Chapter – One
INTRODUCTION

1.1 Background of Agroforestry System.

Nepal is an agricultural country, in which the majority of the people (81%) directly or indirectly depend on agriculture. Most of the people are holding small parcels of farmland with different grades of soil fertility. The area has been characterized with growing population, multi-ethnicity and uneven distribution of farmland.

The agricultural systems are heavily dependent on forest products that serve directly as a source of nutrients through fodder and leaf litter and indirectly as fuel wood, food, medicine and construction materials (Amatya, 1993). It has been estimated that for sustaining 1 ha of agricultural land 2.8 to 18 ha of forestland is required. Denhalm (1991) estimates that 3.5 to 6 ha of forestland are needed to support 1 ha of cropland. As to maintain the desired ratio, more trees on private land become a necessity to the farmers. It is very hard to maintain desired ratio only through community or natural forests. Thus growing more trees on private land has been become essential for the hills farmers.

Agroforestry is a collective name for land use system and technologies in which woody perennials for example: trees, shrubs, plants and bamboo are deliberately combined on the same land management with herbaceous crops and/or animals, either in some farm of spatial arrangement or temporal sequence. In agroforestry system, there are bath ecological and economic interactions among the different components.

Agroforestry has been defined as a sustainable land management systems which increases the overall yield of the land, combines the production of crops (including tree crops) and forest plants and/or animals simultaneously or sequentially, on the same unit of land and applied management practices that are compatible with the cultural patterns of the local population (King and Chandler 1978: 161-168).

Cannel has defined ‘Agroforestry as a land use system (a) in which woody perennial and herbaceous crops are grown together in mixtures. (b) Which provides greater benefits of the land use than agriculture or forestry alone, including one or more of the following: sustained soil fertility, soil conservation, and increased yield, diminish risk of crop failure, ease of management, pest and disease control and/or greater fulfillment of the socio-economic needs of the local population The simplest definition

of agroforestry is the one given by mature according to which 'agroforestry is a form of land use that successfully satisfies the need of the crop farmer, forester and/or stock farmer. The above excerpts clearly indicate that agroforestry is not community of social forestry. They stress the following two common characteristics:

(a) Agroforestry involves deliberate growing of woody perennials of the same unit of land as agricultural crops and /or animals, either in some farm of spatial mixture or in sequence, and

(b) There is significant interaction (positive and/or negative) between the woody and non-woody components of the system, either ecologically and/or economically.

K.F.S. King identified agroforestry system to be:

i) Agri-silviculture: The conscious and deliberate use of land for the concurrent production of agricultural crop and forest crop.

ii) Silvo-pastuoral: This is a land management systems system in which forests are managed for the production of wood as well as the rearing of domestic animals, where cattle graze freely.

iii) Agro-silvo-pastural: A system in which land is managed for the concurrent production of agricultural and forest crops as well as the rearing of animals.

Nair (1985) categorized AF system on the basis of four major criteria which are as follows:

(i) Structural basis: Refers to composition and arrangement of components specially woody ones. The system can be grouped as a agrisilviculture (crops including tree/shrubs, crops and trees). Silvipastoral (pasture/animal + trees) and agro-silvipstoral (crops + pasture/animals + trees). Arrangement of component can be in time (temporal) and (special)

(ii) Ecological basis: Refers to environmental conditions and ecological adoptatability of systems for defined agro-ecological zones. Such as low land and humid tropics, arid and semi-arid tropics, tropical high land and so on.

(iii) Socio-economic basis**:** Refers to level of input of management (low input, high input or intensity or scale of management and commercial goals (subsistence, intermedial and commercial). Classification will depend upon the purpose for which it is intended.

A Dictionary of Forestry by S.S. Negi ,(1988), defines agroforestry as raising a combination of tree and food crops on the same land in close association in a way that all the land including the waste is in put to good use".

The traditional or the indigenous agroforestry systems practiced by the farmers in Nepal from time immemorial have evolved from the "trial and error" experiences of many generations, different agroecoloical regions of the country Hill farming systems are in fact based on many strategies to manage forest, pasture and agricultural lands in an integrated fastion. Traditionally, the farmers in many parts of Nepal plant and protect trees on the cropland, fodder, fruit and timber trees are commonly found scattered through their fields. Trees are also planted also the borders of agricultural lands, have gardens, on fallow and on wastelands. In the hills multipurpose trees are usual planted on terrace bunds major trees species planted on farm land in the hills area shown, below. Fodder trees are generally lopped every year during the time when ground forage is scarce. This practice is also favorable for winter crops as reduces shade against them.

Agroforestry systems are comprised of tree and non tree components grown in close association. Their objective is the maximization of the long term yield of desired products yield is generally drawn from both, tree and non-tree components, directly or indirectly via grazing animals; although on occasions one component, generally the tree may be included only to improve the performance of the other. The essential features of these systems is the close interaction, competitive or complementary, between the tree and non-tree components in their physical dimensions; their life span and their physiological responses provide additional complexity which sets there associations aside from general concerns of either forestry or agronomy.

Agroforestry aims at solving problems of rural development predominantly in the tropics by:

– Increasing and improving the yields of food production.
– Safeguarding local energy supply.
– Production of timber and a variety of other raw materials for the farmer's subsistence for industrial use of and if applicable exports.
– Protection and improvement of the production potential of a given site and environment, increasing the human ecological carrying capacity.
– Safeguarding sustainability through appropriate intensification of land use.
– Improving social and economical conditions in rural areas by creation of jobs and income and reduction of risks.

Development of land use systems which make optional use of modern technologies and traditional local experience and which are compatible with the cultural and social life of the people.

In Nepal, almost 80 percent of the people still live in rural area. Despite the fact, Nepal has great hydroelectric potential (equivalent to that of Canada, USA and maxica combined) less than 2 percent of this latest energy has been tapped. Even if sufficient electricity was generated, most villages would not be in a position to utilize it because of the prohibitive costs and formidable problems of laying out transmission lines. The majority farmers will therefore, have to depend on fuelwood for cooking and heating since long.

1.2 Statement of the Problem

Land is the basis resource. It is therefore important to understand how to gear up the livelihood. Agriculture, in level and sloppy land, has been a long histogenice culture of Nepalese hill dwellers.

Dhankuta district occupies 891 sq km out of this there is limited productive land. So it has three fundamental and resource issues: First, the final limit of land suitability for cultivation is being approached rapidly, second the intensity of use in order to meet the rising demand of agricultural product, and third, undergoing low productivity, land degradation and soil erosion. The region, which provides multitude of natural resource, is degraded by overuse (overgrazing, exploitation of the timber, fodder and fuelwood) and misuse of the available resources.

In all countries the process of agricultural production takes place within an institutional matrix within this matrix, the from of land tenure exerts a profound influence on the level and efficiency of agricultural production it follows, therefore, that the land tenure system in any country tend to freeze the process of agricultural production in their existing form. Similarly, the extent of agroforestry and the involvement of the local farmers are directly related to the flexibility or otherwise of the prevailing from of land tenure.

The problem of rural indebtedness has been a wide spread in Nepal. This is the common problem for rural economy of Nepal. Peasants or tenants of Nepal borrow heavily from money lenders at high interest rate to fulfill their regular and contingent necessities, since they do not avail of any off-form employments and their agricultural production is insufficient. They are force to sell their lands far one to repay their loans. This process of indebtedness has compelled many farmers to out migrate of the search of new land employment. This type of physical instability and deficiency of investment

capital, small, farmers of Nepal can not developed their land productivity. So, the incensement of agroforestry in area may help to minimize such indebtedness which is one of the major problems in Nepal.

Awareness and education can play vital role interims of forest expansion in farmers lands in Nepal. Many of the farmers most likely to be affected by the agricultural forests forming systems are illiterate or have a very poor understanding of the result of their current activities knowledge about seedlings species. Planting techniques, preserving harvesting, marketing are the major steps to adopt. Forest farming systems poor farmers can seldom utilize a tree crop to meet immediate needs which will start producing returns at best a few years in the future to meet immediate needs a tree. Crop which will start, Producing returns at best a few years into the future. Unless the local farmers agree with what is being proposed, they will not participate and may even work actively against the plan. A strong extension education program would be a useful tool to ensure mass awareness and education to the issues. But almost in all rural areas of Nepal these facilities are not still exist.

These are the some vital problems that are attempt to solve after studying the "Agroforestry: impact on rural development, a case study of Dhankuta district" with special reference to the existing pattern and suggestions.

1.3 Importance of the Study

The people of Nepal are heavily exploiting the forests for the supply of fuel wood, fodder, and timber. Consequently, the forest area is declining slowly but surely. Most of the accessible forests are severely degraded as a result of faulty land use practices. There is a faint possibility, that the problem of forest destruction/degradation is mitigated through agroforestry practices. This study has been important due to following reasons.

Nepal needs agroforestry for the following reasons, among others:

- Nepal's forest area has dwindled to less than 30 percent.
- Natural forests are mostly degraded and consequently the mean annual increment (MAI) of woody biomass is very low in the forests.
- High demand for forest products for various purposes including construction, energy, cottage industry, food, fodder.

- The demands will not be met even if all the forests are managed scientifically.
- Most of the forests are inaccessible.
- Transportation and distribution of fuel wood are difficult.
- It will be too costly to manage all the natural forests.
- FAO's declaration of Nepal as one of the three Asian countries having acute fuelwood scarcity: trekking 10 hours or more to bring a headload of fuelwood.

1.4 Objectives of the Study

The main objective of the study is to identify the impacts of agroforestry on rural development in Dhankuta district. The specific objectives are as follows:

1. To examine the benefits of the overall agroforestry system.
2. To assess the impacts of agroforestry on local rural development.
3. To analyze the role of use of non- timber forest products in income-generating activities.
4. To assess the impact of revolving funds in community forestry of the study area.

1.5 Limitation of the Study

Impact study of any agroforestry activities involves the effect of such activities on the social, economic and environmental aspects of the society as a whole. The limitation of the present study includes the following:

- Due to time and other resource constraints; the research work dose not covers all the above aspects.
- The study may not represent the situation of all agro ecological zones in the country.
- The study is done with special reference to the Dhankuta district which represents the mid-hill districts of Nepal.

The study is mostly based on the results of the household questionnaire survey and key informant interviews.

Chapter – Two
LITERATURE REVIEW

2.1 Concept of agroforestry

Agroforestry is the most appropriate technique for promoting people's participation' in aforestation. This system is basically a land use strategy that integrates agricultural and forest production under a common management. Wherever population pressure is high and available land is diminishing agroforestry offers an opportunity for sustainable production in different situations. Therefore, to achieve a desirable level of development in different situations, the aim should be to improve the quality of life of the people, especially the poor and those living a marginal subsistence, at last an important part of rural development.

Agoforestry is a land-use system in which both tree and non-tree components are grown on the same land management unit. The tree component includes tree species, shrubs, bamboos, palm trees and so whereas non-tree component consists of all the agricultural crops, pastures and or animal husbandry. The objective of agro forestry practice is to optimize the land productivity.

The establishment of ICRAF in 1977 was a remarkable event in the area of agroforestry research. The mandate of the council is to initiate, and support research leading to mare sustainable and productive land use in developing countries through integration of better management of trees in land use system.

A definition of agroforestry proposed by the ICRAF gained upside acceptance: "Agroforestry is a collective name for land-use system and technology where woody perennials are deliberately used on the same land-management units as agricultural crops and for animals in same farm of spatial arrangement or temporal sequence. In agroforestry system, there are both ecological and economical interacted between different components."

G.R. Camel Melvin has defined agroforestry as a land use system in which woody perennials and food crops are grown together in mixtures, zonally and/or sequentially with or without animals and which provides greater benefits far the land use than agriculture or forestry alone, including on as more of the following:

Sustained soil fertility, soil conservation, increased yield diminished risk of crop failure, case of management, pest and disease control and/or greater fulfillment of the socio-economic needs of the local population"

The simplest definition of agro forestry is that of K.G. Mafura (1987), according to which, agroforestry is a form of land use that successfully satisfies the need of the crop farmer, forester and livestock farmer.

The above excerpts clearly indicate that agroforestry is not community or social forestry and they stress two common characteristics.

- Deliberate growing of woody perennials on the same unit of land as agriculture crops and far animals either in some from of spatial mixture or in sequence.
- Significant interaction (positive and/or negative) between the woody and non-woody components of the system either ecologically and/or economically several criteria can be used in classifying the agroforestry system due to its character and functions.

According to Nair (1987) agroforestry systems can be classified based on (i) structural basis (ii) functional basis (iii) socio-economic basis (iv) ecological basis

i) Structural basis considers the composition of the components, including spatial admixture of the woody component, vertical stratification of the component mix and temporal arrangement of the different components. The structure of a system can be defined interims of its component and the expected role or function of each of them. In this system the types of components and there arrangement is important. Hence on the basis of structure, agroforestry systems can be grouped into two categories (a) nature of components and (b) arrangement of components.

a) Nature of components, based on the nature of components agroforestry systems can be classified into the following categories (i)Agri-silviculture systems (Crops +trees) (ii)Silvo-pastaral systems (Trees + pasture/animals) and (iii)Agro-silvopastaral systems (Trees + crops + animals).

1. Agri-silviculture systems

Agri-silvicltural system involves the conscious and deliberate use of land for the concurrent production of agricultural crops including tree crops and forest crops.

Based of the nature of the components, this system can be groped into various forms.

i) Improved fallow species in shifting cultivation.
ii) The Taungya system.
iii) Multi-species tree gardens.
iv) Alley cropping (hedgerow inter-cropping)
v) Multipurpose trees and shrub on farmlands.
vi) Crop combinations with plantation crops.
vii) Agro-forestry fuel wood production.
viii) Shelter-belts.
ix) Wind-breaks.
x) Soil conservation hedges.

2. Silvopastoral system

The production of woody plants combined with pasture is referred to as a Silvopastoral system. The tree and shrubs may be used primarily to produce fodder for livestock or they may be grown for timber, fulewood, and fruit or to improve the soil. A silvopastoral system is needed in dry areas; in particular to help meet wood and fodder demands throughout the year. This system is again classified into three categories: (i) protein bank (ii) living fence of fodder and hedges and (iii) tree and shrubs on pasture.

