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Conservation Issues and Utilization of Wetlands in Nepal: A case study from Koshi Tappu Wildlife Reserve

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Abstract

*Wetlands, once considered as the wasteland, are one of the most productive ecosystems with high level of biodiversity on earth. Nepal has a number of wetlands, which are an integral part of local ecosystems, cultures and socio-economic conditions. This study was conducted in Paschim kusaha and Madhuban VDC of Koshi Tappu Wildlife Reserve of Nepal. It is the first wetland of Nepal designated as the Ramsar site in 1987. The study was mainly focused on the people's dependency on wetland, type of resources extracted, people's attitude towards conservation, distribution of Khair (*Senegalia catechu*) inside and outside the reserve area and the current conservation programs and issues on conservation. The data collection was done by questionnaire survey to obtain socio-economic variables; resources dependency and frequency of extraction and line transect survey to obtain Khair data. The result showed that 24.4% of respondents were only dependent on farming as a source of income, 56.2% use guitha as an energy for cooking and 75.1% are dependent on underground water as a source of drinking water. Similarly, 69.2% of respondents were literate and education has a significant relation with people's attitude towards conservation. The firewood extraction was highest (33.8%) followed by reeds (26.9%) and fishing (22.4%) and the extraction was most frequently done by females, peoples having less than sufficient income and those who are residing their for generations. A total of 79.6% of respondents thinks that conservation of wetland is necessary and 37.8% show their willingness to pay for conservation. This shows the people have more positive attitude and the wetland conservation is going well. Also the number of individuals and saplings per individuals of khair plants are found more inside the reserve area. Likewise, 45% of respondents replied human wildlife conflicts like encounter and injury by wild elephant, wild buffalo, crop depredation and trampling, property loss, etc. is the major issue of conservation followed by adult literacy, especially women literacy. Finally the study supports that the alternative livelihood programs, education, involvement of locals in decision making, equitable sharing of benefits will encourage more, for the locals to participate in conservation activities and also helps to built positive attitude towards wetland conservation and management.*

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1. Introduction

Wetlands are the invaluable components of environment, ecology, resource potential and biodiversity. They are among the most productive environments in the world (Thompson and Hollis, 1995), and are therefore tagged as the “supermarket” of biological diversity (Bhandari et al., 2003). Besides being home for an exceptional high level of biodiversity, they contribute in prevention and mitigation of natural disasters, floods, poverty reduction, socio-economic development as well as food and water security (Thapa and Dahal, 2009, Woodward and Wui, 2001, Ostrovskaya et al., 2013). They support important economic activities creating a link between economics and natural resources, which acts as the driving force for the transformations of wetlands (Ndetei, 2006). This indicates that wetlands and people are ultimately interdependent. Thus, the sustainable management of wetlands offers a positive step towards the development of nations and when conservation programs are launched it is necessary to address the empowerment of local people, their involvement and their sustainable livelihood.

In Nepal, wetlands are integrated parts of local ecosystem based cultures. They cover a total of 743,756 ha i.e. 2.6 percent of the total land. Nepal is registered as a party of the Ramsar Convention in 1988 and has registered nine wetlands as Ramsar sites: viz. Koshi-Tappu, Ghodaghodi Lake, Jagadishpur Reservoir, Bishazari Lake, Gokyo, Gosainkunda, Phoksundo, Rara and Maipokhari (Bhandari, 2009). These wetlands are from different geographical locations varying from a wide variety of floodplains of high altitudinal glacial lakes, marshes and hot springs to seasonally flooded forests and grasslands, rice fields and swamps. They have a unique mosaic of habitats with extremely diverse flora and fauna, much of it yet to be biologically discovered (CSUWN, 2000). Though the conservation of these wetlands have never been a hot topic on the political agenda. The conservation of forest and wildlife always was the main focal point for conservation (Sah and Heinen, 2001). There are more wetlands along with a greater forest cover in western Nepal in comparison to the eastern. It is saved naturally because of delayed economic development and as a result later migration from western mountains to terai. The conservation of wetlands is limited to national parks, conservation areas and wildlife reserves. Within these protected areas extraction of resources is completely prohibited, however most of the wetlands

outside the protected areas are open access resources to the people living adjacent to them. Thus these wetlands are vulnerable and are subjected to over exploitation. The extraction is related to the economic status of the people living near by and the resource utilization patterns of these people (Heinen and Kattel, 1992, Sah and Sah, 1999).

Nepal has a number of wetlands in the lowland region along the Indo-Nepalese border. The Koshi Tappu is one of them, which is a diverse natural wetland with rivers, floodplains, ox-bow lakes, ponds and marshes. It has a riverine ecosystem consisting of almost 50 % of Nepal's avian fauna, 63 % of fish species, 175 species of mammals and 26 % of Nepal's herpetofauna. It is home to different endangered species like the Indian Rock Python (*Python molurus*), Asiatic wild water buffalo (*Bubalus bubalis*), Gangetic dolphin (*Platanista gangetica*), Blue bull (*Boselaphus tragocamelus*), Swamp partridge (*Francolinus gularis*) and Bengal florican (*Hubaropsis bengalensis*) (Thapa, 2010). The eastern and western boundaries of koshi Tappu are the embankments designed to minimize the damage on agricultural land from flood. The northern and southern borders fall within the flood plain of the river. Hence there exists no flood refugium for the wild mammals and they regularly come outside to the agricultural land during the annual floods. This creates a huge conflict with the farmers and other inhabitants and also pose a detrimental effect in the conservation of large mammals inside the reserve (Heinen, 1993b).

During the last 34 years KTWR has been significantly changing in its land cover as well as its ecosystem integrity. It is mainly because of the regular shift of Sapta-Koshi River and high human pressure. In comparison to 1976, the forested area is reduced by 94% whereas the grassland is increased by 79%. As a whole the ecosystem has been changed by 30% (Chettri et al., 2013). Also the quality of water in the buffer zone has been degraded because of soil trampling due to over grazing, erosion and leachate (Shrestha et al., 2006). The over-exploitation and excessive harvesting of fish species have severely depleted the fish resources and this has declined the number of migratory bird species who mostly prey on fish (Thapa and Dahal, 2009). Similarly, there is a decreasing trend in the population of herpetofauna all because of excessive harvesting, habitat loss and poaching. The turtle species are killed for meat, *Python molurus molurus* for leather, *Naja naja* is highly venomous so they are killed by

people wherever they are found (Chhetry, 2010). Apart from direct human exploitation of resources from wetlands, the construction of hydroelectric dams and power plants, drainage and irrigation canals, flood control embankments have altered the hydrologic cycle in eastern Himalaya. This has increased the amount of extra nutrients and sediments leading to eutrophication and loss in soil fertility, disturbance in restocking of fishes and high pollution; finally affecting the life of wetlands (Singh, 2001).

Heinen (1993b) in a socio-economic analysis of the people from Koshi Tappu Wildlife Reserve (KTWR) showed a negative attitude towards the reserve mainly because of their socio-economic status, literacy rate, park people conflict and ethnic group of the household. The economic benefits from the ecosystem services of KTWR is approximately USD 16 million each year (Timsina and Ranjitkar, 2104). It is the major resources for most of the marginalized communities who depend for day-to-day food and other daily activities. Fish, mat weaving cattail (*Typha latifolia*), water for irrigating agricultural land, medicinal plants, fodder for domestic animals and firewood are the main products on which indigenous ethnic communities heavily rely on. Beside these direct and economic valuable products they also relied on cultural values like worshipping water, celebrating chhath (festival where people worship setting and rising sun standing in the water) in the riverbank, etc. (BCN, 2008). The people's attitudes towards conservation mainly depend upon their dependency on the wetland. The poor households may not be against conservation. But they are heavily dependent upon the wetland resources. Therefore the restriction done by the management authority for the collection of firewood, fodder, fishes, medicinal plants and other raw materials and the regular conflict and encounter with the wild animals is likely to create negative attitudes among them (Shrestha and Alavalapati, 2006). The local communities who bear more costs for wildlife conservation are less supportive for conservation activities (Kideghesho, 2010).

A similar study was conducted in Ghodaghodi wetland from western Nepal (Sah and Heinen, 2001). The result from this study shows that the resources use pattern has changed between the indigenous communities and the recent immigrants. Their study shows a negative correlation with attitudes, which contradict the general hypothesis that those who benefit more have positive attitudes. This is because the indigenous

communities depend more on forest and recent immigrants more on wetland resources. Also the indigenous communities are shy and rarely visit government offices and think that the conservation program will jeopardize their traditional rights. Attitudes also depend upon their level of awareness on environmental issues, political changes and the government development policies. So, it is necessary to provide better education and encourage them to participate more in conservation activities.

