

# 1 **Species wise carbon stock variation and tree diversity in community forest (a study from community forest of dang district)**

**Researcher:** Anju Subedi

**Supervisor:** Ram Asheshwar Mandal, PhD

Carbon stock and biodiversity have intricate relationship but studies related to these issues are limited. Thus this research was objectively carried out to estimate plant species wise carbon stock soil organic carbon and assess the biodiversity in the community forests. Sungure, Goraksha and Baghkhori Community Forests of Dang district were selected for the study. The map of the study area was prepared and sample plots were overlaid on it. Total 45 nested sample plots were established randomly in community forests. The plots were 20m\*25m for tree, 10m\*10m for pole and 5m\*5m for sapling and 2m\*5m for seedling. Additionally, 45 soil samples were collected from 0-10, 10-20 and 20-30 cm depth. The plants were counted in the plot. The diameter and height of the tree were measured in the forest. Species wise biomass was calculated using equation Chave et al., and the value was converted into carbon. Soil carbon was analyzed using Wakley and Black method. The biodiversity was estimated using Shannon Weiner and Simpson's Diversity Index. The values were statistically compared using One-way ANOVA and Tukey b test. The dominant carbon stock was around 20.61 ton/ha in *Shorea robusta* in Sungure community forest which was followed by *Terminalia tomentosa* with 6.93 ton/ ha and lowest carbon was found in *Acacia catechu* 0.03 ton/ha. Similarly, around 28.15 ton/ha and 33.23 ton/ha carbon stocks were found in *Shorea robusta* and *Terminalia tomentosa* respectively in Goraksha community forest. The lowest carbon was found in *Dalbergia sissoo* with 0.07 ton/ha and in *Rhus wallichii* 0.52 ton/ha in Goraksha and Baghkhori CF respectively. The soil carbon stock of Baghkhori CF was found to be highest in three layers (0-10 cm, 10-20 cm, 20-30 cm) with 26.65, 21.55, 16.57 ton/ha respectively. The soil carbon was 26.30, 17.38 and 14.57ton/ha in 0-10, 10-20 and 20-30 cm respectively in Gorakshya CF while these values were 18.97, 14.20, 11.85 ton/ha respectively in Sungure CF. One-way ANOVA showed that the soil carbon does not differ significantly at 5% level of significance among community forests and same result was using Tukey's b test. The Simpson' diversity index was same in Gorakshya and Baghkhori community but higher in Sungure CF (0.32). The Shannon-Weiner Biodiversity was the highest 1.31 in Sungure community forest and followed by 1.30 in Baghkhori and 1.13 in Goraksha. The result will be useful contribution in REDD+ and biodiversity issues.

**Key words:** Carbon stock, biodiversity, soil carbon, community forest

## 2 Climate change impact and its adaptation measure (a case study from Kankai and Sukedangi community forest of Jhapa district)

**Researcher:** Ambika Uprety

**Supervisor:** Sanjeev Bhattarai

Climate change refers to change in climatic condition over a time period either due to natural variability or due to anthropogenic factors. Global surface temperature has been increased by 0.06 °C/ year and projected to increase 1.2 °C by 2030 which has direct or indirect impacts on people's livelihood. It is important to understand exploration of variation in temperature and rainfall, its impacts on livelihoods of the indigenous community and other community and adaptive measures.

Thus, this research entitled "Climate Change Impact and Its Adaptation Measure (A Case Study from Kankai and Sukedangi Community Forest of Jhapa District)" was objectively carried out to find out the impact of climate change on livelihood of selected community forest user group members and its adaptation measures. Primary data were collected from household survey (n=340 in Kankai and 240 in Sukedangi CF which is calculated by using Cochran's formula), focus group discussion (n=4), key informant interview (n=9), direct observation and the secondary information was collected from the department of Hydrology and Meteorology, CFUG constitution, operation plan, review of the records and reports of the concerned stakeholders and literatures related to climate change were employed to obtain data. Data were analysed using Ms-excel and interpreted in the main text with tables, graphs and figures.

Most of the respondents were unaware about the words "climate Change" in the study sites, they were quite familiar with the irregularities in rainfall pattern, increase in temperature and other weather extremities. The study areas were suffered from invasive species and weeds in the forest and community land due to which forage production reduced. Problem in the irrigation as mentioned by most of the respondents, climatic hazard called drought, low soil fertility, outspread of insect and diseases. Out of total respondents included in the household questionnaire survey, in Kankai CF 30% people have changed their cropping pattern, 30% people have used more manure, fertilizers and pesticides, 20% people had planted trees and grasses and used improved farming system by growing cash crops like vegetables, 10% respondents are raising poultry birds to generate more income and another 10% people had improved irrigation systems. Likewise, in Sukedangi CF 25% people have changed their cropping pattern, 40% people have used more manure, fertilizers and pesticides, 30% people have planted trees and grasses and used improved farming system by growing cash crops like vegetables, 5% people had improved irrigation system. Finally, raising awareness and sharing information on climate change, its impacts and adaptation measures among CFUG members should be conducted to reduce the effects of climate change in study areas.

**Key words:** Climate Change, Impact, Adaptation, Livelihood, CFUG, Climatic Variable

### 3 **Impact of *Mikania* invasion on diversity of native plants and rhino habitat in the buffer zone of Chitwan National Park.**

**Researcher:** Nisham Thapa

**Supervisor:** Ambika Prasad Gautam, PhD

*Mikania micrantha* is a multi-branched, invasive, perennial vine which is native to Central and South America. It has exceptionally fast growth rate spreading like a wildfire in the tropical areas of Nepal that has invaded of about 20 percent area of Chitwan National Park. Despite being a major problem, there exists little information about the ecology and impact of *Mikania* on floral diversity and Rhino habitat in Chitwan National Park. Based on this research gap the main objective of the study is to assess the impact of *Mikania* invasion on diversity of native plant species and Rhino food habitat in Kuchkuche Buffer zone Community Forest of Chitwan National Park. For collecting data, the Buffer zone Community Forest was divided into two strata ie; Forestland and Grassland. Within each stratum, botanical data on floristic composition was collected having 50 plots with 35 plots on forestland and 15 plots on grassland with one percent sampling intensity and 314 meter square of plot size by using the method developed and used by the International Forestry Resources and Institutions . Data was analysed using different diversity indices such as Simpson's Diversity Index, Shannon-Weinner Diversity Index, Pielou Evenness Index and Importance Value Index. On the basis of availability and quality of five major plant species that Rhino favours in its grassland and forested land, its food habitat was analysed under different *Mikania* cover. Out of 50 plots sampled in the study area, 74 percent of plots were found to have *Mikania* invasion. The species diversity was found to be less in *Mikania* non invaded site as compared to invaded sites due to initial stage of *M. micrantha* invasion. *Trewia nudiflora* was found to be dominant over all *Mikania* cover categories whereas *Albizia lucida* had a gradual decrease in IVI with gradual increase in *Mikania* cover. While testing the tree growth, negative impact of *Mikania* cover was seen on IVI of major tree species, and negative correlation was seen between *Mikania* cover and growth performances (DBH and height) of tree species. Summing up, it is concluded that *Mikania* was not found to have negative impact only. It can act positively on the diversity of species as well. Since *Mikania* has impacted the IVI of particular species, the management authorities should be concerned while carrying out plantation of such species and follow interventions to minimize the spread of *Mikania*.

**Key words:** *Mikania*, Kuchkuche BZCF, Forest, Grassland, IVI

#### **4 Assessment of payment for ecosystem services in Shivapuri Nagarjun National Park, Kathmandu.**

**Researcher:** Pukar Tha Shrestha

**Supervisor:** Sanjeeb Bhattarai

Ecosystem Services are the benefits that humans rely upon from functioning ecosystems – such as clean air to breathe, pest and disease control, carbon sequestration and storage, etc. This research focuses on the mechanism to improve the provision of indirect Ecosystem Services (ESs) in which ESs providers receive direct payments from the users of the services. Shivapuri Nagarjun National Park being the mid-mountain represents the enhanced biodiversity and the potential for the ESs.

The research assessed the visitor's WTP for ESs, trend of income and expenditure of last 5 years. The study was conducted in Panimuhan area, Nagarjun area and Sundarijal area of SNNP. For primary data 100 visitors were interviewed using questionnaire in the sampled area. In addition, the secondary data were collected from different annual reports of SNNP of last 5 years, management plan of SNNP and reports of DNPWC. Collected data were analyzed statistically. It was found that both Nepali and foreign visitors have high WTP for ESs including different wildlife, birds, reptiles and scenic beauty. The average willingness to pay by the Nepali tourists (in Nrs) for wildlife, birds, reptiles, resources and environmental services was 329.19, 352.87, 277.43, 545.62 and 1010.81 respectively while, the average willingness to pay by the foreign tourists (in Nrs) for wildlife, birds, reptiles, resources and environmental services was 598.21, 625, 488.93, 2148.21 and 2521.43 respectively. The trend of income seems to be increasing from NRs 36.4 million in 2070/71 B.S. to 53.8 million in 2074/2075 and the trend of expenditure also seems to be increasing from NRs 13.1 million in 2070/71 B.S. to 52.4 million in 2074/2075. There is high potentiality of PES schemes as determined by calculation of Present Net worth (PNW) or Net Present Value, B/C ratio and Profitability Index (PI) which was found to be 49.92, 1.32 and 34.93 respectively.. Similarly, maps demonstrate the physical condition of site and things to be considered during the PES schemes implementation.

**Key word: Key words:** Ecosystem Services, Economic valuation, Willingness to pay, Income, Ecotourism, Economic potentiality

5      **An assessment of income generation through non-timber forest and their impact on livelihoods (A case study of Sapulli Patal, Fuki Salla and Kalki Community Forest from Jumla district)**

**Researcher :** Bhawana Shai

**Supervisor :** Murari Raj Joshi

A case study entitled “An Assessment of Income Generation through NTFP and their Impact on Livelihood” was conducted in Sapulli Patal, Kalki and Fukisalla CFUGs of Jumla district aiming to assess the non-timber forest products and their use for income generation to improve livelihoods of user group members. Both primary and secondary information were collected using preliminary field visit, households survey, focus group discussion, key informant survey, ranking and direct observation, and review of publication related to NTFPs for secondary information. The data collected were processed, tabulated and analyzed using MS excel, and then presented in the forms of tables, figure and descriptive main texts.

In total 142 households from three CFUGs were involved in study, in which participation of women (61%) was higher compared with men. Majority (> 50%) of the total respondents of all CFUGs were illiterate. The main purpose of collecting NTFP species from forests was to use as food and medicine and selling to generate income. Majority of the total respondents (64.6%) of study CFUGs reported that the main purpose of collecting NTFPs was selling to generate income for livelihood improvement. In study CFUGs, 25 NTFP species were found. Out of this, 5 species were traded worth Rs 150,000 per household per year. In these 25 NTFP species, nine species such as Setak chini (*Moringa oleifera*) and Yarsagumba (*Ophiocordyceps sinensis*, Jatamasi (*Nardostachys grandiflora*), Kutki (*Picrorhiza scrophulariiflora*), Ban lasun (*Allium wallichii*), Gucchi chyau (*Morchelia conica*), Padamchaal (*Rheum austral*), Pakhanbhed (*Bergenia ciliate*), and Panchaunle (*Dactylorhiza hatagirea*) were identified as potential non-timber species for conservation, development and management to generate income in future. The market price and number of collector were increasing every year in study areas. As a result large amounts of NTFPs were harvested each year and their status was declining. The involvement of women in NTFP collection was very less compared with men, and collectors were mainly from medium to poor household including Dalit households. The main issues of NTFP collection and marketing were conflicts in collection sites which was followed by over harvesting and problem in marketing and market price.

Finally, it is recommended that training, awareness and motivation program should be launched to promote and sustain NTFPs conservation, development and management for income generation to improve livelihood of study CFUG members.

**Key Words:** Community forests, Community Forest User Groups, Non-timber forest products, Collection, Income, livelihood etc.