3. Agrosilvopastoral system

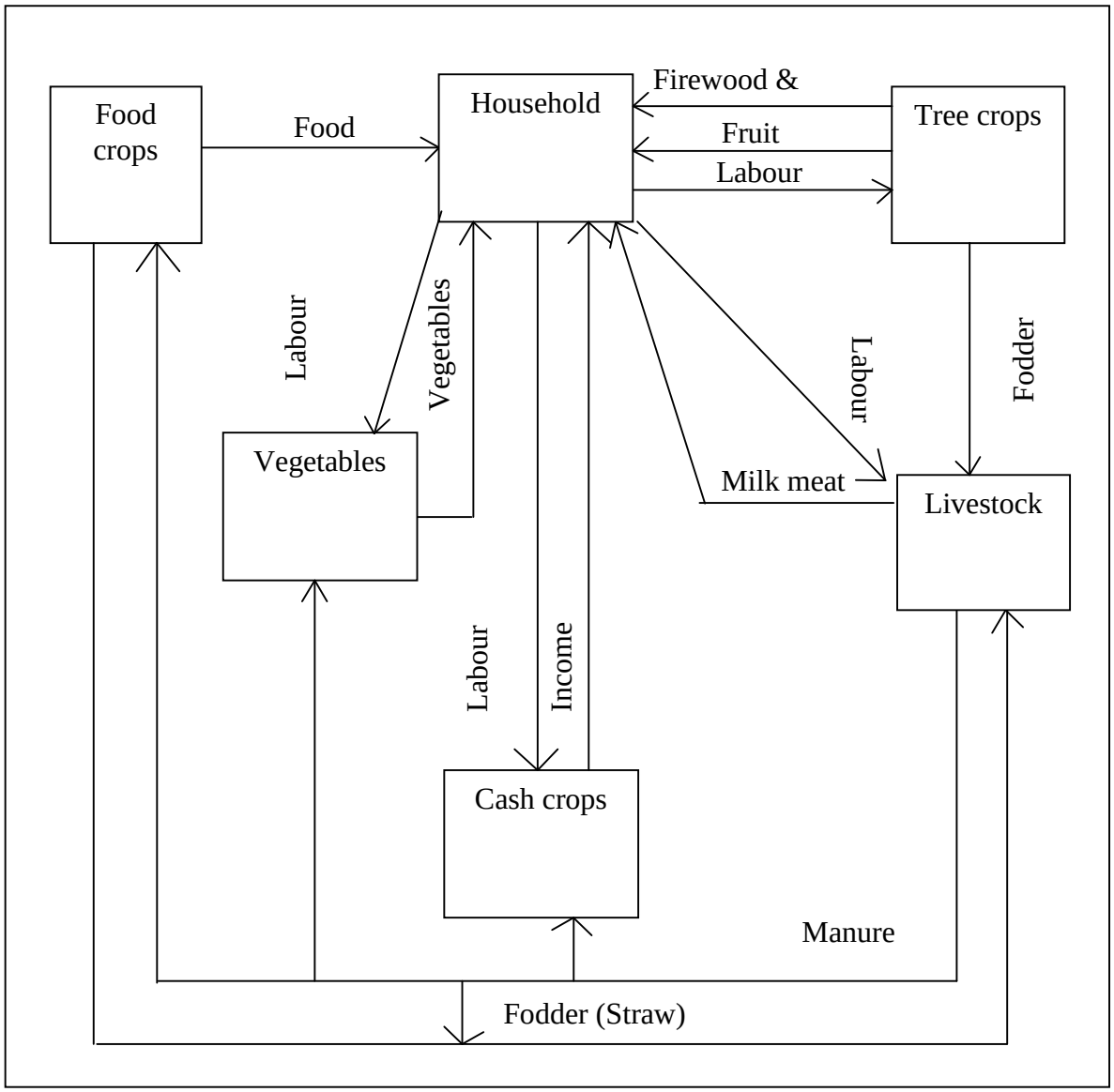
All agro-forestry systems which include trees or shrubs and herbaceous food crops and pastures or animals called agro Silopastoral system. This system has also been groped into subgroups (i) home gardens and (ii) woody hedgerows for browse, mulch, green manure, soil conservation.

i) System of home-gardens is one of the oldest agro-forestry practices, found extensively in high rain fall areas. Many species of trees, bushes, vegetables and other herbaceous plants are grown in dense and apparently random arrangement's although some rational control over choice plants and their spatial and temporal arrangement may be exercised, most home-gardens also support a variety of animals and birds. Fodder/feed for animals/birds and barn wastes are used as manure for crops. Hence one may conclude from the foregoing that, home-gardens represent land use systems involving deliberate management of multipurpose trees and shrubs

in intimate association with annual and perennial agricultural crops and invariably, livestock, within the compounds of individual houses, the whole crop-tree-animal unit being intensively managed by family labour.

Home gardens epitomize the qualities of agro-forestry systems: they are highly productive, extremely sustainable and very practicable. Food production is the primary function of most home-gardens.

Figure 1: Intensive Homegarden Cultivation in Dhankuta



Based on: Nair and Krishnakutty, 1984.

ii) Woody Hedgerows In this system various woody shrubs and trees are planted for the purpose of Prowse, mulch, green Manure, Soil conversation etc. The main aim of this system is production of food/fodder/fulewood/ small timber and soil conservation.

b) Arrangement of Components:

The arrangement of Components gives first priority to the plants. Even in agroforestry systems involving animals, their management according to a definite plan, say a rotational grazing scheme, gives precedence to the plants over the animals. Such plant arrangements in multi-species combinations involve the dimensions of space and time. Arrangement of components can be categories into two categories (i) spatial arrangement (ii) temporal arrangement.

i) Spatial arrangements of plants in an agro-forestry mixture may result in dense mixed stands or in sparse mixed stands. The species may be laid out in zones or strips of varying widths. There may be several forms of such zones, varying from micro-zonal arrangements to macro zonal ones. A common example of the zonal pattern is hedgerow inter-cropping (alley cropping). An extreme form of zonal planting is the boundary planting of trees on edges of plots and fields for a variety of purposes.

ii) Temporal arrangements of plants in agro-forestry may also take various forms. An extreme example is the conventional shifting cultivation cycle involving 2-4 years of cropping and more than 15 years of fallow cycle, when a selected woody species or mixtures of species may be planted.

ii) Functional Basis: This criterion is based on the major function or role of the system, mainly of the woody components, which are productive or protective. These two fundamental attributes of all agro-forestry systems are related with production and sustainability. This implies that agro-forestry systems have a productive function (producing one or more products usually “basic needs”) as well as a service role of protecting and maintaining the production system.

Raintree (1984) argues that any land-use system regardless of its degree of commercialization can be described and evaluated in terms of the outputs of relevant basic needs such as food, energy, shelter, raw materials, cash and so on.

A) Productive Functions :(Producing one or more product of the system). This system can be divided into different subgroups.

i) Food

ii) Fodder

iii) Fuelwood

iv) Small timber

v) Other productions,

B) Protective Functions: It is the sustain ability aspect that makes it different from other approaches to land use, although production is a very important consideration in agro-forestry system.

Agroforestry systems in the protective sense can be divided into this sub groups:

i) Wind break

ii) Shelter-belt

iii) Soil conservation

iv) Moisture conservation

v) Soil improvement and

vi) Shade (for crop and animal and man)

C) Socio-economic Basis: This basis considers the level of inputs of management (low inputs, high inputs) or intensity or scale of management and commercial goals. Based on such socio-economic criteria as scale of production and level of technology input and management, agro-forestry systems have been grouped into three categories :(i) Commercial (ii) Intermediate (iii) Subsistence systems and (iv) ecological basis

a) The term commercial is used whenever the scale of the production of the output (usually a single commodity) is the major aim of the system; the scale of operations is often moderate to large and land ownership may be government, corporate or private labor is normally paid or other wise contracted.

Example include commercial production of agricultural plantation crops such as rubber, oil palm and coconut, with permanent under plantings of food crops, other crops or pasture / animals commercial production of shade tolerating plantation crops such as coffee, tea and coca under over storey shade trees; rotational timber/ food crops systems in which a short phase of food-crop production is used as a silvicultural method to ensure establishment of the timber species, commercial grazing and ranching under largescale timber and pulp plantations.

b) Intermediate agro-forestry systems are those between commercial and subsistence scales of production and management, production of perennial cash crops and subsistence crops undertaken on medium to small size farms where in the cash crops

cater for the cash needs and the food crops meet the family's food needs. Usually farmers who either own the land or have long-term tenancy rights to land, reside and work themselves on the land, supplemented by paid temporary labor. Especially those based on plantation crops such as coffee, coca and coconut. Numerous fruit trees and short rotation timber species.

c) Subsistence agroforestry systems are those wherein the use of land is directed towards satisfying basic needs and is managed mostly by the owner/occupant and his family. Cash crops, including sale of surplus production of commodities and all forms of traditional shifting cultivation are the most widespread examples.

d) Ecological basis takes into account the environmental conditions on the assumption and the certain types of systems can be more appropriate for certain ecological conditions. Based on the major agro-ecological zones. Agroforestry system are grouped into the following categories:

A) Humid sub-humid lowland

B) Simi-arid arid lands,and

C) Highlands

(A) Agroforestry Systems in Humid/Sub-humid Lowlands.

This region is characterized by hot humid climate for all or most of the year and evergreen vegetation. The low land humid and sub-humid topics are by far the most important ecological region in terms of the total human population. It supports extent of area and diversity of agro-forestry and other land-use systems. Because of climatic conditions that favour rapid growth of a large number of plant species, various types of agro-forestry plant associations can be found in areas with a high human population. In areas of low population density trees on rangelands and pastures other Silvopastrol systems, improve fallow in shifting cultivation and multipurpose tree wood lots etc. are that major agro-forestry systems.

(B) Agroforestry Systems in Semi-Arid and Arid Lands.

This region is characterized by rainfalls confined to 9-21 days in July-September, 2-4 ½ wet months, vapor pressure deficit ranging from 9mb in January to 30 MB in April to May, solar radiation incidence (400-500 cal/cm2/ day), high wind velocity (20 kms / hour), high potential evaporatranspiration (6mm/days) and high mean relative humidity (RH) index (70-74.8%).

Several agro-forestry systems are suitable for these semi-arid and arid regions. The most common agro-forestry system is scattered trees in agro-cultural/ cultivated fields, constituting and agro-silvicultural system.

An arid zone is characterized by hostile climatic conditions and hence several independent agroforestry systems are practiced in this region to combat these vagaries. Some improved agroforestry practice has been suggested to better the situation, such as sanddune stabilization, shelterbelt plantation, Silvipastroal and agro-silvicultural systems, windbreaks and boundary plantation. These could be suitably practiced based on situation, purpose and need.

(C) Agroforestry Systems in Highlands

Uneven topography, varying levels of rainfall, degraded and shallow soils at high altitude to deep rich soils in valleys and great climatic variation characterize this area. This area is a storehouse of great biological diversity. The Himalayan region is an excellent example of this type of area.

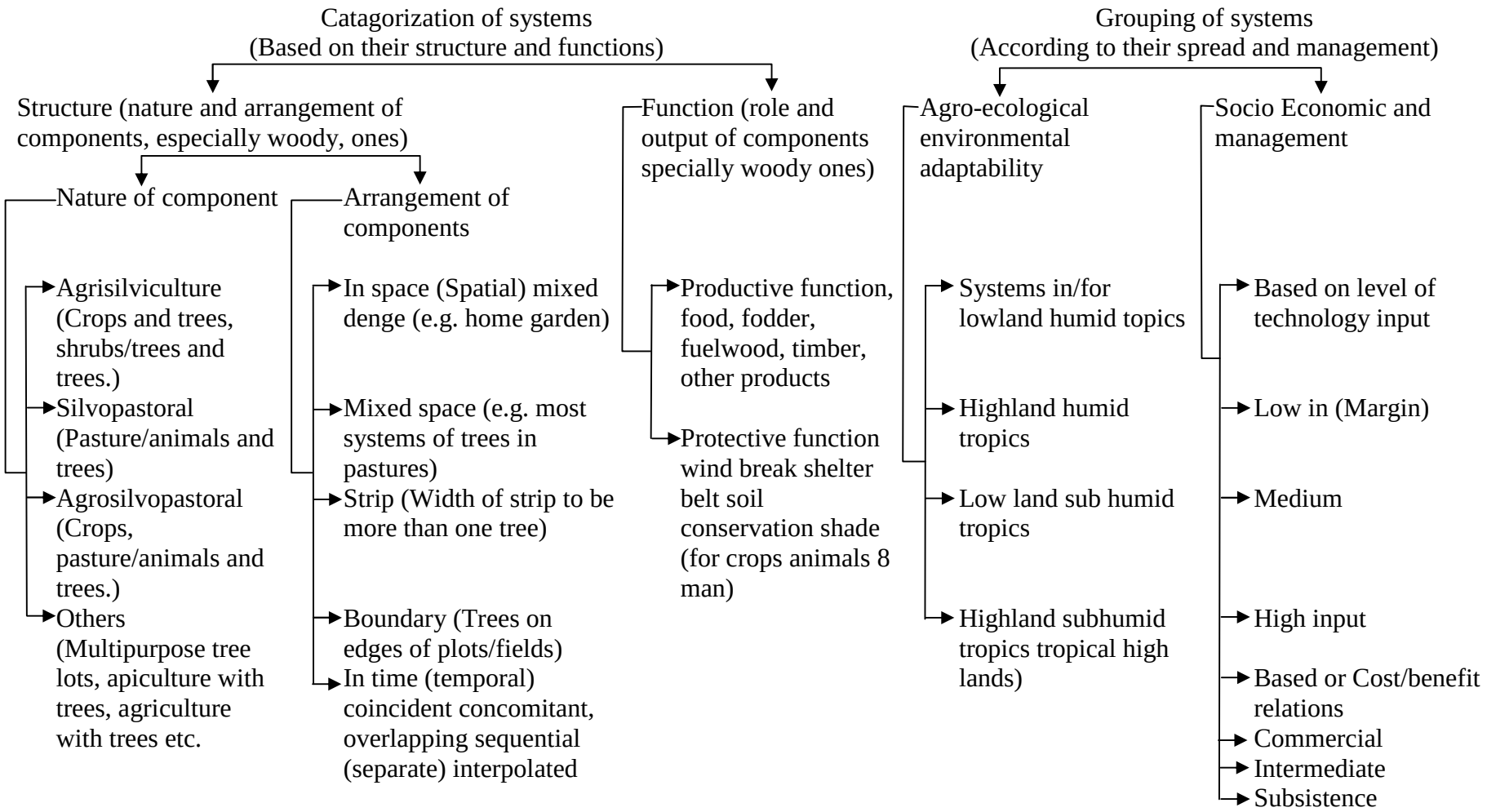
The areas in these high land tropics with significant agroforestry potential and humid or sub-humid, those with dry climates have very low potential. Land use problems in the highlands are similar to those in humid or dry lowlands, depending on climate, with the addition the sloping land and step terrain makes soil erosion a major concern.