Wetland ecosystem services are part of their livelihood strategies for the people living there. It integrates with their social, cultural, economical and political status and strongly influences the sustainability of their livelihood and poverty. If this is not properly conserved and managed this relation will conversely affect the sustainability of the wetland (Finlayson et al., 2011). It is therefore necessary to build a positive attitude among people for the effective conservation and sustainability of the wetland. This can only be achieved when they regard themselves as a “part and parcel of conservation and are strictly responsible towards it” (Gereta, 2010a). This can only be achieved by providing tangible benefits and alternative livelihood options for the wetland dependent communities (Lam, 2004). Also the politicians should develop policies, rules and regulation, commitments and sustainable use of the resources to be put forward for the effective management and conservation of natural resources (Gereta, 2010b).

1.1 Statement of Purpose

The wetlands are the most threatened habitats because of their vulnerability and attractiveness for development (Hollis, 1990). These threats may be either due to natural or human activities like global warming, and climate change or conversion of wetland to agricultural land, over harvesting, development of infrastructures. In Nepal the wetland biodiversity has been under constant threat of encroachment, unsustainable harvesting, agricultural runoff, pollution, siltation and the introduction of invasive species (CSUWN, 2011, MFSC, 2002). Beside these the attitudes of people towards conservation is another major factor for effective conservation. Many studies from the developing nations clearly explain that the people sharing an equal share of benefits possess a positive attitude towards conservation and if the benefits are

not distributed equally then negative attitude will be expressed (Sah and Heinen, 2001). As a result people will show lack of interest in decision making and participating in other conservation activities. Thus, it is always essential to understand the relationship between ethnicity, socio- cultural and economic status, resource extraction and utilization patterns and peoples attitudes towards conservation, before planning and designing an integrated conservation or developmental models (Sah and Heinen, 2001).

Since the passage of National Park and Wildlife Conservation (NPWC) Act 1973, Government of Nepal has created ten national parks, three wildlife reserves, one hunting reserve and six conservation areas where twelve protected areas are along with buffer zones (Acharya, 2014). The rapid development of these conservation programs and activities was partly due to the list of different environmental problems and the voices raised against it. Despite these actions, activities, governmental support and legal protection measures, there is still human encroachment, human wildlife conflict, management problems and over harvesting (Heinen and Kattel, 1992). The study area, the Koshi Tappu Wildlife Reserve has also major issues and obstacles like feral cattle and their grazing pressure, overharvesting, human-wildlife conflict, high encroachment of Wetland Dependent Communities (WDCs) and the regular shift of the river course of Sapta Koshi river in every 5 to 6 years (CSUWN, 2011). Under the Ministry of Forest and Soil Conservation, the government of Nepal has been working in the specified wetland to address these conservation issues as well as to empower and uplift the living standard of WDCs, but still the expected achievements has not been fulfilled so far. The purpose of this study is therefore to explore the current conservation issues, dependency on resources, occupation, resource harvesting pattern and their involvement for the conservation of the wetland.

1.2 Objectives

The general objective of the thesis was to explore the conservation issues and utilization of the wetland whereas the specific objectives were as follows:

1. To test the dependency of the local people on the wetland.
2. To test the knowledge and perception of local people towards the wetland.
3. To study the distribution of Khair (*Senegalia catechu*) species inside and outside the reserve area.
4. To evaluate the conservation program and how people are involved in the conservation program of the wetland.

1.3 Methodology

Study area

Koshi Tappu Wildlife Reserve, shown in Fig. 1-1, lies in the alluvial flood plain of Sapta Koshi River in the South eastern Terai region of Nepal within the geographical co-ordinates of 26°39'00" N and 86°59'00" E (Limbu and Karki, 2003). The elevation ranges from 75m to 81m asl with a total area of 175 km² and a buffer zone of 173 km² (Kafle, 2006). It was established in 1976 and has been enlisted as the first Ramsar site of Nepal on 17th December 1987 (Limbu and Karki, 2003). It is the only remaining habitat of wild water buffalo (Arna) in Nepal. Also it is one of the most important wetlands for many migratory waders and waterfowl. Altogether 486 species of birds have been recorded so far in KTWR (Karki, 2008). It has a riverine ecosystem with 70% of the total area covered by grassland (Peet et al., 1999) and is spread over 16 Village Development Committees (VDCs) of three districts: Sunsari, Saptari & Udayapur (Thapa and Dahal, 2009, Shrestha et al., 2007). Based on the population census of 2001, the total beneficiaries are 93,323 in 16,280 households. Almost 31 % of the population comprises WDCs, which includes most ethnic groups like Mallah, Dusad, Kewat, Bantar, Satar and Jhangar. Among these WDCs, 61% are ultra-poor or poor who earn their livelihood through rice cultivation, wage labor, sharecropping, firewood and timber trade for more than nine months of the year and thus they are highly dependent on wetland resources (CBS, 2012, DNPWC and BCN, 2012, MFSC, 2002). The study was focused on Paschim kusaha and Madhuban VDCs.



Figure 1-2: Khair plant (*Senegalia catechu*)

Data collection methods

The following tools and techniques were used during data collection to address the study objectives. The field data collection was done during the summer from 3rd July 2014 to 10th August 2014 in KTWR, Nepal. The primary data were collected through observations, questionnaires and transect survey whereas the secondary data were obtained by literature reviews.

a. Observation:

A general observation was done inside and outside the adjacent areas of the wetland. The observation helps to record the flow of people and their livestock into the wetland, as well as the amount and types of resources extracted. Furthermore, all conservation activities being carried out and the involvement of locals were also recorded.

b. Individual survey/Questionnaire:

A total of 201 individual surveys were conducted which includes both the open ended and close ended questionnaires (Annex-1). These have helped to generate the quantitative as well as qualitative information from the respondents. The quantitative data includes age, sex, education level, occupation of respondents, amount of resources harvested, frequency of harvesting and the income earned; whereas the qualitative data includes explanatory reasons obtained like why and how they depend upon wetland, their involvement in conservation programs and what they think about wetland. The respondents were directly approached for the study by convenience sampling. The respondents were mainly from the wetland area and few were from the adjacent area to the wetland.

c. Transect survey:

The line transect survey method was used to collect the data of Khair species. A point was chosen in the southeastern part of the reserve and a straight imaginary line was assumed up to the northeastern part of the reserve from that point. The point was chosen in such a way that the straight-line assumed from it passes through agricultural land, marshy land, pond and the forested area. The total number of 44 quadrats was laid and the number of adults and the number of saplings of khair species, landuse type, distance from the settlement area and its location (whether inside or outside the reserve area) was observed in each quadrat. Each quadrat was of 25 X 25 m in size and was laid opposite to each other with an interval of 40m in the assumed straight line. Among these quadrats 26 lied inside and 18 lied outside the reserve area. The plant above 1m of height was categorized as the adult plant and below 1m as the sapling. Also there were four different landuse types: forest, marshy, pond and agricultural land. The plant data was collected as per the format shown in annex -2. There was a difficulty in reaching sites in the marshy land, which are only accessible by elephants. Also there was a high risk of having an encounter with wild elephant, wild water buffalo and snakes. Thus, this creates a limitation for a higher number of plots to be surveyed within the limited time period in this marshy and dense often 6m tall grassland.

d. Literature review:

The secondary data and information was collected from published scientific journals, documents, policy legislations, field reports and government census reports. The data includes the demographic variables as total household, total population, major occupation, income and living standard of wetland dependent communities. Also the relevant literature and information about the biodiversity of the wetland, issues on conservation, people participation, and sustainable management of wetland in the specified region or in the similar regions was extracted.

Data analysis

The primary data on respondents age, household size, education, occupation, income, types of resource extracted, frequency of extraction, obtained from the questionnaire survey and the secondary data on total population of the study area, household size, obtained from literature review were compared, tabulated and then were analyzed with simple statistical tools. The questionnaire data was analyzed by SPSS. The occupation, economic status, age, gender, education of respondents, frequency of extraction and type of resources extracted, major conservation issues, list of programs of conservation were the major variables focused during the analysis of the result. After setting the variables frequency percentage, chi-square test, correlations with each other were tested and the significant relations were identified. The vegetation data was analyzed in excels. The number of specific plant saplings, number of adults, distance form the settlement area and the type of land were the plant was found were the major factors analyzed for the vegetation data. The results were finally interpreted in crosstabs, charts and graphs.

