

Review article

Conservation status of Ramsar sites of Nepal Tarai: an overview

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Abstract

Nepal houses only inland freshwater wetlands, ranging from floodplains of snow-melt-fed cold Himalayan rivers, warm rivers originating in the mid hills, high altitudinal glacial lakes to hot springs, ponds, ox-bow lakes, marshes and swamps. These wetlands support several endemic and globally threatened species of flora and fauna. Besides, wetland sites have significant recreational, religio-cultural and spiritual values. There are over 240 wetland sites in Nepal, of which 163 are in the Terai (plain lowland). Wetlands found in Tarai are comparatively more inventoried than the wetlands of mountains and the Himalayan regions of the country. The Terai region (below 300 m) covers about 14% of the country's total area, where half of Nepal's total populations exist. About 11% population of the country is wetland dependent; majority of them are living in the Terai region. The country has nine Ramsar sites, of which, four are in the Tarai region. Among them, two sites (Koshi Tappu wetland, and Beeshazar and associated lakes) lie inside the protected areas and two sites (Ghodaghodi Lake area and Jagadishpur Reservoir) are distributed outside the protected areas. The Koshi Tappu wetland lies along the floodplains of the Sapta Koshi River in the eastern Tarai within the Koshi Tappu Wildlife Reserve. It is the first Ramsar site in Nepal. Beeshazar and associated lakes lies in the buffer zone of the Chitwan National Park along the inner Tarai of Central Nepal. The Ghodaghodi Lake Area (2500 ha) lies in the far western Nepal, and comprises about 14 large and small ox-bow lakes/ponds with associated marshes, swamps, river/streams, springs, seasonal marshy grasslands and human made wetlands, out of them, Ghodaghodi Lake (138 ha) is the largest natural lake in the Nepal's Tarai. The lake system falls between the Bardia National Park and the Suklaphanta Wildlife Reserve of the country and the surrounding forest functions as an important corridor for the movement of wildlife between these as well as the Tarai and the northern Siwalik hills. Similarly, the Jagadishpur Reservoir (225 ha) which lies in Central Nepal's Tarai is the largest man-made wetland in Nepal for irrigation purpose. It is an important site for migratory and resident birds. In this paper we highlight the status, threats, conservation issues and management practices of these Ramsar sites lying in Nepal Tarai.

Key-words: Ghodaghodi Lake, Jagdishpur Reservoir, Nepal Tarai, outside protected area, wetlands.

Introduction

In the context of Nepal, wetlands is defined as “natural or artificially created areas, such as swamp, marsh, riverine floodplain, lake, water storage area and deep water agricultural land containing water from underground water resource or atmospheric precipitation that may be permanent or temporary, static or flowing and freshwater or saline (HMG/MFSC 2003). Nepal houses several types of inland freshwater wetlands ranging from high altitudinal glacial lakes to hot springs, ponds, ox-bow lakes to river floodplains, marshes and swamps. There are over 6000 rivers, 3252 glaciers, 2323 glacial lakes and 23000 ponds. These inland freshwater wetlands are categorized under 15 types of natural wetlands as classified by the Ramsar Convention. These include: (i) permanent delta; (ii) permanent rivers/streams/creeks; (iii) seasonal/intermittent/irregular rivers/streams/creeks; (iv) permanent freshwater lakes (over 8 ha); (v) seasonal/intermittent/freshwater lakes (over 8 ha); (vi) permanent freshwater marshes/pools; (vii) seasonal/intermittent freshwater marshes/pools on inorganic soils; (viii) non-forested peat lands; (ix) alpine wetlands; (x) wetlands dominated by shrub; (xi) freshwater wetlands

dominated by trees; (xii) forested peat lands and peat swamp forests; (xiii) fresh water springs and oases; (xiv) geothermal wetlands; and (xv) karst and other subterranean hydrological systems (Siwakoti 2007a). On the basis of origin, wetlands of Nepal are broadly classified into two categories: (a) natural and (b) man made. The natural wetlands are lakes/ponds; riverine floodplains; swamps; marshes; whereas, man-made wetlands are water storage/reservoir, deep water agricultural lands (IUCN 1998). On the basis of ownership, they can be categorized as wetlands lying inside the protected areas owned by the Department of National Parks and Wildlife Conservation (DNPWC); public wetlands particularly lying inside forests owned by the Department of Forests (DoF), the public wetlands lying outside the forest areas having conflicting or multiple ownership among different government agencies, and private wetlands owned by relevant property owners.

The total extent and diversity of wetlands in Nepal is still unknown. There is estimation that wetlands occupy approximately 5% (743,500 ha) of the total area of Nepal, but the ‘Inventory of Tarai Wetlands’ (IUCN 1998) estimates that wetlands cover some

724,257 ha alone in Tarai region, which indicates that the coverage of wetlands may be higher than the above estimation. However, the Nepal fourth National Report to the Convention on Biological Diversity (GN/MFSC 2009) estimated 382,700 ha in total (about 2.6% of the country's area). Out of the total wetland area, 34,455 ha have been designated as Ramsar sites of which 68.2% area is in Tarai, 31.6% in High Mountains and about 1% in Mid-hills. The Tarai (to 300 m) is a part of alluvial Gangetic plain, between the Indian border and outer foothills of Nepal and covers about 14% area of Nepal, where about 48% of Nepal's total population are inhabited.