The main agro-forestry systems in tropical high lands are:

a) Production system involving plantation crops such as coffee and tea in commercial as well as small holder systems.
b) Use of woody perennials in soil conservation and soil fertility maintenance,
c) Silvopastoral combinations.

Thus, it can be seen that there may be many approaches to agroforestry classification. However, a system based on the nature of the components and their major functional characteristics for specific purpose appears more logical, simple and pragmatic purpose oriented approach to castigation of agro-forestry systems. The choice for a system may be based on many interacting considerations –social, ecological and economical. The right choice for the right situation is necessary.

Figure 2: Major Approaches to Classification of Agro-Forestry Systems and Practices



Source: Based on: Nair and Krishnankutty, 1984.

2.2 The Concept of Rural Development

The term 'rural' is of course, ambiguous. Most obviously, rural areas constitute the space where human settlement and infrastructure occupy only small patches of the landscape, most of which is dominated by fields and postures, woods and forest, water, mountain and desert. There are also places where most people spend most of their working time on farms, where land is abundant and cheap, where transaction costs are high and political conditions are most difficult. Rural areas are highly heterogeneous. Law potential areas are most difficult. Law potential areas are worst off (Ashley et al. 2002.)

Rural Development is not a new notion in Nepal. It is the synthesis of various attributes that have gone into its making in the past. It has primarily two elements, i.e. rural community and its development. By rural community we conceptualize a social body, which has cohesion, solidarity, spiritual quality of cooperation, interpersonal respect and a certain degree of responsibility. The word 'development' on the other hand, implies: technology, administration, supplies, services, methods and procedures, plans and programs, processes and progress. Rural development covers a wide spectrum of activities encompassing improved productivity, increased employment and thus higher income for target groups as well as minimum acceptable level of food, shelter, education and health (Adhikari, 1992).

Robert Chambers is not satisfied with the definition claiming that women and children surviving in poverty were not included, suggested an amendment. "Rural development is a strategy to enable a specific group of people, poor rural women and men, to gain for themselves and their children more of what they and need. It involves helping the poorest among those who seek a livelihood in the rural areas to demand and control more of the benefits of development. The group includes small-scale farmers, tenants, and the landless.

Rural development is a strategy designed to improve the economic and social life of a specific group of people rural poor. It involves extending the benefits of development to the poorest among those who seek a livelihood in the rural areas. The group includes small-scale farmers, tenants and the landless (W .B, 1978).

Rural development draws our attention towards the agricultural development. It is often confused with agricultural development. It involves more than agricultural development alone. It is very much concerned with agricultural development in countries

where the majority of rural men and women - many of their children - earn part or all the non-agricultural activities in rural areas are directly or indirectly related to the fortunes of the agricultural sector (White, 1991)

2.3 Importance of Agroforestry Systems

Agroforestry is preferred to forestry plantation because it is more profitable than non agroforestry land use systems, and there are advantageous biological and economical intermediate or long term sustainability. Some examples of beneficial biological interactions include complementarily as in bee keeping to increase honey production plus pollination of fruit trees, and supplementary as in coconut and under storey crops.

Positive economic interactions of agroforestry take place when physical output per land unit is enhanced in term of monetary value. Positive biological interaction is also tantamount to positive economic interaction as in producing better quality coffee under shade o at tree.

Advantages:

Agroforestry systems are advantageous for the following reasons:

- Centuries old, generally positive, practices used by hundreds of millions of people in the world.
- Claims of site improvement, increased yield, lower risk being proved.
- Pace of agroforestry research is accelerating in recent years. However, it takes decades attaining an adequate understanding of the dynamics of agroforestry systems.

1) Biological Advantages of Agroforestry

- Increased space utilization: above and below ground utilization in increase total biomass production.
- Improved chemical, physical and biological characteristics of soil as shown below:
    - Soil nutrient cycling or pumping from the lower horizons otherwise not accessible to annual crop root systems.
    - Organic matter inputs through litter fall, pruning or the root system.
    - Major benefit of agroforestry system, particularly with the nitrogen fixing trees.

- Increased productivity: aggregate production from agroforestry is often perceived greater than that from monocultures.
- Reduction in microclimate extremes: modification of temperature in moisture extremes under tree canopies.
- Reduced risk of complete crop failure: plant diversity to reduce the risk of complete crop failure plant diversity to reduce the risk of total crop failure from pest infections or climatic stress, insurance factor for the resource poor farmers.
- Physical support for herbaceous climbers: trees in agroforestry system provide substitutes as poles for climbing vegetable crops.
- Positive use of shade: tea, coffee and cocoa, cardamom benefit from the shade from trees.

2) Economic and Social Advantages of Agroforestry

- Increased income opportunities:

  (i) Opportunities for earning greater income per ha. Per year.

  (ii) Year-round distribution of employment and income.
- Variety of products and/or services:

  (i) Variety of products from the same piece of land

  (ii) Providing shade for crops, human or animal comfort, windbreak or ornament. Potential for improved human nutrition: home gardens can produce up to 40 percent of the total family food and nutrient requirements.
- Crop diversity and reduced risk:

  (i) Reduction of price and income fluctuations due to different and many crops.

  (ii) Reduction of risk of total crops loss.
- Biological stability: predictable yields under given environmental and management conditions.
- Production stability: resulting from the biological stability of the crop or crops and the farmer's ability to manage the crop or crop combination effectively.
- Economic stability: combined measure of production and price stability.
- Reduced establishment costs:
- Improved distribution of labour:

  (i) Labour requirements are evenly distributed over a long period.

  (ii) Rural poverty due to seasonal economic activities associated with annual crops is mitigated.

The farming systems in Nepal make heavy demands through forests. They are based strategies to manage forest pasture, and arable land simultaneously and in an integrated fashion to acquire: food, shelter and clothing. Growing tree in and around farmstead, dry and wet terraces and on river banks are vital for Nepalese farmers who farm the smallest arable land area per capita on the globe. Thus, farmers have combined agriculture and forestry into one practice, which is of diverse farms, types, and systems (Basnyat, 1995).

Bamboo, an important agroforestry component, is dominant in the rural farming systems of both the terai and mid-hills of Nepal. It is mainly grown in homesteads and degraded lands, and helps sustain livelihoods of many rural people that include socially and economically disadvantaged groups. Very few species can match bamboo in terms of usage, as it is flexible, easy to bend and split into small pieces with superior strength. It can be used for house construction, furniture, woven products, small household utility items and leaves fodder bank to be used during the scarcity and in dry season. Tender bamboo shoots provide valuable sources of nutrients for human consumption along with some medicinal uses (Das, 2003).

Shrestha and Suwal (1990) state that raising grasses like staria (staria ancepts) on terrace risers is very commonly practiced in most parts of the extension command are. The risers between terraces are generally left fallow. These terrace risers constitute some 24 percent of the total of the hills. If such areas could be utilized with grass/legumes, extra foliage for livestock could be obtained. This practice is very well adopted without any negative implication for the crops grown. In addition, the terraces are protected from collapse during heavy rain. Broom grass (Tysanolaena maxima) can be grown even on the dry slopes in the hills and areas. Thus, planted on the high terrace risers by the farmers. The foliage of the broom grass is used as a fodder. The inflorescence is used for making brooms, and the rhizome of the plant can protect the terrace. The broom grass can be beneficial to farmers by yielding foliage and brooms, as they can make substantial cash earning from it. Besides, as the rhizomes of broom grass stabilize the soil, the terraces can be well protected from soil erosion.

Why agroforestry is important in Nepal?

- Nepal's is forest area has dwindled to less than 37 percent.
- Nature forests are mostly degraded and consequently the 30 percent mean annual increment (MAI) of woody biomass is very low in the forest.

- High demand of forest products for various purposes including construction, energy, cottage industry, food, fodder etc.
- The demands will not be met even if all the forests are managed scientifically.
- Most of the forests are inaccessible.
- Transportation and distribution of fuelwood are difficult.
- It will be too costly to manage all the natural forests.
- FAO's declaration of Nepal as one of the Asian countries having acute fuelwood scarcity: trekking 10hours or more to bring a head load of fuelwood.
- Annual fuelwood and timber deficits amount to 2.6 million tons and 0.25 million m^3 respectively and the estimates for 2000 are 3.5 million tons and 1.2 million m^3.

2.4 Earlier Research on Agroforestry

2.4.1 Research in Nepal

There are many organizations, which are involved in agroforestry research in Nepal. Most of them are trying to focus their study on growth rates and yield of tree fodder and tree's spacing effect on agriculture crop yield. A combination of tree with herb species is also becoming an interesting study in the Terai and hills. Bamboo raising techniques are also emerging as arable land use options in the Terai. Some organizations are trying to rehabilitate degraded land through Slopping Agriculture Land Technology Economics of fuelwood is food grain production is another area of agroforestry research.

The main objective of agroforestry research is to optimize production and economic return per unit area especially in rural communities. In the last 15 years, agroforestry activities have been much emphasized by the government and NGO's/INGO's which have great potentials for conservation, land reclamation and in upliftment of the socio-economic condition of the local people.

The eight five year plan of planning commission HMG"S -Nepal (2049-2054 B.S.) has emphasized o n the promotion of private forestry and has given the right to use and sell the forest products produced in their farm lands. The legislation published in March 1995, has become more flexible in getting permission to use and sell such private forestry products.

Yadav (1984) stated the problem of deforestation and environment degradation in the hills of Nepal. He defined the effect of such depletion on agricultural production

system of hills of Nepal. The nature of problems he suggested that there is an urgent need for an alternative land use system, which is both productive and protective land use system in nature. Tree inter-cropping with shade tolerant, cash crops, such as tea and cardamom, silvopastoral systems and hortipastoral systems have been proposed as alternative to present land use system for marginal lands in the hills he described.

A tracer study for the re-evaluation of the Sagarnath and Nepalgunj Forestry Development Project revealed that the yield of Sissoo varies with the site. At the same time, the Sagarnath Forestry Development Project was carrying out harvesting and thinking of Sissoo. The data were based on the actual yield obtained from harvested sissoo trees. The average yield of Sissoo was $6m^3$/ha one year. Therefore, the same figures (yield) and products have been taken into consideration. Sissoo would yield initially firewood then poles and logs. The firewood yield was $7.14m^3$/ha one year. It was assumed that thinning would be carried out in every 5 year for 25 years. Initially, the products would be used for firewood. In 15 years, there would be 30 percent poles and 70 percent firewood. It would yield 52 percent firewood and 48 percent poles at the stages of 20 years. In 25 years, it would produce 53 percent logs and 47 percent firewood, assuming that diseases and pest would not affect the yields (Amatya and Amatya, 1993).

B. Thapa, L. Joshi, and S.L. Sherpa, (1989) informed through their combined study, including the major components of the system, their uses, interaction and management practices. They described the prospect and implications of improvements to the system. They realized that the rapid population growth, extension of arable lands on unsuitable slopes, overgrazing of both Forests and grassland and an increasing demand for forest products to meet the basic needs of the growing population has degraded the environment considerably. They stated the deterioration conditions, which are reflected in declining crop yields, severe soil erosion and increasing scarcity of forest products. The nature of problems they suggested is that there is a need for an alternative land use system capable of meeting the basic and capable of the people on a sustainable basis and capable of halting environmental deterioration of the mid- hills of Nepal.

Amatya (1995) described agroforestry and its importance in Nepal. He estate that agroforestry in Nepal is an age-old practice, it is now emerging as new art of science. The aim of developing agroforestry within Nepal is to meet the present and future requirements of firewood, fodder small timbers and environmental protection he described. He defined that use of trees are only concerned to animal fodder in

agricultural terms in the hilly regions of Nepal. Agroforestry as a promising technique to active sustainability in land use. The empirical evidence suggests that agroforestry can provide a sound ecological basis for increased crops and animal productivity, more dependable economic returns and greater diversity. But he has not defined agroforestry a remedy for all land use problems. It is a viable tool, which is able to solve social and economic problems to overcome physiological, ecological and environmental constraints he described.

K. R. Kanel (1995) introduced tree-farming (private) systems as a new ways of fulfillment of the decreased supply of wood products from the national forests of the terai. He has indicated the stumbling block factors of private tree farming systems in Nepal. He has indicated the Harvesting, and transportation permits, land tenancy regulation and export ban of wood products and the intensity of tree schemes cultivated on farms of the terai of Nepal. Policies such as sales tax and excise duties on the processing of timber has increased the price of privately grown wood products in the market but reduced the income to tree farmers. He has indicated the possibility to export privately grown sissow trees to India.

Practices that minimize the rate of soil degradation, increase crop yields and raise farm income are key to sustaining agricultural productivity in the hills of Nepal. The use of farmland is undergoing rapid changes in response to increasing population pressure, deforestation and subsistence needs. Against this background, the study examined the impact of an agroforestry intervention project on farm income based on a sample of subsistence farm household in Dhading district. The project was implemented by NAF in 1993/94 to increase fodder production through the promotion of Agroforestry. A total of 223 households (82 'with' project and 141 'without' project) were interviewed during May-October 1998 to collect information on production. The finding showed agroforestry to be more profitable than the conventional farming system. The results also revealed that the introduction of mulberry (Morus alba) trees for sericulture could further enhance the profitability of an agroforestry based system. Thus, agroforestry has great potential for enhancing food production and farmers' economic conditions in a sustainable manner through its positive contributions to household income (Neupane and Thapa, 2001).

Das and Oli (2001) express that in order to know the tree growing practice in the rural areas of eastern central and far-western Nepal, field survey was carried out during June July, 2000 in the three districts of the terai region of the country, namely

Kanchanpur, Chitwan and Sunsari. The study aims to provide information on preferences of Farmers towards tree species suitable for farmland and to explore the constraints perceived by the Farmers in growing tree species in and around their homesteads. In order to attain the above objectives, formal and informal discussions were held with tree growing households, knowledgeable persons, governmental and non-governmental officials of these districts. Focus group discussion was also held in order to verify the information obtained from the household survey.

They further mention that tree growing on farmland has been alternative support in fulfilling the rural people's demand for forest products. Farmers have been planted tree species to attain more return from their land together with agricultural crops. The study reveals close association between form size and tree growing in all the sites. Despite the popularity of tree growing on farmland, some factors have hindered the progress of such practices in large scale. The energy use pattern in all the three sites was mostly traditional. Government managed forests, together with community forests and tree on farmland, were found to be the main source of forest products in the study sites.

D.P. Acharya, (1989) investigated the socio-economic and cultural factors affecting the adoption of agroforestry systems technologies with a special reference to the terai region of Nepal. The factors which are to be considered for a large scale adoption of tree systems apart from technical and financial considerations are discussed. How the traditional, culture behavior and social milieu of an area affect the adoption of the system have been high lighted by him.

