

**M.SC NRMRD**  
**Abstract of Thesis**  
**1<sup>st</sup> Batch (2015-2017)**

**1. Spatial and temporal distribution of forest fire in TAL and CHAL areas**

**Researcher:** Ashok Parajuli

**Advisor:** Ambika Prashad Gautam, PhD

Each year forest fire is causing enormous damage to the Nepal's forest ecosystems and landscape. There is an immediate need to identify methods to model forest fire risk enabling the sustainability of the natural resources while integrating the local people's priority. This research used the geospatial technology and statistical tools for developing forest fires risk model, adaptation measures and post-fire evaluation in two major landscapes of the country i.e. Terai Arc Landscape (TAL) and Chitwan Annapurna Landscape (CHAL). MODIS hotspot satellite data from 2001 to mid-2018 and other variables were integrated using geo spatial technique. Fire related perception survey was carried out in six districts in order to know the priority of community forest managers using Kruskal-Wallis and Kendall tau's test. A multiparametric weighted index model has been adopted to derive and demarcate the 'forest fire-risk' area map with five categories.

Geospatial results show that fire counts have strong relation ( $R^2 = 0.82$ ) with burnt area where annually 1181 fires occurred by burning 1141 km<sup>2</sup>. Pre-monsoon season (March to May  $\approx 86\%$ ) records major counts maximum in April (54%) with highest in broadleaved forest ( $\approx 79\%$ ) when the temperature is above 30°C ( $\approx 74\%$ ) on the slope below 15% ( $\approx 57\%$ ) towards the southern aspect ( $\approx 57\%$ ). The findings also show that majority of the fire incidents were of anthropogenic origin while Community Forest favoured fuel management and infrastructure along with insurance mechanism. More than half of the total forested area (65%) in the landscape has been found to be high risk where TAL takes two-third of those risk areas. Half of the districts within the landscape fall under the risk with (above 40%) locating mainly in the rural municipalities of the mid-western and central Terai of Nepal. Finally, to enhance the use of fire risk map, collinearity between variables were checked ( $VIF < 2$ ) and then validated with the MODIS hotspots and Kernel Density Estimation (KDE) method. The result indicates 87% of fire counts and 65% of area in the high-risk class respectively. The results of the study are expected to help will help the decision makers to implement preventive measures by identifying and minimizing the risk and impacts caused by forest fires.

**Key Words:** Fire Management, Fire Risk Zone, Adaptation measures, Kruskal-Wallis

## 2      **Assessing the Growth Performance of *Tectona grandis* in Nepal**

**Researcher:** Babu Ram Pokhrel

**Advisor:** Ram Asheshwar Mandal, PhD

The growth performance of *Tectona grandis* was not so far assessed in Nepal. Therefore, this study was objectively carried out to assess the growth performance and relating their growth to soil nutrients. Community and private *T. grandis* plantation forest of seven Tarai districts of Nepal were selected for the study site. Stratified random sampling was carried out to collect the sample. Altogether 215 sample plots having 20m \*25 m size so diameter and height of 8644 plants were measured as well as spacing was recorded. Among total plants, 853 trees having spacing of <2m, 2-2.49 m, 2.5 to 3 m and 4 m from private forest of Rautahat, Nawalparasi and Kapilbastu districts were measured to analyze the effect of spacing on growth. The age of the plantation was noted from plantation report. Meanwhile, 102 soil samples were collected from 0-10, 10-20 and 20-30 cm depths. The basal area, volume, biomass and carbon were analyzed. as well as N,P,K,C, pH and bulk density were analyzed in lab. Moreover, inferential and descriptive analysis was analyzed. The result showed that mean annual stem volume was 171.46 m<sup>3</sup>/ha in community plantation and 92.61 m<sup>3</sup>/ha in private plantation. The study showed that lack of early thinning operation has severely affected the growth of diameter and height where there is high density. The values of soil phosphorus were significantly higher in private plantation than community plantation. Conversion of natural forest, burning and fire risk may be the causes for this. Soil from both plantations was found to be moderately acidic. Other soil parameters like N, K, BD, C were similar in both regimes. It was found that increasing the spacing has positive effect in diameter and height increment. Significant positive correlation was found between the available phosphorus and growth parameters in both plantation areas. Immediate application of thinning operations and planting spacing of greater than 2.5 m has been recommended for better growth performance of *T. grandis* plantation in Nepal. This study will be useful to see the effect of thinning, spacing and soil fertility on growth performance.

