Agroforestry seminar on

"Agroforestry: potential livelihood option for future"

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ABSTRACTS

Organized by

Nepal Agroforestry Foundation (NAF),

International Union of Forest Research Organizations (IUFRO)

Ministry of Agriculture Development (High Value Agriculture Products)

Agriculture and Forestry University, Faculty of Forestry (AFU)

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NEPAL AGROFORESTRY FOUNDATION

Nepal Agroforestry Foundation (NAF) is a non-governmental, non-profit organization founded in 1991 by a group of experts in agroforestry practices, leaders of community-based organizations (CBOs), farmers in the districts of Dhading, Kavrepalanchok, Ramechhap, Sindhupalchok of Nepal and professionals from various disciplines. NAF is an organization that provides innovative farming techniques and community support agro-forestry, supports local organizations, provides assistance to international NGOs and forest management groups. It also works to strengthen the capacity of poor communities for achieving a decent standard of living and have access to basic needs. NAF works at national level in agriculture and forestry projects closely with the Government of Nepal and the Ministry of Environment for the National Planning.

IUFRO - THE INTERNATIONAL UNION OF FOREST RESEARCH ORGANIZATIONS

IUFRO is a non-profit, non-governmental international network of forest scientists,which promotes global cooperation in forest-related research and enhances the understanding of the ecological, economic and social aspects of forests and trees. IUFRO is "the" global network for forest science cooperation. It unites more than 15,000 scientists in almost 700 Member Organizations in over 110 countries. Scientists cooperate in IUFRO on a voluntary basis.

AGRICULTURE AND FORESTRY UNIVERSITY (AFU)

The Agriculture and Forestry University (AFU) was established in Rampur, Chitwan, Nepal in 2010. This is the first agriculture and forestry university in the country. The university aims at producing highly skilled human resources required to work on quality research and development in agriculture. It aims at all round development of agriculture and forestry which would raise the socio-economic conditions of rural people through quality teaching, research and extension in agriculture, livestock and forestry. The mission of Agriculture and Forestry University is to produce competent manpower to promote education, research and development in agriculture, forestry and allied disciplines.

High Value Agriculture Project (HVAP) in Hill and Mountain Areas

High Value Agriculture Project (HVAP) in Hill and Mountain Areas is being implemented with the financial support of International Fund for Agricultural Development (IFAD). The project agreement was signed on 5 July 2010 with the Government of Nepal. Ministry of Agricultural Development (MOAD) is the main implementing body of the project and the project is in implementation through the fiscal year 067/68.High Value Agriculture Project (HVAP) in Hill and Mountain Areas is being implemented with the financial support of International Fund for Agricultural Development.

International Union for Conservation of Nature (IUCN)

The International Union for Conservation of Nature (IUCN) is a membership Union uniquely composed of both government and civil society organisations. It provides public, private and non-governmental organisations with the knowledge and tools that enable human progress, economic development and nature conservation to take place together.

Created in 1948, IUCN has evolved into the world's largest and most diverse environmental network. It harnesses the experience, resources and reach of its 1,300 Member organisations and the input of some 16,000 experts. IUCN is the global authority on the status of the natural world and the measures needed to safeguard it. Our experts are organised into six commissions dedicated to species survival, environmental law, protected areas, social and economic policy, ecosystem management, and education and communication

About Agroforestry

Agroforestry is an age old practice but now emerging as a science. Agroforestry in the Nepalese context can be defined as a system where agriculture crops including Non-Timber Forest Products, Medicinal and Aromatic Plants grown together in a given space and time, to raise the productivity of each component without compromising the yield of others.

Empirical evidence suggests that agroforestry can provide a sound ecological basis for increased crop and animal productivity, dependable economic returns, and biodiversity. Agroofrestry provide provisioning service (fuel wood, fodder, leaf litter, timber, poles among others), regulating service (hydrological benefits, micro-climatic modifications), supporting service (nutrient cycling, agro-biodiversity conservation), and cultural service (recreation, aesthetics) and embraces very many discipline.

Public, Private and Community Partnership (PPCP) in Timur (*Zanthoxylum armatum* DC) Value Chain: A successful model for conservation, economic development and livelihood promotion in Mid-West Nepal.

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In Nepal, several trees species are used in agro-forestry system because of their multiple uses mainly as sources of edible fruits and food, fodder for livestock feed, timber, firewood, soil fertility restorers and medicinal purpose. Among others, in mid hills of Nepal, farmers are planting Timur (*Zanthoxylum armatum* DC) aroma bearing tree species, since many years in marginal land for fencing purpose as a hedgerow in agro-forestry system neglecting its economic value.