6 **An assessment of impact of highway on wildlife and understanding the contribution of community forest to conserve wild animals (a case study in Kawasoti, Nawalpur)**

**Researcher :** Kriti Thapa

**Supervisor :** Jhamak Bahadur Karki ,PhD

Conservation of wildlife from the adverse effect of physical factors is very important. The impact of highway and road expansion is fatal to wildlife and can be recorded for more years to come in future resulting in habitat fragmentation, isolation, road kill and local extirpation of many animals. In this study, sign surveys were conducted for the detection of animals in forests along the highway of Kawasoti in Nawalpur. The study area was laid out in 13 grids each with an area of 1\*1 km<sup>2</sup>. Sign survey along with survey of co-variates (human disturbance, prey and soil) was conducted. Mackenzie's simple single season model was used for the estimation and the data was analyzed using the software PRESENCE 2.12.25. Greater One-Horned Rhinoceros, Common Leopard, Wild Boar and Spotted Deer were found with average estimate of probability of habitat use as 0.79, 0.51, 0.80 and 0.47 with naïve estimate of 0.69, 0.15, 0.76 and 0.23 respectively. The estimates increased from the naïve estimates when influenced by different covariates. Apart from these animals, Golden Jackal, Small and Large Indian Civet, Stripped Hyena, Crested Porcupine, Jungle Cat, and Rhesus Monkey was also seen through camera traps. Perceptions of the people from the CFs and BZCFs were positive. They were aware of the consequences but not much of action had been taken place due to the lack of interest, budget as well as awareness of people about the severe negative impacts on wildlife and their habitats. These animals were seen migrating from the bordering areas of CNP from the south to the northern side evidencing their movement from the highway. Underpass with guiding fence fit as the best alternative against highway expansion for the area.

**Key words:** Highway Expansion, Impact on Wildlife, Occupancy Modeling, Underpass, Nawalpur, Wildlife Conservation.

7 **Assess the impact of road expansion on wildlife and analyze human wildlife interaction in Danda to Chormara forest, Nawalpur.**

**Researcher:** Lochana Adhikari

**Supervisor :** Jhamak Bahadur Karki ,PhD

Roads are important for improving connectivity, transportation, and overall socio-economic development of a country. At the same time, roads lead to wildlife habitat fragmentation, habitat loss, increased human wildlife conflict, and road kills. These impacts of roads can jeopardize the conservation of wild animals. In today's context, Nepal's East- West highway has become risk to wild animals through Wildlife Vehicle Collision. Narayanghat-Butwal highway, part of East-West highway, is expanding from two to four lanes and passes through Danda-Chormara forest which is habitat for many wild animals including tiger. When roads construction are unavoidable, effective mitigations for wild animals should be planned and implemented at the time of roads construction or expansion. Thus, this study was conducted where the study area was divided into 28 grids of 1\*1 sq.km. Wild animals sign survey was done along with human disturbance and soil survey. Key informant survey was done to know the human wildlife interaction. Presence version 2.12.25, was used to analyze the occupancy of wild animals. In this survey, signs of Barking Deer, Wild boar, Spotted deer and Common leopard was found mostly. Wild boar had the highest model average estimate of 0.94 and Common leopard the lowest with 0.45. For all animals the model average estimate was higher than naïve estimate. Human Disturbance Index and Soil Index were covariates for Barking deer, Wild boar and Spotted deer. Both covariates had positive influence on the species. For Common Leopard, Human Disturbance Index and Prey Index were covariates. Human Disturbance Index had negative influence and Prey Index had positive influence on Common leopard. From key informant survey, the interaction of human and wild animals was negative. Crop damage was the main problem created by wild animals and Wildlife Vehicle Collision was main reason for wild animals' mortality. The conflict will increase after expansion of road as perceived by the respondents. An effective wildlife crossing can be a solution to minimize all these impacts of road considering the existing bridges and culverts funneling through guiding fence.

**Keywords:** Sign survey, Occupancy model, Human wildlife interaction, Road expansion, Underpass.

8      **An assessment of the contribution of Community Forest on Livelihood Improvement of Forest User Group Members (A case study from Bhagwati Community Forestry User Group).**

**Researcher :** Mamata Rawal

**Supervisor :** Murari Raj Joshi

An assessment of the contribution of community forest on livelihood of user group members was conducted in Bhagwati Community Forestry User Group of Jumla district aiming to investigate the contribution of community forest management on livelihoods of its users. Both primary and secondary data were collected through household survey, focus group discussion, key informant interview, observation and review of literatures. Field information was analyzed using MS excel and presented in the form of pie chart table, figure and the main text.

CFUG was composed of 140 HHs and managed 47 ha of forest. However, household level questionnaire survey was carried out in 49 HHs among them 51% were Chhetri, 45% Dalit's and 4% Thakuri. Agriculture was the main occupation of study households and 92% of the total respondents were suffered from food shortage problems.

Women and Dalit were also included in CFUG executive committee. Participation in general assembly and meeting was high of Chhetri with 49% followed by Dalit with 37% and Thakuri (14%) and participation in forest protection and management among the community people Chhetri were 47%, 14% Thakuri, and 39% Dalit. Participation in skill development training and tour programs among Chhetri was high followed by Dalit and Thakuri.

**Key words:** Community Forest, Community Forest User Group, Income, Livelihood Improvement

9 **Comparative Study on Contribution of Alternative Energy (Biogas and Improved Cooking Stove) Over Forest Resource Use (A Case Study from Two Community Forests of Dang District)**

**Researcher :** Pratistha Shah

**Supervisor :** Leena Sah

Fuel wood from forest is the main source of energy for cooking and heating purposes for rural people, an important cause of deforestation. So Government of Nepal through AEPC initiated distribution of alternative energy technologies viz. biogas and improved cooking stove to address this issue. This study tries to find the contribution of the two technologies towards forest resource use. It compares biogas and ICS as an alternative to reducing pressure on forest resource, effect on forest income and forest condition.

The study was conducted in two community forest of Dang district viz. Devasthan Community forest (ICS) and Jyoti Community Forest (biogas). The data were collected using PRA techniques. Perception of the local people on the contribution of biogas and improved cooking stoves on fuel consumption, forest income and forest condition was measured on likert scale by scoring the statements on different issues. Forest inventory was done to understand the condition of forest. The collected data were analyzed qualitatively and quantitatively using R software and Microsoft Excel. The data were interpreted using chart, tables, text, figures etc as appropriate.

The result shows that the average amount of fuel wood consumption has been reduced by 55.56% in Jyoti CF and 44.44% in Devasthan CF. Moreover, the result was statistically significant with the application of Wilcoxon signed rank test at 5% level of significance. Furthermore, it was found that income from both CFs has been increased after installation of AETs. Additionally, the result also shows that condition of both CF has improved after installation of AETs. Nevertheless, AETs along with policy intervention is responsible for increment of income from forest and improvement in forest condition.

From this study, it can be concluded that both biogas and ICS contributes towards reduction in fuel consumption, increase in forest income and improvement in forest condition. Additionally, based on this study, it can be said that biogas is relatively more appropriate than ICS in terms of forest resource use.

**Keywords:** Biogas, improved cooking stove, fuel wood, forest income, forest condition, deforestation.

**10 A research report on study of distribution, habitat preference and conservation threats to red panda in Lamtang National Park.**

**Researcher :** Sabin Lamichhane

**Supervisor :** Leena Sah

This study aims to document distribution, population structure, habitat types and conservation threats to Red panda in Suryakunda, Lamtang National Park. The 10 m radius circular plots were taken for vegetation composition and intensity of human disturbances. The concentric circular plots with larger, 10m radius plot for trees, 3m radius was taken for shrubs and bamboo and 1m radius for herbs. It was difficult to study for shrubs and herbs due to snow cover and heavy snowfall during the study period. The sample plots were taken along the altitudinal gradient.

Indirect signs of presence of Red Panda (*Ailurus fulgens fulgens*) was documented during March, 2019 in Polangpati site of Suryakunda BZ area of LNP. Based on fecal pellet groups, Red pandas occurred from 2400m to 4100 m elevation, with abundance of pellets increasing from 3000m to 4000 m as compared to other altitudes.

The results also showed that the Red panda within this population prefer mostly mixed conifer forest over those of cool broadleaved forest and blue pine forest. The mixed conifer forest was dominated by *Pinus roxburgii*, *Tsugadomosa*, *Rhododendron sp(s)*, with bamboo undergrowth. The presence signs of Red panda were observed within 200 m from water sources. The bamboo species found in the study site were *Arundinaria recemosa*, *Drepanostachyum intermedium* and *Arundinaria falcata*. The results showed that maximum presence signs were observed within a close proximity to *Arundinaria racemosa*.

The presence of feral dogs, grazing, poaching, harvesting of timber and bamboo collection were major anthropogenic threats. Further research, awareness programs on its important role in the ecosystem, categorization of habitat into different zones for effective monitoring system are recommended.

**Key-words:** Habitat status, population structure, conservation threats, bamboo species, presence and absence, Red panda, feral dogs, LNP.

## **11 Conservation status, threats and management of plant diversity in Swayambhu religious forest of Kathmandu district, Nepal**

**Researcher:** Santa Kumar Shrestha

**Supervisor :** Mohan Prasad Wagle, PhD

Plant diversity is a renewable natural resource involving all forms of flora at genetic, species and ecosystem levels. Plant population, varieties and interactions determine composition, structure and function of biodiversity. Virchow (1998) has implied the meaning of conservation to the protection of biodiversity for sustainable utilization. Plant diversity conservation is an integral part of forest management providing goods and ecosystem services in terms of provisional, regulating, social and cultural services to the people by maintaining harmony in socio-ecological relationship. It increases aesthetic value of the forest to promote nature based ecotourism generating employment opportunities to improve livelihood of the local people. Public participation creating people's awareness, play vital role for plant diversity conservation in the religious forest. However, religious forest is managed on the basis of forest operational plan by recognized religious community for conservation, management and utilization of forest resources such as land, water and wildlife including plants.

The plant diversity assessment was done by the method of stratified systematic sampling with the measurement of herb, shrub, tree and climber with respect to composition, structure and function of the forest. Plant diversity assessment is required to analyze the conservation status, threats and sustainable management of plant resources in the forest habitat. Similarly, the important value index of plant species provides information for priority based in-situ conservation of threatened species in the forest. In Nepal, Forest Regulation 1995, Article 59 has a legal provision to utilize the income obtained from selling of minor forest produce including utilization of timber and fire wood in the religious activities. Therefore, conservation and sustainable management of plant diversity helps to ensure sustainability of the religious forest promoting nature based religious ecotourism for social, economical and environmental wellbeing in the world heritage site of Swayambhu.

**Key words:** plant diversity, inventory, sustainable management, in-situ conservation, ecotourism.

## 12 Comparative assessment of tree height measurement using different instruments (a study from Chitwan, Nepal)

**Researcher :** Sara Pariyar

**Supervisor :** Ram Asheshwor Mandal, PhD

The height measurement is very complicated and time consuming job in the forestry. The measurement value may differ with use of different instruments and such types of research related to height measurement using different instrument wasn't conducted so far in Nepal. Thus, this research was objectively carried out to assess the variation in height measurement using Clinometer, Rangefinder and Abney level and error caused by the use of the instruments, their precision level in height measurement and identify the most efficient instrument for measurement. Satyadevi community forests in Chitwan district was selected as the study site. Total 110 healthy plants were measured, representing different diameter class 5 cm and above 55 cm with interval of 5. Each class consists 10 plants whose heights were measured. The bamboo pole was used to find the actual height of the plant for diameter class 5-30 cm. The measurement of remaining diameter class was measured applying destructive techniques. The time was recorded for each measurement according to instrument used. Data were analyzed using statistical tools like One-way ANOVA and Kruskal Wallis test to compare the height using different instruments with actual measurement. Error was estimated using the differences between the values and precision was also calculated. The time efficiency was calculated using mean time and estimator  $(E\%)^2 \times T$ . Furthermore, the regression analysis was done to show the correlation between actual height and estimated height measured by instruments. The result showed that, the average value of height of plants were  $5.42 \pm 1.77$ ,  $5.57 \pm 1.47$  and  $5.17 \pm 1.7$  m using Clinometer, Rangefinder and Abney level respectively in 5-10cm diameter class which values were  $23.81 \pm 1.77$ ,  $21.79 \pm 1.47$  and  $22.98 \pm 1.7$ m measured by Clinometer, Rangefinder and Abney level respectively in diameter  $>55$  cm. The differences in mean value between diameter class 5-  $>55$  cm with comparison to actual height measured with Clinometer ranges from 0.16 to 2.74 m whereas measurement with Rangefinder ranges from 0.12 to 1.22 m and 0.10 to 1.88 m for Abney level. The average error percentage is lower with the measurement taken by Rangefinder with the value 2.95% and higher with the measurement taken by Clinometer with the value 8.27%. The average error percentage of measurement taken with Abney level is 4.31%. The average precision of height measurement with instruments shows that Rangefinder is higher than Abney level and Clinometer with very small difference of 0.01 and 0.005 simultaneously. The Rangefinder is the most efficient height measuring instrument since the efficiency value was found to be lowest 842.08 in comparison to estimated value of it using Clinometer and Abney level with 8029.30 and 2378.42 respectively. Since,  $R^2$  value of actual height and measured height using Rangefinder was 0.70 whereas Clinometer is 0.66 and of Abney level is 0.61. It was found that, measured height using Rangefinder performed the most correlation with the actual height of the plant. This research will be useful for choosing the instrument according to precision, bias and time efficiency required.

