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BIODIVERSITY AND ITS USE AT TAUNSA BARRAGE WILDLIFE SANCTUARY, PAKISTAN

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ABSTRACT

This study determined the livelihood conditions of the peoples of three villages (Bait Qaimwala, Basti Allahwali and Jannu) and their dependency on biodiversity of Taunsa Barrage Wildlife Sanctuary, Pakistan from 2009 to 2011. For socio-economic status, Participatory Human Resource Interaction Appraisal method was used and for biodiversity assessment, direct census method and point count were used. Floral biodiversity contained 79 species of plants including; trees (n=48 species); herbs (n=8 species); shrubs (n=9 species); grasses (n=7 species); reeds (n=5 species) and weeds (n=2 species).Fauna included fish (n=21 species), amphibians (n=3 species), reptiles (n=9 species), mammals (n=14 species) and birds (n=171) species. The high illiteracy rate (64 percent) in the surroundings of TBWS was estimated. Overall the local community was dependent on wetland products for use of fuel wood (77 percent), livestock grazing (100 percent), fishing (90 percent), hunting, freshwater turtles trading (10 percent) and others (9 percent). Villagers who live in mud-built houses constitute 42 percent, concrete houses 30 percent and thatched houses 28 percent. Typical means of transportation in the area was still animal driven cart (25 percent). In Bait Qaimwala 75 percent households were ultra poor. In Basti Allahwali 15 percent households were poor, 35 percent extremely poor and 5 percent ultra poor. In Jannu village, 55 percent households were poor and 45 percent were non poor. There is need to reorganize the social sector and help local communities to fully benefit from the potential of ecotourism. In conclusion, community participation for sustainable use of natural resources in wildlife sanctuary will give a new strength to biodiversity conservation in study area.

Keywords: socioeconomic; biodiversity; local communities; resource use, Taunsa Barrage Wildlife Sanctuary.

INTRODUCTION

Biodiversity is a wide concept covering the full range of genetic, ecosystem and species diversity, together with the changeability between and within species, ecosystems and geographic regions. Biodiversity of freshwater provide essential ecological services as provision of water for drinking, fisheries, food production, cultural purposes and transportation (Balian *et al*., 2008). Therefore, the protection of this marvelous diversity of life is one of the important keys to the retention of these services, which are necessary to human well-being and health (Corvalan *et al*., 2005).

Pakistan has a number of the world's rarest animals and plants but these are now in danger from habitat loss and overuse (BAP 2000). Protected areas are significant for the safeguarding of threatened or rare biodiversity and play a great role in the biosphere. Globally, the number of protected areas has been increasing notably over the last few decades (Cosentino, 2005). In Pakistan, total area covered by protected areas is 10.4% of the total land (BAP 2000). Protected areas are usually considered as fundamental for the long-standing safeguarding of biodiversity. Facts for protected area effectiveness in this respect is, however, fairly uncertain in nature (Evans *et al*., 2006). Wetlands support valuable biological diversity that has been contributing substantially to the socio-economics of millions of people of local communities by providing facilities of employment, nutrition, fuel, food, fodder, means of transportation and irrigation (Mokhlesur, 1995).

It is clear and evident that a proper and systematic biodiversity conservation planning is highly essential for the improvement, maintenance and sustainability of any protected area (Foundation for Ecological Security, 2010). A common human nature is that if they can benefit economically from business that depends on nearby natural resources of protected areas, and then they should take immediate action to sustainably manage and conserve those habitats (Salafsky *et al*., 2001). Serious threat to biodiversity is habitat exploitation, establishing protected areas as secure place for biodiversity is crucial need to ensuring the survival of

earth flora and fauna.In protected areas very high dependencyand stress on native resources mainly on wetland goods has been observed. People are highly dependent on sanctuary product for food, fuel, building materials, fodder and grass.

In freshwater biodiversity decline is however over and above that of other systems (Dudgeon *et al*., 2006). Over the last century, despite knowing about biodiversity importance, human pressure on biodiversity increased tremendously. In Pakistan development planners ignored the importance of biodiversity of protected areas and their role to human life.The present paper focuses to categories the biodiversity of TBWS and to identify the significant dependency of local community on biodiversity of the area.