2. Results

2.1 General information about respondents

A total of 201 questionnaires were conducted in two different VDCs; viz: Paschim Kusaha and Madhuban About 2/3 (69.7%) of the respondents were males. Of those who participated in the study were 25.9% below the age of 30 years, 45.3% were between 30 – 40 years and rest above 40 years of age. Among the respondents there

were 10 different ethnic groups where Terai Middle Class comprised the highest (30.3%) and Muslims (6.5%) the lowest.

According to the education level 30.8% of respondents were illiterate and among the literates 28.9 % had education above the higher secondary level. Although most of the respondents had their own land (78.1%), not all of them were involved in farming. Still, farming (24.4%) was the major occupation followed by paid employees (22.9%), business (21.4%) and others like daily wages, quarrying or not active, etc. Despite that 22.9% of the respondents said that they were paid employees and 21.4% were in business, half of them said that their family member is involved in agriculture and livestock rearing as an alternative source of income. The highest percentage of respondents used guitha (56.2%) as energy for cooking and underground water (75.1%) as a source of drinking water. Among them 58.7% had been living there for generations while only 10% had recently immigrated.

2.2 Trends of resource extraction

The frequency of firewood extraction was highest (33.8%), followed by reeds (26.9%) and fishing (22.4%) whereas thatching grass (21.9%), fodder (17.4%) and timber (10.4%) were extracted less. Females (10.5%) went out for resources extraction more often than males (1.5%) ($\chi^2 = 19.15$, $df = 2$, $P < 0.001$). Most people almost never or rarely extracted resources. However, there was a statistically significant relation between the pattern on how people extracted resources and their level of income ($\chi^2 = 27.07$, $df = 4$, $P < 0.001$). People with not sufficient income more frequently extracted resources occasionally, while people with more than sufficient income mostly did not extract (Fig. 2-1). Similarly other factors like occupation in addition to farming ($\chi^2 = 18.19$, $df = 6$, $P = 0.006$), good education ($\chi^2 = 15.41$, $df = 6$, $P = 0.017$), yearly expenditure ($\chi^2 = 10.91$, $df = 4$, $P = 0.028$) have statistically significant relations in comparison to the own land ($\chi^2 = 0.82$, $df = 2$, $P = 0.664$).

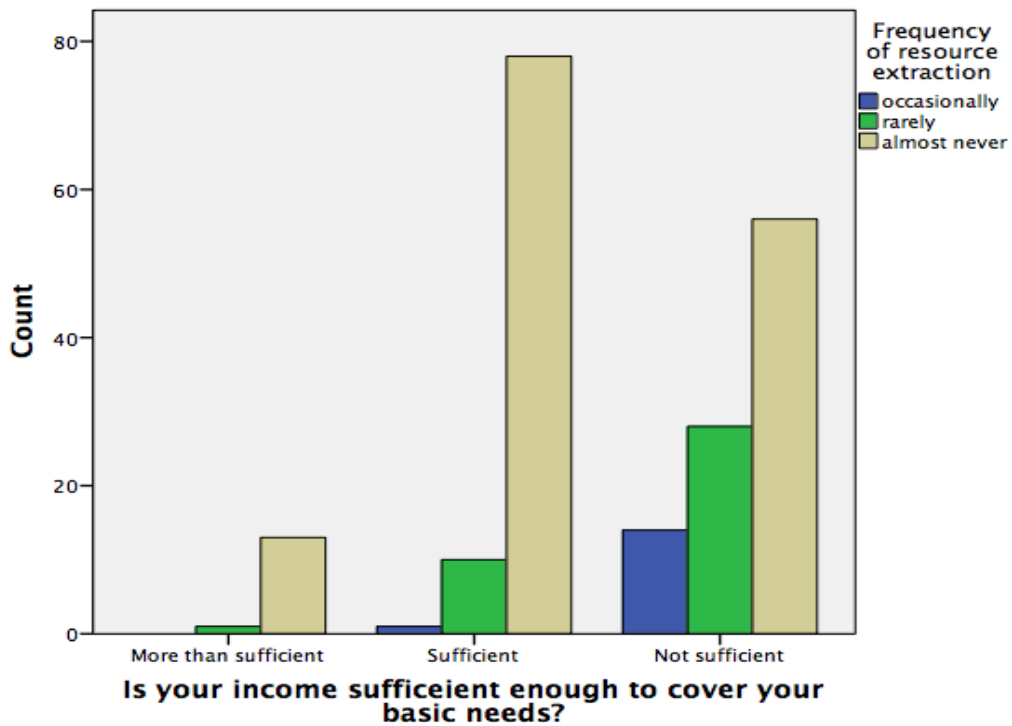


Figure 2-1: Relation between respondent's income and resources extraction

Similarly, the duration of the respondent residing in the wetland area differed significantly how they extracted resources ($\chi^2 = 22.27$, $df = 6$, $P = 0.001$) as shown in Fig. 2-2.

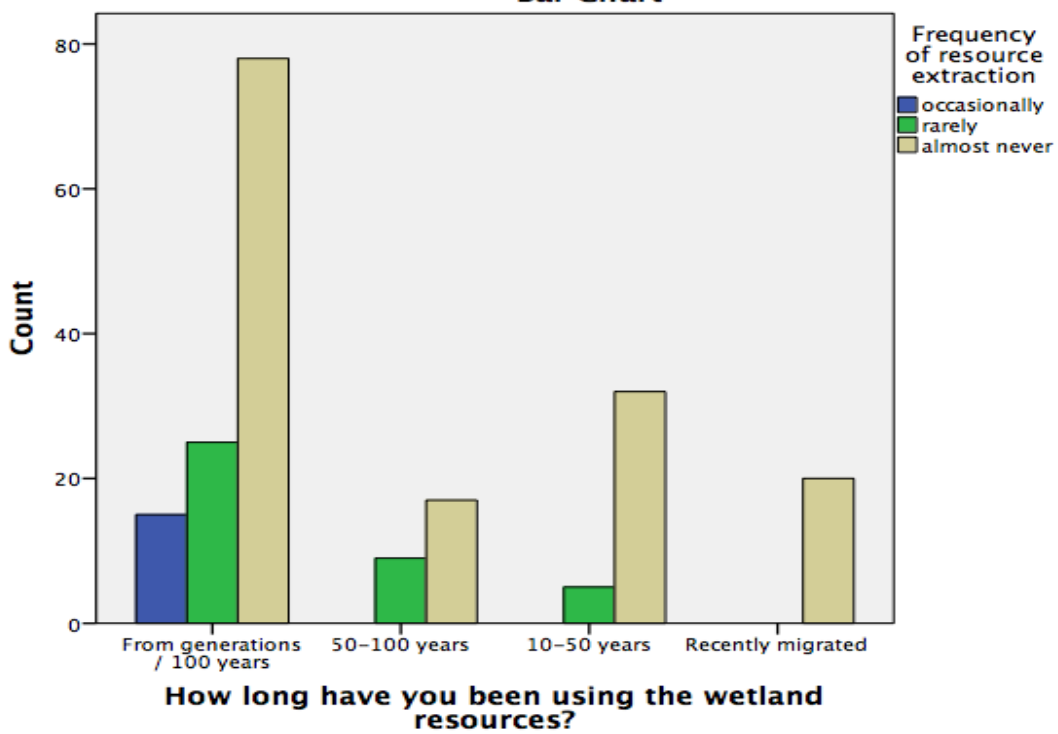


Figure 2-2: Relation between resources extraction and years of settlement in wetland area

2.3 People's attitude towards wetland

Fig. 2-3 shows that the local people's knowledge about the wetland was significantly related to their education level. The people with secondary or higher education were much more aware about the wetland and its functions than lower educated people ($\chi^2 = 35.42$, $df = 6$, $P < 0.001$). Similarly, other factors as gender ($\chi^2 = 7.58$, $df = 2$, $P = 0.023$), ethnicity ($\chi^2 = 31.86$, $df = 16$, $P = 0.010$) and occupation ($\chi^2 = 14.98$, $df = 6$, $P = 0.020$) were also significant but age ($\chi^2 = 5.69$, $df = 4$, $P = 0.224$) was not.