**Keyword:** Instruments, Height Measurement, Precision, Bias, Time Efficiency

13 **Effect of aspects on the growing stock status of *Shorea robusta* and associated plant diversity (a study from Tanahun district, Nepal)**

**Researcher :** Srijana Sigdel

**Supervisor :** Ram Asheshwor Mandal, PhD

Aspects play vital role in growing stock and Plant diversity in the hill forest. There are limited study regarding the effect of aspects on the growing stock and biodiversity. Hill Sal forest is relatively smaller and differ than that of Terai Sal forest. Thus, this study was objectively carried out to assess the growing stock status (basal area, volume and per ha) of *Shorea robusta*, estimate the regeneration status of *Shorea robusta* and calculate the associated Plant diversity in community forests according to aspects in hilly region. Akala, Tekanthumka and Phoksing community forests of Tanahun district were selected as the study sites. Total 60 sample plots were established in three community forests having concentric circular plot of 500m<sup>2</sup> for tree, 100m<sup>2</sup> for pole, 25m<sup>2</sup> for sapling and 10m<sup>2</sup> for seedlings to collect data applying stratified random sampling. The height and diameter were measured from each sample plot and associated species were counted. The basal area and volume per ha were calculated and the regeneration were counted. At the same time, the biodiversity indexes particularly Shannon-weiner, Simpsons and Species richness were calculated. Estimated growing stocks of tree, pole and regeneration were compared according to aspects using parametric and non parametric statistical test.

The basal area of tree and pole of *Shorea robusta* was found to be highest in southern aspect with 25.25±2.23 m<sup>2</sup> per ha in Akala Community forest whereas it was the lowest in northern aspect with 15.99±2.52 m<sup>2</sup> per ha. The volume of trees and poles was highest in Southern aspect with 208.87±25.19 m<sup>3</sup> per ha whereas lowest in northern aspect with 140.51±22.26 m<sup>3</sup> per ha in Akala Community Forest. Statistically, One-way ANOVA showed there was no significant difference in basal area and volume among all four aspects at 5% level of significance in Tekanthumka and Phoksing CF. Likewise, Kruskal Walis test showed there was no significant difference in mean basal area and volume among different aspects at 5% level of significance in Akala CF. The result shows that the number of seedlings per ha was highest in western aspect with 7040±1735.97 per ha where as lowest in northern aspect with 280±149.67 per ha in Tekanthumka Community Forest. The result was significant. Further Tukey's b test showed that there was significant differences in mean number of seedlings between western and northern aspect. The highest Shannon diversity index value with 1.94 and the lowest Simpsons Diversity Index 0.21: both the value represents the highest diversity in the northern aspect. Also the species richness was highest in the northern aspect. The research will be useful to show the growing stock and plant species diversity according to aspects.

**Key words:** Aspects, Basal area, volume, Shannon-Weiner diversity index, Simpsons Diversity Index, Species richness

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14     **Contribution of resin tapping to enhance the livelihood of community forestry user groups (A case study from Kolgare Ratnimare CFUG of Western Rukum District, Nepal)**

**Researcher:** Basanta Rawal

**Supervisor :** Arun Sharma Paudyal

Resin, one of the important non timber forest products, is collected from *Pinus roxburghii* commonly known as Khote Salla. In Nepal resin tapping operation has significantly resulted in bringing changes in livelihoods of the local people. Community Forest Users' Groups of mid hills of mid-western region of Nepal earn revenue from resin and allocate funds for school support, poor support, road construction and other livelihood supportive activities. This study was carried out in Tribeni GA.PA (ward no. 9) of Western Rukum district. It aimed to assess the contribution of Resin tapping operation on employment generation of local people, Budget Development of CFUG and Community development activities.

Household survey with Sampling Intensity 30% was carried out where 108 Households were randomly selected for the study. The primary data were collected from household survey, focus group discussion, key informant survey and informal discussion. The secondary data were collected from DFO Rukum, CFUG OP, related literatures and internet browsing. The data were analyzed by using by descriptive statistics where MS-Excel was used for data analysis and results are presented in Tables, Figures and Graphs. In the study area, it was found that about 25% people were Dalit and Janajati, whereas 75% people were poor. The total income of CFUGs from RT was NRs.6, 29,814 after levying 13% (VAT). Maximum portion of income from CFUGs was used in school support NRs (2, 40,000). This study shows the clear picture of employment opportunity from resin tapping activities and will trigger the policy makers and managers to run this business on sustainable basis. Sustainable resource utilization, promotion of proper and scientific harvesting technique, strict mechanisms for young and inexperienced resin-tappers, awareness about firing and chipping pieces, training for tappers, regular monitoring and inspection is recommended for sustainability of RT.

**Key Words:** Livelihood, Resin tapping, Employment, CFUGs, *Pinus roxburghii*.

15 **An assessment of contribution of community forest on livelihood improvement of forest user group members (a case study from Solabang and Sisnekhola mahila community forest user groups of Rukum (west) district, Nepal**

**Researcher:** Bhupendra Oli

**Supervisor :** Murari Raj Joshi

Community forest is an important source of livelihood of CFUG members. A study on "An Assessment of contribution of community forest on livelihood improvement of forest user group members" was conducted in Solabang and Sisnekhola Mahila CFUGs of Rukum (west) district aiming to assess the overall impact of community forest management on livelihood of CFUG members. Both primary and secondary data were collected conducting wellbeing ranking, household survey, key informant interview, focus group discussion, and field observation etc. and secondary data were gathered from CFUG operational plan and constitution and reports of CFUG and DFO, and other published and unpublished reports, journals and publications. Data were analyzed using MS-excel and SPSS, and interpreted by using tables, figures and descriptive texts.

More women (60%) were involved in study compared with the participation of men. Majority (>50%) of them were Kshetri followed by Brahman, Janajati and Dalit in both CFUGs. Nearly 82% of them in Solabang and 83% in Sisnekhola Mahila CFUGs were engaged in agriculture occupation with about 50% of the total households of Solabang and about 40% of the total households of Sisnekhola Mahila CFUG producing food crops sufficient for year round.

Participation level of Dalit, Poor and Women was also increased in both CFUGs after launching CF programs. Both CFUGs had organized several trainings, tour and workshops to enhance the capacity of users from their own fund and also from the support of DFO, FECOFUN and other concerned government and non-government organizations, which has brought positive change on livelihood of both CFUG members. Average annual income of Solabang CFUG was NRs.3, 82,289 and Sisnekhola mahila CFUG was NRs.72,609. About 89% of this amount in Solabang CFUG and 92% in Sisnekhola Mahila CFUG were used to improve livelihood assets of CFUG members. Finally, 16 Poor and 7 Dalit households in Solabang and 7 Poor and 4 Dalit households in Sisnekhola Mahila CFUG were benefited directly.

**Key Words:** Community Forest User Groups, Livelihood Improvement, Forest Conditions

16 **An assessment of sustainable forest management in community forestry (a case study from Ramnagar community forest user group)**

**Researcher:** Bhuwan Budthapa

**Supervisor :** Arun Sharma Poudyal

An Assessment of Sustainable Forest Management in Community Forestry (A case study from Ramnagar Community Forest, of Rupendehi district with aim of assessing sustainability of CF and the condition of forest.

Different Criteria and Indicators (C&I) were used for the sustainability assessment. Criteria and Indicators used were first selected from C&I made by different organizations (ITTO, CIFOR). Those C&I were re-constructed to fit with objectives and local condition in the study area for their compatibility with management objectives and other prevailing local conditions. In total 79 indicators under 5 criteria were selected for socio-economical and ecological sustainability assessment. PRA tools such as Household survey, Key informants survey; Focus group and Informal discussion were used for socio-economic data collection and ecological data were collected through forest resource inventory. The data were analyzed quantitatively and qualitatively by different statistical tools and computer software program and MS-Excel. It was found that the forest condition of growing stock and regeneration of the forest is good. The sustainability of the community forest in ecological terms is found more effective than that of socio-economical terms.

Among the individual criteria studied 'forest condition and ecosystem health' found most effective with sustainability index 0.93 and 'soil, water and biodiversity conservation' was found least effective with Sustainability Index 0.77. The overall sustainability index (or the status of SFM) of the CF was found to be 0.82 with overall Socio-economical Sustainability Index and overall Ecological Sustainability Index 0.80, 0.85 respectively. It means the Ramnagar community forest has 82% chance of sustainability.

**Key words:** Sustainability, Criteria, Indicators and assessment

**17 An Assessment of Contribution of Community Forestry in Livelihood Upliftment of People (A Case study of Maitar Kapase Community Forest User Group in Sindhupalchok district)**

**Researcher:** Bigyan Acharya

**Supervisor :** Arun Sharma Poudyal

Community Forestry (CF) is any part of the national forest that is handed over to a user group. CF involves participation of local people in forestry activities. Improvement and upliftment of livelihood of people is one of the main focus in CF. CF plays the crucial role in the livelihood improvement. If local people are provided with the necessity of meeting their basic needs from CF then they potentially conserve and manage the forests while if they are deprived of their rights then they may not pay proper attention in management of forest. This study have investigated the role of CF in livelihood improvement of the people of Maitar Kapase CFUG. The study was carried out in order to gather primary data. Primary data was collected from questionnaire, direct observation, Key Informant Interview (KIS), focus group discussion and informal discussion. Secondary data was gathered from relevant literatures such as research papers, journals, case studies, published and unpublished reports and articles, websites, different libraries of study related organizations, study related books and publications, DFO records, operational plan, constitution and records of CF. The data extracted from the study area was analyzed using statistical tool MS Excel.

There was diversified ethnicity of user group in Maitar Kapase CFUG. Majority of the people were engaged in agriculture. Averagely land holding pattern per HHs was 12 ropani. Per HHs 4.28 livestock was reared. An average family member per HHs was found to be 5.72 members. The dependency on forest products were particularly in timber. There had been many trainings, workshops conducted by CFUG to contribute on Human Capital. The status of illegal felling, poaching and forest fire were found to be decreasing. All HHs had permanent toilets. Maitar Kapase CFUG hadn't conducted any IGAs related activities on their own till the date this research was carried out but they had operated "circular fund" for disadvantaged and poor HHs at interest rate lesser than 10%. Majority of user group were Brahmin and Chettri. Major occupation was Agriculture followed by service and business. Majority of people belonged to wealth rank class B. Human capital had been upgraded by organizing different trainings and workshops. There was a healthy participation in general assembly and also freedom to decision making existed. None of the user group held hatred towards each other which mean CFUG had contributed in Social capital as well. The status of forest fire, poaching and illegal felling had decreased. Besides this, different kinds of forest management activities were also conducted to ensure the Natural Capital. Physical Capital had been improved by developing different infrastructures. Though IGAs related programs hadn't been organized by CFUG but "circular fund" had been operated for poor, disadvantaged HHs to be engaged in any IGAs. Also, by generating seasonal employment to user group CFUG had contributed in Financial Capital as well. Conclusively, it was found out that Maitar Kapase CFUG had contributed in all five livelihood assets.

**Key words:** Community forest, Community Forest User Group, Employment, Livelihood Improvement, Income Generation Activities, Fund mobilization.