MATERIALS AND METHODS

Study Site: Present study was conducted (2009 to 2011) in TBWS (30º 30´ N, 70º 50´ E) which is located at an altitude of 137m in district Muzaffargarh, southern Punjab Pakistan. The sanctuary was designated as Ramsar site in 1996. This site forms a very important wintering area for water birds. However, the rare Indus dolphin *Platanista minor* and otter *Lutra perpicillata* were also present in the river in small numbers.

The foremost climate (subtropical) factor that influences biodiversity was annual rainfall 100-400 mm, with relative humidity 25% to 85%. The average lowest temperature in January remains 4.5˚C to 6.0˚C; while, the average extreme in June 41.5˚C-43˚C. The area of the sanctuary is 2,832.8ha. The sanctuary is referred to as a baila in local language (WWF-Pakistan, 2008). Three villages were selected for study including Bait Qaimwala located on the right bank of Indus just South of Taunsa Barrage (30^0 31’ 14’’N, 070^0 57’ 05’’E); Basti Allahwali located on the left bank of Indus immediately south of Taunsa Barrage (30^0 30’ 42’’N, 070^0 50’ 23’’E); and Jannu village located near Liyyah road (30^0 32’ 17’’N, 070^0 55’ 50’’E) (Figure 1).

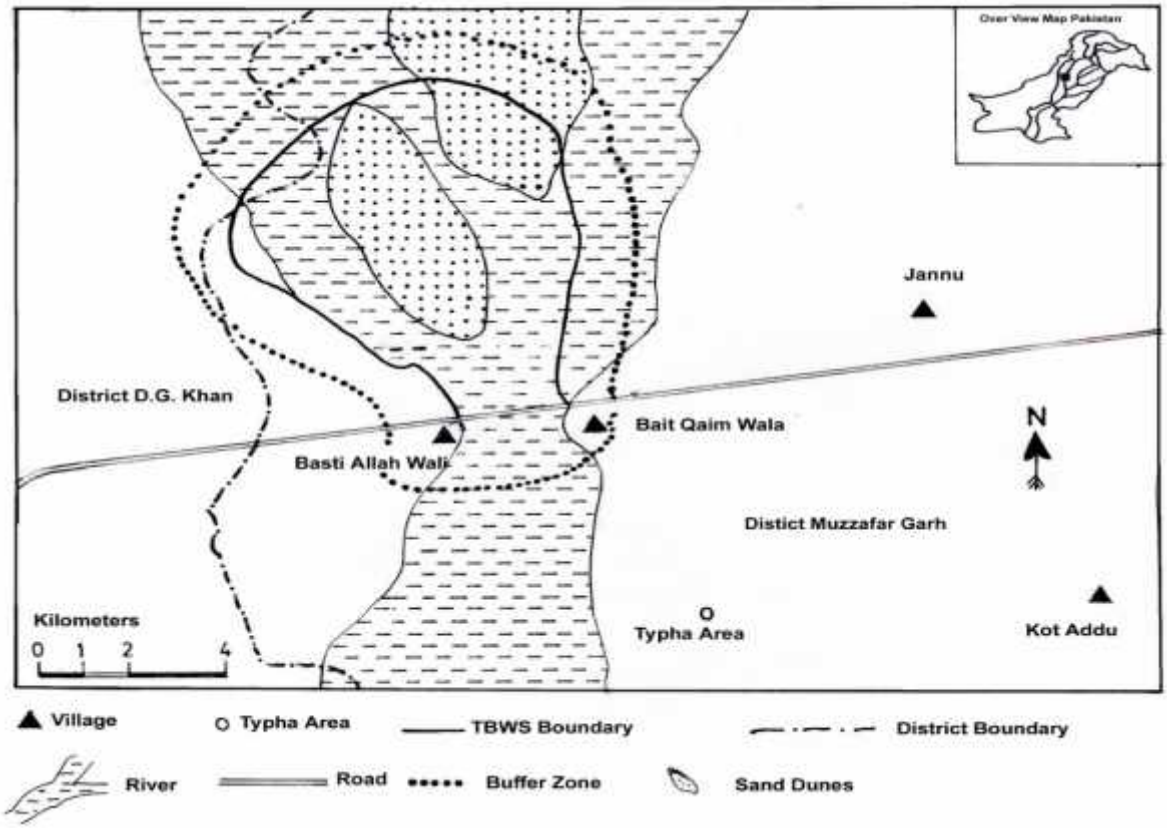

Figure 1. Map of study area (TBWS) and selected villages

Socio-economic survey and PHRIA methodology: The socio-economic aspect of the study was carried out through interviews and meetings with people of selectedvillages. The respondents included farmers, livestock owners, fishermen, basket makers and old people. Data was collected from 394 participants (252 male; 142 female) out of total population (26,551) of three villages. The Participatory Human Resource Interaction Appraisal (PHRIA) field methodology (Scherl

and Forte, 2000) was used to study the village description, village economy, humans and resource interaction. It seeks to enable local people to share, enhance and analyze their knowledge of life and conditions to act (Chambers, 1994; Anyaegbunam *et al*., 2004).

Poverty level or income profile of the residents of study area was assessed by the poverty line specified by Government of Pakistan (Rs 748 per capita per month). Poverty levels were described in January 2012, when one US dollar was equal to 90.4 Pakistani rupees. Poverty categories were described as; extremely poor (>Rs 361.7 or $4.01 per capita monthly income), ultra poor (Rs 542.5 or $6.01 per capita monthly income), poor (Rs 723.4 or $8.01 per capita monthly income and non-poor (Rs 1446.8 or $16.03 per capita monthly income) (Poverty assessment updates, 2008).