Nepal has nine Ramsar sites (Koshi Tappu, Beeshazar and associated lakes, Ghodaghodi Lake area, Jagadishpur Reservoir, Gokyo and associated lakes, Gosaikunda and associated lakes, Phoksundo Lake, Rara Lake and Mai Pokhari). Among these, three sites are outside the protected areas: Mai Pokhari of Ilam in the Mid-hills of Eastern Nepal, and Ghodaghodi Lake area and Jagdishpur Reservoir in the far western and central Tarai region respectively. The present paper focuses the four Ramsar sites of Tarai region: Koshi Tappu, Beeshazar and associated lakes, Ghodaghodi Lake area and Jagadishpur Reservoir.

Significance of Wetlands

Nepalese wetlands are critically important for supporting significant species diversity and population of globally threatened flora and fauna. The wetlands house about 42 species of globally threatened faunal species (about 34 % of the Nepal's total threatened species). Similarly, 17 endemic faunal species out of 20 are wetland dependent (IUCN 2004). The most significant mammal species are Pygmy Hog (*Sus salvinus*), Gangetic River Dolphin (*Platanista gangetica*), Wild Water Buffalo (*Bubalus arnee arnee*), Greater One-horned Rhinoceros (*Rhinoceros unicornis*), Swamp Deer (*Cervus duvauceli duvauceli*); Indian Smooth-coated Otter (*Lutrogale perspicillata*), etc. Over 193 species (about 22.5 %) of birds are dependents on wetlands (IUCN 1998). Similarly, a large number of species of reptiles, amphibian, fish and invertebrates are also inhabited in wetlands. Nepal's wetlands also harbor 11 globally threatened species and 26 endemic species of flowering plants. Many wetland plant and animal species are also under the government protection and CITES lists (IUCN 2004). Although the protected areas are the major safe habitats for these valuable flora and fauna, the wetlands outside the protected areas are also equally important habitats for many threatened biological species.

Many ethnic communities of Nepal are directly or indirectly dependent on wetlands products for their livelihood. About 20 ethnic communities, particularly the inhabitants of Tarai region, are traditionally dependent on wetlands for their livelihood (IUCN 1998). The total population of major ethnic communities which depend on wetlands is 2,449,823 representing about 11% of Nepal's total population (CBS 2002). It covers the population of only 13

ethnic communities, because there is no record of some wetland dependent communities (such as Sunaha, Gongi, Mukhia, Kushar, Kachhare, Poda) in the Population Census Report of 2001. These communities have their own language and culture. Majority of people whose subsistence is mainly based on wetland resources are landless and illiterate. They possess only a small mud made thatched roof hut, a few earthen pots, and hand woven baskets made of bamboo, wild grass and cattail (*Typha* sp.) without any options for their subsistence livelihoods. For example, the Majhis have mainly lived on the bank of Koshi River and have been traditionally dependent on fishing and river transport. Similarly, Jhagars and Batars living in Koshi Tappu area depend on crafts produced from wetland plant (Siwakoti 2007b).

In addition to direct use values of wetlands, they also bear a tremendous significance in terms of religion, culture, and spiritual values. Local people regard wetland as manifestation of god and goddess. The river confluences and shore areas of ponds and lakes, such as Devghat, Barahkshetra, Dhanusha Sagar, Ganga Sagar, Gosainkund, Ghodaghodi Lake, etc., are considered as holy places to purify sins and earn merits for blissful eternal life. The local communities living near the Koshi River and the Karnali River consider the dolphin as a deity or as a reincarnation of god. Wetlands are also important tourist destinations. Many cultural festivals such as Chhatha, Janaipunia, Maghe sankranti, etc. are related to wetlands. All these properties emphasize the importance of wetlands conservation and management (IUCN 2004).

Ramsar Sites in Tarai Region

KOSHI TAPPU WILDLIFE RESERVE

The Koshi Tappu wetland lies in the eastern Tarai within the Koshi Tappu Wildlife Reserve (86°55'15" - 87°05'02" E, 26°33'57" - 26°43'40" N). The Koshi Tappu Wildlife Reserve (KTWR) occupies 17500 ha area including part of Sunsari, Saptari and Udayapur districts of eastern Tarai of Nepal. KTWR was gazetted in 1976 as the only remaining site for the globally threatened Asiatic Wild Water Buffalo (*Bubalus arnee arnee*) and in 1988 became Nepal's first Ramsar site. KTWR area lies in the floodplains of the Sapta Koshi River, the largest of all river basins in Nepal. The southern boundary of the Reserve runs parallel to the Koshi Barrage, 6.5 km to the south. The barrage created a huge reservoir and submerged area (about 4995 ha) between the barrage and the southern border of the Reserve (a buffer zone of the Reserve), which forms an extremely important habitat for migratory water birds. The northern boundary of the Reserve is demarcated along the floodplain of the eastern embankment near Prakashpur, to the village of Tapeshori north to the Trijuga River. The Koshi Tappu wetland forms a complex mosaic of lotic (running water) and lentic (standing water) ecosystems, where more than seven types of habitats occur including permanent, seasonal and regular rivers and floodplains; floodplain; freshwater

oxbow lakes; seasonally flooded grassland; floodplain forest; reservoir and seasonally flooded rice fields. The area has a long history of settlement and over 87% of the total population are involved in agricultural activities. Fishing is also important occupation for the wetland-dependent community.