**18 Status of good governance in urban community forest user group (A case study of Ranibari Community Forest User Group, Lazimpat-3, Kathmandu).**

**Researcher:** Birat Kumar Lamsal

**Supervisor :** Murari Raj Joshi

Study entitled "Status of Good Governance in Urban Community Forest User Group: A case study of Ranibari Community Forest User Group, Kathmandu Metropolitan city-3 Lazimpat was conducted to assess four pillars of good governance namely participation, accountability, predictability and transparency each with four indicators for study as well as to identify the issues, challenges and opportunities for practicing good governance in study urban CFUG. Both primary and secondary information were collected using Participatory Rural Appraisal tools and techniques such as questionnaire survey, key informant interview, focus group discussion, direct observation, review of reports and publications. Information were analyzed using MS excel 2013 and represented in the form of bar diagrams, pie chart, tables and spider web diagram for clear perception of good governance situation in study CFUG with main text. All 39 households of Ranibari CFUG were involved in study, in which 97% were literate. The participation of men in study was higher compared with the participation of women. Majority of them (72%) were business persons and service holders. Results of the study revealed that the overall status of governance in Ranibari CFUG was very good obtaining 51 score out of 64 total score. While comparing four pillars of good governance, participation and predictability were found better compared with transparency and accountability. Out of total 16 score, participation has obtained 14 score and predictability has secured 13 score, while transparency and accountability each has obtained 12 score. This result shows that community forest user group members of urban community forest were also quite aware on good governance process and practices. Finally, it is recommended that participation of women and disadvantaged group members in CFUG executive committee should be ensured based on recent community forestry guidelines and CFUG level good governance training and awareness programs should be organized to enhance skill and knowledge of CFUG members on good governance principles and practices.

**Keywords:** Accountability, Community Forest User Group, Governance, Participation, predictability, Transparency etc

**19 Vulnerability and adaptation strategies of rural people to climate change in mid-hills of Nepal (A comparative study from three CFUGS of Patan Municipality of Baitadi district)**

**Researcher:** Jyoti Paudel

**Supervisor :** Murari Raj Joshi

Climate change vulnerability depends upon various factors and differs between places, sectors and communities. People in developing countries whose subsistence livelihood depends mainly upon agriculture and livestock production are identified as particularly vulnerable. Main components of vulnerability can be measured with exposure sensitivity and adaptive capacity. This study applied Livelihood vulnerability index (LVI) to measure climate change vulnerability and analyzed adaptation practices in three community forest namely Lamadanda Jhimahude Ejar, Dipchan and Dahabahela of Baitadi district. The study was completed on 120 randomly selected households respondents through data collection and analysis on socio-demographics, livelihoods, social networks, health, food, water and natural disasters and climate variability and adaptation practices. Data were aggregated using a composite index and differential vulnerabilities were measured. . The result of study revealed that Dahabahela (0.36) community forest users group is most vulnerable followed by Dipchan (0.35) and Lamadanda Jhimahude Ejar (0.3) respectively. The value of exposure was found to be higher than adaptive capacity in all communities. The study recommend that adaptation strategy should be developed taking into consideration of water availability, food security and natural disaster control in order to reduce sensitivity and exposure along with increasing adaptive capacity.

**Key words:** adaptation, exposure, sensitivity, vulnerability

20     **Assessing the Contribution of Agroforestry on Livelihood of Community Forest User Group Members (A Case study from Bhagwan Thumki and Sano Ban Pandey Gaon Community Forest User Group of Kavrepalanchok District**

**Researcher:** Kabita Mahat

**Supervisor :** : Murari Raj Joshi

Case study on “Assessing the Contribution of Agroforestry on Livelihood of Community Forestry User Group Members” was conducted in Bhagwan Thumki and Sano Ban Pandey Gaon CFUGs of Banepa Municipality, Kavrepalanchok district aiming to investigate the existing agroforestry systems and their contribution on CFUG member’s livelihood. Both primary and secondary data were collected using Participatory Rural Appraisal tools such as household survey, key informant survey, focus group discussion and direct observation etc and review of reports and agroforestry related publications. The collected data were analyzed were using MS excel, and presented in the form of tables, figures and main text.

The average land holding in Bhagwan Thumki was 8 Ropani and in Sano Ban Pandey Gaon was 10 Ropani. The main agroforestry systems found in CFUGs were home gardens, agrisilviculture, trees in and around agricultural fields, silvopasture and commercial crops such as Cardamom under tree etc. In these systems, 22 different tree species were grown in which 42% fruit trees, 34% fodder species and 24% fuel wood and timber species. In household level, more trees were found in Sano Ban Pandey Gaon CFUG with 10 fodder trees, 7 fuel wood and timber trees and 11 fruit trees per households compared with Bhagwan Thumki CFUG where 6 fodder tree, 4 fuel wood and timber trees and 8 fruit trees per households were found. Agroforestry had direct impacts on livelihood of CFUG members which were fodder, fuel wood and timber supply and income generation. About 46% of the total households generated income from livestock and their products, 25% of them had income from horticulture crops, 10% of them obtained income from timber, and 8% of them had income from bamboo and beekeeping to improve their livelihoods. Majority (80%) of them wanted to plant multi-purpose tree species, 50% of them reported fruit trees to plant and 40% of the total respondents wanted to plant fodder species. However, lack of knowledge and lack of quality seedlings of desirable species and marketing problem of timber products were identified as major constraints for agroforestry promotion in study CFUG areas.

Finally, it is recommended that CFUG members should be trained on agroforestry, and good quality seedlings of desirable species should be provided for agroforestry development in study CFUG areas.

**Key Words:** Agroforestry, Community Forest User Groups, Agrisilviculture, Income, Livelihood.

## **21 An assessment of habitat use by tiger and impact of Narayanghat-Butwal road expansion on tiger and its prey species in Arunkhola-Dumkibash forest, Nawalpur**

**Researcher:** Muna Giri

**Supervisor :** Jhamak Bahadur Karki, PhD

Tiger is one of the charismatic and iconic creature found across the world. Prey depletion is one of the main reasons of declining of tiger so conservation of prey species for conservation of flagship species as tiger is must. Two major covariates has been considered in this study for estimation of tiger occupancy i.e. influence of prey index as well as human disturbance index. Sign survey of tiger and its prey species was conducted by dividing the study area into 30 grids of 1\*1 sq km. Occupancy model using PRESENCE 2.12.10 software was used for analysis of occupancy. Simple single-season model using MacKenzie model has been used. Altogether four models were derived including covariates (Prey index and Human disturbance index), all models were considered for analysis as it yield AIC less than two. The naïve estimate of probability of occurrence of tiger was 0.47 while model average estimate using occupancy was 0.50. Positive influence was shown by prey index on habitat use by tiger whereas negative influence was shown by human disturbance index which shows that availability of prey means presence of tiger. The result signifies protecting wild prey and reducing human disturbance could aid in conservation effort of tiger. Impact of road expansion can be seen easily as it creates physical barrier when animals are unable to cross the road easily because of increased road width and high traffic volume as well as speed. So impact on wild animals was assessed through social survey which was mostly based on perception of informative people that provided insight into the severe impacts of road project on large carnivores like tiger as well as its prey species and further management interventions to be carried out conservation effort. Therefore, different mitigation measures as underpasses along with fence should be applied for the conservation of tiger as well as its prey and ease their movement across the road.

**Key Words:** Prey depletion, Flagship species, Sign survey, Occupancy model, Road expansion, Conservation, Underpass.

22      **Assessment of carbon dynamics in different aspects of hilly region (A case study from three community forest of Ramechhap District)**

**Researcher:** Namita Shrestha

**Supervisor :** Ram Asheshwar Mandal, PhD

Reducing emissions from deforestation and forest degradation significantly contribute to overall efforts to stabilize Green House Gases (GHGs) concentration in the atmosphere. Aspect is one of the major factors affect the carbon stock in community forest. However, there is limited study related to aspect wise carbon stock in community forests. Therefore, this study was objectively carried out to estimate the plant carbon and their variation according to aspect, compare the soil carbon according to aspects in community forests and estimate contribution of different carbon pools in total carbon stocks. Sallaghari, Ghadichhap and Simleparipakha Community Forests of Ramechhap district were selected for the study. Total 35 samples plot were laid down from community forests applying stratified random sampling considering aspects as strata. The circular plot of size 250m<sup>2</sup> were laid down for the sampling tree and pole having diameter >5 cm; 100m<sup>2</sup> plots were established for sapling having dbh 1-5 cm and 1m<sup>2</sup> plots were established for LHG and soil sample collection. The comparison of carbon was statistically done applying Independent t- test, One-way ANOVA and Tukey's B test. The percentage was applied to assess the contribution of carbon pools. The results showed that, total plant carbon in Sallaghari CF was found to be highest in north aspect with 78.28 t/ha and lowest in west aspect with 63.79 t/ha. The soil organic carbon was estimated as highest in north aspect with 35.98±1.36 t/ha and in west aspect it was found lowest with 28.99±0.35 t/ha in Sallaghari CF. The contribution of different carbon pools in north and west aspect of Sallaghari CF was found to highest percentage in above ground tree/pole with 76.80% and 59.62% carbon and it was followed by soil organic carbon with 43.39% and 31.24% respectively. This can be useful to enrich REDD+ policy.

**Key words:** Carbon sequestration, Plant biomass, Soil organic carbon, Global warming, Carbon emission.

**23 Ecological and economical analysis of *Nardostachys grandiflora* in Patarashi Gaupalika of Jumla district.**

**Researcher:** Pranil Devkota

**Supervisor :** Ambika Prasad Gautam, PhD

The study of this study was to assess the resource status, marketing of Jatamansi in Patarashi Gaupalika of Jumla district including the trade routes and destination market of wild collected Jatamansi. Primary data and secondary data were collected and analyzed both quantitatively and qualitatively. The result of this study shows that total of 11, 21,231 Kg of Marc and 32, 820.25 Kg of Oil of Jatamansi exported through CITES export permit between 2008-2017. District level Five Year Management Plan showed that 22 districts are the source districts of Jatamansi. Out of which Jumla and Humla has the highest potentiality to produce more than 50,000 Kg of Jatamansi. Kartik- Mangsir is the best harvesting season of Jatamansi. Jumla Bazaar is the main collection center of Jatamansi from which it is transported to Nepalgunj, Mahendranagar, Nawalparashi, and Kathmandu by air traffic and by bus. Most of the European countries are the destination market of Jatamansi. Most of the people in the study area are illiterate so they prefer NTFPs collection is the main source of income. In year 2075 the income from Yarsagumba, Setochini and Banlasun is NRs 26, 44,000, NRs 17, 66,000 and NRs 13, 03,000 respectively in the study area. Jatamansi harvesting is the main source of income in the past but due to the ban of Jatamansi trade in unprocessed form Yarsagumba, Setochini and Banlasun are the prime species of household income in the Gaupalika area. Jatamansi is included in IUCN red list as Critically Endangered and CITES Appendix II so its trade is ban in unprocessed form.

**Key words:** Jatamansi, Yarsagumba, Setochini, Banlasun, Marketing

## 24 **Current status and sustainable management potential of lokta (*Daphne spp.*) in buffer zone of Khaptad National Park.**

**Researcher:** Prashant Shah

**Supervisor :** Ambika Prasad Gautam, PhD

*Daphne spp.* (Lokta) is one of the important middle and high altitude Non-Timber Forest Products (NTFPs) of Nepal which is used to make handmade paper known as Nepali Kagat, cure for intestinal disorder and parasite, used for ropes and strings. Despite its economic and ecological importance, there is insufficient information regarding quality and quantity of Lokta. This study has been conducted in four Buffer Zone Community Forests of Khaptad National Park that extends over four districts (Doti, Achham, Bajhang and Bajura) in western Nepal where species being harvested and used without any scientific management strategy and plan.

This research specifically aims to identify current growing stock, annual allowable harvest and price and demand structure of Lokta in the four BZCFs of Khaptad National Park.

The research will explore the indigenous harvesting techniques of Lokta which could be an aid in forest management and planning process. Both primary and secondary data have been used in this study. Primary data was collected through forest inventory and using PRA tools like questionnaire survey, Key Informant Interview. Secondary data was collected from several published and unpublished journals, research papers and maps. Data was analyzed and presented in bar diagram, chart, tables and formulas. Lokta was found growing well in all study sites with high density indicating that existing resource status would be increased through proper resources management. From field study, a minimum weight of one paper is 20 gm and cost NRs. 20 per paper. While in a Kori altogether there were 200 papers and cost NRs. 4000 per Kori. At one time they supplied 12000-15000 paper and it costs NRs. 300000 and profit of NRs. 250000.