**Key words :** community, growth, plantation, private, spacing, , *Tectona grandis*

### **3 Assessment of Human Elephant Conflict In Koshi-Tappu Wildlife Reserve, Nepal**

**Researcher:** Bhoj Raj Pantha

**Advisor:** Jhamak Bahadur Karki, PhD

Human-Elephant Conflict (HEC) is one of the key challenges of the wildlife conservation in Koshi-Tappu Wildlife Reserve (KTWR), Nepal. Inhabitants around the reserve are suffered from human depredation, crop raiding and property damage, which results in negative attitude of local people towards elephant conservation. So, it is rational to assess the HEC in KTWR. This study was objectively carried to assess the nature, extent and spatial distribution of major conflict sites, to explore the causes of HEC and to assess the ways that reduce the HEC and people's perception towards elephant conservation in KTWR. Key informant's interviews; focal group discussions, site observations and households survey method were adopted to collect primary data and secondary data was collected from office record of KTWR, published articles and Journals. Data were analyzed using different graphs, charts, Likert's scale and non parametric test. Most of the crop raiding and property damage by elephant were occurred at night whereas Male elephant frequently damage during the harvesting season and paddy was the highest damaged crop in KTWR. Damage trend was increasing in last five years. Eleven people died and thirteen people were injured by elephant attack whereas one Male elephant was also killed during last five years period. In all human casualties, 20.83% cases were reported in <200m, 29.16% in 200-500m, 12.5% cases in 500-1000m and 37.5% cases in >1000m from the reserve boundary. There was no significant difference between distance from the reserve boundary and human casualties but elephant was biased towards male and 79.16% human casualties were offended at the age of 40-70 years. Highest casualties were recorded in year 2017 and maximum numbers of cases were reported in Kushaha-Laukahi BZUC (42.54% property damage, 82.16% crop raiding and 37.5% human casualties). However, people perception was found positive towards elephant conservation. 71%-82% people were agreed that elephant should be conserved. Habitat management, extension of reserve area, conservation awareness program, alternative cropping, built and rebuilt of electric fencing and easy and satisfactory compensation/relief process could be the solution to reduce HEC in KTWR.

**Key words:** Conflict, Elephant, Crop raiding, Human casualties, Koshi-Tappu Wildlife Reserve (KTWR).

#### 4 Effect of Slope Aspect and Altitudinal Gradient on Carbon Stock Dynamic and Stand Stability in *Pinus roxburghii* Plantation Forest of Kavrepalanchok, Nepal

**Researcher:** Bishow Dhakal

**Advisor:** Ram Asheshwar Mandal PhD

The altitude and aspect are important factors affecting the carbon sequestration and stands stability but such studies are very limited in *Pinus roxburghii* plantation, Nepal. Thus, this study was objectively conducted to assess, analyze and compare carbon stocks and stand stability condition between different altitudes (above 1000m and below 1000m) and slope aspects (North, South, West and East). Plantations of *Pinus roxburghii* at Ratomate CF, with 650-1500m altitude, facing North and West and Bhirbari Solathape Community Forest having 750-1300m altitude, facing South and East were selected as the study sites in Kavrepalanchok district.