Recognising high potential role in value chain and trade of this underutilised cash crop,High Value Agriculture Project in Hill and Mountain Areas (HVAP)selected Timur as a high value commodity for economic growth in its working areas mainly Surkhet, Aachham, Jajarkot and Salyan during the past five years, are noteworthy. Adequate information on economic approaches to sustainability and economically viability of Timur; however, is lacking or is not readily available in context to Mid-hills of Nepal.

Timur has been established as an integral source of income for women, landless and unemployed people particularly in the HVAP program areas. The nature of the plant as its ability to grow in less fertile soil; its availability in forests and the surrounding agricultural lands without affecting in agricultural productivity; and long experience of the rural women and poor in collection has made it a suitable plant species for livelihood improvement of the poor in mid-hill districts of the country. Timur value chain has been identified as one of the important sub sectors in HVAP. The project is facilitating in overcoming the problem of production, harvesting, storage and market promotion for sustainable production. In this context, HVAP is pursuing public private community partnerships (PPCPs) to deliver growth and positive development outcomes in agro-forestry sector. In Nepal, PPCPs in agriculture are relatively new concept. Collaborative effort of public and private sector for the sustainable Timur production and conservation and income derived through Timur based agro-forestry system is one of the value chain strategies currently promoted by HVAP in its working areas, as it is providing economic safety net to the resource poor producer groups.

This paper will, therefore, focus on public, private sector and community involvement in Timur production and trade for sustainable economic growth.

Keywords: Timur, Aroma, Neglected, Underutilised, Value chain, Hedgerow, Agro-forestry, Income, Safety net, Public private community partnerships

Planting Cardamom as an Understory with Nepalese Adler -One of Promising Forest Based Agroforestry System in Nepal

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Agroforestry is the deliberate growth and management of trees along with agricultural crops and/or livestock in systems that are ecologically, socially and economically sustainable. Its basic principal is to maintain productive capacity and protective and ameliorative ability to the system so that it's productive and protective capacity outweighs the monoculture agricultural/forestry systems that they replace. Nepalese economy is agriculture based but base of this agriculture itself is highly dissected terrain, steep slopes, fragile geology and often affected by recurrent landslides and flooding. It needs some special types of agro forestry system to protect it with and sustain people's livelihoods. This paper explores case study of one of the successful forest based agro forestry system practiced in Sotipakha community forest user group located in mountain hill district, Nepal. It includes planting cardamom as an understory with Nepalese Adler which is practiced for more than one decade as an income generation activity of forest users group making in harmony with ecology and economy in community forestry in Dolakha districts. It shows how one can make wise uses of land resource that can help twin objectives; one to raise socio economic status of people and two to promote environmental goods and services. This case study will help to identify research priorities and identify needs, opportunities and mechanisms for inter-institutional collaboration for technology development.

Key words: *agroforestry, forest based Agro forestry, cardamom cultivation in understory with Nepalese Adler*

Farmer's Attitude, Perception and Practices on Agroforestry Activities in the Mid-Hills of Nepal

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Agroforestry is a widely used practice in the mid hills of Nepal where farmers usually plant multipurpose tree species to manage their household requirements and needs of fuel wood, fodder and timber. Often farmers are depended to the forest to satisfy these needs that are in general questionable from long term sustainable use of the forest resources. A study was conducted to understand the current status of agroforestry practices in terms of farmers' attitude and perception in the mid hills of Nepal so that appropriate strategies to promote agroforestry activities could be developed. Deurali VDC of Gorkha and Bandipur of Tanahun were purposively selected to conduct this research which was largely based on use of a structured questionnaire survey and informal discussion. A total of 103 households were surveyed. Findings revealed that about two-fifths of the respondents reported about possibility to flourish agroforestry in bond and terrace riser whereas presence of poisonous plants was also widely acknowledged by the respondents in their land. Likewise about half of the respondents in both sites had willing to plant fodder trees as well as agroforest multipurpose trees which was more prominent in Bandipur than in the Deurali of Gorkha. Respondents have well realized that planting trees in the farmland is the best strategy to reduce dependency to forest for fuel wood and fodder. Moreover, gender involvement in the agroforestry practices was in favor of jointly done work for the activities such as fodder tree species selection, land size determination for planting trees and fodder nursery preparation. This scenario was more or less similar in both the sites. It is thus revealed that there is a positive attitude and response of farmers in the mid hills of Nepal in promoting agroforestry practices that needs further detail study to formulate appropriate planting policy and develop site specific guidelines that would be more of gender friendly.