The CFUG members should be trained for Lokta fiber collection and processing. To widen the market opportunity, market analysis and networking between CFUGs and entrepreneur should be established locally as well as nationally.

**Key words:** Lokta, BZCFs, Growing Stock, Annual Allowable Harvest, Price ,demand

## 25 Effect of sample plot shapes in forest inventory (a study from two community forests of Chitwan district).

**Researcher:** Pratigya Paudel

**Supervisor :** Ram Asheshwor Mandal, PhD

Plot based sampling method is applied for forest inventory in practice. The plot shapes create edge effect on the estimation of growing stock. In fact, comparative study of effect of sample plot shapes on forest inventory has not been assessed so far in Nepal. Thus, this study was objectively carried out to compare the estimated growing stock from complete inventory and sampling with various plot shapes (Rectangular, Square, and Circular) and find out the efficient sample plot shape for inventory. Jaldevi and Panchkanya community forests of Chitwan district were selected as the study site. Complete inventory and Systematic sampling with varying shapes were carried out. Altogether 135 plots were measured; 15 plots for each stage (tree, pole, and sapling) and each plots shapes were taken. The diameter and height were measured and numbers of plants were counted. Time was recorded for plot layout and measurement and mean time spent was calculated. Growing stock was calculated from the data collected through complete inventory and sampling with varying plot shapes and were compared using One-way ANOVA at 5% level of significance. In case of tree, 108 N/ha were recorded in the complete inventory, while the sampling with Rectangular, Square and Circular plots presented mean values of 121, 120, and 116 N/ ha respectively. Basal area was found to be 25.72 m<sup>2</sup>/ha in complete inventory while the sampling with Rectangular, Square and Circular plots showed mean values of 22.29, 22.01 and 21.65 m<sup>2</sup>/ha respectively. The volume of trees was found to be 251.59 m<sup>3</sup>/ha in complete inventory while the sampling with Rectangular, Square and circular plot showed mean values of 229.78, 228.29 and 224.17 m<sup>3</sup>/ha respectively. In case of pole, 748 N/ha were recorded in the complete inventory, while the sampling with rectangular, Square and Circular plots presented mean values of 787, 760 and 740 N/ ha respectively. The Basal area was found to be 18.91 m<sup>2</sup>/ha in complete inventory while the sampling with Rectangular, Square and Circular plots showed mean values of 19.86, 19.78, 18.36 m<sup>2</sup>/ha respectively. The volume of poles was found to be 158.39 m<sup>3</sup>/ha in complete inventory while the sampling with Rectangular, Square and circular plot showed mean values of 168.85, 165.77, 154.18 m<sup>3</sup>/ha respectively. In case of sapling, 2208 N/ha were recorded in the complete inventory, while the sampling with rectangular, Square and Circular plots presented mean values of 2587, 2400, 2293 N/ ha respectively. The result showed that, none of them were found differed significantly. When compared the inventory time taken in sampling with Square, Rectangular, and Circular plot shapes, Circular plot recorded minimum time at all stages. Also, the estimator  $(E\%)^{2 \times T}$  for the circular sample plot was lower in comparison with square and rectangular plots. Thus, circular plot is the best plot shape and more economical as per the study. The study will be useful to determine the plot shape based on the resource availability and purpose of the work.

**Keywords:** Inventory, Growing stock, Sampling, Plot shape, Sampling Efficiency

26      **Human-leopard conflict in buffer zone of Shivapuri-Nagarjun national park, Nepal  
(a case study of Tarkeshwor municipality)**

**Researcher:** Puspa Kumari Mishra

**Supervisor :** Leena Sah

Human-wildlife conflict is a rising issue in the field of conservation of biodiversity. Most of the conflict is seen in and around the buffer zone area. The study about human-leopard was conducted in the buffer zone between Shivapuri and Nagarjun National park. The study aimed to explore the impact of human-leopard conflict within the buffer zone of the Shivapuri-Nagarjun National Park. The study focuses on finding the impact of regular encounter with leopards and its frequency on human settled area on the livelihood of locals, understand people's perception toward leopard and its conservation and their response on compensation and relief program provided to the victim of human-leopard conflict. The questionnaire survey on 121 households were conducted with structured questions in the buffer zone. Key informant Interviews (KII) was done with the person of the national park and buffer zone user group user committee chair person. Approximately 80% of the people of the buffer zone were affected by the park's animals through livestock predation and crop destruction. The frequent visit of the leopard in the buffer zone area has mildly impacted the livelihood of the local people but the predation on livestock has made people cautious. Despite the problem created by the animals, people have positive attitude toward leopard with 73% of the people supporting the conservation of leopard in National park. Through the survey I found out that 46% of the respondent have not even heard about the Relief fund program which is considered the weakness of the National Park.

**Key words:** common leopard, human, conflict, Kathmandu

## 27      **Status and threat to wetland birds of Jagadishpur reservoir, Kapilvastu, Nepal**

**Researcher:** Rajan Bhusal

**Supervisor :** Jhamak Bahadur Karki, PhD

Jagadishpur reservoir is largest man made reservoir and Important Bird Area of Nepal. Status during the migratory season is important information for the management of the reservoir for increased numbers of birds on that season. Thus, the study was conducted in Jagadishpur reservoir, Ramsar site of Kapilvastu, Nepal in February 2019 with the aim to study the status and threat to the birds found in that reservoir. To study the population of bird direct observation and absolute count method was used. The survey was carried out for four weeks, once a week in every Monday. Similarly, to know the threat to the bird, interviews and household survey was carried out. Data was entered in MS excel 10 and presented in bar diagram, pie chart and table.

In total 52 bird species were recorded belonging to 19 different families. Eurassian coot (*Fulica atra*) was the dominant species followed by the Lesser Whistling duck (*Dendrocygna javanica*). Among the 52 bird species, 27 species were winter visitors and rest 25 were residential. Habitat destruction, human pressure, water pollution due to use of herbicides and pesticides in agricultural fields, boating for recreation, movement of vehicles in dike, fishing for commercial purpose and presence of invasive species were the main threats to the birds in Jagadishpur reservoir. Awareness raising, conservation program and regular monitoring are recommended for improvement of the bird habitat and its conservation.

**Key words:** Jagadishpur reservoir, Important Bird Area, threat, status, conservation

## **28 An assessment of good governance in community forest user groups: ( a case study from two community forest user groups of Kabhrepalanchowk district)**

**Researcher:** Rupa Chapagain

**Supervisor :** Shiva Shankar Neupane

A research entitled “An Assessment of Good Governance in Community Forest User Groups: (A Case Study from two Community Forest User Groups of Kabhrepalanchowk district) is a comparative study of two CFUGs of Kabhrepalanchowk District that lies in Province 3. This study has twin crux objectives i.e to assess the governance status in these two CFUGs as well as to identify the issues, constraints, challenges and opportunities of practicing good governance. Four elements of good governance, namely Participation, Transparency, Accountability, and GESI (Gender and Social Inclusion), each with four indicators which was practiced by SAMARPAN Project were defined as a measure and analyzing indicators for the study.

The study was conducted in a community forests with Scientific management (Bhagwan Thumki CF) and Normally managed (Pandey Sano Ban CF) with the vision of assessing the current governance status of four pillars of Good Governance namely Participation, Transparency, Accountability, and GESI (Gender and Social Inclusion), each with four indicators. The other objective of the research was to identify the issues, constraints, challenges and opportunities of practicing Good Governance. The field study was carried out collecting both primary as well as secondary data by using PRA tools and techniques such as questionnaire survey, key informant interview, direct observation, review of reports and publications.

The data gathered were analyzed using MS excel and spider web tool and represented by bar diagrams, tables and spider web diagram for the clear perception of the situation of good governance in respective CFUGs. The total sample size was determined by using the formula developed by Pagose et. Al (1978) and adopted by Thapa 1990 in Nepal i.e  $n = N (1 + Ne^2)$ , where  $n$ = sample size,  $N$ = Population Size and  $e$  = desired errors (10%). In this study, total 110 households were taken as samples which include the respondent from both CFUGs.

Both men and women including different caste, age, and occupation and education level have participated in the study. The results of the study revealed that the overall status of governance in Bhagwan Thumki CFUG was ‘Excellent’ with 84.37 % of the total attainable score where as that of Pandey Sano Ban CFUG was ‘Good’ with 65.62 % of the total attainable score. However, both CFUGs scored low points in terms of transparency.

It is recommended that both the CFUGs should improve the level of transparency in CF’s income. Fund management is a must to build trust, and therefore, regular public auditing and sharing the information in committee meetings and general assembly are pre-requisites of transparency. More effective means of disseminating information and decisions to all the users must be made in both studied CFUGs

**Keywords:** GESI, Accountability, Community Forest User Group, Governance, Participation, Transparency

**29      Impacts of climate change on watershed and livelihood of people living in its vicinity (a case study from Thotnekhola and Pataleswara CFUGs of Phewa watershed)**

**Researcher:** Safalta Bhandari

**Supervisor :** Sanjeeb Bhattarai

Climate Change is the global challenge of our time to watershed conservation and livelihood security. Although Nepal has a negligible share in the global emission of Greenhouse gases, it is vulnerable to climate change impact due to its fragile mountain ecosystem. Most of the poor households are also affected by frequent drought and change in monsoon pattern, and other natural disasters, leaving them with few mechanisms to cope with rising food prices. Nepal is characterized both by a highly variable climate regime and by fragile ecosystems. Its temperature is increasing at alarming rate  $0.06^{\circ}\text{c}$  per annum more than the global average. This phenomenon of climate change has directly affected the natural resources like land, water and forest resources. Those people who directly depend on these resources are becoming vulnerable day by day. To verify this, a case study entitled “Impact of Climate Change on watershed and livelihood of People living in its vicinity” was conducted in Phewa watershed of Kaski district. The main objective of the study was to present the local level climate change impacts on watershed and livelihood of the users” and to identify adaptation measures for improving livelihoods of the people while reducing their vulnerability to climate change. Also, the objective of the program is to assess the trend of change in temperature and rainfall in the study area. Various participatory rural appraisal tools and techniques such as household survey, key informants interview, focus group discussion, and trend analysis were done for collecting primary data. Households of all caste and all categories of well-being of people were selected by simple random sampling method. Meteorological data of the study area from the Department of Hydrology and Meteorology, Pokhara supplement primary information and various published and unpublished literatures were used for collecting secondary data. Collected data were analysed using MS-Excel 2010. The study revealed that majority of the people were dependent on agriculture and it was found this sector had been adversely affected by the climatic variability. Decrease in agricultural production, loss in biodiversity, depleting of water resource and decrease in soil productivity in the area were the impacts observed during field study. This report assesses the nature and type of climate change impacts on watershed and water dependent people in Nepal, by reviewing available literature and compiling the observations and perceptions of local people. A key conclusion coming out of this review is that climate change is not only an issue of international concern but is now a local problem in Nepal.

**Key words:** Climate change, watershed, livelihood, CC impact, CC adaptation v

**30 Assessing carbon stock and ivi in river side forest areas (a study from Tamakoshi river of Dolakha district)**

**Researcher :** Sagar Budhathoki

**Supervisor :** Sanjeeb Bhattarai

Occurrence of natural as well as artificial disaster has directly damaged the ecosystem services which need better alternatives to resolve them but there are limited studies regarding this. Thus, this study was objectively carried out to assess the total and species wise carbon stock and IVI of tree species of riverside forest. For this riverside forest of Tamakoshi river located on Dolakha district was selected as a research site. All together 46 permanent plots were established applying stratified random sampling. The diameter and height of trees, pole and sapling (DBH  $\geq$  5 cm) were measured from each sample plots. Meanwhile, diameter of regenerations (1 < DBH < 5) cm, was also recorded. Herbs, shrub and litter were collected from concentric plots. Additionally, the soil samples were collected from 0 - 10, 10 - 20 and 20 - 30 cm depths. The total above-ground trees/poles biomass was calculated using the equations (models) developed by (Chave *et al.*, 2005) for moist forest and soil samples were analyzed in lab. Later, the biomass was converted into carbon which was further employed to assess the carbon sequestration by each tree species. The result revealed that the carbon stocks in above-ground vegetation in Riverside forest of Tamakoshi river was found to be  $64.25 \pm 6.41$  t/ha. Carbon stocks in above-ground leaf, litter and herbs in Riverside forest of Tamakoshi river was found to be 12.234 kg/ha and of Dead wood and stump is found to be 346.003 kg/ha respectively. The soil organic carbon found was  $38.59 \pm 2.81$  t/ha. The total carbon stock on the study area was obtained as 115.698 t/ha. The highest IVI was recorded for *Shorea robusta* with IVI of 138.585 followed by *Terminalia tomentosa* with value 29.867. Thus *Shorea robusta* has high value in both carbon stock and IVI.