Estimation of Biodiversity: Biodiversity censuses of TBWS were carried out with in 30 day intervals. Number of birds, reptiles, and mammals were identified and counted with the help of binoculars with magnification of10 × 50 and spotting scope of magnification 20 × 30 × 60. GPS (Magellan) was used to record coordinates of the area and to access the extant of sanctuary area. Flora of the study area was identified by direct census method. All species identified in field by the help of local community and by the use of books Shinwari *et al.*, 2006 and Mirza, 1997. Plants, birds, reptiles, mammals and other biodiversity was identified by using books and field guides (Roberts, 1991, 1992, 1997; Grimmitte *et al.,* 1998, Mirza, 1998; Shinwari *et al.*, 2006; Mirza and Wasiq 2007). Night surveys were conducted mainly for the observation of nocturnal mammals and bird's species (Hill *et al*., 2005) from 11:00 pm to 04:00 am.

RESULTS AND DISCUSSION

Biodiversity of study area: Flora of the study area contained 79 species including trees (n=48 species); herbs (n=8 species); shrubs (n=9 species); grasses (n=7 species); reeds (n=5 species) and weeds (n=2 species). Floral diversity is a characteristic group of plants that grow naturally together in a particular environment. Locals collect timber from the sanctuary which is used for making furniture and firewood. Ayurvedic practitioners collect herbs and shrubs from the wildlife sanctuary for treatment of various diseases. Major plant species observed in the surroundings of the study area are given in Table 1.

Table 1: Number of trees species identified in TBWS.

Name of trees	Bait Qaimwala (n=number of trees)	BastiAllahwali (n=number of trees)	Jannu (n=number of trees)	Percents of total number of trees
Acacia nilotica	150	60	50	2.911
Albizia lebbeck	600	500	650	19.596
Dalbergia sissoo	50	30	80	1.791
Eucalyptus camadulensis	1500	2000	2500	67.189
Ziziphus mauritiana	50	70	65	2.071
Mangnifera indica	100	150	50	3.359
Phoenix sylvestris	45	40	100	2.071
Morus laevigata	30	25	35	1.007