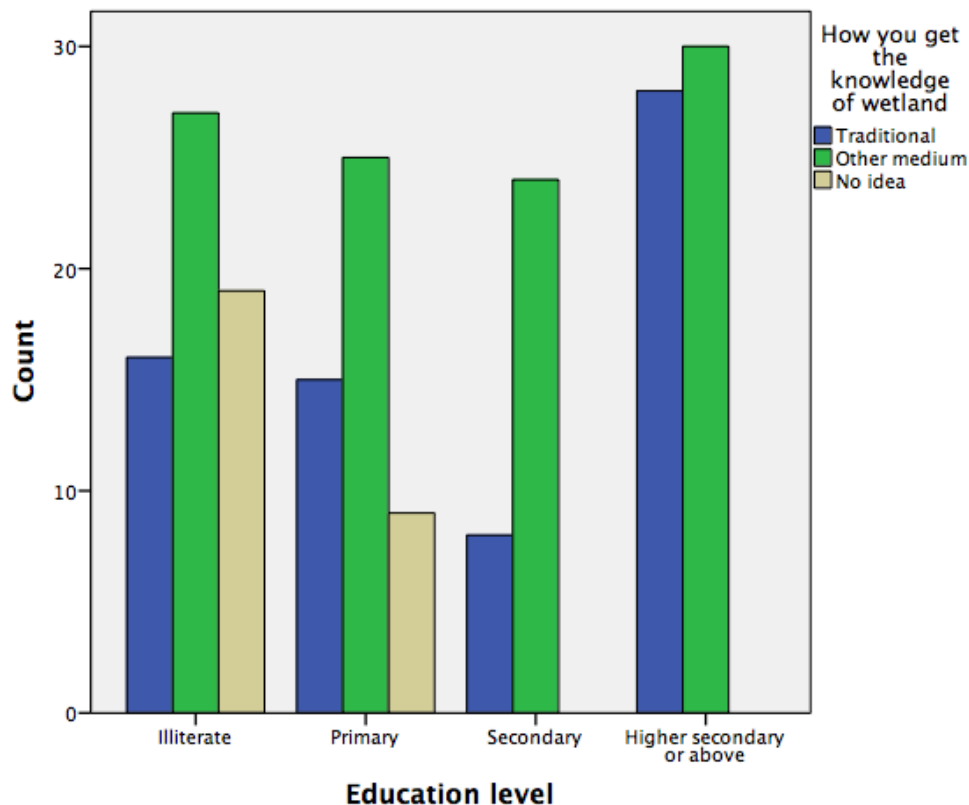


Figure 2-3 Relationship between respondent's knowledge about wetland and their education level

The way the two genders thought about the necessity of conservation of wetland was significantly different ($\chi^2 = 19.36$, $df = 1$, $P < 0.001$) as shown in Fig. 2-4. Similarly, people with higher education found it more necessary to conserve wetlands ($\chi^2 = 28.92$, $df = 3$, $P < 0.001$).

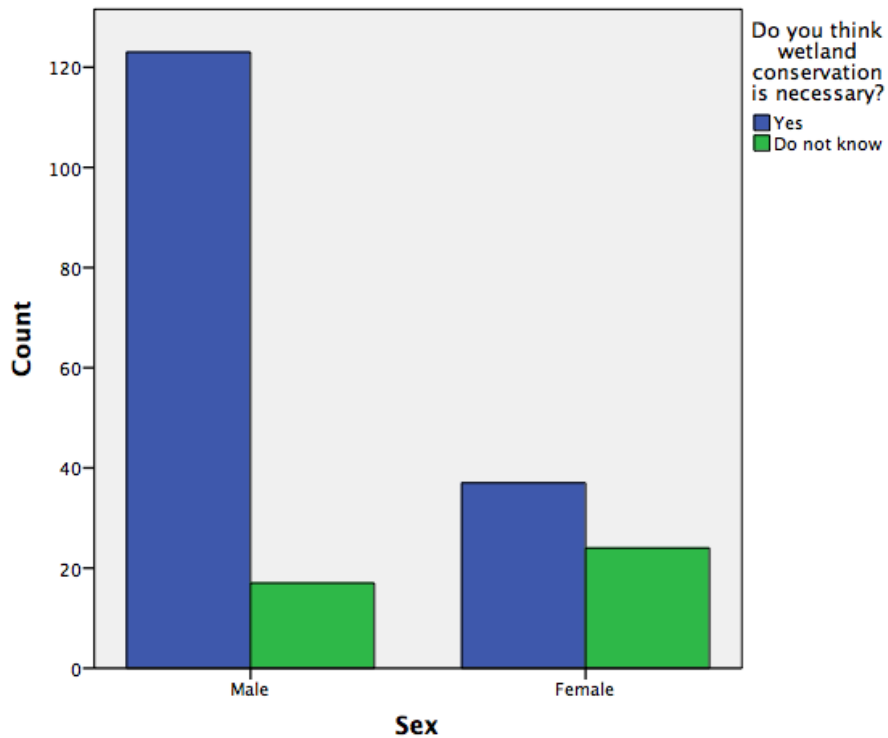


Figure 2-4: Gender attitude towards conservation

2.4 Willingness to pay for conservation

People's willingness to pay for the conservation of wetland was strictly significant with relation to the education, area of land they own and their yearly expenditures. People with higher education (Fig. 2-5) ($\chi^2 = 71.73$, $df = 3$, $P < 0.001$) and more land area (Fig. 2-6) ($\chi^2 = 27.79$, $df = 2$, $P < 0.001$) show that they were more willing to pay. Also respondent having household yearly expenditure of more than 250,000 NRS (\approx \$2539 @ current rate) indicated more willingness to pay ($\chi^2 = 49.25$, $df = 2$, $P < 0.001$) (Fig. 2-7), however occupation ($\chi^2 = 1.81$, $df = 3$, $P < 0.612$), was not significant. Similarly, gender was a significant factor ($\chi^2 = 12.25$, $df = 1$, $P < 0.001$) though only 45.7% of males and 19.7% of females ($n = 201$) indicated their willingness to pay.