2.4.2 Research at the International Level.

A.Young (1981) pointed out the potential of agroforestry systems to contribute soil conservation. He has stated the appropriate agroforestry systems, which have the potentials to control the erosion, maintain soil organic matter and physical properties and promote efficient nutrient cycling. He has recommended an urgent need for research to acquire further experimental evidence to support agroforestry as an important system for productive and protective sense.

The potential effects of agroforestry systems on conservation and development have been well documented panama has seen a substantial rise in the number of projects with an agro forestry component in the 1990s. There has been insufficient research on the actual impacts of these projects on smallholder farmers and their attitude towards

these systems. The study explores the perceived socio-economic and environmental impacts of five agro forestry projects in panama. A total number of 68 small holders were administered semi-structured interviews. In addition, 13 agroforestry experts from NGOs, government departments and research institutes were interviewed and their responses were compared with those of the small holders. While the project led to increases in the standard of living by providing wood products and fruits for domestic consumption, farm income levels generally remained unchanged. This was primarily due to limited market development, the lack of marketing organizations and poor access roads.

In terms of environmental impacts, the farmer's responses suggested as length decline in slash and – burn agriculture, and an increaser in tree planning activities. Farmers observed some environmental be refits, including reduced soil erosion, increased soil fertility and improved quality and quieting increased agroforestry adoption included insufficient agro forestry extension, inappropriate project design as managements (such as top-down management approaches, and the use of food incentives), small holder's economic constraints, and target policy issues. Recommendations are proposed to improve project design and managements, and to address the recommendations are proposed to improve project design and management, and to address the economic and policy constraints (Fischer and Vasseur, 2002)

UNCED (FAO, 1994) emphasized on the introduction of new agroforestry systems, which lead to a more rational and complete use of soil fertility and energy and enhance synergetic relations between species. They are on the opinion that such agroforestry systems help to minimize the risk of diseases and diversity economic opportunities for small-scale farmers.

Z. Zhahua (1994) advocated that the objectives of managing agro forestry are.

- To raise land productivity including the production of biomass, food, forage fire wood, raw materials far industries.
- To increase arable land area.
- To promote farmer's economic and living standard
- To use the natural resources fully and
- To protect ecological environment effectively.

P.Singh et al. (1994) stated that agroforestry has much to offer in checking land degradation trend in providing much needed products, viz food, fodder, firewood,

timber, medicines etc. is of special significance in Asia – Pacific region because of deterioration in land-man ratio. Very high rate of deforestation and about 75% of this deforested area is used for agriculture and diverse needs of farmers on a sustainable basis. Furthermore, they are on the opinion that agroforestry being a site specific technology needs to be developed according to the local need.

Garrity (1994) stared that the agroforestry has been popularized among decision makes as a conservation farming solution to sustain the productivity there fragile a land. Consequently, there is an enormous demand for sound upland agroforestry technology.

Swaminathan (1987) postulates that there is an opportunity to design more efficient and ecologically sustainable agroforestry system by putting the large food grain stocks of today to intelligent use. Agroforestry systems designed to overcome physiological, biological, ecological and economic constraints can help to enhance efficiency.

A. K.Gupta (1993) has tried to deal per myths regarding agroforestry policies, research, programmes and activities with particular reference to marginal land in dry regions. He has chosen his pick essentially guided by the prevalent dogma among the policy markers. He concluded the time tested practice of integrating agro forestry systems with livestock, craft and other economic enterprise in dry regions remains the only viable and sustainable way of restoring productivity of crops should be grown and growing crops where tree should be grown. far this process be called the paradox of agroforestry products by indication that one should not thrown a baby with bath water, hence market is a great leveler for agroforestry he said .

P.K.R. Nair (1984) analyzed and compiled what is actually known on the subject drawing on relevant information and research from across disciplinary and geographic boundaries. Equally or even more importantly, he has pointed at what is not sufficiently known and outlined priority research field which scientists can propose in order to make valuable contributions, eventually leading to better use of soil resources in agro- forestry and other farms of land use in tropical and sub-tropical developing world.

B.S. Chundawat and SK. Gautam (1993) dealt the conceptual background and definition of the agroforestry systems. They defined the history of Agroforestry, agro-ecological zonification, socio-economic aspects of Agroforestry, agroforestry systems for small holding, arid, wet and hilly areas and for fuel wood production, multi-purpose trees in Agroforestry, soil productivity aspects of Agroforestry, economics of agro

forestry and it's extension. They also defined agroforestry as a he said of new scientific discipline and the solution to problems of sustaining agricultural production in India.

In the Brazilian Amazon, mass deforestatation had reduced from a sequence of road building extractive logging, and pasture development during the pass thee decades. Ranches have consolidated small agricultural holdings, pushing farmers to move to forest frontiess as urban fringes, prompting further deforestation and social instability. In response to the conversion of amazonian forests, the authors sought to identify both economically viable and sustainable development alternative within the Brazilian state of Para. There, local farmers of Japanese decent have developed a variety of agro forestry systems in which 10 to20 ha. field yield incomes are comparable to the ones from 400 to 1200 ha of pasture. In addition such crop fields generate substantially more rural employment per hectare than do pasture. On going forest conversion to pasture is clearly not a product of sound economic decision making. Improved land zoning and public policies could favor agroforestry over further pasture expansion, stabilizing rural populations wile helping to conserve the Amazon's remaining forests (Yamada and Gholz; 2002).

J.S. Douglas (1982) suggested the role of forests and tree-crops in farming and offers detailed advice and information on various economic species. The use of their product for food and raw materials, planting techniques and suggestion and guidance for the outing and operation of forest farming schemes is also described.

2.5 Legal Aspects of Agroforestry

The Government of Nepal Forest Sector Policy was first declared in the Sixth Five-year Plan (1981-85), which emphasized community participation in the management, conservation and utilization of forest resources. This array of divers experiences gained it's greatest focus in 1987, when the government undertook the task developing a 20 year MPFS (1989) that has placed priority on community and private forestry programs with some 47 percent of the total budget allocated to the sector to support those programs (Malla, 1999).

2.5.1 Master plan for the forestry sector policy, Nepal

The MPFS (1988) has strictly mentioned long -term objective to meet people basic need for fuel wood, timber, fodder and other forest products on a sustainable basis,

to contribute to food production through an effective interaction between forestry and framing practices, and to protect the land against the degradatation by soil erosion, flood, landslide, desertification and other affects of ecological imbalance. The MPES farmed the basis for a draft Forest policy in 1989, the first priority of which was to meet the basic forest-product needs of local people through community forestry and private planting.

The MPFS (1998) emphasizes the role of district forest offices in providing seedlings, and has set planting targets of more than 21 million fodder trees and 44 million fuel wood trees by the year 2011 for the community and private forestry programs.

2.5.2 Forest Act 1993 and Regulations 1995

This is the new constitution made in the forestry sector after the restoration of democracy. High priority is given to community forestry and private planting program together with handing over the protection and management of community forests to the actual user and encouraging the people for private planting on the basis of classification of forest by the act.

The Forest Act (1993), especially in its provision relating to community forest, has clearly explained that DFO hand over any part of national forest to 'user group' in the form of a community forests in the prescribed manner entitling it to develop, conserve, use and manage prices. According to an operational is also defined. The owner of a private forest may develop, conserve and mange it or use or sell and distribute its products by fixing their prices as he likes. Any individual or institutional desirous of having a private forest registration may apply to the DFO for registration and DFO provider necessary technical assistance to the owners.

Under the private forestry programs, the government has encouraged creation of private planting by supplying free seeding and technical advice. The program is also supported by the free distribution of ICS to save Fuel and Protect health (Joshi, 1993).

Chapter – Three

DESCRIPTION OF THE STUDY AREA

Dhankuta district is located in eastern Development Region of Nepal. It is a mid-hills district of the country. This district is located between the latitude $26^0$53' to $27^0$19' North and longitude $87^0$19' to $87^0$33' East and its elevation ranges from 120m to 2702 m and total area of the district is 891 sq.km. The bordering districts are Terathum and Pachthar in the east, Bhojpur and Udaypur in the west, Shankhuwasaba in the north and Morang and Sunsari in the south. Politically, Dhankuta district is divided into 35 VDCs and one municipality.

Table 1: Physical Setting by to Altitude

Category	Height (m)	Percent
1.	<305	5.00
2.	305-610	27.00
3.	610-915	23.00
4.	915-1220	17.00
5.	1220-1525	13.50
6.	1525-1830	10.00
7.	1830-2135	4.00
8.	>2135	0.50
Total		100.00

Source: District Profile 2061, DDC Dhankuta.

Table 2:Land Use Pattern

Land Type	Area (ha)	Percent
Aribal Land	40,723	49.00
Khet	8,660	10.80
Bari	32,063	39.05
Forest	36,383	44.11
Grazing Area	220	0.04
Others	5,203	6.40
Total	82,429	100.00

Source: CBS, 2001, and District Dhankuta.

Map 1

Map of Nepal

map of dhankuta

Table 3: Land Ownership Pattern

Land Size (ha)	No. of Farmer Households	Total Land (ha)	Percent
>0.1	843	45.10	3.43
0.1 to 0.2	1,345	185.10	5.47
0.2-0.5	5,041	1,712.70	20.5
0.5-1.0	7,140	5,132.40	29.04
1.0-2.0	6,623	9,146.90	26.94
2.0-3.0	1,907	4,412.70	7.76
3.0-4.0	917	3,034.30	3.73
4.0-5.0	355	1,568.60	1.44
5.0-10.0	251	1566.30	1.02
< 10.0	30	945.10	0.13

Source: CBS, 2001, and District Dhankuta.

3.2 Climate

There exist a diversity of weather and climate in the country because of multifarious topography. Consequently, the country experiences tropical, isothermal, taiga and tunra types of climate. In the study area, the climate is subtropics in nature. Normally the temperature falls down 5^0C in January, February and reaches a maximum of May June (Table 4).

3.3 Rain-fall

Normally monsoon arrives over eastern Nepal in around mid- June. The monsoon covers 60 to 80 percent of the country in annual total rainfall. Due to rugged terrain, the volume of rainfall varies sharply from place to place. Large amount of rainfall generally occurs over the foothills of the Churia hills. This resulted on the hilly region and less in the foothills of the great Himalayas. In winter due to influence of western disturbances, western Nepal especially Northwestern sector of the country receives rainfall greater than that of eastern sector. At higher elevation most of the precipitation falls in the form of snow.

In Dhankuta district the highest rainfalls occur in the month of July. The month-wise distribution at rainfall in Dhankuta is as given below in Table 4.

Table 4: Data of Temperature and Rain Fall in Dhankuta

Month	Temperature (C^o)		Rainfall (mm)
	Maximum	Minimum	
January	14.50	5.18	19.10
February	16.88	6.79	0.00
March	21.90	12.20	6.00
April	22.32	13.13	103.60
May	23.31	15.48	201.10
June	23.55	16.78	365.10
July	22.61	17.25	553.70
August	23.68	17.85	138.20
September	22.72	16.41	235.80
October	20.94	12.57	77.50
November	18.75	8.72	3.20
December	16.40	6.60	0.00

Source: Agricultural Research Center; Phakribash, Dhankuta.

3.4 The Farming System

Generally, the agricultural land of the site is divided into Khet (wet land /low land) and Bari (dry land/upland) according to land orientation and cropping pattern of Nepal.

Khet refers to the land where waters retain on the surface or upper soil layer, making it suitable for paddy cultivation. Paddy is the stable food for the livelihood in the study area as well as throughout the country. Farmers measure their wealth according to the amount of Khet they process. Khet land is lower slop, leveled, and irrigated terrace land, which is generally, used for cultivating rice during the monsoon season and something wheat or potatoes during the winter.

Bari refers to the land other than the wetland, which is generally non-irrigated and rainfed. Bari is usually upper-slop; out sloping and rain-fed terrace land, which is generally used for growing maize and millet. Farmers produce maize, mustard; tomato and other green vegetables in Bari land.

Table 5: Cereal Crops

Crops area (ha) and production (mt)

Crops	1999/2000	2002/2003	Area
Paddy	23,131	25,556	1,906
Maize	30,600	33,813	20,195
Millet	8004	8038	8,117
Wheat	4243	6150	27,365
Barley	25	25	24

Source: DOAD Dhankuta

Table 6: Cash Crops

Crops area (ha) and production (mt)

Crops	1999/2000	2002/2003	Area
Oil seed	809	963	1028
Potato	17,702	18,875	1739
Sugarcane	40	13	25
Tea	15	35	150

Source: DOAD, Dhankuta

Table 7: Pulses

Crops area (ha) and production (mt)

Crops	1999/2000	2002/2003	Area
Lentil	69	87	139
Chick pea	3	3	5
Pigeon pea	3	3	3
Black gram	414	498	813
Soya bean	428	468	5581

Source: DOAD, Dhankuta

Above three tables 5, 6 &7 shows the farming patron of Dhankuta district. Out of total farming land wheat has found in large area i.s.27,365ha. , but according to production Maize take first place, in Dhankuta Maize production is 33,818 mt.(2002/03). Cash crop is also one of the important agri-production, in cash crop potato is best choice of farmer in Dhankuta .The total area and production of potato is 1739 ha. and 18875mt. respectively in year 2002/03. In pulse only Soy bean is in a large figure other is in ineligible, the total production is 468 mt in 5581ha land.

3.6. Demography

The population of Dhankuta was estimated 166,479 in 2001 census. The population is growing at the rate of 1.29 percent per annum. The male sex ratio is 96.70 in Dhankuta. The population density is 187 per sq km and urban population is about 12.41 percent in Dhankuta. Following table shows more details about demography characteristics of Dhankuta.

Table 8: Demography Characteristics of Dhankuta

Particular	1981 census	1991 census	2001 census	2005 projection
Total population	129,781	146,386	166,479	175,237
Male	66,183	72,080	81,841	86,145
Female	63,598	74,306	84,638	89,091
Sex ratio	104	97	97	97
Total households	22,332	27,425	32,571	34,284
Average households size	5.8	5.3	5.11	5
Literacy rate%	31.2	48.5	63.98	63.98
Population density per sq.km	145.7	164.3	187	197
Dependent population	-	-	73,979	77,871

Source CBS (2003)

3.7. Education

Dhankuta district is in number one position in male literacy rate among eastern hill district. Dhankuta haves 1 college, 5 Higher secondary schools, 310 schools and 50,724 regular school- going children.

Table 9: Number of Schools, Students and Teachers

Type of School	No. of Schools		No. of Students		No. of Teachers		
	Total	Private	Total	Girls	Total	Train	Female
Preprimary	34	13	2,195	1,151	120	-	53
Primary	310	13	31,828	15,914	1,061	278	268
L. Secondary	86	9	11,789	5,621	299	158	38
Secondary	52	6	4,912	2,288	160	102	6
Total	310	41	50,724	24,974	1,640	538	365

Source: District Education Office, Dhankuta, 2061/62BS.