Some of the most common trees in the area included *Acacia catechu, A. farnesiana, A. nilotica, A. Senegal.* The herbs and shrubs in the area included *Nelumbium speciosum, Orthanthera viminea.* Grasses used for grazing livestock in the area included *Saccharum arundinaceum, Saccharum spontaneum, Saccharum munja.* Branches and stems of *Acacia nilotica, Albizia lebbeck, Dalbergia sissoo, Eucalyptus camadulensis* and *Morus laevigata* used as fuel for cooking food by local community of TBWS. Various dominant woody plants that provide goods and services were *Acacia haematoxylon*, *Boscia albitrunca* and *Acacia erioloba* (Milton and Dean, 1995). Riverine forest along the Indus River was dominated by *Populus euphratica,* and *Dalbergia sissoo* in connection with *Tamarix dioica*. Additional vegetation includes *Salsola barysoma, Pisumarvense, Prosopis cineraria, Eleusine compressa, Acacia nilotica, Cynodon dactylon*, and *Panicum antidotale*.

Wetland goods like the fruit of lotus was used by ayuverdic practitioner for curative purposes, 40% of the people use the roots of the plant as a source of food. *Typha angustata* and *Tamarix dioca* plants were used for prayer mat and basket making which was one of the most important cottage industries in the area. Thatching material for roofs like *Typha angustata* was also collected from the sanctuary area. Local community of taunsa barrage was dependent on biodiversity of the protected area that was available around it. Taunsa barrage is an important wintering area for waterfowl, notably for *anatidae* family, and breeding area for several species. Most dominant species of birds observed at Taunsa

barrage were *Fulica atra, Bubulcus ibis, Egretta garzetta, Aythya ferina, Corvus splendens, Ardea purpurea*, *Larus ridibundus, Sterna aurantia* and *Sterna melanogaster*. Less common visitors included *Cinconia cinconia*, *Phoenicopterus ruber, Rostratula benghalensis, Aythya nyroca.* Taunsa barrage is famous due to the presence of mammals as *Platanista minor, Axis porcinus, Canis aureus, Felis chaus, Susscrofa cristatus and Lutra perspicillata.* Fauna of the area comprised of rich variety of fish (n=21 species), amphibians (n=3 species), reptiles (n=9 species), mammals (n=14 species) (Table 2) and birds (n=171 species).

Table 2: Shows observed fish, amphibians, reptiles and mammals at study site.

S.No	Scientific name	Common name	Habit
1	*Axis porcinus*	Hog Deer	Mammal
2	*Bagarius bagarius*	Devil Catfish	Fish
3	*Bufo stomaticus*	Indus toad or Desert Toad	Amphibian
4	*Calotes versicolor*	Indian Garden Lizard	Reptile
5	*Canis aureus*	Asiatic or Golden Jackal	Mammal
6	*Carassius auratus*	Goldfish	Fish
7	*Channa marulius*	Dowlah	Fish
8	*Channa punctata*	Spotted Snakehead	Fish
9	*Chitra indica*	Chitra Turtle	Reptile
10	*Cirrhinus mrigala*	Mrigal	Fish
11	*Cirrhinus reba*	Reba Carp	Fish
12	*Clupisoma garua*	River Catfish	Fish
13	*Ctenopharynodon idella*	Grass Carp	Fish
14	*Cyprinus carpio*	Common Carp	Fish
15	*Eutropiichthys vacha*	Batchwa	Fish
16	*Felis chaus*	Jungle Cat	Mammal
17	*Funambulus pennantii*	Northern Palm Squirrel	Mammal
18	*Gibelion catla*	-	Fish
19	*Hemiechinus collaris*	Long-eared Desert Hedgehog	Mammal
20	*Herpestes javanicus*	Small Asian Mongoose	Mammal
21	*Herpestes edwardsi*	Indian Mongoose	Mammal
22	*Hypopthalmichthys molitrix*	Silver Carp	Fish
23	*Kachuga smithi*	Brown or Smith's River Turtle	Reptile
24	*Labeo calbasu*	Orangefin Labeo	Fish
25	*Labeo gonius*	Kuria Labeo	Fish
26	*Labeo rohita*	Rohu	Fish
27	*Lissemys punctata*	Indian Flap-shell Turtle	Reptile
28	*Mastacembelus armatus*	Baam	Fish
29	*Nesokia indica*	Short-tailed Mole Rat	Mammal
30	*Notopterus notopterus*	Asian Knifefish (Pholi)	Fish
31	*Ophisops jerdoni*	Punjab Snake-eyed Lacerta	Reptile
31	*Oreochromismoss ambicus*	Tilapia	Fish
32	*Pipistrellus ceylonicus*	Kelaart's Pipistrelle	Mammal
33	*Pipistrellus kuhlii*	Kuhl's Pipistrelle	Mammal
34	*Platanista minor*	Indus Blind Dolphin	Mammal
35	*Python molurus*	Indian Python	Reptile
36	*Rana limnocharis*	Indian Cricket Frog	Amphibian
37	*Rattus rattus*	Roof Rat, or House Rat	Mammal
38	*Rita rita*	Khaga	Fish
39	*Scotphilus kuhlii*	Common Yellow-bellied Bat	Mammal
40	*Speratas arwari*	Singhari	Fish
41	*Sus scrofa*	Wild Pig or Indian Wild Boar	Mammal
42	*Aspideretes gangeticus*	Indian Soft Shell Turtle	Reptile
43	*Varanus bengalensis*	Indian Monitor Lizard	Reptile
44	*Wallago attu*	Wallago	Fish
45	*Xenochrophis piscator*	Checkered Keel-backed Snake	Reptiles