Key words: *Multipurpose tree species, Sustainability, Forest-dependency, Agroforestry*

Ethno-Medicinal Plants of Kanchanpur Municipality of Saptari District, Nepal. A Case Study of Jamuwa Village

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The ethno-medicinal study was carried out in Jamuwa village of Kanchanrup Municipality, Saptari district, Nepal to explore ethno-medicinal plants and traditional knowledge of their practices by local people of the study area that is far beyond from any modern medicinal practices. The study area was very rich in plant diversity including medicinal plants. The plants were used by local people as different remedies were only viable in the study area. The study area was situated East-West Mahendra Highway between 26° 41" to 26° 39" N latitude and 86° 56" to 86° 57" E longitude. The study area is frequently dominated by Tharu community i.e about 80 % and rest were followed by Mushar, Bantar, Malah, Muslim, Horizon, Newar, Brahmin, Chhetri, etc. Most of the elderly people were illiterate and no one had any academic degree and agriculture was the major occupation of the study area peoples. However, agriculture products were not enough to meet their need for the whole year. The area was surveyed from 21 May 2016 to 13 June 2016 to collect medicinal plants and information on traditional medicinal practices by interviewing in semi-structured questionnaire on local language with local healers, Dhami, Jhakhari and some knowledgeable old men and women who have had an experience of the particular treatment. Plant speciemens were collected from natural habitat as well as some extent from domesticated areas and made its herbarium by means of local procedures. These speciemens were identified and cross-checked with local healers, standered literature, journal publication and reports etc. with help of universities lecturers, professsors. The well berberium were deposited at department of Botany, Tri-chandra multiple college, Sarswati Sadan, Kathtmandu. Altogether 127 plants species were collected along with detail of their use. Among them 84 (66.7 %) were wild and 43 (33.3 %) cultivated habitat, 49 (38.6 %) herbs, 26 (10.3 %) shrubs 36 (28.3 %) trees, 13 (20.5 %) climbers, 2 (1.5 %) runners, and 1 (0.8 %), most commonly parts used were leaf and seed (15.1 %) and least was root tuber (0.7 %), highly used form of medication was liquid drug (21.3 %) and least was in the form of pickle (0.7 %) were documented which were being used for medicinal purposes. A total of 50 types of diseases as well as health disorders were cured in local level and highly plants were used for curing Diarrhoea, Dysenetry, Sexual disorder, Gastric problem, Wounds and skin allergy etc. The indigenous Knowledge and practices of the local tribal people on the utilization of plant resources as medicine should be documented and preserved before they get lost and disappeared due to increasing integration. For future trade and commerce, concept of wise use of the plant diversity should be promoted by providing orientation and trainings from the concerned authorities.

Key words: *Medicinal plants, traditional knowledge, Dhami jhakhari*

Agroforestry Market Chain Interrupted by Fuel Crises:A case study of ethnic of Central Nepal

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Agroforestry practices have been one of the viable options to enhance livelihood among the peoples of Makwanpur in Nepal. This practice provides income among ethnic groups (Chepangs, and Tamangs) for supporting livelihood in these areas. The "Undeclared Economic Blockades" in the country since September 2015 had created a lot of problems in the economy of Nepal, and its spill over effect had also affected the marketing of Agroforestry products.

It was very difficult to take food stock in the market, this has caused an increase in local consumption. This study is mainly designed to analyze the impact of border blockades in terms of income from the Agroforestry product in Raksirang Village Development Committee (VDC) in Makwanpur district. A purposive sample of 50 households (14 percent) was randomly selected to collect primary data.

More than 60 percent respondent had a delay in sale, we're able to receive low rates for their products at the farm, and has to pay the right rate for transporting the products in the market center. Self consumption of Agroforestry was higher during a period of Blockades as a new coping strategy. The market price of food commodity (mainly rice, pulses, and vegetable oils) was raised by more than 50 percent in an average. Income from sale of Agroforestry was much lower after economic blockades compare to before blockades. A buffer stock required to mitigate the crisis. The government should continue to supply essential things (food/non food) from own resources in case of a crisis situation.

Keywords:- *Agroforestry; Blockades; livelihood; Ethnic; Crisis*.