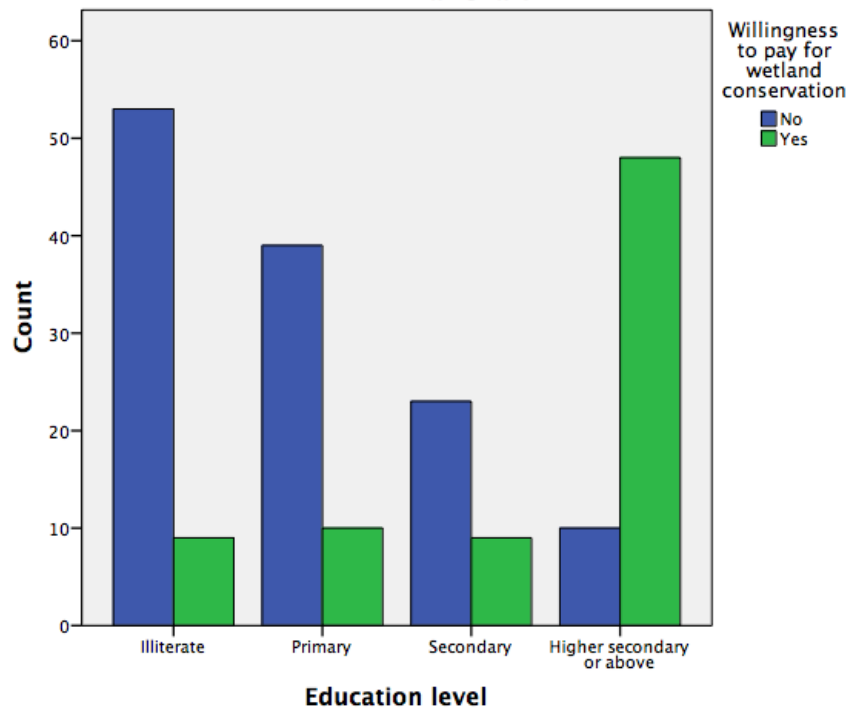


Figure 2-5: Education level and their willingness to pay for conservation

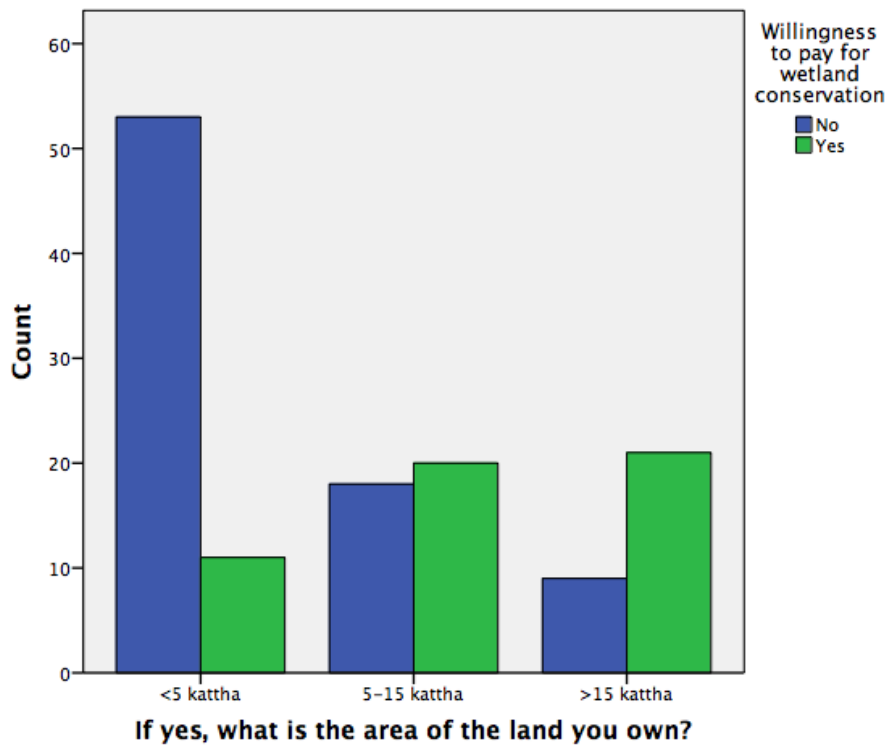


Figure 2-6: Land own and their willingness to pay for conservation

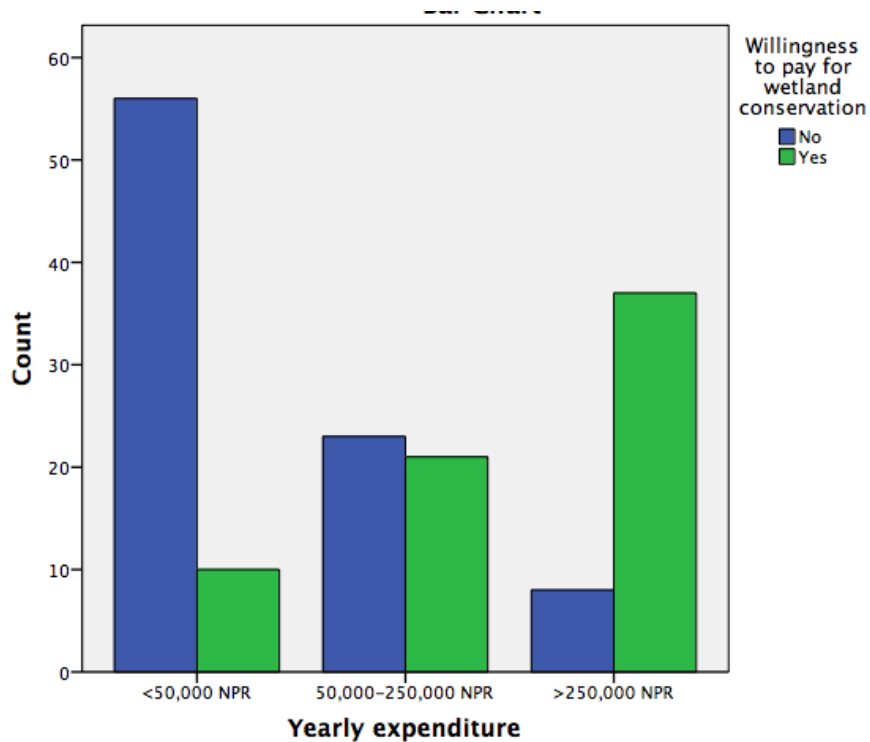


Figure 2-7: Yearly expenditure and their willingness to pay for conservation

2.5 Conservation programs and local involvement

The respondents had their own view about the participation of people in conservation activities. 55.2% thought that both males and females should participate whereas 3% thought only females should participate while the rest thought only males (41.8%) should participate in the conservation activities. However, among these only 34.8% were actively involved either in management or planning for wetland conservation. Also 43.7% of respondent thought that it is the government's duty to conserve and manage wetlands whereas 33.4% thought it's the local communities duty and the rest (22.8%) thought it should be done by NGO or INGOs.

The regular patrolling into the wetlands by army officials was one of the major programs currently running followed by spur monitoring and awareness campaigns for the conservation and management of wetland. 45% of the respondents thought that human wildlife conflict is the major issue on wetland conservation and management while 35.3% thought that adult /woman literacy was the major problem.

2.6 Analysis of Plant data

The data obtained from the field shows that there are more number of individuals of khair species inside the reserve area compared to outside (Fig. 2-8). There are no new recruitments in marshy lands but there were fewer numbers of adult individuals in agricultural land and at the periphery of the pond whereas in the forest area the number of trees and their recruitment of the plant is the highest (Fig. 2-9). Similarly, more individuals per quadrat as well as saplings per adult was found at a greater distance from the settlement area (Fig. 2-10) but the number of saplings per adult decreased a bit again at the very highest distance >3km.

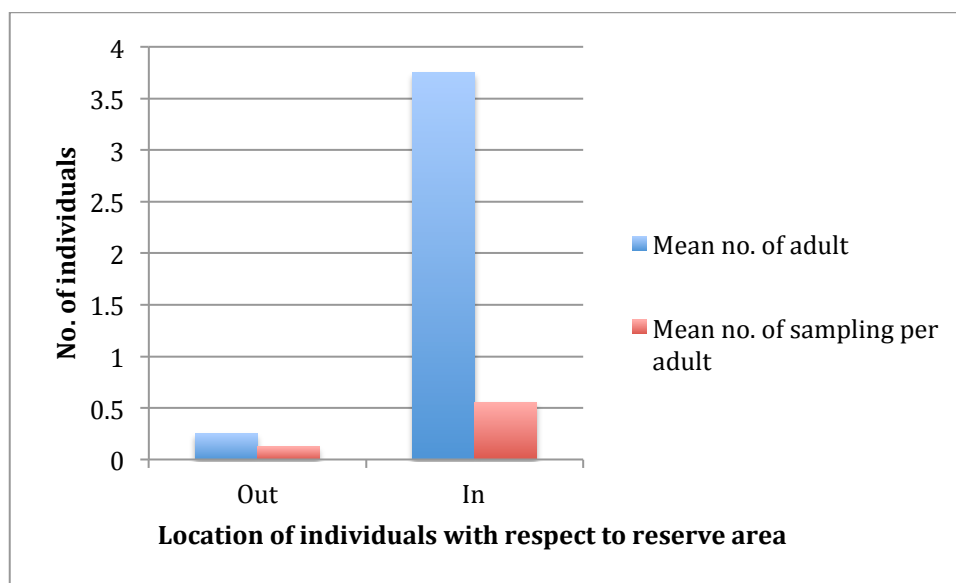


Figure 2-8: Number of individuals and number of saplings per adult per 25X25m² inside and outside the KTWR