**Key words:** Carbon stock, Importance value index, Biomass, soil organic carbon.

31 **Comparison of carbon stock in chure, bhabar and plain (case study from Mahottari district)**

**Researcher :** Sandhya Sharma

**Supervisor :** Himlal Shrestha, PhD

Case study on “*Assessing the Contribution of Agroforestry on Livelihood of Community Forestry User Group Members*” was conducted in Bhagwan Thumki and Sano Ban Pandey Gaon CFUGs of Banepa Municipality, Kavrepalanchok district aiming to investigate the existing agroforestry systems and their contribution on CFUG member’s livelihood. Both primary and secondary data were collected using Participatory Rural Appraisal tools such as household survey, key informant survey, focus group discussion and direct observation etc and review of reports and agroforestry related publications. The collected data were analyzed were using MS excel, and presented in the form of tables, figures and main text.

The average land holding in Bhagwan Thumki was 8 Ropani and in Sano Ban Pandey Gaon was 10 Ropani. The main agroforestry systems found in CFUGs were home gardens, agri-silviculture, trees in and around agricultural fields, silvopasture and commercial crops such as Cardamom under tree etc. In these systems, 22 different tree species were grown in which 42% fruit trees, 34% fodder species and 24% fuel wood and timber species. In household level, more trees were found in Sano Ban Pandey Gaon CFUG with 10 fodder trees, 7 fuel wood and timber trees and 11 fruit trees per households compared with Bhagwan Thumki CFUG where 6 fodder tree, 4 fuel wood and timber trees and 8 fruit trees per households were found. Agroforestry had direct impacts on livelihood of CFUG members which were fodder, fuel wood and timber supply and income generation. About 46% of the total households generated income from livestock and their products, 25% of them had income from horticulture crops, 10% of them obtained income from timber, and 8% of them had income from bamboo and beekeeping to improve their livelihoods. Majority (80%) of them wanted to plant multi-purpose tree species, 50% of them reported fruit trees to plant and 40% of the total respondents wanted to plant fodder species. However, lack of knowledge and lack of quality seedlings of desirable species and marketing problem of timber products were identified as major constraints for agroforestry promotion in study CFUG areas.

Finally, it is recommended that CFUG members should be trained on agroforestry, and good quality seedlings of desirable species should be provided for agroforestry development in study CFUG areas.

**Key Words:** Agroforestry, Community Forest User Groups, Agrisilviculture, Income Livelihood etc.

**Researcher :** Sanjeev Sharma

**Supervisor :** Arun Sharma Poudyal

Climate change is the phenomenon generally caused due to long time alteration in weather pattern. This generally happens due to alteration in anthropogenic activity and due to emission of harmful gases known as green house gases. Hence, to cope with such phenomenon GON has developed many strategies and took part in many conferences such as UNFCCC, COP and so on. Similarly developed many adoptive measures include NAPA, LAPA and so on. Generally focuses on bottom up approach, Based on the concept that forest sequesterate carbon, GON developed community forestry approach, It is the approach generally developed to aids in the major climate related activities and also to uplift the livelihood and to conserve the forest by the local people.

Similarly, CF is the approach developed to conserve, protect and to uplift the livelihood. It is the forest conserve by the people, to the people and for the people. Hence, community forestry is only taken as the forest for production of timber, NTFP, Fuel wood and so on. So i explored the knowledge of local people about not only its role for production but also it plays a vital role in climate regulation by sequestering carbon. Similarly I explored their knowledge about management of forest in such a way that ultimately aids in sequestering more carbon and ultimately reflects the beauty of forest. Hence I found out the biomass, carbon stock, and assessed the management options fruitful for more sequestration and so on.

Likewise, I conducted primary and secondary data collection methods and data were collected by the help of many devices like GPS, D tape, Survey compass, Linear tape, Weighting machine, and so on, to find out more information about forest and based on this I applied systematic technique and found out the sample plots by using GIS technique and based upon objectives started measuring the biomass, carbon content of AGTB, LHG, SOC, BGB and AGSB. Hence within limited time and budget I completed my research.

I would like to recommend that CF must take part in REDD plus pilot project as they can be benefited from it. Similarly silvicultural management must be implemented so that more benefit can be achieved.

**Key words:** Climate Change, carbon, silviculture, NTFP,CF.

### 33 **Occurrence, distribution and future risks of forest fire in Arghakhanchi district.**

**Researcher :** Satish Bhusal

**Supervisor :** Ambika Prasad Gautam, PhD

Forest fire has proved to be a major uncontrolled disaster that occur in nature which causes imbalances in ecosystem and endangers the biodiversity by reducing the floral and faunal wealth, which is also emerging as burning issue from local to global. The study was carried out to high forest fire vulnerable district, however, there is still lacking the forest fire trends and fire risk zonation. Recognizing the problems and lacking of fire related research, this study was proposed to overcome from this problem. This study was focused on identifying occurrence and distribution of forest fire, locality factors that are responsible for forest fire, perception of people through the direct and indirect observation as well as preparation of Forest fire risk zonation map. MODIS hotspot satellite data from 2002 to 2018 and other variables were integrated using geo spatial technique. The topographic and land cover (fuel) related data archived from International Center for Integrated Mountain Development and Land Processes Distributed Active Archive Center from NASA official website. The layers of each variable were prepared and overlaid on it for finding the forest fire risk zone. Fire related perception survey was carried out in whole district (including 3 municipality and 3 rural municipality) in order to know the priority of people. ArcGIS10.5, Excel, Kernal Density Estimation model and SPSS program were used to analysed the data.

The result showed the average 22 fire occurrence with 14,807.19 ha forest was burnt throughout the year. Highest number of forest fire incidents was observed in 2016 in the April month which it is followed by May. Broadleaved forest having southern aspect with elevation less than 1000m is more prone to forest fire. Temperature greater than 33°C, with slope higher than 35% having less than 1000m from road and settlement area has been found to be high risk. Sitganga municipality records about 78.45% of forest fire . Overall, results show that, the trends of forest fire incidence found to be increasing. To minimize the risk of forest fire, Close coordination and cooperation needs to be established by the forest department with DFO and local level government for implementing effective forest fire management strategies and actions.

**Key Words:** MODIS, Kernal Density Estimation, People Perceptions, Fire Management

### 34 “Assessment of the land use land cover change and encroachment of national forest in Lamahi municipality, Dang district, Nepal”

**Researcher :** Saugat Thapa

**Supervisor :** Him Lal Shrestha, PhD

Land-use Land-cover change is the change in the biophysical cover and use of land for different purposes. Urbanization can be considered as the observable transformation of the spatial pattern of LULC, such as the transformation of agricultural land into built-up area or the gradual transformation of rural landscape into urban forms. The transformation of rural landscape to urban landscape has caused various impacts on ecosystem structure, function, and dynamics. Knowledge about LULC has become increasingly important since it the driver of local, regional and global environmental change. Encroachment is the illegal conversion area of the forest land into other land. Use is another major cause of disturbance to forests and other wooded lands in Nepal. Satellite remote sensing has been widely used to detect forest change, assess rates of reforestation or deforestation, and update existing forest maps. This study was carried out using Remote Sensing and GIS techniques and was aimed at identifying the forest cover change, causes, rate and trend of encroachment from 2000 to 2019 by classifying and analyzing Landsat ETM+ image of 2000, 2010 and Landsat OLI\_TIRS image of 2019. Key informant interview, GPS, Google Earth, direct field observation and various literatures were used to collect spatial and socio-economic data. Supervised classification was performed using maximum likelihood classifier with the help of direct field observation, Google earth and topographic maps. The study area was categorized into 5 LULC classes i.e. Forest, Water, Agriculture, Settlement and Bare land. The area converted from Forest to Agriculture and Settlement was considered as the encroachment. The result shows that the forest area (major land cover) was converted to the four land use classes. Most of the forest was converted into Bare land followed by Agriculture and Settlement. According to the KII encroachment of forest was 1000 ha up to 2000 and in my study the encroachment was 751 ha from 2000-2010 and 380 ha from 2010 – 2019. The trend of encroachment was decreasing from past to present. According to the study causes of encroachment were construction of East-West highway, inappropriate forest policy, Flood in the Rapti River, Population pressure, Political decisions and Migrations. **Key words:** LULC, Image classification, Landsat, Encroachment

**Researcher :** Shrijan Sapkota

**Supervisor :** Him Lal Shrestha, PhD

The study was carried out with the broad objective of “assessing land use land cover change and its impact on human wildlife conflict in Shivapuri Nagarjun National Park”. It has three specific objectives: a) assessment of land use land cover change b) assessment of the impact of LULC change on human wildlife conflict and c) assessment of the nature of human wildlife conflict.

The study was carried out in Shivapuri Nagarjun National Park, covering the Buffer Zone of Tokha and Budhanilkantha Municipality from January 2019 to April 2019. Impact of LULC on human wildlife conflict has not been fully appreciated. The necessary data for the study was collected through questionnaire surveys, key informant interviews, field observation and training samples collection. Data collected during the field work was analyzed using both quantitative and qualitative methods. LULC classification was done with the help of satellite imageries (Landsat images ETM+) of 2000, 2010 and 2019. Image preprocessing and enhancement was carried out using ERDAS Imagine 2015. ArcGIS 10.5 was used for supervised classification.

From the study, net gain of 152 ha of forest area, 210 ha of Settlement area whereas net loss of 354 ha of agricultural land between 2000 and 2019 was observed. The study shows that more than 75% respondents found to bear crop damage. Wild boar, barking deer, monkey, porcupine and bear were found to be the wild animals causing crop damage. 48% of the respondents reported livestock depredation by wildlife. The wild animals causing livestock depredation were Leopard, Wild Cat and Yellow Throated Marten.

The study concludes that there is rapid LULC change in the study area. This study evidently showed that buffer zone community perceived human-wildlife conflict as a problematic issue. Livestock depredation and crop damage, as two nature of consequences due to wildlife. The human wildlife conflict in Shivapuri Nagarjun National Park was found to be increased due to the factors such as conversion of agricultural land into woodland, inadequate mitigation measures, closeness to forest habitat and increased number of wild animals.

**Key Words:** Shivapuri Nagarjun National Park, Land use land cover change, human-wildlife conflict, supervised classification.

36 **Assessing the contribution of community forest on livelihood of forest user group members (a case study from Yangudhi community forest, Kaligandaki rural municipality, Syangja district)**

**Researcher :** Srijana Bhattarai

**Supervisor :** Murari Raj Joshi

Community forest is one of the most important natural resource for rural livelihood. A case study on “Assessing the Contribution of Community Forest on Livelihood of Forest User Group Members” was carried out in Yangudhi community forest of Kaligandaki Rural Municipality of Syangja district. The main objective of this research was to find out the contribution of community forest on livelihoods of user group members. Both primary and secondary data were collected through household survey, focus group discussion, key informant interview, observation and review of literatures. Information was analyzed and presented in the form of table, figure and main text. The participation of men in study was slightly higher (50.4%) compared with women. More (47%) CFUG members were engaged in agriculture followed by business, labor and service. They had 4 animals per households and 24% of the total respondents had food deficit though out the year. Total forest area was 42.67 ha dominated by *Shorea robusta* trees. There were 64 trees, 874 poles, 1158 sapling and 6367 seedling per hectare in community forest. Total volume of timber, pole and fuel wood in five block were 981.18, 1375.97 and 2595.09 Cft. respectively.