Stratified random sampling was applied to collect the data. Altogether 60 samples were collected. Specifically, concentric sample plots having 250, 100, 3.14 and 1 m<sup>2</sup> for tree, sapling, seedling and LGH was used respectively. Destructive method was applied to collect samples of seedling, litter and herbs/grass. In addition, 48 soil samples were taken from 0-10, 10-20 and 20-30cm depths representing the slope aspects and different altitudes. Collected data was processed and biomass carbon was calculated using equation developed by Chave *et al.*, Then, biomass was converted into carbon multiplying with 0.47. Soil carbon was analyzed applying Walkley and Black method. The c/h ratio was used to evaluate the stand stability. Independent-sample t-test was used to compare the effect of altitude on carbon stock density as well as c/h ratio. Moreover, one way ANOVA was applied to check the effect of slope aspect on carbon stock as well as c/h value.

The result showed significance difference in total carbon stock between different altitudes; higher with 268.06±15.62 t ha<sup>-1</sup> in below 1000m and lower with 218.85±14.11 t ha<sup>-1</sup> in above 1000m. The total carbon stock was seen highest in North with 272.89±26.11 t ha<sup>-1</sup>, lowest in South with 207.57±19.27 t ha<sup>-1</sup>, 228.97±18.19 t ha<sup>-1</sup> in West and 267.38±23.61 t ha<sup>-1</sup> in East slope aspect. However, one way ANOVA showed that there was insignificant effect of slope aspects on total carbon stock.

Furthermore, the result showed significance difference in c/h ratio between different altitudes; higher with 0.48 in above 1000m altitude and lower with 0.46 in below 1000m. The c/h ratio was seen to be highest in North with 0.49, lowest in West with 0.45 where 0.48 in South and 0.46 in East slope aspect. However, one way ANOVA showed that there was insignificant effect of slope aspect on c/h ratio. Since, c/h value ranged between 0.45 to 0.49, tree strata stability condition was interpreted as unstable in both altitudes and all slope aspects. This research will be useful to show the effect of altitude and slope aspect on carbon stock as well as the stability condition of the forest.

**Key Words:** Carbon sequestration, Stand stability, Altitude, Slope aspects, *Pinus roxburghii*

## 5 **Illegal Trade Status of *Pterocarpus Santalinus* and its Management Options in Nepal**

**Researcher:** Dambar Bahadur Bhandari

**Advisor:** Jhamak Bahadur Karki, PhD

*Pterocarpus santalinus* Linn.f. Family Leguminosae (Red sander) under CITES Appendix- II, is an endemic plant species to southern India. Being a high demand of heartwood of Red sanders in international markets is causing the decrease of the species in wild habitat. Generally, smugglers use Nepal as transit for illegal export of Red sanders to China. In this context, Government of Nepal has seized the illegal specimens of Red sanders and filed several cases. Therefore, this study was objectively carried out to assess the illegal trade status, routes and management options of seized and confiscated specimen of *Pterocarpus santalinus* in Nepal. Qualitative approach was used in collecting primary data and includes methods like Key informant interview(46) and short meeting, while secondary data were collected from respective National CITES management and scientific authorities, DFOs/PAs/Courts case registration registers related to Red sanders. The information's were analyzed using SPSS, Microsoft excel, Arc GIS, and Google earth.

A total of 272.4 Metric tons of Red sanders were seized and confiscated in 106 events from two PAs and 20 District forest offices. Kathmandu valley was the main trade hub of the specimen which connects to China and other global market via land and aerial routes. Along with detours, for transporting of the specimen, traders used both manual (porter) as well as vehicles such as two wheelers and four wheelers. The wide ranges of vehicles including ambulances and vehicles modifications were used for concealment and mis-declaration for smuggling mainly from seven exit points for China.

Out of detained quantity, 36.928 Metric tons was already repatriated to India moreover different courts have ordered to seize 143.96 Metric tons and manage it as per the rule. In addition, 27.48 Metric tons of unclaimed specimens were confiscated. 171.44 Metric tons specimen of *P.santalinus* need to be repatriated as provisioned by CITES Convention, (the) CITES Act of Nepal and courts' decision. If the country of origin is not interested to repatriate, in line with CITES act and provision, either can be utilized for medicinal purpose or to destroy. Thus, there is immediate need to capacitate the manpower to identify, and regulate the entry of specimen.