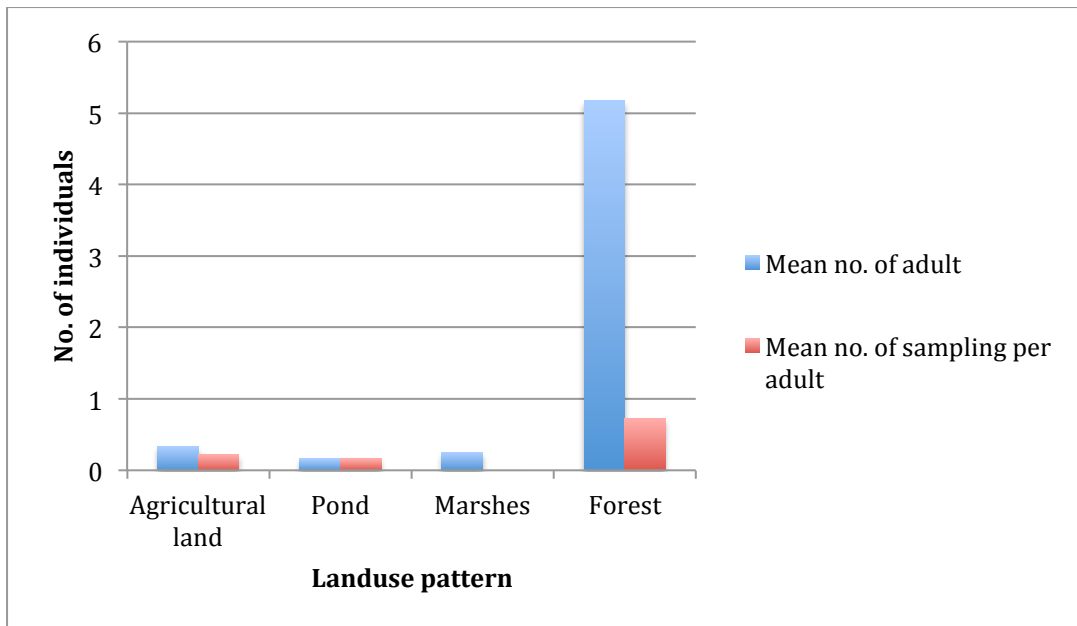


Figure 2-9: Number of individuals found in different land area

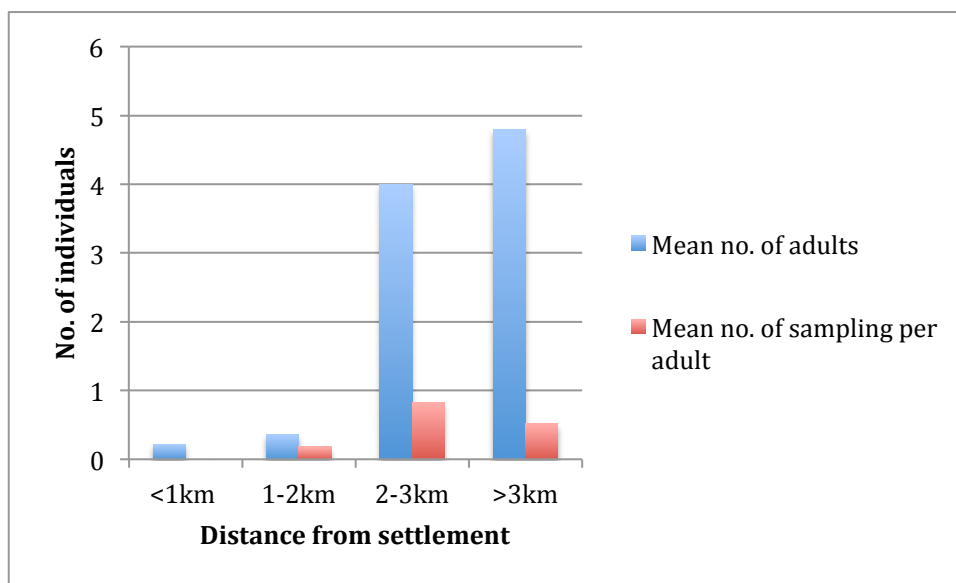


Figure 2-10: Adult Khair plants and saplings per adults found at different zones from the settlement

2.7 Additional comments by respondents

Almost 38% of respondents think that providing alternative livelihood training programs like fishing, tourism and training of mats and bags preparation from wetland grasses will encourage locals to participate more in wetland conservation activities. Also when people were asked about their interest in participating conservation activities, 82.9% said that they were interested in doing free labor, awareness

campaign, local discussion, plantation, sanitation and waste removal activities; whereas few (6.9%) were interested to be part of the wetland management committee and 10.1% in fund raising or donation for wetland conservation and management.

3. Discussion

The analyses explain that the demographic as well as socio-economic condition around KTWR is continuously changing. Around 10% of the respondents were the immigrants, who immigrated within the last 10 years whereas 59% of the families had been living there for more than 100 years. This indicates the immigration trend of the area and it clearly indicates that more than 42% of the population had immigrated from the hilly region over the last 100 years. The current population growth rate is around 1.25% per year (CBS, 2012).

Though agricultural is the major source of income in KTWR, people are also involved in business like teashop, grocery shop, tailoring, fishing, tourism, handicrafts (preparation of mats, bags from wetland grasses; Cattail *Typha latifolia*), firewood collection and quarrying sand. They were also involved in construction labors in cities and other daily wages activities. This indicates that most of the people residing in and around KTWR are highly dependent on wetland resources either for their basic needs or for their source of income. A similar study shows that 67% of the households around Ghodaghodi Lake are dependent on it either for food or as the source of income (Lamsal et al., 2015). Likewise 94% of the people around Nyumba Ya Mungu wetland in Tanzania (Halima and Munishi, 2009) and more than 80% of population living around wetlands in Uganda are dependent on the nearby wetland resources for their basic needs and livelihood options (Turyahabwe et al., 2013).

The extraction and utilization of resources affect the wetland status. Apart from direct exploitation like poaching and hunting of animals, medicinal plants, timbers; many tropical wetlands are degraded by informal economic activities to support human livelihoods like fishing, firewood collection and water supply (Barbier, 1993). The people residing nearby KTWR were also highly dependent on firewood for cooking. The lack of alternative energy might have influenced the high extraction of firewood from the reserve area. This was followed by the collection of reeds basically for

handicrafts preparation and fishing. Similarly the surrounding population comprises 31% of WDCs and among them 61% are ultra-poor or poor (CBS, 2012, DNPWC and BCN, 2012, MFSC, 2002) who are incompetent to afford concrete housing or metal roofs and this has increased the regular extraction of thatching grasses.

The surrounding area outside the reserve is agricultural land, so, people depend on wetland for fodder collection during the cultivated seasons. The reserve was guarded by the army officials and thus the over extraction of firewood, farming inside the reserve wetland area was not found. The timber extraction was done once a year or as allocated by the KTWR office, on a quota basis. Rice farming is the major source of income in tropical and sub tropical wetlands followed by hay collection for livestock in temperate wetlands. The collection of reed beds (*Phragmites australis*) for thatching and even as cattle fodder has been carried out also in Poland and other European countries. In Romania it was harvested for paper production (Hartig et al., 1997). By 1986 the United States alone has lost 54% of its wetlands, among which 87% was lost by agricultural development, 8% by urbanization and 5% by other types of conversion (Barbier, 1993).

“The experience has proved that the effective conservation of natural resources cannot depend merely on prohibition and that it is necessary to investigate the user’s knowledge and attitudes towards these vulnerable resources and then encourage their sustainable use” (Pyrovetsi and Daoutopoulos, 1999, Badola et al., 2012). The results show that the knowledge and the attitude towards wetlands depend upon the level of education, gender, ethnicity and the level of income. Similar conclusion was drawn by Pyrovetsi and Daoutopoulos (1997) in their study that negative attitudes of indigenous communities depend upon a variety of factors like their low education level, lack of awareness about environmental issues, lack of participation in conservation activities and also the government policy on agriculture (Pyrovetsi and Daoutopoulos, 1997). The environmental awareness, regular participation in environmental projects is highly significant in influencing WDCs likelihood towards wetland conservation and management and also helps them to understand government rules and regulations towards it (Mombo et al., 2013).

Apart from education and awareness, the level of dependency for resources, conflict with wild animals and park officials also determines the attitudes of people towards

conservation. The people who were more troubled by wildlife crop raiding, regular encounter with wild animals, property destruction by wild animals possess more negative attitudes towards conservation (Røskoft et al 2007). Also the households living closer to the reserve area, the household having larger families, higher dependency on resources and with poor socio-economic condition are less concerned about the conservation and shows negative attitudes towards it (Shrestha and Alavalapati, 2006).

The attitude of people determines their willingness to pay for conservation but also depends upon their education level, economic status and the governmental policies. My results show that 38% of people were willing to pay for conservation while at the other end among the unwilling people 44% were interested to contribute but were unable to do so, while 15% were completely uninterested because they said that their contribution would not be properly utilized. There is a high level of corruption and a complete lack of transparency and accountability. The remaining 66% said that neither do they know the importance of contributing nor do they have any decisive power to decide in their household. Also they were not satisfied with the government, as it does not provide any compensation for the crop loss or property damage. There was also a difference in attitudes and willingness for contribution between males and females. It was probably because females were more uneducated and does not have any decisive power in the family. Only the people with higher education level, good yearly income and a regular participant in conservation activities were willing to contribute for conservation. It was found that 28% were willing to pay NRS 100 (\approx \$ 1 @ current rate) and 10% NRS 500 (\approx \$ 5 @ current rate) respectively per year. This shows that the local people are positive towards conservation only if they are aware of conservation and found long-term benefits. This will also encourage them to participate more in conservation activities. The conservation organization should therefore provide more community programs and include locals in planning and decision making process (Lamsal et al., 2015).

A previous study has shown that 65% of respondents does not like KTWR or the conservation of this wetland. It was because the KTWR officials completely restrict locals in utilizing its resources (Heinen, 1993a). Then the management realized it and introduced an incentive program allowing locals to harvest grasses, fodder and even

firewood on a quota basis. Also the government of Nepal has already reformed the protected area rules and regulations and has promoted a community based conservation approach (Heinen and Mehta, 2000, Shrestha and Alavalapati, 2006). Similarly, a conservation project was launched in KTWR with joint undertaking of Government of Nepal, Global Environment Facility and United Nations Development Program (CSUWN, 2011, DNPWC and BCN, 2012). The result of this study shows that 80% of respondents were interested in conservation of this wetland and among them 34% said that it should be completely handed over to locals. Currently, there are different conservation activities, which are conducted regularly in the reserve area. The KTWR office has prepared its management plan and is functioning according to it (Buckton et al., 2009). The Nepal army is guarding the reserve and they conduct regular patrolling every day and night. An Awareness program is also being conducted regularly. Almost 83% of the people were interested to provide free labor, active participation in awareness and local discussion, plantation, sanitation and waste removal activities. They were also interested to be in the management committee of the conservation program and 10% were ready to provide donations or involve themselves in fund raising activities.