3.8 Forest Situation

Forest is an important source of rural needs in the district. The subsistence economy prevalent in the rural area of the district is directly or indirectly dependent upon the forest resource. The type of forest is mainly based on the physioclimatlic condition of the topography of course; there is reciprocal relationship between physio-climatic condition and the natural vegetation. The natural vegetation of the district can broadly be divided into three types. These are discussed here under.

3.8.1 Sub-tropical Forest.

The sub-tropical forest can be found in the valleys and the river basins of Arun, Tamar and their main tributaries. This type of forest is found below the 1000m attitude. This is hard wood type forest having broad leaf and generally green almost year round. Main species of such types of forest are sal, simal, sissaw, khayar, karam and satisal.

3.8.2. Temperate Forest

The temperate type of forest can be found in the mid-land and the lower part of Mahabharat lekh. The forests in the altitude ranging from about 1000-2100 meters can be classified as the temperate forests.In Dhankuta district, these types of forest can be found

within the altitude of 1000-1700 meters, just above the basins and tars mode by the rivers and in the midlands and lower Mahabarat Lekh. Major tree species are uttis, salla, chanp, katus, and Lankuri.

3.8.3. Cool Temperate Forest.

The cool temperate forest can be found in between the altitudinal range of 2100-3300 meters but in the context of Dhankuta district such types of Forest is available from the altitude of 1700 meters. Because of the cold type climatic condition, the soft wood tree species like uttis, Devdar, pine, Gobre salla and Gurans are dominant in this range.

3.9 Community Forest in Dhankuta

The history of community forestry in Dhankuta district goes back to the late 1970s. The government introduced panchayat forest and panchayat forest and panchayat protected forest laws in 1978. Local forest patches could be handed over to the panchayat in the lowest level political units as the community. However the community Forestry in the present day sense started in 1989 in this district with the beginning of handing over the local forest to local user communities and local forest user communities began to form their FUGs developing an operational plan. By July 1987, there was only one FUG having 137 household user members of 26 ha of the forest area and this process has been expanding rapidly to date. By June 2006, there were a total 346 FUGs comprising 34000 households with 25,600 ha. of forest.

3.10. Development Activities

There are many NGOs, INGOs and local level organizations working in Dhankuta with various objectives LFP, SOLVE, FIFOCAN, HIMAWANTI, dairy co-operatives, and local organizations are some of the organizations operating in study area.

LFP is working with the goal to facilitate community forestry User Group in terms of management and utilization of the Forest. They are working through local NGOs and launching different income generating activity focking very poor user.

Chapter – Four
RESEARCH METHODOLOGY

The field survey for the study was accomplished during May of 2006. The study is largely of impact evaluation type.

4.1 Unit of the Analysis

The researcher has acquired in-depth information about the local agroforestry at two levels: VDC, municipality level. Rajarani VDC, Parewading VDC, Ghorlikhraka VDC and Dhankuta municipality where LFP are operating there programme, household level; visit to 62 household's respondents, who are beneficiaries of LFP's IGA program and user group level (The users from 16 community forestry user groups has been approached)

4.2 Research Design

Mainly descriptive as well as analytical research design has been employed to study the agroforestry management practices. The present study has made an attempt to describe and document the nature of existing agroforestry system.

In order to fulfill the research objectives and to answer the research questions, it was necessary to collect both primary and secondary data. Besides interview, questionnaire and observation relevant secondary information were also collected from both published and unpublished sources related to the present study. Although, both qualitative and quantitative data are used in the study, the main part of the research depends on primary data.

The population list (at household level) of the study area (3 VDCs and Dhankuta Municipality) was obtained population census 2001. In study area L.F.P. have launching IGA program through local, NGOs, (SOLVE, RARA, FAFCOFUN, HIMAWANTI) by providing Final support to (FUG). The reveled each other user in certain time period and this program is running in 97 FUGs out of 342.

To study individual efficiency of each local NGOs choose one area for one local NGO. The study area was chosen by purposive and FUGs by lottery method.

Table 10: Number of Sampled by area, FUG and HH.

Study area	Local NGO	Program running FUGs	Sample	Total no. of H.Hs.
Rajarani	RARA	4	3	60
Ghorlikhraka	SOLVE	5	4	105
Parewading	HIMANWA-N-TI	4	3	56
Dhankuta Municipality	FAFCOCUN	3	2	20

Source: Field Survey, 2006

4.3 Research Instruments

The study utilized survey questionnaire method to acquire information from the sampled household applying both qualitative and quantitative research approach, the information was gathered with a set of semi-structured questionnaires, direct observation and various checklists for the key informant interviews.

One the onset of the research, the researcher pre-visited the study sites and informal discussion was carried out with class elders, farmer VDC representatives, local NGOs and other very informants in order to trace the actual status of agroforestry activities in the farmer's field, the influences of agroforestry project, and the conservation measures undertaken.

4.4 Data Collection

The data and information for the study was gathered during May 2006 with help of animals of local NGOs. The interviews of respondents were taken at places and time of the respondent’s convenience for them. Before interviewing, the purpose of the interview was explained of them clearly.

4.4.1 Primary Data Collection

The study is both qualitative and quantitative. In pursuing the objectives of, the study household questionnaire survey, key informants interview, direct observation and informal interviews were carried out for obtaining the data and related information.

The household questionnaire survey mainly focused on the research objectives. As the total number of households is 48, it is not possible to meet all respondents at their homes, Thus 50% of the questionnaires were completed in the farmer's (respondents) field and the rest 50 percent at their homes.

Key informant interview is the second type of total used together in-depth information checklist is prepared to guide interviews of the following key informants (a sample of checklists is attached in Appendix 2).

Non-governmental sectors: former local leader, school teachers, leasehold ranger, the community forestry member and LFP officers.

Governmental organizations (GOS): District Forest Office. (DFO), District Agriculture Development Office (DADO), District Agriculture Development Office (DADO), District Development committee (DDC), District Vetnarry Office and the Village Development Committee (VDC).

Direct observation and informal interviews did play plotted curial role in the information collection.

4.4.2 Secondary Data Collection

The secondary data and information were gathered by reviewing the available resources and documents from various offices, organizations, VDC municipality DDC. The general information about the VDC was gathered from DDC, Dhakuta and Dhankuta municipality. The researcher visited libraries of NARC, to and government offices to acquire other information through literature review.

4.5Data Analysis

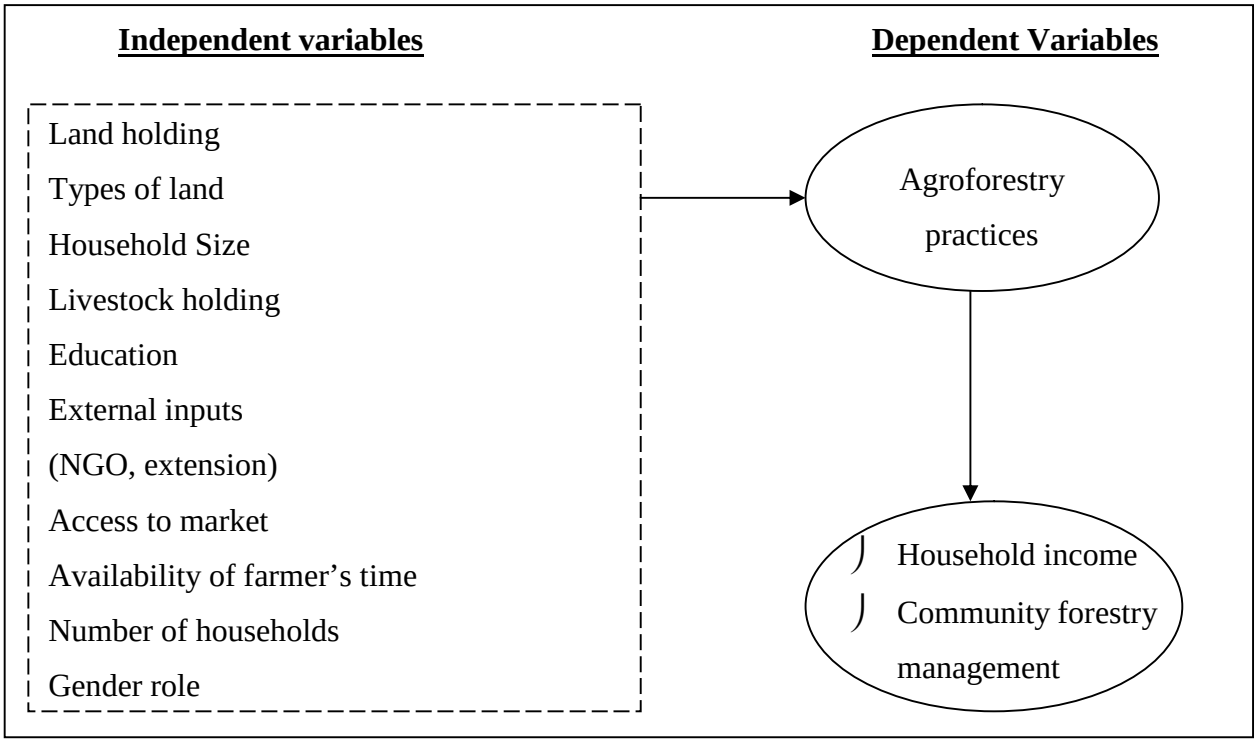
The data collected form primary and secondary sources were classified and then tabulated from obtaining all the answers to the research questions. The available information from question sheets was tabulated analyzed manually.

Descriptive statistical tools like frequencies, percentages, means and standard deviation are used to present the general findings of the study. Mostly tables, but graphical figures, too are used fro describing the information.

4.6 Conceptual Framework

Agroforestry adoption by farmers brings significant economic benefits, increases the level of farm income due to improved and sustained productivity so, the agroforestry practices increases the income of the households and might after the economic status of the local farmers in the study area. Also, the pressure on community forest reduces due to the availability of fodders. Forage, fuel wood and timber in their own land. Considering those assumptions, the conceptual framework is designed for the study, which is presented in Figure 3.

Figure 3: Conceptual Framework of the Study



Chapter – Five

RESULTS AND DISCUSSION

This chapter deals with results and discussion simultaneously form the analysis of data obtained from the study sites, utilizing different techniques to acquire detailed information.

5.1 General Household Information

The general household information encompasses general household characteristics, education status of the household member ethnicity and livestock holding size in the study sites.

Table 11: General Household Information

Area	Household population	Household size	Total population	Age below 15	Male		Female	
					Total	%	Total	%
Rajarani	16	4.75	76	24 (31.58%)	37	48.68	39	51.32
Parewading	16	4.93	79	23 (29.11%)	44	55.53	35	44.31
Ghorlikhraka	20	5.6	112	52 (46.43%)	51	45.53	61	54.47
Dhankuta Municipality	10	5.7	57	15 (26.32%)	26	45.62	31	54.38
Total	62	5.22	324	114 (35.19%)	158	48.76	166	51.24

Source: Field Survey, 2004,

Note: Figures in parentheses are percentages.

The total number of sampled household is 48 and the average household size is 5.22 , which is slightly lower compared to national household average sizes of 5.45 and higher than district household size of 5.11 (CBS, 2003).

The average percentage of male population is 48.76, which is slightly lower compared to district and national averages of 49.16 and 49.9 respectively. Similarly, the average percentage of female population is 51.24, which is slightly higher compared to district and national averages of 50.84 and 51, respectively (CBS, 2003). The average percentage of below is population is 35.19, which are slightly lower compared to district of 36.93.

Table 12: Distribution of Household Population by Sex and Literacy level

Literacy level	Rajarani		Parricide		Ghorlikhraka		Dhankuta Municipality		Total
	Male	Female	Male	Female	Male	Female	Male	Female	
Literate	21 (6.48)	21 (6.48)	24 (7.41)	15 (4.63)	27 (8.53)	30 (9.26)	20 (6.17)	17 (5.25)	
Illiterate	9 (2.78)	5 (7.72)	20 (6.17)	20 (6.17)	20 (6.17)	35 (10.80)	16 (1.85)	14 (4.32)	45.99

Source: Field Survey, 2006,

Note: Figures in parentheses are percentages.

Table12 revels that the average total percentage of literacy is 54.01 which is slightly higher than national average of 53.7 percent and near about 10-29 percent lower than district average of 64.30 percent (CBS 2003).

Among four areas in Rajarani VDC the average literacy rate is equal between male and female. Other hand one interesting finding according field visit is that in Ghorlikhraka VDC female literacy is higher than male literacy where district literacy in average of 54.50 and 74.50 percent, respectively.

5.2 Livestock Holding Size

The people of the study area raise a large number of cow and oxen, goat's buffaloes and others. According to the field study, the total population of goats is 255,

whereas cows and buffaloes together are 104. i.e. cows are 89 and buffaloes are only 15. The numbers of pigs are 45.

People raise cattle in large number because it provides manure, milk and milk products. Energy for plough fresh urine and dung. For purifying houses which is religious value of cattle.

Table 13: Average Livestock Size per Household and the Purpose of Rearing

Area	Type	Average	Purpose
Rajarani	Goats	4.16	Meat, manure
	Cattle	1.56	Milk, manure, religious
	Buffalo	0.19	Milk, manure, meat
	Pig	1.13	Meat, religious
Parewading	Goats	5.50	Meat, manure
	Cattle	1.69	Milk, manure, religious
	Buffalo	0.13	Milk, manure, meat
	Pig	0.63	Meat, religious
Ghorlikhraka	Goats	3.00	Meat, manure
	Cattle	1.50	Milk, manure, religious
	Buffalo	0.45	Milk, manure, meat
	Pig	0.45	Meat, religious
Dhankuta Municipality	Goats	2.80	Meat, manure
	Cattle	0.60	Milk, manure, religious
	Buffalo	0.10	Milk, manure, meat
	Pig	0.80	Meat, religious

Source: Field Survey, 2006,

In Dhankuta, the total numbers of goats are 1, 53,318, cattle 1, 56,077, buffaloes 25,329, and pigs 44,441 (Annual Report 2061/62, District Vetnerary Office,Dhankuta.

In whole Dhankuta district, there are huge productions of livestock products. Total milk production is 24,193 (MT) annually among this 12,302 (MT) goes on market for sell and rest is personally used.