**Key words:** *Pterocarpus santalinus*, Confiscation/ Seizure, Route, Management options, illegal Trade

## 6 **Distribution Occupancy, Potential Habitat and Conservation of Recolonized Himalayan Wolf in Upper Mustang Annapurna Conservation Area, Nepal**

**Researcher :** Deu Bahadur Rana

**Advisor :** Him Lal Shrestha PhD

Annapurna Conservation Area (ACA) is highly potential and domineering ecological habitats for wildlife and fauna. The region is home to elusive wild animals such as Himalayan wolf, Snow leopard and Tibetan fox. Himalayan Wolf (*Canis lupus chanco*) is the ancient lineage of the dog-clade which is historically inhabiting in the Nepalese Himalaya, which has been extirpated from the most of its historic range since a couple of decades. Majority of the people in the region depends on livestock herding and tourism. Maximum Entropy (MAXENT) model was used to find the potential habitat of Himalayan wolf in Upper mustang, ACA. Presence-only data were collected throughout the feasible 2\*2 Km<sup>2</sup> grids. To get the better result 13 environmental variables were computed. Raster images were worked in ArcGIS and EDRAS Imagine and computed in MAXENT. The Naïve occupancy of Himalayan wolf was estimated 71.87%. Relative Availability Index and average entropy values were 2 sign samples/ km and 7.929 respectively predicting the whole study area potential wolf habitat. 1089 km<sup>2</sup> area is estimated as potential Himalayan wolf habitat out of 2076.56 km<sup>2</sup> studied. The study also shows high habitat overlapping between carnivores and livestock.

MAXENT model has shown high level of predictive performance with an 'Area Under Curve' between 0.876±0.983 and average Standard Deviation 0.044. It is understood that AUC value closer to 1, more suitable the model against computed predictive variables whereas lesser the value of Standard Deviation, less chance of over-fitting among the presence data. The model has revealed the precipitation of coldest quarter contribute significant role in predicting the wolf habitat distribution between 3000m to 5300m. This study finds that, grassland with the slope less than 20 degree and area near to the river are best for potential distribution of wolves, and acts as the baseline information for further research and conservation despite of very few studies and information documented in the Nepalese Himalaya. Imminent action and more studies should be initiated for species conservation. Furthermore, research on elusive animals like wolf, their suitable prey base and human-wolf relationship by building communal harmony and through effective conservation techniques is very important for future.

**Keywords:** Himalayan wolf, Carnivores, Livestock, Distribution, Occupancy, Maximum entropy, Potential habitat, Conservation

7 **Economic importance and Conservation status of Yarsagumba (*Ophiocordyceps sinensis*) in western Nepal (A study from Guthichaur Rural Municipality-Jumla, Province: Karnali)**

**Researcher:** Krishna Ram Dhital  
**Advisor:** Ambika Prasad Gautam, PhD

Yarsagumba acts as crucial role for economic building and livelihood opportunities in western Himalayan district. Each year, after the celebration of Nepalese New Year, the operation for Yarsagumba harvesting starts on. This harvested Yarsagumba served as annual income source and employment opportunities for rural livelihood. To assess the economic dependence and conservation status was the most objectives of this research. So, both primary and secondary data collection was done with using simple random methods with household's survey in 197HHs, 2 focus group discussion, numbers of key informant survey with rest secondary sources data. These data were input in MS excel 10 and then analyzed with using MS excel 10 itself, R and GIS. This research shows that, mean annual increment of Yarsagumbas' harvester was with 9.1 percent which helps to create 39 days of mean annual employment status. Similarly, with this Yarsagumba other five more NTFPs were highly harvested from the study site in which Setokchini was highest with 65 percentage of engagement. Again all these NTFPs shares about 65.1 percent of annual income sources of household and Yarsagumba shares alone with 70.2 percent of in total contribution of NTFPs. Similarly majority of harvester prefers for the rangeland of Dolpa with 76.1 percent followed by Jumla and Mugu. Almost of these harvesters believes on Yarsagumba is in decreasing rate with 30 percent of respondents believes that Yarsagumba is decreasing with more than 50 to 100 percent of rate. Though local harvesters believes on Yarsagumba is in decreasing but there is not any conservation initiative done by local harvesters itself, local authority and forest office etc. Similarly for the Yarsagumba harvesting and trading, Forest Act 1993, Forest rule 1995, Himalayan National Park Rule 1979, Yarsagumba Management (harvest and trade) Directive 2016 are major rules and policies acting upon Yarsagumba. Finally continuous increasing in the number of harvester and less in the number of Yarsagumba harvesting ultimately threaten on economic building of local livelihood and ecological abundance. Similarly poor conservation initiative will also harm on sustainable harvesting and management of Yarsagumba.