However there are still a few major conservation issues and people thinks that the government should address it effectively. The joint presence of human and wildlife in the densely populated area is the reason for the increasing number of human wildlife conflicts (Müller-Böker and Kollmair, 2000). Almost half of the respondents (45%) think that human wildlife conflict has not been addressed properly. The crop raiding by wild buffalos and wild boars is continuously going on. The trampling of crops by wild elephants is another problem. A study done by Timsina and Ranjitkar also shows that 80% of people agreed that crop raiding is the major cause for park people conflict (Timsina and Ranjitkar, 2104). A similar study shows that 85% of crop raiding is done by wild buffalos and 15% by wild boars (Limbu and Karki, 2003). Beside crop damage, regular encounters with wild buffalos and wild elephants, property destruction by wild elephants is another problem. 58% of the respondents think that injury by wild animals is the cause for human wildlife conflict. Though the reserve had provided a solar fence to locals to protect them from wild elephants, they said that it is not enough because it is hard to see the elephant hiding behind your house or nearby bushes or in the dark. Even our study team got an encounter with the wild

elephant during our study. Nothing serious had happened but the elephant was moving around in the study area. In another study almost 99% of the respondents claimed that wild elephants were the major animal to cause human injuries or deaths followed by wild buffalos (95%) and wild boar (75%) respectively (Timsina and Ranjitkar, 2104). The respondents said that the government does not have any rules and regulations to provide compensation for crop loss or even for human injury or death by wild animals.

The lopping of trees was another problem in KTWR. This has created a conflict between park officials and the locals. The locals want to use their rights to harvest the trees and its branches from the nearby reserve area and the reserve officials do not allow this. They said they have set a quota system for the locals but locals argue that it is not enough and it cannot meet their daily needs. However they did not answer about the amount they harvest or not behind the quota limit as it is termed illegal by KTWR rules and guidelines. But a result obtained by an informal discussion shows that 48% respondent agreed that the illegal tree cutting is one of the problem for park people conflict (Timsina and Ranjitkar, 2104). Usually the reserve is dominated by *Saccharum spontaneum* and *Phragmites karka* but there are also other species like kapok, sugarcane, cattail, *Sorea robusta*, *Senegalia catechu*, *Dalbergia sissoo* (BCN, 2008, Forestry Nepal, 2010, Karki, 2008, Rosenbach, 2013, Peet et al., 1999). The specific plant Khair (*Senegalia catechu*) data was collected in the field. From this study it was found that the population of Khair species inside the reserve area is good and conserved more in comparison to the population outside the reserve area. The numbers of adult Khair species as well as new samplings were found more inside the reserve area. Similarly more numbers of adults were found as we move farther from the settlement area. This may be because the individuals nearer to the settlement area are being harvested more in comparison to the farther ones. Usually, there is agricultural land and ponds within 2km of settlements area and after 2km more number of individuals and samplings per adult individuals were found. So, they harvest more trees outside the reserve area, as they do not want any trees in their agricultural land. Similarly from the general observation it was clearly seen that other plant species were also conserved more inside the reserve area in comparison to the individuals outside the reserve and this is because the reserve office restricts cutting erect trees inside the reserve area. They also said that because of this restriction they

do not choose specific tree species for harvesting and harvest whatever species they found broken or fallen and utilize it as a fodder if liked by animals or as firewood. This shows that the data collected for the specific tree species could give the best result for the distribution of khair but can be simply generalize for the tree species found in that area.

Apart from illegal harvesting and human wildlife conflict 35% of the respondents said that education is the major problem for conservation. People are uneducated and they do not understand the importance of conservation. Most of the respondents argued that there should be an adult literacy class and women should be given high priority. The conservation organization should give focus on educating people and providing knowledge on environment, wetland and conservation importance. They also think that there is a need of alternative livelihood programs to reduce their dependency on wetland and also to encourage and increase their active participation in conservation and management activities. The organization should also start confidence-building programs among locals to win their trust, support, participation and involvement for wetland conservation (Shrestha, 2013). They should focus on providing training on ecotourism, homestay, and handicrafts preparation; and may be providing employment in the wetland area as village scouts or guards. Though there were numerous conflicts, people were positive towards the conservation in the present study.

Also the study tries to understand the current status of wetland. An observation was done along with the observation checklist to find out the observed impacts and the projected impacts. The change in river course was observed every four or five years, which arise a flooding threat in the nearby area. This was found usually because of the huge siltation in Koshi River. It has a characteristics of very high discharge and high sediment flux from the upper siwalik range (Wells and Dorr, 1987, Sinha et al., 2008). The siltation has also a negative impact on fishery resources and this decrease in fish reduces the number of wetland migratory birds. During the discussion the respondents said that the vegetation was also destroyed in the latest flooding and now it is recovering back. Also the banning by reserve, in cutting erect trees and its branches has helped the trees inside the reserve area to grow rapidly.

The overall study suggests that the conservation program is going well. The wetland though is regularly affected by shifting of river course and over grazing, the attitude of people was found to be changing and they were positive towards conservation. The community-based conservation was successful in mountain and hilly regions but the situation was quite different in terai region (Sah and Heinen, 2001). But this change in attitudes will bring a new hope for conservation. Thus a management committee should involve user groups and other representatives from governmental and other non-governmental organization. There are many other success stories in Nepal (Heinen and Mehta, 2000, Heinen and Yonzon, 1994) upon which a new model or scheme can be launched and implemented effectively for wetland conservation.

4. Conclusion and Recommendation

4.1 Conclusion

The dependency of people on the wetland depends upon the type of resources extracted from it and also the socio-economic condition of the people settling around it. The result from our study shows that the people around KTWR are highly dependent of firewood, fodder, reeds and fishing. The population around the park is found to be increasing and this increase in population will certainly increase the level of extraction of the resources in future. Also most of the people do not have permanent occupation to support their basic needs which force themselves to rely more and more on wetland resources.

The people with education, income more than enough to sustain their basic needs, those who already participate in conservation activities, were more willing to contribute for conservation. They were also ready to participate in free labor, fund raising or awareness raising activities. The result shows that the conservation program and the conservation status of this wetland are in good condition. Even the wetland is regaining back its vegetation and its ecosystem integrity that was lost by the recent flooding. The number of tree species and number of individual of each species are found more when we move inside the reserve area. Though there is a conflict between park authority and the locals for their resources utilization rights, the regular patrolling by Nepal army and the ban in cutting erect trees is found to be a positive

aspect to reduce poaching, over grazing and over exploitation. The good aspect found in this area was the positive attitude of people towards conservation but still there is a need of education and an awareness program; so, that more people will be positive and also take an active participation in conservation activities. The education will also help for women upliftment and encourage them to participate in discussion and decision making processes. Also there is a need of an alternative livelihood programs to support their income level and to discourage them in exploiting more resources.

The conflict with wild animals is increasing. There is more crop loss each year. Also the old people, women and children are quite vulnerable for conflicts. They are easily injured or are even fatal to attacks by wild animals. These conflicts will then help in shaping the attitude of people towards conservation. So, the government should focus on reducing conflicts between locals and wildlife as well as between locals and park authorities. Also the conservation program launched should try to involve more and more local people for program implementation and decision-making. Also the indigenous people are socially and culturally attached with the wetland and they have their own traditional way of wetland conservation and management. Thus, the community based wetland management approach which includes the best of indigenous and scientific knowledge should be promoted and launched to attain sustainable management practices and even to achieve the sustainability of the wetland.

4.2 Recommendations

The following recommendations are suggested from this study for an effective management and conservation of this wetland.

- Education and awareness programs should be conducted regularly. The need of women education and their interest in participating in education was highly indicated by the local women during the fieldwork.
- Programs about renewable energy should be launched. E.g. subsidized scheme for the installation of solar energy, training for preparation and utilization of improved cooking stoves, bio-briquette.
- Training about alternative livelihood programs should be effectively implemented. Eco-tourism and homestay can be a good way to provide local

employment. Similarly marketing of the homemade handicrafts is also essential for the locals.