The Koshi Tappu wetland is known as an Important Bird Area (Baral and Inskipp 2005) and largest heronry in Nepal which supports about 486 species of birds including several globally threatened and endangered species (Baral 2005). About 50,000 water birds have been counted during winter and the population of common pintail (*Anas acuta*) was the most notable (Scott 1989). At least three critically endangered (White Rumped Vulture, Slender-billed Vulture, Lesser Florican), two endangered (Bengal Florican, Greater Adjutant Stork) and several vulnerable (including Swamp Francolin) bird species were reported from the area, in addition to last surviving population of Asiatic Wild Water Buffalo and Gangetic Dolphin (BPP 1995; WMI/IUCN 1994). Similarly, 670 vascular plant species are recorded from the wetland (Sah 1997; Siwakoti 2006).

Based on following criteria the Koshi Tappu Wildlife Reserve has been designated as a Ramsar site in 1988:

- It supports the last remaining population of Asiatic Wild Water Buffalo in Nepal, the Ganges River Dolphin, Gharial, and eight species of globally threatened wetland birds.
- It holds more than 20,725 water birds of 44-80 species (1994-1996 Asian Waterfowl census), 16,327 birds of 81 species (Singh 2001) that would exceed 20,000 when adding individuals of rest 400 species.
- It supports more than 1% population of globally threatened Swamp Francolin *Francolinus gularis*, 100% population of the recently described subspecies of Nepal Rufous-vented Prinia *Prinia burnesii nepalicola* (Baral *et al.* 2007).

BEE SHAZAR AND ASSOCIATED LAKES

The Beeshazar and associated lakes (27°37'04.6" N, 84° 26' 11.3" E) lie 7.2 km south from East-West Highway following Khageri canal in Gitanagar and Bachauli Village Development Committees of Chitwan District, as a part of inner Tarai (*Doon*) region of central Nepal. The wetland system lies amidst the Tikauli forest and consists of series of lakes, marshes and swamps occupying an area of 3200 ha within the buffer zone of the Chitwan National Park, a World Heritage Site. The wetlands provide excellent habitat for globally threatened species of birds and water hole for large mammals. The tropical Sal (*Shorea robusta*) dominated Tikauli forest surrounding the wetlands acts as a corridor and refuge for the movement of large mammals of the National Park including the Great One Horned Rhinoceros and Royal Bengal Tiger between the Siwalik range and the Mahabharat mountain range. A total of 26 mammals, 18 species of herpetofauna, and 271 species of birds have been reported from the area, of which 60 species are wetland dependent including several globally threatened species (such as the Lesser Adjutant



Fig. 1. Location map of Ramsar Sites of Nepal Tarai (Kafle 2005).

Stork, Great Spotted Eagle, Black-bellied Tern, Ferruginous Duck, Pallas Fish Eagle) (IUCN 1998; Bhuju *et al.* 2007). The wetland also supports the largest number of Marsh Crocodile outside the protected area as well as a small population of Indian Rock Python (BPP 1995). The aquatic vegetation includes *Ceratophyllum demersum*, *Ipomoea aquatica*, *Cyperus species*, *Leersia hexandra*, *Eichornia crassipes*, etc.

Based on following criteria the Beeshazar and associated lakes have been designated as a Ramsar site in 2003:

- An extensive typical oxbow lake system of the inner Tarai inside the buffer zone of Chitwan National Park, a World Heritage Site, providing excellent habitat for endangered wildlife species.
- Assemblage of some rare and endangered large mammals, birds, reptiles and monogeneric plant species importance for conserving biological diversity.

GHODAGHODI LAKE AREA

The Ghodaghodi lake area (28°41'03" N, 80° 56'43" E) lies in the Kailali district of far western Tarai of Nepal (Fig. 1), at the base of the Siwalik hills, the youngest mountain range of the Himalayas. This wetland covers about 2500 ha area including about 14 large and small ox-bow lakes/ponds with associated marshes, swamps, river/streams, springs, seasonal marshy grasslands and human-made wetlands (canals, irrigated fields, ponds, etc) surrounded by tropical deciduous mixed sal (*Shorea robusta*) forest in the lower slopes of Siwalik hills. Major lakes are Ghodaghodi (138 ha); Nakhrodi (70 ha); Baishawa (10 ha), etc. The wetland lies at an elevation of 205 m asl and experiences a tropical vegetation type with influence of the Western Himalayan floristic province as exemplified by the occurrence of a willow (*Salix sp.*) in the lake

area. This area features a monsoon climate characterized by hot rainy summer and cool, dry winter. On account of its location in the western part of Nepal, it is also exposed, to some extent, to Mediterranean climatic conditions, characterized by winter rainfall in relatively higher proportions compared to the central and eastern parts of Nepal. The lake system falls between the Bardia National Park to the east and the Suklaphanta Wildlife Reserve to the west and the surrounding forest functions as an important corridor for the movement of wildlife between these protected areas as well as the Tarai and the Siwalik hills. The wetland system is bordered by three Village Development Committees (local politico-administrative unit), namely Sandepani, Darakh and Ramshikharjhala, with population of 43,687.

The people's occupation is predominantly farming with traditional use of natural resources. People depend on the wetland area for fishing, livestock grazing, and collection of fodder, firewood and various non-timber forest products (NTFPs). The water is also used for irrigating surrounding cultivated land. Tharus, an indigenous ethnic group comprising 51.3% of the total population of the area, are the most traditionally dependent community on wetland resources. The wetland area bears high cultural and religious values for the indigenous Tharu community.