**Keywords:** Yarsagumba, Trade, Jumla, NTFPs, Livelihood, Conservation

## **8 Assessing the distribution pattern and regeneration status of *Pterocarpus marsupium* (Bijaysal) in three community forests of Kanchanpur District.**

**Researcher:** Hemant Budhathoki

**Advisor:** Ambika Prasad Gautam, PhD

*Pterocarpus marsupium* (Bijayasal) is a tall deciduous tree species belonging to the family Fabaceae. This multipurpose tree species mainly inhabit in tropical forest areas mainly in the far-western Nepal. Because of rarely abundance, GoN has enlisted this tree as protected tree species since 31 December 2001. The International Union for Conservation of Nature (IUCN) has also categorized this species as “Near Threatened” in the red data book. There are very few past studies regarding the distribution of tree and poles in different elevations, diameter and height distribution and regeneration status of *Pterocarpus marsupium* in Kanchanpur district. Therefore, to fulfill the gap, this research was conducted. Similarly three community forests (CF) namely; Sahid Smriti CF, Bedkot CF and Janahit Mahakali CF were taken as study sites. The stratified systematic sampling method was used for the study. Quantitative data were analyzed by simple statistical tools such as frequency, mean, percentage, standard deviation and range and qualitative data information and attitudes were analyzed by ordering, ranking with descriptive manner. The results are presented through text, Tables and Figures with interpretation accordingly. The result show scattered distribution of *Pterocarpus marsupium* in all three Community Forests. It was found limited even in pocket area. All the surveyed trees and poles of *Pterocarpus marsupium* were found below the 350m elevation above mean sea level. It was found mainly distributed along the Churia foothills. The regeneration status was found to be relatively good in Janahit Mahakali Community Forest of Krishnapur Municipality and poorest in Bedkot Community Forest of Bedkot Municipality. Control in open grazing and forest fire favored the natural regeneration of *Pterocarpus marsupium*.

**Key words:** Bijaysal, distribution, Tree and Poles, Regeneration, Threatened, Kanchanpur

9 **Effects of integrated watershed management on soil carbon and fertility in Bhataulikhola and Kulekhani watershed, Nepal.**