Majority (86%) of the total respondents reported that forest product supply form CF was increased greatly after forest handed over to users. Vast majorities (90%) of the total respondents were participated in general assembly of the CFUG and nearly 54% of the total respondents participated in decision making meetings of the CFUG. Approximately 73% of the total respondents reported that CF benefits were shared fairly and equitably. This year CFUG have generated Rs 54, 450 from forest products, membership fees and penalties, donations and interest from loan and Rs 92, 050 during study year was mobilized in different livelihood improvement activities such as forest management, community infrastructure development, training and income generation activities implementation etc. Finally, Rs 35,550 was mobilized as loans for vegetable farming, poultry, goat raising, tea shops etc and 6 households belonging vi to the poor and disadvantaged families were directly benefitted from this CFUG funds. It is recommended different kinds of training on forest management as well as on income generation of poor and disadvantaged households should be provided and implement.

**Key words:** Community Forest, Community Forest User Group, Income Generation, Livelihood Improvement etc.

**37 An assessment of role of community in socio-economic upliftment of poor and disadvantaged group (a case study from Patle CFUG of Lalitpur district)**

**Researcher :** Srijana Dahal

**Supervisor :** Arun Sharma Poudyal

Community forestry in Nepal is considered as an innovative program, which can contribute in livelihood improvement of user group members. However, this program has been criticized for not being able to meet the needs of the poor, women and disadvantaged group members. Regarding this prospective, the research entitled, “An Assessment of the Role of Community Forestry in Socio-Economic of Poor and Disadvantaged Groups” was carried out in Patle CFUG of Lalitpur district. The main aim of this research was to analyze the socio-economic condition of poor and disadvantaged groups and their participation in benefit sharing and fund mobilization process of the study CFUG. Different Participatory Rural Appraisal (PRA) tools and techniques such as household questionnaire survey, discussion with key informants, well-being ranking, field observations etc and review of literature and publication related to the role of community forestry programs in livelihood improvement of its members were used to gather field level primary and secondary information. Field information was analyzed using MS Excel 2016. The analyzed data were interpreted in the form of charts, tables, figures and main texts.

The literacy rate of the poor and disadvantaged groups in Patle CFUG was low. Most of them (54%) in Patle CFUGs were dependent in agriculture for their living. About 51% of the total respondents in Patle CFUG hold less than 3Ropani of land and were faced high food deficiency. Participation of poor and disadvantaged group members was increasing in different events and programs of community forestry in Patle CFUG. They have strengthened their social relations with other CFUG members and committee members also have knowledge regarding their rights and fund mobilization. Majority of the total poor and disadvantaged respondents in Patle CFUG reported that they had received capacity strengthening training and tour programs from the CFUG. They have reported that there was equity in forest products distribution and benefits sharing, but the voice of the poor and disadvantaged group members was only heard during decision making process but not taken into action. This can be the hindrance for the participation of poor and disadvantaged group members in decision making process. However, CFUG has generated Rs 1,28,000 from the sale of forest products, membership fee, leaf litter, fodder. Out of this, nearly 40% was spent in community forest protection and management, community development and income generation activities implementation for the benefit of the poor and disadvantaged households. Finally, 35% of the total poor and disadvantaged respondents have improved their socio-economic condition by raising goats and 39% by vegetable farming activities supported by the Community Forest User Group executive committee. Finally, it is recommended that training and awareness programs related to the rights of the poor and disadvantaged group members should be conducted at CFUG level to make CFUG more inclusive in decision making.

**Key Words:** Community forestry, Disadvantaged groups, Poor, Socio-economic improvement

38 **Crown openness and regeneration status in pine forest (a case study from Chappani Gadhidanda CF, Kavrepalanchowk)**

**Researcher:** Subodh Bhattarai

**Supervisor :** Sanjeeb Bhattarai

Silviculture is the art and science to control the establishment, growth, composition, health, and quality of forests (Helms, 1998). Every silviculture system involves harvesting of over storey trees either singly or in groups (O'Hara, 2002). This creates the gap on forest canopy which represent opportunities for forest regeneration (O'Hara, 2014). In this research I tried to give study about the relation between two variables crown openness as an independent variable and regeneration as dependent variable. Research site Chappani Gadhidanda CF, Bhulmu-4 was selected for the research purpose. This site has been used for research purpose earlier by EnLiFT project. 4 treatment plots including 2 selections, 1 negative thinning and 1 shelterwood with 1 control plot that is 5 research plots in total were already constructed and time was enough for regeneration to come after tree harvesting. Two species was dominant in upper canopy that is *Pinus patula* & *Pinus wallichiana*. Total 30 sampling points was constructed of 1m<sup>2</sup> in each research plot for regeneration and crown openness data collection. Sampling plots was constructed on the basis of systematic random sampling method which was within each 10m×10m crossing grid of research plot on the SE direction. The result showed that there is obvious relation between crown openness and regeneration because there was significantly higher number of regenerations in the plots with more crown openness and vice versa and also the correlation between two variables was found to be 0.9144. At 5% level of significance, there was significant difference in crown openness within research plots and same was the case for regeneration number except plots 2&5 and 1&2 was not significantly different. This research illustrates the effect of crown openness and regeneration status of pine forest which will be important tool on Nepalese context and worldwide for scientific society and decision makers who are concerned in silviculture science.

**Key Words:** Silviculture, Regeneration status, Crown Openness, Forest canopy

**39 An assessment of human-monkey conflict and foraging species in Bidur municipality-5, Pipaltar, Nuwakot.**

**Researcher:** Sujan Khatiwada

**Supervisor :** Jhamak Bahadur Karki, PhD

A research entitled "An assessment of human-monkey conflict and foraging species in Bidur Municipality-5, Pipaltar, Nuwakot" was conducted in Pipaltar village. The main objectives of this research were to quantify the economic losses from the crops raid by monkey annually, to assess the foraging species in natural habitat, to explore the perception of local people toward the monkey and to assess deterrent methods that local people practiced in chasing monkey. The field study was carried out by using PRA tools and techniques such as questionnaire survey, key informant interview, focus group discussion, followed by direct observation. Foraging species in natural habitat was assessed through quadrat sampling methods. 70 households were selected randomly from the monkey impacted household purposively. Both men and women were participated in questionnaire survey. The population and the problem of monkey was increasing from four years ago. The monsoon crop was lost excessively every year. The maize (*Zea mays*), millet (*Eleusine coracana*) and black-eyed pea (*Vigna unguiculata*) was lost in higher amount of 156, 55 and 26 Kg per HH annually. Discussion with 10 respondents having similar land of 0.4ha upland/bari for cultivation and whose houses were near the forest revealed that they had to bear the loss of Rs.3,8450 per HH from monsoon crops in the year 2075 BS. 66% of respondents believe that monkey had taken from Kathmandu, so population was increasing rapidly and monkeys were showing unusual behaviors. Just after 2072 BS, four people were bitten by monkey. Only 57% of respondents were saying that the monkey should be conserved. *Pinus roxburghii* and *Shorea robusta* was the dominant species in study area having relative density of 40% and 36% respectively. Catapult (43% respondents) and the dog with people (33% respondents) was the best deterrent methods followed by shouting and chasing (19% respondents). The research showed that unscientific and unmanaged translocation of monkey was the major cause to increase human-monkey conflict. Therefore, there is an urgent need to implement conservation measures to mitigate human-monkey conflict.

**Keywords:** Deterrent method, crops raid, impact, foraging species, Maize and millet.

40     **A study on status of water sources and its impact on livelihood practices in Sardhukhola watershed of eastern Nepal (a case study from Sunsari district of Nepal).**

**Researcher:** Madan Raj Bhandari

**Supervisor :** Kishor Aryal

Watershed resources are the foundation of ecosystem integrity and livelihoods of mountain people. Management status of watershed determines land productivity, vegetation cover and water regulation within the watersheds. Well managed watersheds might have sustainable water flows and positive impacts on livelihood whereas poorly managed watersheds might possess land degradation, loss in vegetation cover and scarcity of water resources. In this regard, this study entitled "status of water sources and its impact on livelihood practices in the Sardhukhola watershed of Eastern Nepal" was carried out to understand the status of water resources and its impact on rural livelihood practices.

This study was conducted in Sardhukhola Watershed of Sunsari district. This watershed is a major source of drinking water for people living in Dharan Municipality. In addition, this watershed also provides provisioning services like food, fodder, fresh water and energy to upstream and downstream areas. This research was conducted to know the present status of the water source around Sardhu River, including its trend of availability, human interventions and its overall impact on livelihood of people living in the watershed. This study analyses the change in cropping pattern within watershed due to degrading condition of watershed and change in water availability as comparison to past (15-20 years period).

Both field observation and social survey were carried out during research work. Natural as well as anthropogenic causes of watershed degradation such as landslide, flood, pollution, deforestation, degradation and over exploitation of natural resource were also studied under this research topic. Questionnaire surveys were done to understand people's perception towards the watershed and water source. Key informant survey and group discussion were conducted with various stakeholders of Dharan sub-metropolitan city and watershed dwellers from both upstream and downstream. Secondary data were collected from various sources. Social data of quantitative origin were analyzed using SPSS. The findings of the study are presented in charts, tables and bar diagram.

Finding of this study shows that sources of water have been decreasing such as rivers, wells and water springs are being degraded. Frequent occurrence of landslide, sedimentation and seepage of water in both upstream and downstream as well as water pollution that is caused by household garbage and improper infrastructure development are seen to be the major reasons behind the degradation of watershed and water source. People living in the watershed also perceive that water resources are drying and watershed is degrading continuously. However due to proper management of water supply in comparison to the past; distance to fetch the water has been decreased as various water supply boards are providing water through tap water supply. There is an increasing gap between demand and supply of water resources and people are expected to face severe scarcity of drinking water in the near future. After earth 2072, water availability within the watershed is also found to be decreasing. Most of the Household adopting agriculture has found to be shifting their cropping pattern. Lack of irrigation facilities and costly irrigation facilities are found to be the major reason behind the shift in cropping pattern. Activities of upstream people are causing pollution in water source of downstream people. Moreover, there is a weak co-ordination between upstream and downstream people to solve the major issue of watershed. Nevertheless people are interested to be involved in payment for ecosystem services mechanism, especially for proper water supply.

**Key Words:** Water resource, drinking water, Sardukhola watershed, upstream, downstream.

41 **Population status, diversity and conservation threats of birds of Badhaiya tal  
Badhaiyatal rural municipality Bardiya, Nepal**

**Researcher:** Roshan Singh Thakuri

**Supervisor :** Jhamak Bahadur Karki, PhD

The present study entitled “Population status, diversity and conservation threats of birds of Badhaiya Tal, BadhaiyaTal Rural Municipality, Bardiya, Nepal” was carried out from early February to late March of 2018. The direct count method using vantage points (n=4) was followed for the status of birds and questionnaire survey (n=59) was conducted to understand the conservation threats. During the study, a total of 51 species of water birds belonging to 16 families and 5 orders were recorded. Out of 51 species, 22 species were resident, 17 species were winter visitor, 6 species were occasional visitor and 6 were rare winter visitor. The highest number of birds was found in first week of February (n=1532) and second largest was in third week of February (n=1466). Fourth week of March had the least population of the water birds (n=478). The diversity was found highest (H=3.2, D=14.2) in fourth week of February and lowest (H=2.5, D=8.7) in fourth week of March. The bird communities were found to 83.37% similarity between winter and spring. Major conservation threats found were fish farming in Tal for commercial purpose, dumping solid waste in the tal, thriving of water hyacinth, agricultural seepage, hunting of birds and collecting eggs, disturbance to birds from the noise from recreational activities, livestock grazing and infrastructure expansion on the edge of tal. The efforts to promote sustainable use of Badhaiya Tal, well managed recreational activities, minimization of dependency on wetland, discouraging of the nutrient increasing factors in Tal, ownership feeling of local people can establish this wetland as an important site for wetland avifauna and other large number of other bird species. Removal of water hyacinth *Eichhornia cracippes* time to time is being helpful for conservation of Badhaiya Tal via population control but scientific measure for the maintenance of the water level should be provided.