The Ghodaghodi Lake is a largest natural ox-bow lake in the Tarai and having finger-like projections, with associated marshes and meadows. The lake is characterized by deposits of soft shale and conglomerates. The soil type varies from alluvial to clay. It is fed by direct precipitation during the monsoon season and by surface flows from the watershed area, ground water springs, and small streams. Water depth varies from 1-2 m during the dry period to 3-4 m during the monsoon season. A weir constructed in the outlet has been impounded more water used for irrigation. Water deposited during the monsoon slowly recede through seepage to streams and thus lost through evaporation. The wetland area harbors 473 species of plants, including over 95 aquatic macrophytes and critically endangered *Pterocarpus marsupium* (IUCN 2004) and wild rice (*Oryza rufipogon*). Similarly, about 16% avifauna (140 spp.) of the country, including critically endangered White rumped Vulture (*Gyps bengalensis*), Slender-billed Vulture (*G. tenuirostris*), endangered Ferruginous Duck (*Aythya nyroca*), Lesser Adjutant Stork (*Leptotilos javanicus*) and nearly 1% population of Cotton Pygmy-goose (*Nettapus coromadelianus*) have been reported from the Ghodaghodi wetland area (Baral 1992). It also supports several species vulnerable animals such as Smooth-coated Otter (*Lutra perspicillata*), Common Otter (*Lutra lutra*), Marsh Crocodile (*Crocodylus palustris*), Golden Monitor Lizard (*Varanus flavescens*), etc. (IUCN 2004).

Based on following criteria the Ghodaghodi lake area has been designated as a Ramsar site in 2003.

- It is an example of a specific type of wetland, which is large, rare and vulnerable in the western Tarai.

- It supports an appreciable assemblage of rare, vulnerable or endangered species or sub-species of plants or animals or an appreciable number of individuals of any one or more of these species.
- It also regularly supports substantial numbers of individuals from particular groups of waterfowl, indicative of wetland values, productivity or diversity. Where data on populations are available, it regularly supports 1% of the individuals (*Nettapus coromadelianus*) in a population of one species or species of waterfowl.

JAGDISHPUR RESERVOIR

Jagdishpur Reservoir (27° 35' N and 83° 05' E) lies in the Niglihawa Village Development Committee of Kapilvastu district of Nepal (Fig. 1), about 10 km north-west to the district headquarters Taulihawa. It lies at low elevation (197 m asl) with a tropical monsoon climate of hot rainy summer and cool, dry winter. The Reservoir is surrounded by Jagdishpur village in the southwest, Bandauli village in the southeast, Rajkullo village in the east, Bikuli village in the northeast, Harnampur and Kusma villages in the northwest. Muslims, Tharus, and people migrated from hilly areas are settled around the Reservoir. The Reservoir was impounded in 1972 by diverting the Banganga River for irrigation purpose. Currently, it is a largest reservoir in the country constructed for irrigation with a total area of 225 ha and water surface area of 157 ha (Baral and Inskipp 2005). The reservoir is the main source of water for irrigation of at least 406 ha land in the Kapilbastu district. The water level in the reservoir fluctuates from a maximum of 5-7 m to a minimum of 2-3 m.

This site is considered as paradise for birds. It provides shelter to at least 18 species of mammals, 8 species of reptiles, 42 species of indigenous and migratory birds and 25 species of fishes (Baral and Inskipp 2005). Similarly, several plant species occur in the reservoir and the adjoining areas. The major aquatic plant species are *Ageratum conyzoides*, *Ceratophyllum demersum*, *Cyperus* spp., *Hygrorhiza aristata*, *Typha elephantina*, *Ipomoea carnea* ssp. *fistulosa*, *Leersia hexandra*, *Nelumbo nucifera*, *Nymphoides hydrophyllum*, *Oryza rufipogon*, *Ottelia alismoides*, *Paspalum distichum*, *Polygonum hydropiper*, *Vetiveria zizanioides*, etc. Plantation of *Dalbergia sissoo* is common along the embankment. The associated species in the plantation areas mainly consist of alien taxa, such as *Cassia occidentalis*, *C. tora*, *Chromolaena odorata*, *Croton bonplandianum*, *Hyptis suaveolens*, *Parthenium hysterophorus*, *Xanthium strumarium*, etc.

It is currently managed under the Reservoir Management Committee involving local community. The Committee has leased this Reservoir for commercial fish culture. Some southwest part has been used for recreation (boating) purpose.

Based on the following criteria the Jagdishpur Reservoir has been designated as Ramsar site in 2003.

- Assemblage of some rare, endangered, and monogeneric plant species holds importance for conservation of genetic diversity.
- Presence of aquatic macrophyte species, that support in feeding, breeding, rearing and staging of waterfowls (both resident and migratory), fishes and invertebrate populations.
- Presence of some fish species that support food value for water fowls (for resident and migratory)
- The reservoir at times supports 4% of the estimated population of regional vulnerable migratory wintering Ferruginous Ducks (*Aythya nyroca*).
- Resident Sarus Cranes (*Grus antigone antigone*), the regionally endangered and the tallest flying bird species in the world, utilize this habitat.
- It also supports 1% of the regional population of Lesser Whistling Duck (*Dendrocygna javanica*).
- Resident stork species (Open-bill and White-neck) are the recommended species for protection due to their susceptibility to become endangered species through various anthropogenic causes.

All the Ramsar sites of Nepal Tarai have rich biodiversity and possess high socio-economic and cultural values. However, they are facing several threats. The major threats, their underlying issues and opportunities for conservation of wetlands including Ramsar sites are discussed below.