**Researcher:** Pasang Tamang

**Advisor:** Ram Asheshwar Mandal, PhD

Integrated watershed management is importantly considered as effective tools to manage natural resources including soil. Thus, it is rational to evaluate the effect of management on the soil characteristics. This study was objectively carried out to show the spatial and climatic condition of the Kulekhani and Bhataulikhola watersheds, assess the vegetation cover change 1992 and 2015 of the watersheds, determine soil fertility and organic carbon and compare them. The spatial image of 1992 and 2015 was archived from USGS portal. In addition, the digital elevation model was also prepared. Altogether, 144 soil samples were collected from three different altitudinal gradients and four land use types. Soil samples were collected from 0-10, 10-20 and 20-30 cm. The images were classified into forest, shrub, grass, sandy area and barren land. These thematic maps were compared. In addition, Soil organic carbon and nitrogen were analyzed using Walkley and Black and Kjeldahl method respectively and available phosphorus was analysed by Bray method. The result showed that there was increase in forest area 1647.04 ha in Kulekhani but it was decreased by 1911 ha in Bhatauli watersheds. The results showed that mean SOC of Kulekhani watershed altitude below 1700m was the highest  $26.71 \pm 3.07$  t ha<sup>-1</sup> in Agriculture land and total nitrogen was  $0.13 \pm 0.01\%$  in Forest land. SOC was the highest  $43.75 \pm 7.03$  t ha<sup>-1</sup> in Shrub land between 1700-2000m. Total nitrogen was the highest  $0.25 \pm 0.03\%$  Shrub land and altitude above 2000m mean SOC was found highest  $42.31 \pm 2.23$  t ha<sup>-1</sup> in Agriculture land and total nitrogen was the highest  $0.85 \pm 0.78\%$  in shrub land. Meanwhile, SOC of Bhataulikhola watershed altitude below 1700m was the highest  $6.15 \pm 0.72$  t ha<sup>-1</sup> in Agriculture land and total nitrogen stock by  $0.09 \pm 0.01\%$  in agricultural land. Between 1700- 2000m altitude, SOC was the highest  $11.26 \pm 0.09$  t ha<sup>-1</sup> in Forest land and the highest total Nitrogen was  $0.25 \pm 0.03\%$  in Agriculture land. At altitude above 2000m mean SOC was found to be highest in Agriculture land  $14.25 \pm 0.3$  t ha<sup>-1</sup> and total nitrogen was the highest in agricultural land  $0.31 \pm 0.01\%$ . The present study revealed that the effect of integrated watershed management was significant on soil organic carbon and its fertility enhancement. Soil organic carbon depends on the soil depth highest in 0-10 cm depth and minimum in 20-30 cm depth. Soils of better management watershed stocks higher SOC and N,P,K compared to less management watershed.

**Keywords :** Integrated watershed, Landuse, organic carbon, Total nitrogen, soil depth

## 10 Distribution effects and management option of *Mikania micrantha* in Solakhpur forest

**Researcher:** Rita Yadav

**Advisor:** Ram Asheshwar Mandal PhD

*Mikania micrantha* is one of the major threats of forest ecosystem to conservation biodiversity in Nepal such as Terai areas of Nepal and protected areas of Terai forest. Such types of research are limited in Nepal. Thus this research was objectively carried out to know the distribution of *Mikania micrantha*, its effects on different sectors and local management options. Solakhpur in Sabaiya subdivision forest was selected as the study site. The random sampling was applied to carry out the research. Altogether 34 samples were taken for study to know the distribution of *Mikania micrantha* in different location established by grid for exacted location participatory survey was used for taking sample. The samples were of 25 m × 20 m for trees, 10 m × 10 m for poles and 5 m × 5 m for regeneration. Total 100 questionnaire survey, focus group discussion and Key informants interviews were taken. The diameter height and distance were measured and regenerations were counted. Distribution mapping was prepared, simple statistics, t-test and one way ANOVA, multiple comparison test were applied for statistical comparison. The results showed that distribution of *M. micrantha* was found in different sites such as more in riverside areas followed by forest area, grazing land. Invasion of *M. micrantha* has created no plant growth on the ground. Tree species were invaded by *M. micrantha* such as *Shorea robusta*, *Anogiosus latifolia*, *Terminalia tomentosa*, *Acacia catechu*, *Dalbergia sissoo*, *Mallotus philipinesis*, *Bombax ceiba*, *Alostania scholaris* etc affected by *M. micrantha* inside the Forest. Major distribution was seen outside the forest area at roadside, farmland, home garden and riverside of village area likewise grass availability were decreased on the bank of river, roadside and surrounding areas of public lands outside the Solakhpur forest. Tree species invaded by *M. micrantha* were observed such as *Eucalyptus cameldulensis*, *Dendrocalmus strictus*, *Dalbergia sissoo*, *Mangifera indica*, *Pseudium guava*, *Hetrophyllus spp.*, *Acacia Catechu* plants outside the forest area. Local people were using both Herbicides to overcome weed infestation as well as traditional methods such as uprooting, digging, drying and burning of lati (lahara/jhar /vine) were practiced to minimize invasion *M. micrantha* on their farms. Uses of biomass of *M. micrantha* in dried cow dung, fencing wall of farm house and also used to warm in cold season outside the forest. Altogether distribution of *M. micrantha* was found in 32 locations of forest, most invasion were seen at boundary of forest, disturbed sites, riversides, temple sites and grazing sites of forest area moreover roadside area outside of Solakhpur forest were also seen invaded by *M. micrantha*. The independent t-test showed that there was significant difference in number of affected plants due to invasion of *M. micrantha* in different location of forest and One way ANOVA showed that there was significant difference in effect of invasion of *M. micrantha* with respect to different site. The core area of *Shorea robusta* forest, its regeneration and *Tectona grandis* forest are potential to invade by *M. micrantha* so valuable forest of Solakhpur must be protected from invasion by IAPs.