Multipurpose shrub *Flemingia macrophylla*: a potential dry season fodder for ruminants in Nepal

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Feed deficit in terms of crude protein and total digestible nutrients is a high alarming situation of ruminant production system in Nepal, which becomes more critical during winter and spring seasons. With the aim of mitigating the differential span of nutrient demand and supply to the ruminants in Nepal, several strategies including the promotion of new potential multipurpose fodder species are being understudy. This paper on one hand, reviews the journal articles and thesis from the original works done in Nepalese context, and on the other hand includes the report of the original works done to compare the Flemingia with other multipurpose fodder leguminous shrubs. Low density planting in 0.9m × 0.7m resulted higher dried fodder biomass than high density planting of Flemingia. Likely, defoliation at the height of 0.75m from the ground level had shown better fodder yield. Wet season defoliation with three months defoliation interval had shown greater performances. Application of 50 kg P ha-1 with 30 kg N had significantly enhanced the fodder and fuelwood yield without altering the fodder quality of mature stands of Flemingia. The original research data of comparing Flemingia with other perennial multipurpose leguminous shrub had shown that the Flemingia can produce substantially higher fodder yield in comparison to Leucaenaleucocephala and Tephrosia candida with the fair yield of fuelwood. This fodder had shown good nutrient digestibility with fair short term intake rates to goats. The reviewed information and the results of the studies had revealed that the Flemingia macrophylla could be one of the alternate for mitigating the feed and nutrient deficit situation of the ruminants in Nepal.

Key words: *Planting density, defoliation, fodder, fuelwood, quality*

Agroforestry Practices for Food Security and Livelihood Improvement:A case study of Mustang district

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A case study was conducted in Marpha and Jomsom Village Development Committee of Mustang district to understand the potentiality of agroforestry practices for food security and livelihood improvement. The study areas were located in 2650-2710 m altitude from the sea level with annual rainfall less than 500 mm. The main objective of the study was to assess existing agroforestry practices and their contribution in food security, nutrition and livelihood improvement of farmers. Both primary and secondary information for the study were collected using Participatory Rural Appraisal tools and techniques such as key informant discussion, semi-structure questionnaire survey with farmers and traders, focus group discussion and direct observation and reviewing of published and unpublished documents related to agroforestry practices and their contribution on farmer's livelihood.

Majority of the respondent farmers were ethnic Thakali (60%) and Gurung (20%) followed by Dalits (20%), who were disadvantaged community of Nepal. The average household size of respondent farmers was 8 with minimum 2 and maximum 17 members. They owned bari-land on an average of 0.55 ha with a minimum of 0.45 ha and maximum 0.65 ha. They had cattle (jersey cow and jhopa), sheep, goat and horse on an average of 6 livestock per household with a minimum of 2 jersey cow and maximum 21 goats in a household.

The main agroforestry system of the study areas was agri-horti-silviculture system, where willow (*Salix* species), bhote pipal (*Populus* species), blue pine (*Pinus wallichiana*) and dhupi (*Juniperus* species) were planted around apple (*Malus domestica*) orchard and crop fields. A major portion of the study population (80%) was found growing 30-80 trees and shrubs around their farms and fruit orchard with 186 apple trees on an average. The crops grown as understory included potato, naked barley, buckwheat, maize, oat, bean and vegetables. They produced food crop sufficient only for 5 months. About 20% of total respondents have grown jai grass, rye grass and white clover for their livestock. Majority of the respondents (80%) reported that trees grown around apple orchard have provided fodder, leaf litter for making compost manure, fuel wood and timber for household use. These trees also acted as wind break to protect fruits from strong wind during early stage of fruit development, and beautified the local environment. However, some farmers (20%) have experienced tree shade as one of the main problem for growing understory crops and fruits successfully in study areas. To reduce the shading effects of willow

trees to understory crops, they have pruned the upper branches of trees in every 2-3 years for opening the tree canopy to permit sunlight needed for understory fruits and agriculture crops.

The average income of study households was estimated Rs 232000 from apple and Rs 22000 from potato. One farmer has generated Rs 15000 from the sale of vegetables grown in fruit orchard and another one farmer has earned Rs 150000 from cow milk. They spent majority (85%) of their income in food item purchase for food insecure 7 months, health and sanitation, education of their children, house construction and maintenance, apple orchard development and management and religious function and ceremonies. Finally, this study has suggested a strong relationship of agroforestry practices with food security and livelihood improvement of farmers of study areas, and concluded a new approach for synchronization of agroforestry practices in farming systems of study areas.