Table 14: Livestock Base Production Export of Dhankuta District

Product Name	Production (MT)	Export (MT)	Price (RS.)	Export area
Milk	24,193	12,301	1,20,00,000	Local market, DDC Kathmandu, Pokhara, Dharan, Local market
Meat	4,720	3,132	4,50,00,000	
	500	400	1,00,000	

Source: District Vetnerary Office Dhankuta

5.3 Existing Agricultural

Agriculture is the backbone of the given population and its economy is predominately agrarian in nature. But it is subsistence in quality main occupations and secondary occupations of the sample population are related to agricultural, forestry and livestock. The crop production does not provide sufficient food grain to a full year for the given population. Therefore, people are forced to be engaged in additional and secondary occupation.

5.3.1 Distribution of Farmland

Farmland is divided into two types, irrigated (Khet land) and non-irrigated (Bari land). Bari land includes non-arable or pakhobari, which is kept especially for ensuring the supply of fodder, fuel wood, and timber by the farmers. Khet land is mostly cultivated and is devoid of trees, as rice yield diminishes substantially under the shade of tree crown. Maize and millet crops on Bari land are less susceptible to yield reduction under the shady condition. Therefore, farmers often cultivate them along with tree species (Gilmour and Nurse, 1995).

According to the size and availability, the farmlands are classified into five categories for the sake of the study: less than five Ropani, five to ten Ropani, ten to fifteen Ropani, and fifteen to twenty Ropani and above twenty Ropani.

Table 15: Land Distribution Patton (Area in Ropani)

Area	Number of sampled households	Households by farm size					
		Landless	<5	5-10	10-15	15-20	>20
Rajarani	16	-	9 (56.50)	-	4 (25)	1 (6.25)	2 (12.25)
Parewading	16	2 (12.75)	4 (25)	6 (37.50)	3 (18.50)	1 (6.25)	-
Ghorlikhraka	20	2 (10)	5 (25)	3 (15)	7 (35)	2 (10)	1 (5)
Dhankuta Municipality	10	3 (30)	3 (30)	2 (20)	2 (20)	-	-

Source: Field Survey, 2006,

Note: Figures in parentheses are percentages.

Table 15 reveals that most of farmers have less than five Ropanies of landwhich is very poor position for cultivation. Only 12.25 percent in Rajarani VDC and 5 percent in on Ghorlikhraka V.D.C. have more than 20 Ropani lands, which is only 2 and 1 household respectively.

5.3.2. Association of Tree Species in Farmer's Land

About 85 percent of the households have multipurpose tree species of fodder, fuel wood, and timber and fruit trees of different varieties in the study sites. Trees are mainly grown on bund, terrace risers around the home garden edges of Bari land frontiers of other farmer's land. No one is interested to grow tree species in Khet land but very few large landholder or who are living in the city away from the sites have mango, orange etc. Only few of the farmers have their own forestland, from where they meet demand for fodder, fuel wood and timber. Most of the fodder, fuel wood and timber trees are naturally grown, but the farmers are planting trees of different species by collecting seedling and saplings through different sources.

Fuel wood, fodder and timber species found in the private land are: Salla, Bakaino, Jamuna, Koiralo, Tanki, Utish Dudhole etc. Das (2000) states that the most important criteria for fodder tree selection in the mid-hill villages are their availability during dry season, nutritional value and palatability and labour require. Ments for fodder

during monsoon season, compared to the winter season, when women spend more time to collect and grasses. The general allocation of land for forest, fruit.

Table 16: Allocation of Land by Household for Forests, Fruit Trees and Vegetables

Plant	Number of hh doing kitchen gardening	Number of hh doing bari land
Green vegetables	10 (16.13)	4 (6.45)
No vegetables	30 (48.39)	35 (56.45)
Green vegetables + fruit + trees	3 (4.84)	5 (8.06)
Forest trees	0 (0.00)	10 (16.13)
Forest + fruit trees	0 (0.00)	7 (11.29)
Fruit trees	10 (16.13)	12 (19.35)

Source: Field Survey, 2006.

Note: Figures in parentheses are percentages.

Table16 reveals that the highest percentage of households (48.39%) did not grow vegetables in their kitchen garden; while as many as 75.95 percent did so in Bari land. Farmers did not grow forest trees and fruit trees in their kitchen garden. Forest trees are planted in Bari land by 16.13 percent of the households.

5.3.3 Association of Food Crops in Farmer's Land

Farmers of study area grow different types of cereal crops in different seasons. In one season more than two crops are cultivated mixed and intensive farming is popular. The farmers inter-mix varieties of seed species.

The following table makes it clear.

Table17: Modes of Cultivation of Various Crops and Trees in Bari Land

Cultivated Crops	Planting Time	Harvesting Time
Maize, soybean, pumpkin, cucumber	May - June	October - November
Mustard	September	January - February
Mustard, Pulse, Barley	September - October	January - April
Wheat	October - December	April - May
Wheat, Sarshum	October - December	April - May
Millet, Rainch, Filinge	August - September	November - December
Phaper	August - September	December - January

Source: Field Survey, 2006

Table17 shows that different types of cereal crops are cultivated with mixed cropping pattern in study area. According to the nature of mixed cropping, quality of cultivated land, altitude of settlement, socio- cultural value of crops and socio-economic importance of crops, modes of cultivated crops and planting period are different in study area.

Maize, millet, potato and other vegetable are the main Agrin production of study area. Especially, people cultivate for domestic use but sometimes people sell this product in local market.

Table18: Modes of Cultivation of Various Field Crops and Vegetables by Quantity in Bari Land

Cultivated crops	Production quantity by households (kg)				
	<300	300 - 600	600 - 900	900 - 1200	>1200
Maize	36 (58.06)	14 (22.58)	7 (11.29)	0 (0.00)	0 (0.00)
Millet	41 (66.13)	5 (8.06)	3 (4.84)	0 (0.00)	0 (0.00)
Potato	20 (32.26)	9 (14.52)	12 (19.35)	5 (8.06)	2 (3.23)
Green vegetables*	40 (64.52)	10 (16.13)	1 (1.61)	3 (4.84)	4 (6.45)

Source: Field Survey, 2006

* In Green vegetables include mainly cauliflower, cabbage, cucumber and tomato

Note: Figures in parentheses are percentages.

Table shows almost of all households 92.47 percent cultivate maize in their Bari land but the production quantity is very little out of 92.47 percent households majority of household cultivate less than 300kg, which is 58.06 in percent. Farmers Practice both seasonal and off-season vegetable growing. The majority of the farmers cultivate potatoes tomatoes, cabbage and others. Without potato 93.55 percent households cultivate green vegetable in their land.

5.3.4 Sufficiency of Food From the Farmlands

Food sufficiency at the household level is determined by the number of months for which food is availability to the households. The result reveals that there is great variation among the farmers, in items of food sufficiency. Most of the households have food sufficiency of 5-8 months through production in their farmlands. The detailed description of food sufficiency from the farmland is in table.

Table 19: Food Sufficiency of the Households From The Farmland

Area	Number of sampled households	Number of households with food sufficiency		
		0-4 months	5-8 months	9-12 months
Rajarani	16	5 (31.25)	8 (50.00)	3 (18.75)
Parewading	16	2 (12.50)	9 (56.25)	3 (31.25)
Ghorlikhraka	20	3 (15.00)	10 (50.00)	7 (35.25)
Dhankuta Municipality	10	5 (50.00)	3 (30.00)	2 (20.00)

Source: Field Survey, 2006

Note: Figures in parentheses are percentages.

Table reveals that the highest food sufficiency is observed in Ghorlikhraka V.D.C with only 35 percent of the households having food sufficiency and the lowest in Rajarani V.D.C with 18.75 percent for 9 to 12 months. The majority of household food-sufficiency for 5-8 months with 48.39 percent.

5.4 Impacts of Agroforestry on Community Forestry Management.

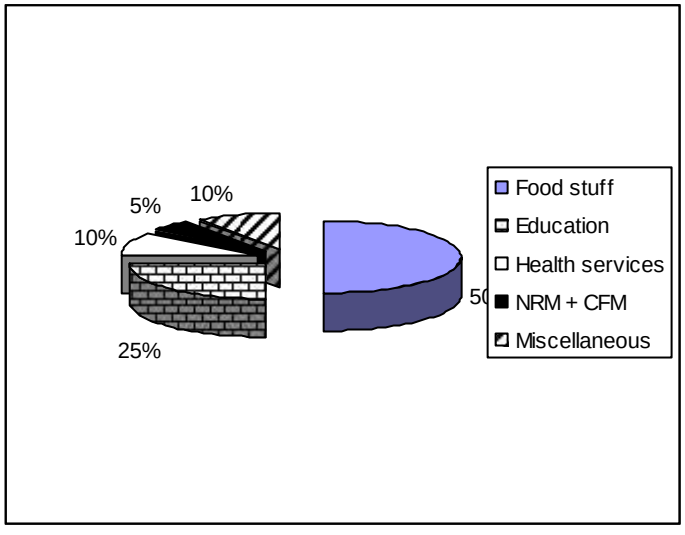
There is a general need for agroforestry in Nepal due to its potential contribution in the production and management need of community forests. Trees of different species in private land not only fulfill the household demand for timber, fuelwood, and fodder but also significantly contribute in the management of community forests. People from the adjacent community forests area less interested to expand. Community forests fro collection of forest products, or they require fewer amounts of forest products than before.

Access to alternative fodder sources is dealing, as government forests are gradually being handed over to local communities and rules and regulations are enforced, which allows fodder collection only for certain period of the year. As fodder scarcity increase, there will raise in the values of trees planted on farmland. Therefore, agroforestry can substantially reduce the pressure on community forests and assist in the management of community forests.

5.4.1. Allocating of Income for community forests management

The higher the level of income, the greater will be the degree of freedom to farmers to spend more money in social and environment management, development and protection. Poverty reluctantly dooms people to exploit natural resources including community forests, these by degrading forests and the environment.

Figure 4: Allocation of HH Income .



Source: Field survey, 2006,

Foodstuff includes all nutritious diets (stable and non-stable). Education includes primary education to university level education. Health services include primary health care and the cure of chronic disease. Natural resources management includes management of soil, water and forests. Likewise, the miscellaneous category includes entertainment, petty expenses, donation, clothing and overhead.

Figure reveals that 40 percent (25% education, 10% health and 5% NRM and CFN) of the household income is allocated directly or indirectly for natural resource management including community Forestry.

Allocating 25 percent of the income for education will raise the level of knowledge, skills, attitude and experience of the dwellers in the study sites, thereby assisting in local NRM and CFM. Likewise, allocating 10 percent of the income for health services increase the productive hours and manpower, thereby assisting in the NRM and CFM. Similarly, investing 5 percent of the income, in NRM; including CFM, directly assists in the management of community Forests in the study sites.

5.4.2. Drudgery Removal and Utilization of the Spared Time

Basically, the distance to community forests is directly proportional to women's and children's work and drudgery, i.e. the longer the distance, the greater will be the drudgery and work for women and children. Cooking and talking care of cattle constitute the major tasks for women and children, because they have to collect fulewood for cooking and heating, fodder and leaf litter as the bedding material for livestock. They collect those products from community for as well as form their own farmland. The depletion of forests by leaps and bounds has substantially increased women's and children's workload to go and collect forest products York (1990) estimates that in some parts of the Himalayas, Women and children spend 100 days a year together fuelwood and fodder. A recent study in Nepal; Carried by International Food policy Institute, has indicated that the description of Forest resources has added one hour per day to the time required for women to collect fuelwood and fodder. The detailed descriptions regarding distance between the households and the community forests are presented in table

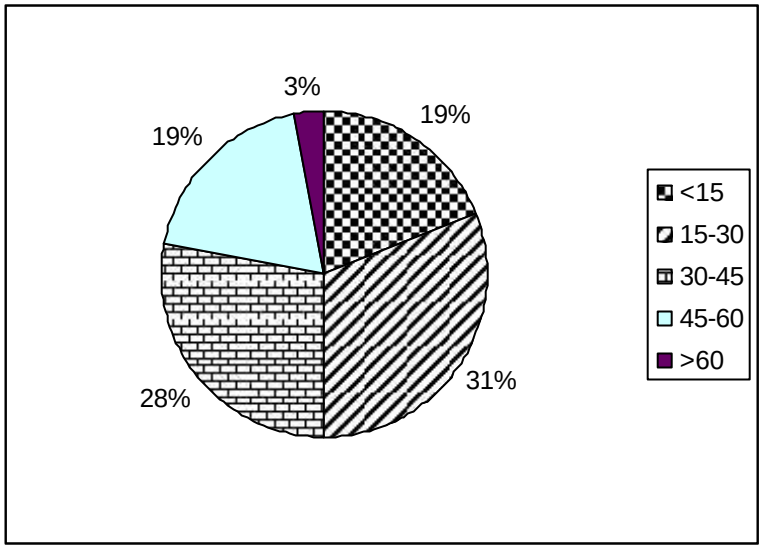
Table 20: Distances Between The Household And The Community Forests

Area	Distance to community forests (in minutes)					Total
	<15	15-30	30-45	45-60	>60	
Rajarani	6	7	3	0	0	16
Parewading	2	4	4	6	0	16
Ghorlikhraka	2	5	5	6	2	20
Dhankuta Municipality	2	3	5	0	0	10
Total	12	19	17	12	2	62

Source: Field Survey, 2006.

As shown in Table12, households needs to walk for less than 15 minutes to reach community forests, followed by 19 households who require covering 15-30 minutes walking distance to reach the community forests. Likewise, the distances 30-45 minutes and 45-60 minutes' walk are 17 and 12, respectively. Only 2 household needs to walk more than 60 minutes to reach the community forests. Figure shows the percentile view regarding the distance to be traveled to reach community forests.

Figure 5: Distance to be Covered by the Households to Reach the Community Forests



Source: Field Survey, 2006.

As seen from Figure 5 the high percentage (31%) of the households opined that they need to travel 15-30 minutes to reach community forests, followed by 31 percent, who require 30-45 minutes to reach community forests. Likewise, equally 19 percent of he households opined that they need to <15 and 45-60 minutes to reach community forests. Similarly; only 3 percent of the households opined that they require more than 60 minutes reaching community forests.

5.4.3. Control of Soil Erosion

Forest canopy directly reduces the kinetic energy of the rainfall water, these by reducing the extent of soil erosion induced by water. Moreover it acts as a physical barrier for the flowing water carrying detached soil particles on the surface of land. Furthermore, it also acts as a physical barrier (wind break and shelter belt) for the air induced soil erosion. It is very effective where land is arid or semi-arid. agroforestry not only ameliorates the environment, but also assists directly to manage community forest by increasing the soil fertility and the productivity of crops and forests the detail of percentile views regarding control of soil erosion managing and community forests is provided in table

Table21: Control of Soil Erosion

Area	Control of soil erosion (in percent)			Total
	10-20	20-30	30-40	
Rajarani	5 (31)	6 (38)	5 (31)	16
Parewading	4 (25)	8 (50)	4 (25)	16
Ghorlikhraka	7 (35)	8 (40)	5 (25)	20
Dhankuta Municipality	6 (60)	2 (20)	2 (20)	10
Total	22 (35)	24 (39)	16 (26)	62

Source: Field Survey 2006.