Threats

Wetlands are playing fundamental ecological roles and constitute a resource of great economic, cultural, scientific and recreational values. To maintain their roles and values the ecological processes of wetlands should continue functioning. Unfortunately, these days, wetlands are among the Nepal's most threatened ecosystems. A study carried out by IUCN Nepal (IUCN 1998) in Tarai wetlands reported that there are 94% of total wetlands used for fishing, 70% for grazing, 69% for irrigation and 59% for plant harvesting. The wetlands are experiencing various kinds of threats, and these are broadly categorized as:

- *Destruction and degradation of wetland habitats*: Major factors responsible are high rate of drainage and reclamation of wetlands for housing, urban and industrial uses; inappropriate wetland management due to high water pumped for dry season crop, fish harvesting, etc.; modification of land use for agriculture; and fragmentation due to encroachment. Human encroachments (e.g., cultivation by illegal tree felling and reclaiming the area) along the shore and ridges of Ghodaghodi area is rapid. The Jagdishpur Reservoir is occasionally dried up for its maintenance, which has also contributed in the loss of native biodiversity. The

destructive flood of 2008 on the eastern embankment of Koshi Tappu led to the loss of habitat of several globally threatened species, including Swamp Francolin.

- *Loss of wetland ecosystem integrity*: Major factors responsible for the loss of wetland ecosystem integrity are construction of dams, barrage, etc. for hydropower, irrigation and flood management; over-extraction of ground water for domestic and other water requirements; increasing pollution by the use of high doses of pesticides/herbicides and fertilizers in the surrounding agricultural land, industrial waste and domestic sewage; and sedimentation. The dynamic nature of the Koshi River and the creation of Barrage have altering the water regime of the area and increased the rate of sedimentation. Almost 69% of wetlands are threatened by sedimentation and siltation and 61% by agricultural run off (IUCN 1998). Due to heavy accumulation of agricultural run off, the Ghodaghodi lake system is changed to hyper-eutrophic condition and almost covered by macrophytes. It is also severely affected by natural eutrophication. The extensive proliferation of macrophytes has been changing the habitat of birds, also rising up the lake bottom due to accumulation of organic matters. Several marshy floating islands have been developing in the Ghodaghodi Lake accelerating seral succession towards dry land. The succession is rapid in the Nakhrodi Lake of the Ghodaghodi lake complex, changing the lake into marshy land, where *Ipomoea carnea* ssp. *fistulosa* and *Salix* species are prominent. Similarly, the rapid succession in Beeshazar Lake is taking place by invasion of *Leersia hexandra*.
- *Depletion of species abundance and diversity*: Major factors responsible are over harvesting of bio-resources (fishing, grazing, poaching, etc.); destructive harvesting practices (fish bombing, electro-fishing, poisoning, draining, use of small mesh nets, etc.); introduction of invasive alien species of plants (e.g., *Alternanthera philoxeroides*, *Ceratophyllum demersum*, *Eichhornia crassipes*, *Ipomoea carnea* ssp. *Fistulosa*, *Leersia hexandra*, *Mikania micrantha*, *Paspalum distichum*, etc.) and animals (exotic fish species). Over 3,000 cattle reside inside the Koshi Tappu Wildlife Reserve and further >10,000 cattle from surrounding areas graze in the wetland area. Similarly, over 12000 cattle are recorded grazing the shoreline forests at Ghodaghodi. The wetland is gradually leading to terrestrial habitat. The alien invasive species have been affecting the habitats of water birds and other faunal species in these wetlands. Among the alien invasive species, *Ipomoea carnea* ssp. *fistulosa* is the most problematic species, which is luxuriant along the marginal side of the Jagdishpur Reservoir disturbing the underneath vegetation and other biota. This species also blocks the flow of water causing sedimentation and filling up of the reservoir. To reduce the problem of

sedimentation in the Reservoir, the Irrigation Department of Government of Nepal has started a mechanism for controlling the growth of the *Ipomoea carnea* ssp. *fistulosa* by using herbicide (2,4-D) since last 3 years, although the use of herbicides and poisons does not comply with the rules of Ramsar Convention. As a result, the growth of the weed has been decreased to some extent. However, still there are a sufficient number of green stems of the *Ipomoea carnea* ssp. *fistulosa* which can invade the habitat again if the herbicide is not sprayed regularly. The Jagdishpur Reservoir has been given to fish contractors on lease for 10 years since 2007. The fish contractors released large number of the exotic fish fingerlings (grass carp, silver carp, common carp, naini and bighead, etc.) by removing all the native fish species. According to local people, the native fishes (*Walgo* species, *Chauna* species, etc.) can kill the introduced species and hence before releasing the fingerlings they completely dry up the Reservoir during April. It means that most of the native wetland species including fish have been died. Similarly, many small ponds of the Ghodaghodi area are also leased to fish contractors. Over fishing is common in and around the Koshi Tappu Wildlife Reserve, leading to decrease in fish population. This has affected the population of gharial, dolphin and other aquatic animals which depend on fish as a major food supply. Fishing is the main source of income for many landless wetland dependent communities of the area.

