On the whole there are approximately 6000 large and small river and streams. These all provide about 40 percent of the annual flow of the river Ganges and 70 percent of its dry season flow. Along with these about 5000 ha of scattered lakes are the major waterbodies of the country.

Most of the lakes in the highlands are oligotrophic and many are of recent glacial origin. Severe flooding during summer monsoon and constant shifting of the river channels have created wide flood plains with a mosaic of sand and shingle banks, oxbow lakes, patches of riverain forest marshes and seasonally flooded grasslands. These areas are rich in ecological diversities. This is reflected in the great variety of woodland fauna. A total of 164 indigenous species of fishes, 130 species of waterfowl and the aquatic reptiles include two threatened species of crocodile have been recorded (Shrestha and Nepali; 1987).

The High Himalayan National Parks contain the major headwater watershed of the country. The Khumbu catchment of Sagarmatha National Park drains into the Dudhkoshi, a tributary of the Sapta-Koshi river system. Makalu National Park contains the Arun and Barun rivers of Sapta-Koshi system. Langtang National Park contains part of the Trishuli and parts of Indrawati watershed. Annapurna conservation. Covers the parts of their headwater of Marshyangdi and Kaligandaki and all the head area water area of Madi, Seti and Modi rivers tributaries of Gandaki system. Tributaries of Karnali river originate in Shey-Phoksundo and Rara National Parks. There are also many glaciers and high altitude fresh water lakes. Dudhpokhari, Gosaikunda, Lake Phoksundo and Lake Rara are the major lakes which are famous in he country. Lake Rara is the largest and Lake Phoksundo is the deepest freshwater lakes of the country.

National parks and Wildlife Reserves in the Terai are situated in the downstream of this major systems. Besides these there are many small tributaries which are also playing major role to transfer nutrition and energy within and outside the park area.

LEGISLATION AND GOVERNMENT POLICY

The National Parks and Wildlife Conservation Act 1973 was introduced to provide a legal basis for Nepal's conservation programme. Article 5(j)of the National Parks and Wildlife conservation act 2029, prohibits the obstruction or diversion of any river, stream or other sources of water flowing into national park or reserve or the introduction of any harmful or explosive substances therein (NPWC Act; 1973).

Following this legal provision government has introduced Royal Chitwan National Park Regulation (1974), Wildlife Reserve Regulation (1975), Himalayan Mountain National Park Regulation (1979), and Soil Conservation and Watershed Management Act (1982). According to these legal provisions government is trying to protect water flow as well as biodiversity of protected areas. But in most cases these rule and regulations seems unable to defend the bad impact upon national parks caused by the activities outside the park boundary. In this case two prominent examples are cited here.

BHRIKUTI PAPER MILL

This mill was designed and built by the donation of Chinese government in 1980. This is situated at the western bank of River Narayani (Gankdaki) about 20 kilometer upstream for the RCNP. The effluent from the plant including dioxin is discharged directly into the river (James et al; 1992). In the park three species of endangered animals dependent on the river system occur, e.g. Gangetic Dolphin (Plantanista gangetica); Gharial Crocodile (Gavialis gangeticus); Grey-headed Fishing Eagle (Icthyophagaichyoetus). Besides of these species several aquatic species as well as human, domestic and wild animals living in the downstream are influenced by the polluted water.

KOSHI BARRAGE

This barrage is just in south of Koshi Tappu Wildlife Reserve (155 km^2). This wildlife Reserve was established in 1976 as a wetland wildlife reserve. About 50

percent area is covered grasslands which are being more or less modified every year by shifts of the riverbed with subsequent deposition of silt. The lower portions entirely dominated by mudflats and marshes which have formed within the dam retention area after its construction. Extensive lowland area is converted to flooding basin. The construction of dam has had a profound impact on physical features of the areas, its vegetation and fauna, and human life of the region. About 12,000 people of the basin have been moved out and resettled elsewhere. The dam has altered habitats in favor of some species especially the Waterfowl, while other species have been on the loosing side.

Bauer (1987) has carried a detail field study after the severe monsoon floods and described the effect of dam on flora and fauna of the reserve. Before the construction of dam flooding of the plains had less area coverage, was less frequent, lasted less time, and deposited less silt, after construction, the extent of these destabilizing ecological elements must have vastly increased. Large area of grassland are bring covered with silt annually. Mostly open and degraded riverain forests are being reduced every year. It is estimated that more than 90 percent of the species lost after the dam construction, by changing tracts of the Koshi in upper part and massive siltation on the lower part.

Besides these already occurred examples, there are some large scale projects proposed to establish in the Himalayan rivers. Much more severe impact on biodiversity of the region may provide by those projects but the government policy seems more towards the implementation of the project. Most important example of those proposed projects are; Arun-III Hydro Electric scheme in Makalu National Park, Karnali Hydro Power Project (Chisapani), Kaligandaki Hydro-power, and Upper Koshi High Dam. Construction of such a big project in the fragile Himalayan watershed could laid a big impact in the surrounding environment.

CONCLUSION

Water bodies within the protected areas are the most important flow resources. Once misutilized this resource we can not use again. This can be exhausted. It will not exhaust itself, a large degree of biodiversity of the park will

deteriorate economic as well as moral values of the areas deteriorate. Many aquatic species will disappear. Energy and nutrient flow within the ecosystem will be interrupted. Some sort of regulatory activities may provide certain level of economic values, i.e. irrigation hydroelectricity, flood control. But in the long run these activities may not sustain the environment. Nature has its own regulatory processes and achieve its dynamic equilibrium state itself. Therefore, a good management policy of a protected area also needs to protect the natural processes.

Water quality is another most important aspect which is directly influenced by the activities of its basin area. Toxicity, turbidity, and sediment flow are directly related with water quality. Most of the species of wetland protected areas are closely related with water. Thus, water flow management should followed the whole basin area rather confined within the limit of protected area boundary. In this perspective water flow protection should be considered as a holistic approach to save the mother earth and to protect the species diversity.

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