- Conservation without local involvement will not be sustainable, so it is necessary to encourage locals to participate and to focus on bottom up approach for decision-making processes.
- The locals injured from wild animals attack should be provided with immediate and free medical treatment and also the government should provide compensation scheme for crop loss and human deaths.
- There is a need of continuous research under different themes of wetland conservation in this area and the KTWR and government should link these researches finding during the designing and implementing wetland conservation and management action plans.

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Annexes

Annex – 1

Questionnaire for the thesis entitled “**Conservation Issues and Utilization of Wetlands in Nepal: A case study from Koshi Tappu Wildlife Reserve**”; conducted for the partial fulfillment of the degree of Masters of Science in Natural Resources Management from Norwegian University of Science and Technology (NTNU), Norway.

General Information:

Date of Interview (DD/MM/YYYY): / /.....

Name of Respondent:

Age: Sex: Male Female Third Gender

Address:

District		Municipality / VDC	
Ethnicity of the Respondent:			
Education:			
Illiterate	Literate		
	<input type="checkbox"/> Primary	<input type="checkbox"/> Secondary	<input type="checkbox"/> Higher Secondary or Above
Family Structure:	<input type="checkbox"/> Nuclear	<input type="checkbox"/> Joint	Family Size:
Head of the Family:	<input type="checkbox"/> Male	<input type="checkbox"/> Female	
Distance of Respondent’s house from paved road: minutes walking time			

Socio-Economic Profile:

1. What type of house are you living in?
 - a. Permanent
 - b. Semi-permanent
 - c. Temporary
 - d. Others (specify).....
2. What is the status of sanitation?
 - a. Open
 - b. Simple
 - c. Pan without septic tank
 - d. Closed septic tank

3. What is the source of drinking water?
 a. Lake b. Stream/Spring c. Public tap d. Underground water e. Others
 (specify)

4. Do you own a land?
 a. Yes b. No

If yes could you please provide me the information on your land?

Type of Land	Area in Katha
Khet	
Bari	
Barren	
Forest	
Others (specify)	

5. What is your household member's economic activity? Tick the appropriate answer.

Activity	Tick	Activity	Tick
Crop Farming		Livestock	
Cash crop		Dairy Cattle	
Food crop		Sheep/Goats	
Paid Employee		Poultry	
Government		Business/Shop	
NGO		Handicraft	
INGO		Tailoring	
Foreign Employment		Fishing	
Other (specify)		Tourism	
Plant Products Harvested		Other (Specify)	
Reeds		Mining/Quarrying	
Grasses		Not Active	
Medicinal plant		Too old	
Wild food plant		Disabled	
Firewood		Sick	

Timber logging		Others (specify)	
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6. What are the expenditures in your family?

Activity	Expenses per month (NPR)
Food	
Agriculture	
Health	
Education	
Business	
Others (Specify)	

7. Is your income sufficient enough to cover your basic needs?

- a. More than sufficient b. Sufficient c. Not sufficient

8. What are the sources of energy being used in daily activities?

- a. Firewood b. Kerosene c. Electricity d. Biogas e. Others (specify)

Dependency on Wetland:

1. What kind of resources that you depend on for your daily activities are obtained from the wetland? Rank in the order of 1 to 5, 1 being the least and 5 the highest percent of dependency.

Resources	Rank	Resources	Rank
Firewood		Wood for timber	
Grasses for livestock		Medicinal plants	
Reeds		Thatching grass	
Fishing		Raw materials for handicrafts	
Others (Specify)			

2. How often you extract these natural resources from the wetland?

Resources	Frequency of trip for collection (per month)	Time to reach that area (minutes)	Time needed for collection (minutes)	Total collection and their market value (NPR)		Sold to others		Purchases others from	
				Quantity	Value	Quantity	Value	Quantity	Value
Firewood									
Grasses for livestock									
Wood for timber									
Medicinal plants									
Reeds									
Thatching grasses									
Fishing									
Raw materials for handicrafts									
Others (Specify)									

3. Are there any resources that were used previously but no longer in access these days from wetland? List in the order of importance.

1		4	
2		5	
3		6	

4. How long have you been using the wetland resources?
 a. From generations/100 years b. 50 years c. 10 years d.
5. What is the harvesting pattern of the resources?
 a. Quota harvesting b. Threshold harvesting c. Proportional harvesting
 d. Proportional threshold harvesting e. others (Specify).....

Knowledge and Perception towards Wetland:

1. Have you heard about Wetland?
 a. Yes b. No
2. How do you know about wetland?
 a. Radio b. Newspaper c. TV d. Posters e. Schools f. Publicity
 campaigns g. Others (Specify)
3. What do you understand by wetland?
 a. Lakes b. Marshes c. Rivers d. Paddy fields e. Reservoirs f.
 All of the above
4. What do you think are the functions of wetlands?
 a. Water conservation and Regulation b. Pollution removal c. Biodiversity
 conservation and wildlife protection d. Climate regulation e. Flood control
 f. Provisioning of aquatic products
5. What do you think are the causes for the damage/destruction of wetland?
 a. Urban expansion b. Over-exploitation of resources c. Over-fishing d.
 Construction of infrastructure e. Excessive application of pesticides
 and chemical fertilizer f. Discharge of wastewater g. Over-hunting
 h. Aquaculture
6. As a regular beneficiary of goods and services supplied by the wetland do you think the wetlands are worth conserving?
 a. Yes b. No

7. What do you think is the most effective way to raise awareness for wetland conservation?

- a. Radio b. Newspaper c. TV d. Posters e. Schools f. Publicity campaigns g. Others (Specify)

8. In order to support the conservation activities of the wetland are you ready to contribute from your side?

- a. Yes b. No

If yes, how would you like to contribute from your side?

- a. Fund-raising b. Free labor c. Donation d. Others (Specify)

9. Have you ever been involved in any activities concerning wetland areas?

- a. Management b. Conservation c. Not involved d. Other (Specify)

10. Have you ever been involved in planning a wetland inventory?

National level		Regional level		Local level	
<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No

11. You receive a lot of direct benefits from wetlands that do not have market price, in this case would you be willing to pay some amount of money for the conservation and management of wetland?

- a. Yes b. No

If Yes, how much would you be willing to pay per month for the conservation of wetland?

- a. Rs 1000 b. Rs 500 c. Rs 100 d. Rs

If Yes, how much would you be willing to pay per year for the conservation of wetland?

- a. Rs 10,000 b. Rs 5,000 c. Rs 1000 d. Rs 500 e. Rs

If No, which of these best describes why you are unwilling to pay for the conservation of wetland?

- a. Willing to pay but I am unable b. I am able but unwilling to pay c. Not able and unwilling to pay d. Others (Specify)

Conservation and Management of Wetland:

1. Are you actively involved in the conservation and management of wetland?
 - a. Yes b. No

If yes, which are the major activities that you were involved in?

- a.
- b.
- c.

2. Who do you think is major responsible for the conservation and management of wetland?

- a. Government b. INGO/NGO c. Locals d. Others (specify)

3. What are the major programs undergoing for the conservation and management?

- a.
- b.
- c.

4. Who do you think are more actively involved in conservation activities? Why?

- a. Male b. Female

.....

5. Is there any program to encourage locals to participate in conservation activities?

- a.
- b.
- c.

6. Is there any program to empower women from WDC?

- a.
- b.
- c.

7. Is there any alternative livelihood opportunities/program?
- a.
 - b.
 - c.
8. Do you think the wetland conservation and management activities in KTWR are sustainable? If No, what are the weakness and what do you propose for improvements?.....
-
-
-
9. Any other comments/suggestion:

Thank you!!!!

Annex -2

Data collection sheet for Khair species in the field:

Transect No.:		Quadrat No.:					
Landuse type: Forest <input type="checkbox"/>		Grassland <input type="checkbox"/>		Marshes <input type="checkbox"/>		Barren <input type="checkbox"/>	
Soil type: Loam <input type="checkbox"/>		Clay <input type="checkbox"/>		Sandy <input type="checkbox"/>		Gravel <input type="checkbox"/>	
Status of soil: Dry <input type="checkbox"/>		Moist <input type="checkbox"/>		Wet <input type="checkbox"/>		Very wet <input type="checkbox"/>	
Distance from settlement: Very far <input type="checkbox"/>		Far <input type="checkbox"/>		Near <input type="checkbox"/>		Very near <input type="checkbox"/>	
No. of <i>Senegalia catechu</i> above 1m height:							
No. of seedling of <i>Senegalia catechu</i> :							
Other tree species:							
Local name:		Scientific name:			No. of individual:		
Harvesting of trees:							
Branches removed		Whole tree cut down		Burned partially or whole		Uprooted	
Name of sps	No	Name of sps	No.	Name of sps	No.	Name of sps	No.