Issues

Although some wetland loss is inevitable and can even benefit man, but much is detrimental and unavoidable. Inadequate planning, inconsistent policies and inadequate management institutions and tools are major underlying causes for wetlands loss and degradation. In Nepal, poor integration of wetland biodiversity conservation into sectoral plans and policies, followed by poor coordination between implementing agencies (management agencies, line agencies, local NGOs and communities), inadequate technical and institutional capacity, poor information base, low awareness for wetland biodiversity conservation, management and decision including high local community dependence on resources but low level of participation in the management are some of the issues responsible for the degradation of wetlands. All the issues are the combination of poor understanding of the values of wetlands and the consequent omission of the values from the economic calculus which determines the decision affecting wetlands. This is also illustrated by multiple or conflicting ownership of wetlands for resources use among the various government agencies. For instance, water bodies of Nepal fall under the jurisdiction of the Ministry of Water Resources; similarly, wetlands lying within the national forests are under the domain of the Ministry of Forests

and Soil Conservation (MFSC); while wetlands lying inside the protected areas fall under the domain of DNPWC. Ponds used for fish production are under the Department of Agricultural-Directorate of Fisheries Development; the reservoirs used for irrigation come under the Department of Irrigation (DoI), and the water bodies used for power generation are under the Nepal Electricity Authority. Besides, some wetlands are being claimed by the local government units such as District Development Committees, Municipalities and Village Development Committees (IUCN 1998). In some cases, lands are owned by the government but usufructs belong to the intermediaries or the tenants. Such types of conflicting ownership also exist in Ghodaghodi wetland between the Forests Department, Kailali District Development Committee and surrounding Village Development Committees. However, conservation and sustainable development of wetlands is possible only through coordinated and integrated approach of different responsible institutions/ organizations with the active participation of local communities.

Wetlands Management Practices

The values of wetlands for globally threatened biodiversity conservation and subsistence livelihoods, especially to wetland dependent communities, who are most marginalized, land poor and deprived among the poor, are being understood and recognized in Nepal. The country became signatory to various multilateral environment agreements of which the convention on wetlands (Ramsar Convention), the Convention on Biological Diversity (CBD) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) are important ones linked to wetland biodiversity conservation. The MFSC is responsible to regulate the multilateral agreements related to biodiversity and wetlands conservation. The country has also formulated various policy and legal measures and set up various responsible institutions for wetland conservation.

Policy Measures

Nepal Biodiversity Strategy (NBS) (HMG/N/MFSC 2002) has stipulated strategies to promote sustainable safeguarding of wetland habitats and identified some key actions to conserve wetlands (Belbase 2007). However, majority actions mentioned in NBS are yet to be implemented due to resources and other constraints. The only recommendation of NBS which has been implemented is the formulation of National Wetland Policy 2003, which aims to conserve and manage wetland resources wisely and in a sustainable way with local people's participation. The National Wetland Policy 2003 is an innovative policy instrument formulated and endorsed by MFSC, which recognizes local communities as immediate beneficiaries of successful wetlands management. It covers and addresses the wide array of issues which are indeed crucial for the conservation and sustainable use of wetlands as well as sharing of

the benefits arising from the utilization of wetland resources. However, the policy remains to be implemented by formulating respective laws and regulations. As long as this policy is seen to be a policy document of the MFSC, it is unlikely to be implemented effectively, because, there are different ministries and agencies that are also managing the wetlands. They should be made responsible for implementing different components of the policy in their respective areas. To make the wetland policy compatible with different relevant ministries some work has been started to review the policy. If the pace of implementation of recommendations of the government endorsed policies is so slow, then it is unlikely that the conservation of wetlands will get any due importance and consequently their destruction is likely to continue (Belbase 2007). Similarly, the Nepal fourth National Report to the Convention on Biological Diversity (GN/MFSC 2009) target 1.2 pointed out the protection of the areas of particular importance to biodiversity including nine Ramsar Sites by undertaking multiple approaches. However, the progress is not as expected.

Legal Measures

Existing sectoral legal frameworks that have an implication over the conservation of wetlands are the followings:

The Aquatic Life Conservation Act, 1961 (amended in 1999) is one of the Nepal's oldest pieces of legislation, which aims to protect aquatic life. The Act, while defining water, has mentioned all types of water bodies including lakes, marshes, swamps and wetlands. It has, however, not made any provisions to ensure conservation and management of such wetlands. It does not comply with the Ramsar Convention while defining aquatic life, because it does not cover the waterfowl. It makes room for water management in private property, but fails to make provisions for the conservation of aquatic life within private water. It prohibits many activities that potentially bring about detrimental effects to aquatic life. The Chief District Officer (law, order and security maintaining authority in district) is the regulating authority that often fails to give it to required priority. Its implementation is poor especially outside the protected areas and tremendously leading to loss of many valuable species such as Gangetic Dolphin.

The National Parks and Wildlife Conservation Act 1973 aims to conserve faunal biodiversity throughout Nepal. The District Forest Officer and other law executing agencies have authority to regulate this Act outside the protected areas. The Act does not define wetlands; however, protection of wildlife within protected area system makes it possible to conserve wetlands as well.

Buffer Zone Management Regulations 1996 is capable of ensuring conservation and sustainable use of wetlands resources in buffer zones of national parks and reserves. Buffer Zone Management Regulations 1996 has also recognized the local use rights and the existence of customary laws and has made rooms for the participation and involvement of local communities in

conservation and sustainable use of natural resources, including wetland resources of buffer zone areas of the protected areas.

The Soil and Watershed Conservation Act 1982 allows to properly managing the watersheds. The Act outlines the essential parameters necessary for proper watershed management of sympatric rivers and lakes but it does not provide the room for community participation in the decision making process which impedes the effective implementation of the Act by the Department of Soil Conservation and Watershed Management.