Note: Figures in parentheses are percentages

Table 21obtaived from the data on the study sites shows that the highest percent (50%) or 8 of the households viewed that control of soil erosion by agroforestry is 20-30 percent in Parewading V.D.C. Likewise, the lowest percentage (20%) or only 2 of the

households opined that erosion was reduced 20-30 percent in Dhankuta municipality. Similarly, the highest percentage (60%) or 6 households of Dhankuta municipality opined that soil erosion was reduced by 10-20 percent. The lowest percentage (25%) or 4 of the households perceived that soil erosion educed by 10-20 percent in Parewading V.D.C. Furthermore, among the 30-40 percent soil erosion control category, the highest percentage (31%) or 5 of the households and the lowest percentage (20%) or 2 of the households are in Rajarani VDC and Dhankuta municipality respectively. In totality the highest percentage (39) or 24 of households viewed that control of soil erosion by agroforestry is 20-30 percent and lowest percentage (26%) or 16 in category 30-40 percent. Similarly, in 10-20 percent category opined in percent (22%) or 350 the households.

5.5. Income- generating Activities Program.

Socially and economically marginalized people and communities will be mainstreamed into development process based on equality as well as equity approach various programs will be implemented to improve the situation of senior citizens, disabled people and marginalized communities, and collaboration as well as co-organization will be expanded with INGO/NGO's in launching such programs. Among those programs IGA program one of the most important program, which is launching by LFP in Dhankuta District through community forestry. This IGA program is target on rural poor community forest user by providing small amount of found.

In order to get load the beneficiary needs to be a member of community forestry and they will follow the FUGs rule, which is set by them self for their own need. In priority basis the fond is provided and priority is given to very poor and disadvantage uses. The fund's reveled in certain time period either installment basis or in the end of the terms. Continuous financial support by external agencies in FUGs may cause the probability of probability of leading the FUGs to wards the cycle of dependency syndrome and the goal of sustainable development of FUG cannot be achieved. Now the government's Forestry programme rules allow farming of non-timber forest products and also some cash crops that do not affect the growth of community forests. Therefore, IGA has become basic programme of forest user groups. In the study area IGA programmes are in initial stage.

5.5.1 Revolving Found Use Pattern in Different IGA.

Framer has used the given fund in different purpose as their need. Which is show in below.

Table 22: Revolving Found Use Pattern

Area	Found use in				Total
	Goat	Pig	Goat and pig	Others	
Rajarani	2	1	12	1	16
Parewading	11	3	0	2	16
Ghorlikhraka	8	12	0	0	20
Dhankuta Municipality	3	7	0	0	10
	24 (39%)	23 (37%)	12 (19%)	3 (5%)	62

Source: Field Survey, 2006.

In above table the highest number of house hold involved in goat keeping i.e. 39 in percent secondary 37 percent of household involved in pig keeping. Both the goat and pig is kept by percent of household. According to respondent opinion in short term pig is more profitable but because of cultural and traditional all farmer can't keep pig.

5.2 The Budget Allocation of LFP to Revolving Fund

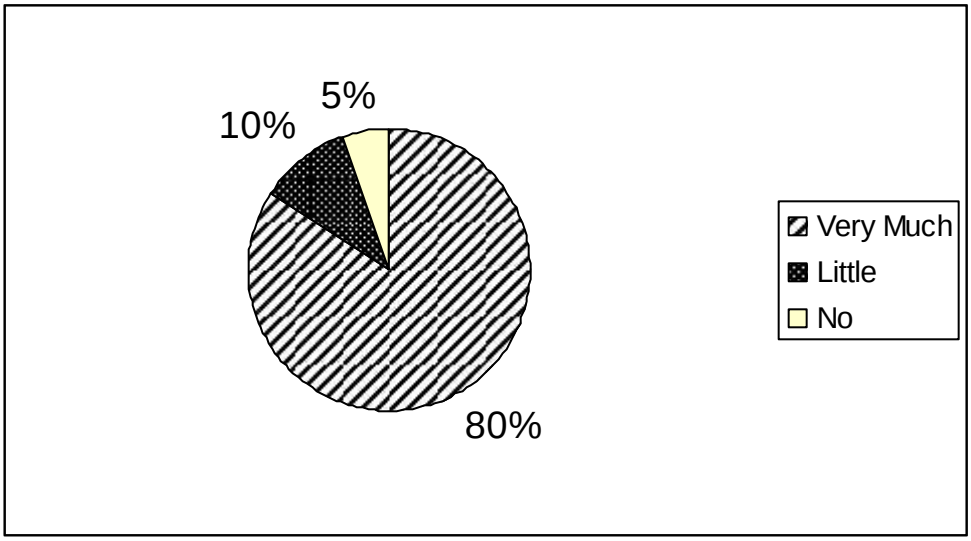
LFP provide small amount of financial support for community forest and those FUGs uses that found as revolving land. End of April 2006 from start of Feb. 2005 the total amount of land is 15, 75,827 into 96 FUGs. The amount is between 750 to 20,000 which is determine from the economic status of FUGs, higher the status lower the fund and lower the status higher the fund (See Appendix 1).

5.3 Opinion of the Respondent towards the Revolving Fund

All respondents told that the effort about revolving fund is great though due to the low amount of money of revolving fund. It is difficult to raise the life standard of the

customers. They viewed that "We are not poor because of not involving ourselves in livestock farming, even though, it is a positive effort". All respondents viewed that the revolving fund should be increased.

Figure 6: View on the Revolving Fund



Source: Field Survey, 2006.

As seen in above figure 80 percent people viewed that revolving found is very much beneficial for their economy. Ten percent of respondent opinioned revolving fund is little beneficial and 5 percent of the respondent viewed that fund is nothing can do for them.

Chapter – Six

COST-BENEFIT ANALYSIS OF AGROFORESTRY SYSTEM IN DHANKUTA DISTRICT

6.1 Background

Cost-benefit analysis is an economic appraisal of the cost and benefit of alternative courses of action. It is a systematic method to identify and measure, economic benefits and cost of the systems or programmers, significant evaluate these effects. From an economic point of view crop tree farming or agro-forestry system is a single production system of system components, tree and agriculture (Arnold; 1982). The basic purpose of investigating an Agro-Forestry System from economic point of views is:

- To investigate whether the agro forestry system provides higher national income than those obtainable from other systems.
- To provide sufficient and appropriate information to decision markers in making mare rational decision about the allocation of scarce resources.

In an agroforestry system the benefits are the values of the incremental outputs of goods and services made possible by the system and the cost are the value of the incremental real resources used by the system. The cost and benefits of the agroforestry system are identified and their valuation techniques applicable to the study area (Dhankuta district) are discussed in the following coming sections.

6.2 Identification of Costs and Benefits

At the most basic level, a cost-benefit analysis methodology involves identification of all the effects and measured in some common unit so that aggregate benefits can be compared with aggregate costs. The objectives of the cost-benefit analysis play an important role in out lining the cost and benefits of the system.

The objective could be any of the following such as

- Maximization of net income
- Income distribution
- Job opportunities or increase in proportion of saving etc.

Gittinger (1984) has suggested taking one objective as principle criteria and accommodating all other objectives as for as possible. The cost of the system is anything that reduces the objective, which in economic terms is the willingness to accept compensation. The benefit is anything that contributes to the objective and this in economic terms is the willingness to accept compensation. The benefit is anything that contributes to the objective and this in economic terms, is willingness to pay. The basic method to identify the costs and benefits of an agroforestry system is the examination of the differences between the availabities of inputs and outputs within and without the system. Anderson (1979) has categorized the effects of systems as compared into direct and secondary and has further divided than into tangible and intangible effects. These categories are shown later.

6.2.1 Benefits of the Agroforestry Systems

The output, which increases the income or the objective, is the benefits of the systems.

6.2.1.1 Direct Benefits of the Agroforestry System.

Direct benefits from agro-forestry systems could be tangible and intangible. The production of fuelwood timber, fodder, food/cash crops etc. are the main tangible benefits. Others might arise from increased production quality improvement; change to the time of sale, cost reduction and from avoidance of loss has postulated that an agroforestry land use system will have the same output value at a lower resource cost. The increased output or the input saved is the tangible benefits to be included in the analysis.

The maintenance or restoration of land productivity enrichment of soil, protection of soil from erosion provision of shade, shelter from wind etc. are some of the intangible direct benefits made available by the systems.

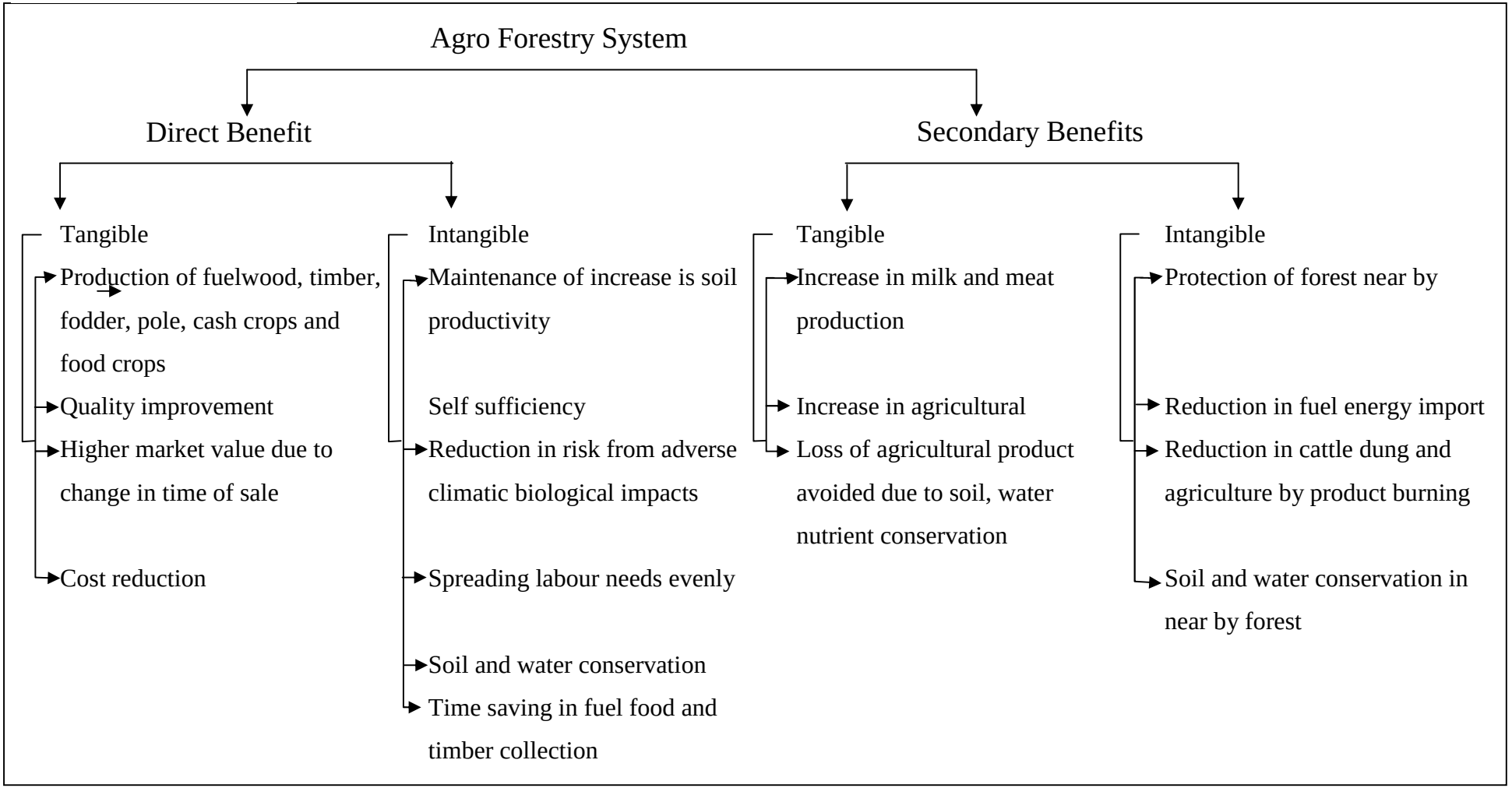
6.2.1.2 Secondary benefits of the agroforestry System

There are those benefits resulting from the introduction of agroforestry systems which are not entirely received by participating farmers. These are generally obtained outside the area of concern. The examples of secondary benefits are the reduced rate of situation in irrigation, water reservoir down stress resulting from an agro-forestry system

aimed at reducing soil erosion up stretch. Similarly, the fuelwood, timber, fodder produce in agroforestry reduce the pressure of near by the areas of government owned forests. The forest thus protected and its beneficial effects are the secondary benefits strength.

Figure: 7

Possible Benefits of Agroforestry System



6.2.2 Cost of the Agroforestry Systems

In financial analysis, the goods and services, which are used to reduce output, are regarded as the cost of the systems, but in cost benefit analysis the items which reduce the net benefit of the system or the main objective are also to be classified as the cost. The main categories of cost are land, labour, capital (Hoekstra 1985) and all other negative impacts exerted by the system in reducing the objective.

The cost of the system can be divided into two categories

- Direct costs
- Secondary costs

6.2.2.1 Direct Costs

The direct costs of an agroforestry system are not difficult to identify. The physical goods such as, seed, seedlings, fertilizers, pesticides, irrigation charges etc. land and labour are the major costs in the system. The infrastructure requirements like extension services and the direct negative impacts of the system also come under this category.

These physical goods are the real tangible fertilizers, pesticides, irrigation charge system accepter paid directly in monitised from, hence called tangible direct costs.