The arid subtropical climate of Pakistan is ideal for reptiles but not suitable for amphibians. Indian Python (*Python molurus)* by following IUCN category of near threatened was reported in the surrounding of taunsa barrage. In turtle's one species *Chitra indica* was endangered and *Aspideretes gangeticus* was recorded as vulnerable. Due to the discrepancy of Baila(island in middle of the upstream river) habitat, it becomes disastrous for the burrowing species when it becomesflooded.

Study on diversity of avifauna revealed the presence of 171 species (a total of 58,598 birds) belonging to 48 families. Bird's density recorded in two years of field surveysat TBWS was 6.9 birds per hectare, while in 2009 to 2010 it was 5.74 birds per hectare, and in 2010 to 2011 it was recorded 6.26 birds per hectare (Figure 2).

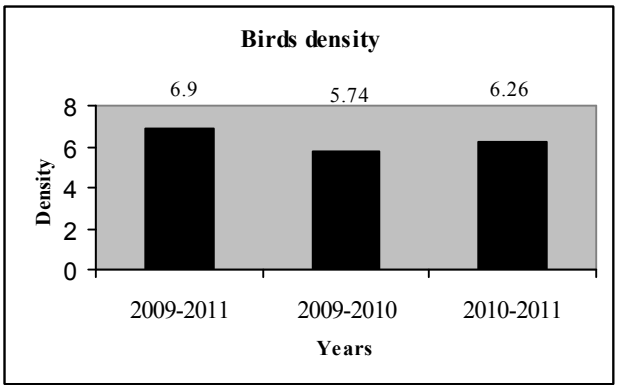

Figure 2: Diversity of avian species at TBWS (2009-2011).

During the field surveys it was observed that wild animals like the migratory birds were caught by nets and baskets for eating, hog deer (*Axis porcinus*) was also shot dead by the locals and hunting parties for its meat and also as a sport. Birds like the black partridge (*Francolinus francolinus*), grey partridge (*Francolinus pondicerianus*) and chukor partridge (*Alectoris chukar*) kept as pets. Dolphins and turtles trapped for the body fat which removed and used by hakims in medicines.

Turtles were caught for export toChina where it was an essential part of the menu. East Asian markets have been importing large quantities of freshwater turtles and their parts from Pakistan. Freshwater turtlesillegally captured from rivers of Pakistan and transported to China, Hong Kong, Korea and Vietnam since 2002. This illegal trade in freshwater turtles is on its peak during the last eight years in Khyber Pakhtunkhwa, Lahore, and Karachi (WWF-Pakistan, 2012). Snakes were caught by the local people for selling them to snake charmers and for export. Wild boars (*Sus scrofa*) were hunted as a sport; they were also caught by the local people for fights with blood thirsty dogs at their annual get together (mela).