The Water Resources Act 1992 tends to make legal arrangements for determining beneficial use of water resources, preventing environmental and other hazardous effects thereof, and also for keeping water resources free from pollution. The Act gives the ownership of all water resources to the state. However, the institutional framework and the technical infrastructure of the executing agency do not respond to its ownership. The Act provides provision of the environmental impact assessment for any possible mobilization of water resources. However, to what extent the water resources encompass wetlands are not clear since the Act does not mention wetlands whatsoever.

The Electricity Act 1992 forbids the negative impacts on the environment, such as soil erosion, flood, landslide and air pollution while generating, transmitting or distributing electricity. However, it does not acknowledge wetlands or water pollution.

The Forest Act 1993 (first amendment 1999) aims to maintain and manage the national forests and makes provisions indirectly to conserve the floral and faunal diversity of Nepal. The Act defines forest but not any ecosystems including wetland, although a wetland in government managed forests can be declared a protected forest as per section 23 of this Act. Under the provisions in Community Forestry, local communities became formal managers of wetlands in case if these exist within the territory of their community forests. But, there is no evidence of the community having formally been handed over or managing a wetland as community forest.

Following the principles of decentralization, the Local Self Governance Act 1998 was promulgated which aims to empower and give the responsibility of development to the local government at district and village levels. The Act and rules under it, to a certain extent, provide ownership to local government agencies of overall natural resources within their boundaries. However, this provision is not very clear and contradicts with the provisions made in other Acts (Forest Act, National Parks and Wildlife Conservation Act, and Water Resources Act).

The various sectoral legal measures dealing with wetlands conservation cannot provide legal base for the conservation of wetlands and implementation of Ramsar Convention. Unless there is a specific legislation for conservation of wetland, Nepal's wetlands cannot be protected effectively. The legislation should be based on the National Wetland Policy 2003. It can be inferred, therefore, that unless well defined wetland legislation is formulated and

implemented the word wetlands may not get to *de jure* recognition in the courts or law books (Belabse 2007).

Institutional Arrangements

Wetlands of Nepal, unless defined otherwise, belong to the state. Different wetlands, particularly distributed outside the protected areas, are under various management regimes. Some of these are government managed wetlands, such as Deoria lake of Kailali is managed by the Department of Plant Resources under MFSC; Jagdishpur Reservoir is under the Management of DoI (as being a Ramsar site, recently the Supreme Court has directed MFSC to manage this wetland for technical matters); wetlands of Lumbini Sacred Garden are under the jurisdiction of the Lumbini Development Trust; and Ghodaghodi Lake is under the management of the DoF. Many wetlands are aquaculture ponds under private property managed by the owner. The owner has been paying land tax to the government. Community can manage communal wetlands distributed, leasehold or religious forests. Several lakes and ponds have been given on lease by different local government units within their jurisdiction to individuals or institutions for fisheries or other purposes. Some wetland areas in Koshi Tappu adjacent to the Koshi Barrage have been given to the Government of India in lease for 199 years as per the agreement of 1957 on the Koshi Project between two countries.

The protected area system of Nepal consists of a network of nine national parks, three wildlife reserves, three conservation areas, and one hunting park, including ten buffer zones around the protected areas and all these protected areas and associated wetlands are being managed by DNPWC. The protected areas cover c. 19.73% of Nepal's total area. Recently, Government of Nepal declared two new conservation areas and proposed one new national park aiming to extend the coverage of protected areas to 25%. A total of five protected areas, Chitwan National Park, Bardia National Park, Koshi Tappu Wildlife Reserve, Parsa Wildlife Reserve and Suklaphanta Wildlife Reserve are distributed in the Tarai region, with diverse wetland habitats and rich species biodiversity. The Ramsar Sites specific management plans are under the process of development. A draft management plan for Ghodaghodi lake complex has been forwarded to MFSC for approval. The DoF, Ghodaghodi Development Committee (local NGO), networks of 17 community forest user groups and local government units are identified as implementing partners for the plan. Preparation of the management plan for Jagdishpur Reservoir is under process with the involvement of DoI, DoF, local water user groups, local government units, NGOs, etc. The buffer zone management committee of Beeshazar Lake is also preparing a management plan of the area.

Conclusions

The importance of wetlands has been well recognized in Nepal for the conservation of globally significant biodiversity as well as for