Key words: *agroforestry ,food Security , livelihood, improvement, farmer*

Strengthening village economies through Agroforestry innovation with biochar for carbon capture and increased agriculture productivity in middle hills of Nepal

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The reforestation of the Earth may well be the last resort to save humanity from climate change and bio-monotony. If we don't start now to grow trees, even if only with small projects, the dust under the sky will cover the last blade of grass. In Nepal, when the disaster of the trembling earth struck, women farmers of Ratanpur village in middle hills of Nepal decided to plant trees and recreate life so that the lost generation will return. 10,239 trees were planted in the year 2015 followed by plantation of 16210 trees in the year 2016 with wider participation including second village (Bandipur) women group in the same region. A total of 86 (66+20) households of the two villages of western Nepal are united for implementing this project. The objective of this reforestation with biochar was to re-fertilize and protect the soil, capture carbon and generate a stable income as a climate smart agriculture. These pioneers became the first village in Nepal to sell carbon credits from plants that grow food for their children and sequester carbon for the planet. Of the total of 10,775 trees planted in the first year by 30 farming households, more than two third of the trees survived in the new agroforestry system that sequestered the equivalent 74 t CO2 per year. Carbon payment was made to the first farmer families in presence of District Forest Office staff and Community Forestry User Group members. The study revealed that due to the carbon credits the first year participating farmers have been able to increase their extra income by 13% compared to second year planting group (6%). The poverty level also varies significantly between groups (first village poverty level = 24% and second village = 50%). Starting from third year after plantation income increase will significantly rise as from then on forest garden products begin to be harvestable. Timber or non-timber forest products produced from these agroforestry systems are linked to enterprise development. Currently a piloting is carried out to produce cinnamon essential oil with the use of energy released through the process of biochar making in a Kon-Tiki kiln under leadership of Ithaka Nepal.

Keywords: t*rees on farms, terrace risers, carbon sequestration, REDD, fodder production.*

Importance of Trees Outside Forest (TOF) for Immediate Earthquake Response/Recovery

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Earthquake of April 2015 severely affected one-third population of Nepal: killing almost 9000 people and completely destroying more than 500,000 private houses along with loss of significant number of cattle and other public properties. For construction of immediate shelter after earthquake, people used various forms of timber including bamboo and poles of easily available trees. TOF were major source of timber for construction of houses/shelter for both human and cattle. However, the study on extent of use of such trees is still limited. Therefore, this study was carried out in Thulosirubari VDC of Sindhupalchok to analyse the importance of TOF for immediate earthquake response. Participatory rural appraisal including focus group discussions, semi-structured interviews and formal and informal meetings were carried out to explore the use of TOF.

More than 80% of the household have trees in their own land where species such as Chilaune (*Shima wallichi*), Kutmiro (*Litesea monopetala*), Khotesalla (*Pinus roxburghii*) and Bamboo are common. Among surveyed households, more than 75% respondents reported that they used Chulaune for pillar (khaba) to develop temporary house, whereas bamboo was used for all kind of poles (dada/vata/balo) in more than 80% of temporary houses. Both Bamboo and Chilaune were either extracted from their own land or from neighbour's land, i.e TOF which were easily available and collected based on necessity. We could not draw any statistical conclusion in choice of species to construct temporary houses by wealth categories. However, we have observed that people who have sufficient and varieties of trees in own land, have selected strong and hard wood for permanent house construction whereas those who do not have choice, are planning to use any available tree species. People were highly aware about importance of trees to cope with disaster, though selection of species was still debatable because of limited knowledge.

Key words**:** *trees outside forest, earthquake, recovery, temporary houses*

Agro forestry Practices in pro-poor leasehold forest

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The study entitled "Agro forestry Practices in pro-poor leasehold forest*"* was carried out to analyze the contribution of agro forestry in food security and income growth of poor household and floral diversity enhancement in leasehold forest. Nepal has been practicing the propoor leasehold forestry program since 1990 for the livelihood improvement of marginalized women, Disadvantage poor groups. Leasehold forest may handover for operating Agro forestry, which was prescribed in the forest act 1993. Structural and functional criteria were used to identify and classify agro forestry system used in leasehold forest. Friedman's two-way analysis of variance test by rank was used to find out the most preferred agro forestry species. Shannon-Weaver (S-W) diversity index was used to analyze the status of floral diversity in leasehold forest where agro forestry was practiced. Forests can be conceptualized within food security dimensions as their availability contributes directly on food consumption, indirectly on income of individuals to purchase foods. This study follows qualitative approach for content analysis of forest related different products and their uses and the key uses for wood fuel energy, direct food and nutrition and income benefits were also synthesized.