Owing to the above use to the wildlife resources turtles, migratory birds, large snakes like the python have gradually decreased in number. Huge disturbance to wildlife has been observed in the area when people from Loralai, Baluchistan migrate in to the TBWS area for goat and sheep grazing after the cotton harvesting season has ended.

Socio-economics of the villagers around TBWS: Three villages that constituted 3,793 households with an average number of 7 people per household were selected for study. The total human population estimated was 26,551 around the sanctuary area. Maximum number of households (1832) was recorded at Bait Qaimwala. The population structure as number of males and females; and an average number of people per household in each village was also estimated and their percentage given in Table 3. On the whole villagers live in mud houses (42%), concrete houses (30%) and thatched houses (28%).

In Bait Qaimwala 75% people were ultra poor, 25% relatively non poor. In Basti Allahwali 15% household were poor and 35% were extremely poor, 5% ultra poor, 40% were non poor (Table 4). In Jannu village, 55% households were poor and 45% were non poor. In the surroundings of TBWS 90% villagers had their own livestock; it was their secondary source (20%) of earning.

The typical means of transportation in the area was still cart (25%) driven by donkey and bull. Some other means of transportations however are also used (Figure 3). Besides that private means of transportation were not luxury items that were affordable for 15% population. Percent of means of transport depicts that villagers were poor they could not afford the fast means of transportation, mostly people preferring animal driven cart that were in their approach and less expensive.

Table 3: Number of households and population structure of Bait Qaimwala, Basti Allahwali and Jannu village

Villages	Number of household	Total population	Percent of female and male	Average peoples/HHs
Bait Qaimwala	1832	12824	50.2%; 49.8%	7
Basti Allahwali	762	5334	50.2%; 49.8%	7
Jannu	1199	8393	50.4%; 49.6%	7
Total	3793	26551		

Table 4: Poverty description of selected villages in the study area.

Poverty categories	Bait Qaimwala (percents of HH)	Basti Allahwali (percents of HH)	Jannu (percents of HH)
Extremely poor	0	35%	0
Ultra poor	75%	5%	0
Poor	0	15%	55%
Non-poor	25%	40%	45%

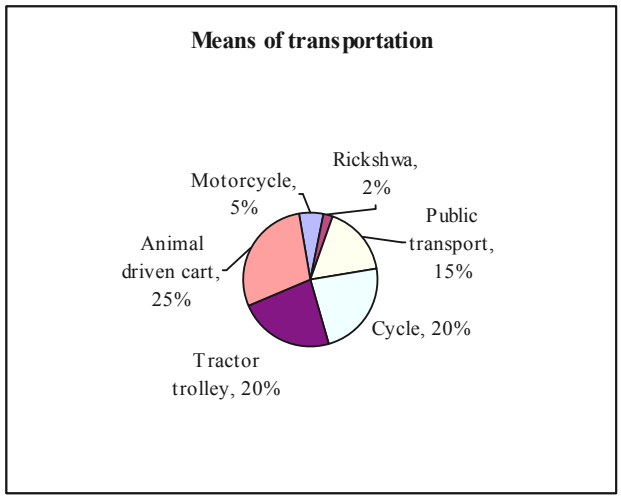

Figure 3: Vehicles used by the communities of taunsa barrage.

The occupational activities like labor, fishing, basket, rope, fans weaving and ralli making were increased 65% during summer months while decreased 35% in winter. Overall the local community was dependent on wetland products as for fuel wood (80%), grazing (100%), fishing (90%), hunting (5%), and freshwater turtles trading (10%).

Local people living near sanctuary area primarily grow food crops for family consumption, the excess being sold in the nearby market. The main crops found around Taunsa barrage were wheat (35%), sugarcane (50%), sunflower (5%), cotton (7%) and rice (3%). The agriculture communities cultivate 16% for subsistence while 84% cultivate for cash crop. The key sources of cash revenue in Bait Qaimwala and Jannu village were farming (60% and 80%, respectively); inhabitants of Basti Allahwali were mainly dependent on fishing (80%). The political and social influence of large landowners was undeniable and casts a strong influence to natural resources, including those inside the Wildlife Sanctuary (WWF-Pakistan, 2006). Achieving sustainability, enable earth to continue supporting human life.