**Key Words:** Wetlands, Birds, Diversity, Threats, Conservation

42      **Analysis of forest fire trend and risk zone mapping using remote sensing and geographic information system in Rupandehi district**

**Researcher:** Sandeep Bagale  
**Supervisor :** Himlal Shrestha, PhD

Forest fire is burning issue in the world. It is one the major cause of forest destruction and degradation. Although in some ecosystem fire plays vital role for ecosystem dynamics and productivity the overall impact of forest fire is negative. Its impact can be seen in environmental, economic and socio culture of a country or a society. Fire is a disaster in itself causing billions of wealth in suppressing activities. As we know prevention is better than cure, it will be best to prevent future forest fires. In developing countries like Nepal, fire can be seen as a major disaster. To prevent future fires and to plan and implement plans a detailed study must be carried out. This research attempts to study the forest fire in Rupandehi district of Nepal by use of geospatial data and local perception data. Moderate Resolution Imaging Spectroradiometer (MODIS) fire data was used for analysis of trend and vector data was used for calculation of burned area in specific time period. The study looks up into forest fire trend from 2002-2018. 355 fire hotspots were found, out of which 229 hotspots were detected as forest fire. Fire hotspots were only found in five local governments. Local perception survey was done through purposive sampling was done in those local governments. Key informant questionnaire survey was done for perception survey. Forest fire and its relation to different driving factors was also studied. 110 key informants were selected, questionnaire was done in order to get meet the objectives. ArcGIS 10.3 and MS- Excel 2013 was used for geospatial and statistical analysis respectively. From the study it is found that most forest fire are deliberate in nature. The most fire occurred in closed canopy broad leaved forest. Months of March, April and May are found to be most fire sensitive months. Efficient coordination with different CFs, District Forest Office, different agencies, and institution is important for forest fire prevention and control. Policy for life insurance for firefighting teams and people should be formulated.

**Key words:** Forest fire, MODIS, ArcGIS, Risk zone

43      **Status of good governance in community forest user groups (a case study of Masthamadhau and Thapley community forests of Achham district)**

**Researcher:** Arjun Dhungana  
**Supervisor :** Murari Raj Joshi

*Mikania micrantha* is a multi-branched, invasive, perennial vine which is native to Central and South America. It has exceptionally fast growth rate spreading like a wildfire in the tropical areas of Nepal that has invaded of about 20 percent area of Chitwan National Park. Despite being a major problem, there exists little information about the ecology and impact of *Mikania* on floral diversity and Rhino habitat in Chitwan National Park. Based on this research gap the main objective of the study is to assess the impact of *Mikania* invasion on diversity of native plant species and Rhino food habitat in Kuchkuche Buffer zone Community Forest of Chitwan National Park. For collecting data, the Buffer zone Community Forest was divided into two strata ie; Forestland and Grassland. Within each stratum, botanical data on floristic composition was collected having 50 plots with 35 plots on forestland and 15 plots on grassland with one percent sampling intensity and 314 meter square of plot size by using the method developed and used by the International Forestry Resources and Institutions . Data was analysed using different diversity indices such as Simpson's Diversity Index, Shannon-Weinner Diversity Index, Pielou Evenness Index and Importance Value Index. On the basis of availability and quality of five major plant species that Rhino favours in its grassland and forested land, its food habitat was analysed under different *Mikania* cover. Out of 50 plots sampled in the study area, 74 percent of plots were found to have *Mikania* invasion. The species diversity was found to be less in *Mikania* non invaded site as compared to invaded sites due to initial stage of *M. micrantha* invasion. *Trewia nudiflora* was found to be dominant over all *Mikania* cover categories whereas *Albizia lucida* had a gradual decrease in IVI with gradual increase in *Mikania* cover. While testing the tree growth, negative impact of *Mikania* cover was seen on IVI of major tree species, and negative correlation was seen between *Mikania* cover and growth performances (DBH and height) of tree species. Summing up, it is concluded that *Mikania* was not found to have negative impact only. It can act positively on the diversity of species as well. Since *Mikania* has impacted the IVI of particular species, the management authorities should be concerned while carrying out plantation of such species and follow interventions to minimize the spread of *Mikania*.

**Key words:** Accountability, Community Forest User Groups, Governance, Participation, Transparency, Predictability etc.

**44 Assessing the contribution of community forest on livelihood of user group members (a case study of Satya and Sarashwoti community forest user groups of Lalitpur district).**

**Researcher:** Ram Sundar Ghimire

**Supervisor :** Arun Sharma Poudyal

The research study on Assessing the Contribution of Community Forest on Livelihood of User Group Members (*A case study of Satya and Sarashwoti Community Forest User Groups of Lalitpur district*) was conducted in Satya and Sarashwoti CF of Lalitpur district. The main objective of the study was to assess the overall role of community forests on livelihood improvement of user group members by promoting local environment. Both primary and secondary data were collected using PRA tools and techniques such as wellbeing raking, household survey or semi-structured interview, key informant interview, focus group discussion, and field observation etc, and secondary data were gathered from CFUG and DFO records, and other published and unpublished reports, journals and publications. Majority of the total respondents (47%) were small farmers having land in between 3-4 ropani. Only 15% of the total respondents of both CFUGs were producing food sufficient for year round from their farmlands. The rest of the households were suffered from food security problems and had managed foods from different alternative sources such as sale of livestock and their products, labor, business and other sources. Satya and Sarashwoti Community Forest CFUGs have generated Rs. **73375** and Rs. 51000 respectively from the sale of forest products, membership fees and fines, and rewards, and nearly 35% of that fund was used on livelihood improvement. Capacity of 135 CFUG members in Satya CFUG members and 91 CFUG members in Sarashwoti CFUG has been strengthened through trainings, workshops and study tour. Due to this, the forest dependents were capable in doing forest management and IGA such as goat farming, poultry farming, vegetable farming, and sewing and (*Thysanolaena latifolia*) Amrisho Cultivation, Bamboo Cultivation and community development activities such as road and school construction, toilet construction etc. Finally, poor, women and Dalit households in Satya CFUG members and in Sarashwoti CFUG were benefitted directly from community forestry development and management activities.

**Key words:** Community Forest User Group, Community Forest, Community development, Livelihood improvement, Income generation activities etc.

45 **Exploring the uses of bamboo as a means of soil conservation, land restoration and its status in Madi municipality, Chitwan district, Nepal.**

**Researcher:** Niraj Dhakal

**Supervisor :** Shiva Shankar Neupane

Bamboo protects steep slopes, soils, waterways, prevents soil erosion, sequester carbon and brings many other ecosystem benefits. Chitwan is highly affected by flood and drought, restoring soil fertility and nutrients in those lands is a challenge. Bamboo species has stood up as a key factor in restoring degraded land. Bamboo are generally found in tropical and subtropical areas of Nepal. Madi municipality in Chitwan district has more than 20 small rivers. These areas are highly affected by the impact of flood. With agriculture being the major occupation of Madi, it is necessary to restore environmentally degraded land for maximum production. This study assessed different local techniques practiced by local people for soil conservation and restoring environmentally degraded land with combination of bamboo.

Purposive sampling was carried out because of time constraints and area being huge due to scattered bamboo stands. Questionnaire survey, key informant survey, focus group discussion and direct observation was carried out to collect the data. Also, secondary data were acquired from journal articles, reports, national park office, books and various other sources. This study helped to show how bamboo are located throughout the study site. Condition of land having bamboo and understanding its importance for land restoration was assessed. Different case studies assisted to show importance of bamboo in riverbank. The survey provided positive results with 16 bamboo species found from the area. Bamboo are found more in riverbanks than Khet and Bari. Bamboo is playing an important role in reclaiming degraded land, changes in soil condition from various places having bamboo is the indicator of it. Cost for construction of structural measures is high, which is one of the reasons why most of the landowner preferred bamboo as a natural embankment protection than other trees and structural measures. Madi is suitable to grow bamboo species as it consists of lots of rivers and it supports people's livelihood too.

**Key word:** Bamboos, Soil erosion, land restoration, environmental conservation

46 **Human-elephant conflict and its mitigation measures (a case study of Hungse Dumse community forest, Damak, Jhapa)**

**Researcher:** Prajina Rai

**Supervisor :** Jhamak Bahadur Karki, PhD

Human-Elephant conflict is the significant problem in Nepal and one of the major threats to the long term survival of Asian elephants. Hungse Dumse community forest is one of such place where numerous conflicts between Asian elephant and human settlements are occurring. The current study was conducted to access the extent of conflict such as crop damage, property damage and human casualties. Besides people's perception and attitude towards wild elephants and the techniques adopted by the local peoples to reduce the conflicts was studied. The study was conducted in ward no 2 and 3 of Damak Municipality lying near forest. Household survey was conducted in effected households of Hungse Dumse CF, Damak, Jhapa using Simple random sampling techniques involving both semi structure and open ended questions. Total 200 heads of effected households were interviewed along with 15 key informants and 4 focus group discussion. People of Hungse Dumse largely depends on subsistence agriculture and relies on primary crops like paddy, maize, wheat, millet of these two major crops paddy and maize were mostly raided by elephants in two peak harvesting season Oct-Dec. for paddy and Maize for April-July. The total estimated economic loss in last two years was found to be NRs 1.6864 million. The damages were more acute near jungle area. Two peoples have been killed and three minor injuries had occurred by wild elephants in last 14 years.

Several techniques have been used to chase wild elephants from the field however use of fire and shouting was the most commonly used mitigation measures but the people were not satisfied with these traditional mitigation measures due to their limited effect. Despite increased HEC in that area majority of respondents showed positive attitude towards conservation of elephants. There was no relation between elephant damage experience and peoples attitude towards elephants conservation. This study implies that the presence of wild elephants has increased the vulnerability to the local peoples living around the Hungse Dumse CF, Damak, Jhapa. A quick relief scheme to the effected households and solar fence for should be implemented for the reduction of conflict between people and wild elephants.

**Key words:** Asian Elephants, Human-Elephant Conflict, Crop damage, Property damage, Human casualties, Relief scheme

**47 Assessing air pollution tolerance index and anticipated performance index of some tree species for development of urban forest in Kathmandu valley**

**Researcher:** Asmita Rai

**Supervisor:** Ram Asheshwar Mandal , PhD

Effectiveness of Urban forest in improving air quality depends on plant species planted, thus it is important to choose species that is tolerant to air pollution. However, poor selection of appropriate species has been a major hurdle in Urban forest development in Nepal. There are very limited studies related to it. Thus, this study was objectively carried out to find appropriate species for development of Urban forest based on indices: APTI (Air Pollution Tolerance Index) and API (Anticipated Performance Index). Roadside plantations from Baneshwor to Tinkune, Pulchowk to Maitighar and National Botanical Garden, Godawari of Kathmandu valley were selected as study sites. Air Pollution Tolerance Index of five tree species namely *Cinnamomum camphora*, *Ficus benjamina*, *Ficus elastica*, *Prunus cerasoides* and *Syzygium cumini* was assessed by analyzing their biochemical parameters i.e. Total Chlorophyll (TCH), pH, Ascorbic Acid (AA) and Relative Water Content (RWC) in the lab. Similarly, Anticipated Performance Index of these species was evaluated by incorporating biological and socio-economic characteristics along with APTI values. APTI showed that *Cinnamomum camphora* ( $18.40 \pm 2.51$ ) and *Ficus elastica* ( $17.421 \pm 4.27$ ) were tolerant whereas *Prunus cerasoides* with lowest APTI ( $10.175 \pm 0.51$ ) was sensitive. *Ficus benjamina* ( $13.660 \pm 1.09$ ) and *Syzygium cumini* ( $11.930 \pm 0.41$ ) were intermediate to air pollution. One-way ANOVA followed by Tukey's b showed that there was significant differences in APTI as well as biochemical parameters of different species according to sites. Linear regression analysis of biochemical parameters revealed that Ascorbic acid ( $R^2=0.9666$ ) is the most influencing factor to determine the air pollution tolerance capacity of plants. API indicated that *Cinnamomum camphora* and *Ficus elastica* with 75% score (API =5) are very good performers while *Ficus benjamina* and *Syzygium cumini* with 56.25% score (API = 3) are moderate performers. *Prunus cerasoides* with 31.25% (API=1) is very poor performer. Based on these indices (APTI and API), the present study recommends *Cinnamomum camphora* and *Ficus elastica* as suitable tree species for development of Urban forest in Kathmandu valley for abatement of air pollution sustainably .

**Key words:** Urban forest, Air Pollution Tolerance Index, Anticipated Performance Index

**48. Comprehensive forestry internship at international union for conservation of nature,  
Nepal.**

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**Supervisor :** Him Lal Shrestha, PhD