The study was conducted in forty (40) pro-poor leasehold forest group of four district of Nepal. This study showed that economic contribution of Leasehold forest was Rs.14941/hhs/yr/ (internal product consumption Rs. 8346/hhs/yr and Market sale or consumption Rs.6592/hhs/yr) and the contribution of leasehold forest in food security was 2.5 month/hhs/yr. Silvo pastoral was major agroforestry system practiced and Livestock husbandary was extra sources of income for majority of poor households. *Artocarpus lakoocha, Grass species (Stylosanthes guianensis, molasses and bamboo), Ficus species, Leucena lecucephala, Melia Azadirach* were most preferred agroforestry species. The study showed that the overall diversity index was (SWDI or H') 2.29 and showed that fodder and timber tree had high species richness and evenness than grass, live fence and medicinal, fruit and shrub species. Annual consumption of grass and fodder by livestock were high. Health care and Medicine consumption was in very low quantity than other forest product. Contribution of fodder, fruit, fuel wood, medicine trees, local and exotic grass seems satisfactory. The study concluded that the agroforestry has great role in economic contribution and food security and biodiversity conservation in propoor households that are participated in propoor leasehold forest of Nepal.

Keywords*: leasehold forest (LF), agroforestry, food Security, economic contribution, diversity*

Promoting Rights and Livelihoods through Forest and Farm Producer Organisations: Lessons of FFF Programme in Nepal

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Recognizing the role of forest and farm in the farm household economy and wellbeing, a global programme called Forest Farm Facility was designed and is under implementation in 10 countries including Nepal. The progamme aims to improve income and food security from sustainable forest and farm management of smallholders, women, community and indigenous peoples. The programme is supported by three conceptual pillars which are; strengthen producer organisations for business and policy engagement; catalyse multi-sectorial policy platforms and link local voices to global programme. Since its implementation, the programme has successfully contributed in consolidation of local producer groups into effective and inclusive groups and strengthens their entrepreneurial capacity in access to credit, input supplier and dialogue with market actors. The programme has catalysed/initiated a national and three district levels cross sectoral platform to discuss the issues related to policy and institutional hurdles of small holder producer organisations related to rights and livelihoods of the smallholder producer groups. Nepal's FFF Programme has succeeded in playing vital role in bridging issues and gaps at local level and bringing it forward to national level platform. FFF programme has facilitated in establishment of linkages of smallholder producer groups to the service providers and market actors and has successfully built their capacity in business knowledge. Furthermore, FFF programme has contributed in building capacity of women, indigenous groups by improving access to market information and policy platforms.

Keywords: *forest, income, food security,indigenous group,farm*

Agro-Forestry: An EBA Intervention for Adapting Against Climate Change Impacts

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The land use systems are having remarkably diverse contribution to the peoples' livelihood to sustain their usual needs. Local people are dependent to the forests for the forest based products such as timber, fuelwood and fodder and they are also dependent to the agriculture for the major crops for sustaining food requirement. If we see the livelihood of rural people their livelihood depends with agriculture for crops and animal husbandry. Thus, they largely dependent with forest, agriculture, grasslands.

Agroforesry is thus in solution to liaise the climate change impacts on agriculture and forest land uses which contributes to mitigate the pressure to the forest. Agroforestry has the possibility of services on livelihood options as well as mitigating climate change impacts.

Above ground biomass and soil organic carbon are providing services for the mitigating climate change where as farm trees and high value crops are providing the services to supply fodder, fuelwood, small woods and grasses which basic requirements for rural livelihoods. The major crops of agriculture in agro-forestry provides the food security situation.

The technologies practices to optimize the benefit from the agro-forestry technique thus provides the multiple benefits from the single land use system.

The results from the study on Gorkha, Rasuwa, Chitwan, Lamjung, Mustang and Bajhang shows that the agroforestry practices provides such opportunity to the small holder farmers. However, there should be the EbA approach to optimize the benefits using the ecosystem services thus the ecosystem itself will also be maintained, livelihood will also get the benefit and the enhancement of resilient capacity of the people to adapt against adverse impacts of climate changes.

Keywords: *ecosystem, adaptation, mitigation, above ground biomass, SOC, food security*