**Key words:** Effects, Invasion, IAPs, NTFPs, Management,

## 11 Comparative assessment the effects of forest management activities on tree species diversity composition and its stocks

**Researcher:** Yom Bahadur Oli

**Advisor:** Ram Asheshwar Mandal PhD

The global biological diversity have been affecting due to the anthropogenic activities. The quality timber is main concern of the forestry professionals. Sustainable forest management practices have been just initiated in Nepal. There may be positive or negative effects on species diversity, composition and stock. The studies related to these issues are limited in Nepal so this research was objectively carried out to explore and assess the effects of forest management activities on tree species diversity, composition, and its growing stock.

The 1-yr and 7-yr old felling series (FS) as well as control plot of three sub-compartments in Tilaurakot collaborative forest were selected as study site. Stratified random sampling was applied based on felling series. Altogether 76 samples were taken in nested quadrates having 20m\*25m for trees, 10m\*10m for poles, 5m\*5m for saplings and 5m\*2m for seedlings respectively. At centre soil samples were collected from 0-10, 10-20 and 20-30cm depths. Diameter at breast height (DBH) and height of trees and poles were measured and number of saplings and seedlings was recorded. Additionally, crown widths of trees and the distance of competitor trees from the subject tree were measured. Species richness was estimated by the number of species found in felling series and diversity was estimated by using Alpha, Beta, Gamma, Simpson's diversity index, Shannon diversity index and evenness formula. Species composition was determined by applying frequency distribution, growing stock was estimated applying the formula of volume and density. The limiting factors were assessed using competition index, typical tree crown area. Moreover, soil components N, P, K and OM were estimated by using Kjeldahl method, Olsen's and Somers method and Colorimetric method respectively.

The Simpson's diversity index, Shannon diversity index and evenness were found to be the highest ( $0.740 \pm 0.052$ ), ( $1.689 \pm 0.213$ ) and ( $0.909 \pm 0.004$ ) respectively in 1-yr old felling series at over storey on contrary it was found to be the highest ( $0.780 \pm 0.035$ ), ( $2.153 \pm 0.261$ ) and ( $0.935 \pm 0.102$ ) respectively at under storey in 7-yr old FS. However one-way ANOVA showed that there was no significant differences ( $p > 0.05$ ) in the indices values. *Shorea robusta* was dominant in all FS followed by others like *Terminalia alata*, *Terminalia belerica* and *Adina cordifolia*. The tree density and volume were found to be the highest (62) and (84.71 m<sup>3</sup>/ha) respectively in control plot. The competition index and typical area were found to be the highest ( $0.294 \pm 0.005$ ) and ( $38.847 \pm 6.682$ ) correspondingly in control plot. The soil N, P, K and OM were found to be highest at 0-10cm soil layer in all FS. The effects of management practices showed the variation in species diversity, composition and stock. Additionally, the competition among the trees was less in intensively managed forest. This research will be helpful for forestry professionals to understand the effect of management practices.

**Keywords:** Management, Diversity, Composition, Stock, Competition, Felling series.