Due to the insufficiency of the diversified livelihood options in the appearance of going up poverty, native people with draw natural resources as fishing, poaching, fuel wood collection, grazing of livestock and other needs by earning money throughout trade of the extracted assets. In tourism and boating, 10% people of the villages Bait Qaimwala and Basti Allahwali were engaged. While in fishing, 80% villagers of Basti Allahwali were involved. Sindhi and Sheikh (80%) of Bait Qaimwala were related to fishing and basket making (use *Typha angustata, Tamarix dioca*). The communities were mostly involved in Typha (*Typha angustata*) and Lotus (*Nelumbium nuciferum*) harvesting and their percent share in the occupations was 35%, while other professions were less than 15%.

This high dependency on natural resources was due to the insufficient earning sources, and unawareness. Nevertheless, these factors play their role for giving up the sustainable use of natural resources in protected areas, ultimately damaging the plants as well as wildlife species and disintegration of natural habitat (Ikpa *et al*., 2009).

Assessment of flora and fauna across an ecological gradient in nature reserve was made by Jury *et al.* (2007), findings showed that wetlands had the highest zoological diversity as results of adaptation compel by nature events, as socio-economic analysis informed that eco-tourism management raise from public to private, to spin off greater benefits to the resident.

The empirical findings revealed that wetlands support 87% livelihoods of the inhabitant, moreover also contribute positively to welfare outside the area as 70% hydropower of the country depends on water regulation. Wetlands were the source of a diverse number of streams, added to their biological and ecological value (Mombo *et al*., 2011). Main threats to biodiversity of TBWS were mainly classified into two, one was natural threat and the other one was anthropogenic threat. Among man induced factors were grazing of livestock, hunting, agriculture, unchecked fisheries and encroachment of land near the sanctuary area. Poverty related issues emerged as a major cause of unsustainable use of wetlands.

In the rural development and conservation of protected area government and local administration has paid less attention. This wealth of protected area biodiversity significance was not known to the problem. The TBWS is an important source of livelihood for local communities who assemble their daily life requirements through various usages. Due to the insufficiency of the diversified livelihood options in the appearance of going up poverty, native people with draw wild resources. Due to an increase in human activities resulting in degradation of the habitat for wildlife is reducing in size. Logging for

timber and fuel wood collection by the local villagers results in the reduction of habitat for biodiversity. There is also a lack of monitoring of these activities and to what extent they endanger the natural resources. It is clear that although TBWS is a Ramsar site there was still going on unsatisfactory use of products and services accumulated from the sanctuary area a condition that threatens its biodiversity conservation.

Efforts have been expended on the conservation of biodiversity in the study area. Community participation in the enforcement of law is required for sustainable ecosystem management.The local resident and stakeholders lack up to date information about the sanctuary. The peoples of study area were highly illiterate (64%). The living conditions of the community were very poor, and were unaware about the importance of natural resources. Local communities' positive response is essential for biodiversity conservation, protection and sustainable management.

The high dependency of rural people on wetland resources and the enormous potential that sustainable management of these assets offers for livelihood enhancement and national growth was such that safeguarding of biodiversity must also address sustainable livelihoods. The negative attitudes of local communities could be hazardous to the future of TBWS and threaten to destabilize the outcomes of the sustainable management activities. Many studies depicts that the costs of management result in unenthusiastic attitudes whilst benefits create an optimistic position (Fiallo and Jacobsen, 1995; Nepal and Weber, 1995). Flourishing maintenance therefore depends on the degree of local hold and the positive attitudes of people of the society towards maintenance policies (Rao *et al*., 2002).

To minimize local community dependency on TBWS, it is important to reorganize tourism sector and help local communities to fully benefit from its potential to generate additional income and employment opportunities. The establishment of a well organised wildlife trade monitoring network is imperative in combating the wildlife trade in endangered species of animals and plants. Creating attentiveness and constructing the capacity of wildlife and customs establishment is required for improved surveillance.

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