the subsistence livelihood of over 11% country's population. However, these wetlands are suffering from sedimentation, habitat loss, discharge of industrial and agricultural run off, unsustainable harvesting of resources, alternation of species composition due to heavy grazing and colonization of alien invasive plant species. The various environmental threats and underlying causes for wetlands degradation are the major challenges for the conservation of wetlands of Nepal. Recognizing the uses and values of wetlands for ecological roles and biological conservation different legislations have been formulated. Despite various legal instruments related to wetlands, a well defined mechanism that can be effective in wetland management is not available. The first amendment (1999) of the Aquatic Life Protection Act 1961 has included the word wetlands while defining water, otherwise, the term is not defined by any existing law. Even the reclamation of wetlands is not prohibited by law. However, the Nepal Biodiversity Strategy 2002 has recognized the importance of wetlands and aimed to promote sustainable conservation of wetlands with a recommendation for the unified national wetland policy and legislations. The National Wetland Policy 2003 is the first policy for wetland conservation, which has realized that without active people participation wetlands cannot be conserved. Still legislation with the definition of wetlands in the line with Ramsar Convention is awaited. There is also an urgent need to harmonize existing sectoral laws, policies, authorities, jurisdictions over the wetlands. Ramsar Sites specific collaborative management plans are needed for the sustainability of wetlands. Although such management plans are under the process of development, the effective implementation is the major part as learned from past experiences. The Ramsar Convention's obligations is mandatory for the contracting party, however, the existing practices, such as drying up the reservoir, introducing exotic fish species and using herbicides and poisons as in Jagdishpur Reservoir are not complying with the Ramsar Convention obligations. Further, the heavy dependency of poor people to wetlands without alternative options for livelihood is a major issue for wetland conservation. Similarly, the current unstable political condition of Nepal is also one of the major challenges for the protection of wetlands biodiversity of Nepal. The situation of wetlands lying in the High Mountains and Mid-hills is also not very different than the Tarai. A number of government agencies, international conservation partners (IUCN, WWF, UNDP-GEF funded wetland project, etc.), national NGOs/CBOs, etc. have been involved in various activities to overcome these challenges. However, the conservation efforts can be sustainable only when the wetland dependent community are actively involved in decision making process and benefited *in lieu* of conservation.

References

- Baral H.S. 1992. *Ghodaghodi Lake System: a National Treasure*. Nepal Bird Watching Club, Kathmandu, Nepal.
- Baral H.S. 2005. *Birds of Koshi*. Second Edition. Department of National Park and Wildlife Conservation (DNPWC), Government of Nepal and

- Bird Conservation Nepal (BCN), Kathmandu, Nepal.
- Baral H.S., Basnet S., Chaudhary B., Chaudhary H., Giri T. and GC S. 2007. A new subspecies of Rufous-vented Prinia *Prinia burnesii* (Aves: Cisticolidae) from Nepal. *Danphe* 16(4): 1–10.
- Baral H.S. and Inskipp C. 2005. *Important Bird Areas in Nepal: Key sites of Conservation*. Bird Conservation Nepal, Kathmandu, Nepal and Birdlife International, Cambridge, UK.
- Belbase N. 2007. Legal and policy aspects of conservation of wetlands: opportunities and challenges. In: *Himalayan Wetlands: Risks, Challenges and Opportunities* (B. Bhandari and G. Joo, eds.), pp. 101–112. Ramsar Wetlands Centre, Changwon, Korea.
- Bhujju U.R., Shakya P.R., Basnet T.B. and Shrestha S. 2007. *Nepal Biodiversity Resource Book: Protected Area, Ramsar Sites and World Heritage Sites*. ICIMOD/MoEST-GN/Nepalnature.com and UNEP, Kathmandu, Nepal.
- BPP 1995. *Biodiversity Profile of Terai and Siwalik Physiographic Zones*. Biodiversity Profiles Project Pub. No. 12, His Majesty's Government of Nepal, Ministry of Forest and Soil Conservation, Kathmandu, Nepal.
- CBS 2002. *Nepal Population Census 2001*. Central Bureau of Statistics, Kathmandu, Nepal.
- GN/MFSC 2009. *Nepal fourth National Report to the Convention on Biological Diversity*. The Ministry of Forests and Soil Conservation, Government of Nepal, Kathmandu, Nepal.
- HMG/N/MFSC 2002. *Nepal Biodiversity Strategy*. The Ministry of Forests and Soil Conservation, His Majesty's Government of Nepal, Kathmandu, Nepal.
- HMG/N/MFSC 2003. *National Wetland Policy*. Ministry of Forests and Soil Conservation, His Majesty's Government of Nepal, Kathmandu, Nepal.
- IUCN 1998. *An Inventory of Nepal's Terai Wetlands* (B. Bhandari, ed.). IUCN Nepal, Kathmandu, Nepal.
- IUCN 2004. *A Review of the Status and Threats to Wetlands in Nepal*. IUCN Nepal, Kathmandu, Nepal.
- Kafle G. 2005. *Avifaunal Survey and Vegetation Analysis Focusing on Threatened and Near-Threatened Species on Ghodaghodi Lake of Nepal*. A Report Submitted to Oriental Bird Club (OBC), UK.
- Sah J.P. 1997. *Koshi Tappu Wetlands: Nepal's Ramsar Site*. IUCN, Bangkok, Thailand.
- Scott D.A., ed. 1989. *A Directory of Asian Wetlands*. IUCN, Gland, Switzerland.
- Singh G.R. 2001. *Community Development and Biodiversity Conservation through Bird Watching Tourism at Koshi Tappu Ramsar Site in Eastern Nepal*. M.Sc. Thesis, Charles Sturt University, Australia.
- Siwakoti M. 2006. An overview of floral diversity in wetlands of Terai region of Nepal. *Our Nature* 4: 83–90.
- Siwakoti M. 2007a. Wetland types and associate vegetation in Nepal: an overview. *Wetland Science* 5(3): 193–200.
- Siwakoti M. 2007b. Wetlands conservation and sustainable livelihoods in Nepal. In: *Souvenir, National Seminar on Sustainable Use of Biological Resources* (April 22–23, 2007), Pokahara, Nepal, pp. 45–50. Ecological Society, Kathmandu, Nepal.
- WMI/IUCN 1994. *Biodiversity of Koshi Tappu Wildlife Reserve and its Adjoining area. Applied Database for Integrated Biodiversity Conservation in Nepal*. Woodlands Mountain Institute/IUCN Nepal, Kathmandu, Nepal.