Some intangible direct cost that might be incurred is discussed below:

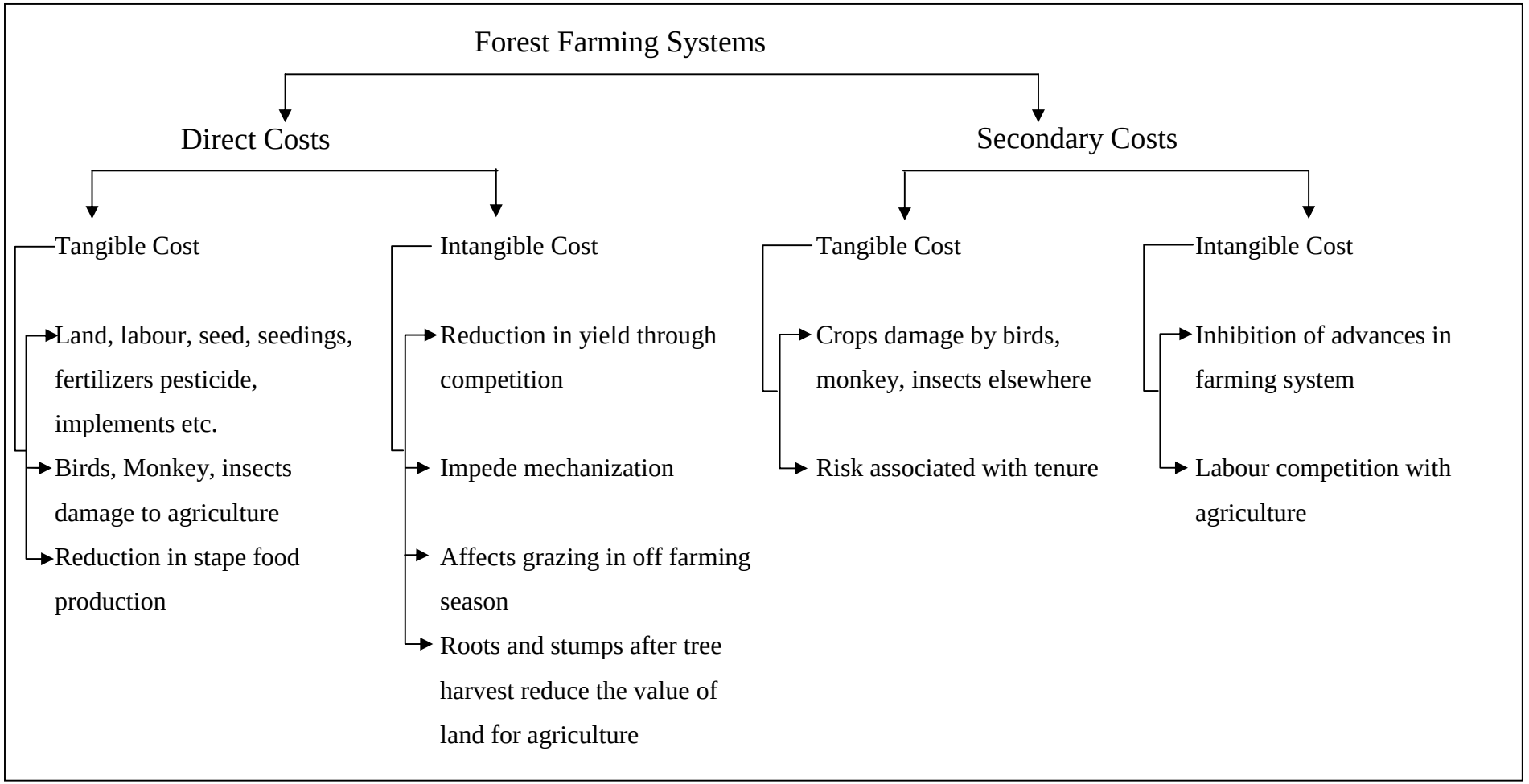
- There could be a competitive interaction between the system components, a negative impact on the agricultural crops because of the possible increase in birds, rodents, termite, insect population, monkey hence the production might decrease.
- Farmers graze their cattle on farmlands and riversides. When the main harvesting is over they graze their animals on farmlands, if there are agroforestry plantation, they do not graze their cattle on farmlands. Hence, this restriction generates the extra costs. This restriction deprived of grazing and they will have to be taken to near by forest or start stall-feeding, which needs extra labour and cash to collect/buy the fodder and feed. The farming itself will require some cost to clear the grasses for next season cropping.
- After the tree rotation, the left over stumps and roots in the land reduces its value for agricultural production. So, some cost will increase to up root those stumps.

6.2.2.2 Secondary Costs

The costs, which do not incur directly, are the secondary cost. In an agro-farm forestry or agro forestry system there are the inputs, which are required for the introduction of the system but are not paid in full by the participating farmers. An example secondary cost is the damage caused on neighboring farms by an increased birds, insect, monkey because of inclusion of trees on a farm.

Figure: 8

Possible Costs of Agroforestry System



6.3 Valuation of Costs and Benefits in Crop-tree Oriented System

Here, the emphasis is on the specific nature of agroforestry cost and benefits. Cost may be defined as inputs multiplied by their unit price and benefit for a person is the market value of goods and services obtained from the programme and cost is the market value of goods and services inputted to obtain those benefits. Sometimes the cost and benefit of the person determination or valuation of costs and benefits of the individual is not succeeded to reflect the value to the society as a whole. The market values of the society oriented goods and services are not easily determined. There items determined the "Shadow Price". This valuation allows an assessment of the economic efficiency of the system in a consistent way. A benefit for a society could be a cost to an individual person and a cost to a society could be a benefit to an individual person. Society oriented benefits and costs are more than outputs and inputs. The direct benefits are measured by willingness to pay for the direct outputs and the direct costs are measured in terms of foregone production. The crops and tree combination system have many intangible cost and benefits which may have some positive or negative effects upon the people's welfare which are complex to determine.

6.3.1 Valuation of Inputs

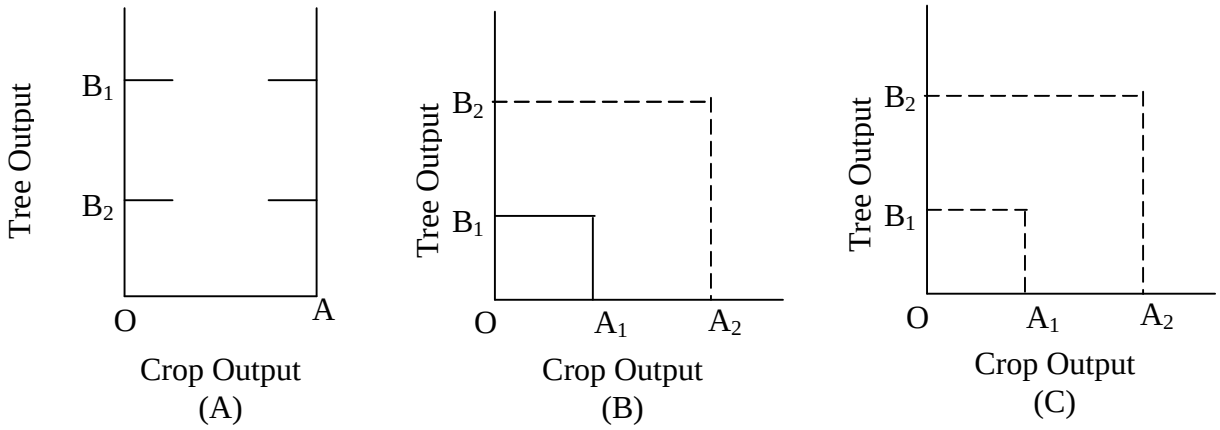
In a private economic analysis inputs are valued either at commercial prices or at opportunity cost depending on whether they are purchased or with drawn from alternative uses on or off farm. In a public economic analysis inputs are valued at their opportunity cost/value to society as a whole, usually refereed to as a shadow price. Generally land, labour and capital are the major direct cost for every crop-tree oriented production system. One by one for these inputs, I have done short description below.

- **Land**

Land accepted for agroforestry system is valued at its opportunity cost, which is mainly determined by its present use and its potential productive capacity. Gittinger (1984) has suggested that the valuation of cost through the path where taking the gross value of the lands output at its economic price and by deducting all the costs of production of the economic price, including allowances for hired and family labour and the interest on the capital engaged. The opportunity cost of the land is the net value of production foregone then the use of the land is changed. The less productive land is the

lower its cost, a high fertile land will thus have a very high costs. Intensive production types of land have high costs. However there is a biological interaction between the tree and other components in the system.

The representation of supplementary, complementary and competitive production possibility curves for crop and trees is made hereunder.



The figure (A) shows the supplementary production possibility curve of crops and trees. The level of tree output can be increased from B_1 to B_2 without affecting the crop output of A. Hence such kind of land's opportunity cost is zero.

The figure (B) shows the complementary production possibility curve of crops and trees. An increase in level of tree output from B_1 to B_2 causes a simultaneous increase in the level of crop output from A_1 to A_2 in this case the land cost will be zero.

In the last figure (C) shows the competitive production possibility curve of crops and trees. In the figure, an increase in the level of output of other components. The land cost could be very high.

- **Labour**

In a private economy all hired labour is valued at its market price, while all family labour is valued at its market price, while all family labour is valued at its opportunity costs, which differs depending on length of time required, the type of labour and the sex. In perfectly competive market the price of labour would be determined by its marginal value product that is the value of the additional product that one additional labour could produce. The market wage paid to the labour could be an estimate of the opportunity cost if labour is in short supply. If the labour is in excess then, its opportunity cost may be very close to zero.

The skilled laboures in Dhankuta and its periphery can be consider being in short supply but, in the sense of unskilled labour of Dhankuta can be consider to be in surplus.

The valuation of labour market in Dhankuta differs to season and or existence of off farm employment opportunities. This implies that if tree oriented system with combination to crops doesn't compete at all agricultural labour of Dhankuta are either unemployed or not very productively engaged than the opportunity cost of labour considerably less than the market wage rate. But if it competes with agricultural practices then the opportunity cost can be even higher than the market wage rate.

For the sake of simplicity, most analysis use hired labour wage rate as an approximation of opportunity cost increasing the price by 25 percent under the peak season and decreasing it by 25 percent under off-season conditions.

- **Capital**

All capital inputs, which need to be purchased or diverted from elsewhere are valued at their market price in a private economic analysis. Those which are not easily valued in the market price should be valued, through its shadow prices. The taxes, subsidies, credit transactions etc. do not use the real resources these are only the transfer of claims to real resources from one person to another. Shadow price of the capital item may differ from its market price because of government taxes, subsidies, credit transactions etc.

6.4 Valuation of Outputs

Similar to the inputs valuation, outputs are also valued at the market price or opportunity cost in a private economic analysis and at shadow prices in a public economic analysis.

- **Timber**

In the private economic analysis, timber is valued at the local market price (In Dhankuta Forest product supply community determined the price of timber). In commonly sold and/or purchased by the timber based industries. If the timber from social or government lands, the valuation of such timber should be the net of the cost of labour for cutting the logs preparation and transport costs from the forest. Timber is valued either in terms of alternative construction materials or such alternative materials

which used by forest based firms and industries in the substitution of forest based materials.

- **Fuelwood**

In the private economic analysis, fuelwood is valued at the local market price. If commonly said and/or purchased by the farmers concerned. To value the standing volume of fuelwood, the price to the used should be the net of the cost of labour for collecting it and transport cost. If neither is the case, fuelwood is valued either in terms of alternative fuels used by the farmers or in terms of labour saving made. A frequently use alternative fuel source is kerosene and some times dried cattle during (In Dhankuta). The main tree species used as fuelwood in the district are as follows: Salla, Uttish, and other tree species in seasonable basis.

- **Fodder and Leaf Litter**

Three leaves and pods have increasingly been recognized as potential source of animal fodder in agroforestry system. In a private economic analysis tree leaves may be valued at market price if it can be sold locally. However, if leaves are not sold, it can be evaluated on the basic energy or protein value. For the valuation of leaves to public analysis the shadow price will be fulfill through market and opportunity prices, subsidies and taxes. Tree leaves as fodder and leaf litter are not sold in the local market as monitised form even in Dhankuta. Agricultural by product or residues are used in the form of fodder highly in Dhankuta. If the animal husbandry is expanded largely in Dhankuta, there will be no question to sell tree leaf litter as monitised unit for the fulfillment of fodder demand.

The tree leave and litter are not only for fodder animals. It can be valuation in the sense of nutrients and organic matter to the soil. As tree leaves in the sense of fodder and its monetised local market, leaf litter has also the same condition or there are no recorded instances of leaf litter being sold commercially in the local market, but it would be valuation through opportunity prices at the alternative path for the generation of organic matter of soil through green manure in addition to chemical fertilizer.

- **Valuation of Environmental Outputs**

Many outputs from agroforestry are indirect benefit to environment, and its sustainable development. But environment oriented outputs are complex to be known so

it is not possible to value in monetary terms. But many environment economists have tried to values and encompass it with the valuation systems which are:

- Improvement or increase in soil productivity
- Water conservation in farming areas.
- Preservation of productive capacity of soil.

Chapter – Seven

ECONOMICS OF AGROFORESTRY SYSTEM IN DHANKUTA

Agriculture in most parts of the country is virtually exclusively geared to creal growing and livestock rearing by conventional means. Cereal demands annual cultivation's which are enormously expensive in labour or machinery requirement, large inputs of water and fertilizer and are extremely vulnerable to the vagaries of the weather. The rocketing price of oil and the scarcity of fertilizers constitute a further threat to nutritional standards in the poor farmers.

In areas where agricultural productivity is poor, demand for agricultural output is going up, employment opportunities and potential are limited; there is a possibility of shifting the land use to agroforestry while changing the land use systems, it is important to see that production of food grains does not decrease correspondingly. If trees could be grown as intercrops with traditional food crops without affecting the crop yield substantially, it would be acceptable to the rural poor.

Agroforestry systems are sustainable even brought prone areas. The grain yield in the areas is very low during the normal monsoon season, and returns are very marginal during the drought affected year. Because of this reason small and marginal farmers in these areas are poor and unable to increase their income. Under the existing land use system most of the villages are engaged in food production. There is little scope for earning higher wages through food production. However, due to the lack of alternative opportunities, farmers spend their time in agriculture or remain idle. agroforestry can generate additional employment in two ways, firstly farmers have to put additional labour to maintain trees and to harvest the produce and secondly, agroforestry can support new areas of employment. Due to uncertainly of rain fall and low return, most of the small and marginal farmers are negligent and do not attend to agricultural operations regularly. This leads to further reduction in the crop yields and degradation of agricultural land. By introduction Agroforestry, farmers will tend to take good care of their crops and land as they are sure of the profitability.

The large areas of the country are affected by salinity, alkalinity, acidity and water logging, unscientific land use practices have led to a further increase in the area affected by toxicities and deficiencies, such degraded lands can often reclaimed by

agriculture and forestry combination systems while providing poor farmers with some income. Many species of trees can grow well in these problem areas where most agricultural crops alone can not.

In this paper I have tried to deal with some reasons regarding agroforestry system with special reference to the Dhankuta District. I have chosen my peak essential guided by the prevalent dogma among the policy makers.

Agroforestry, in true sense has been realized as a need of the day, it does not confine to the regional, geographical or agro-climatic boundaries. agroforestry concept is of universal application.

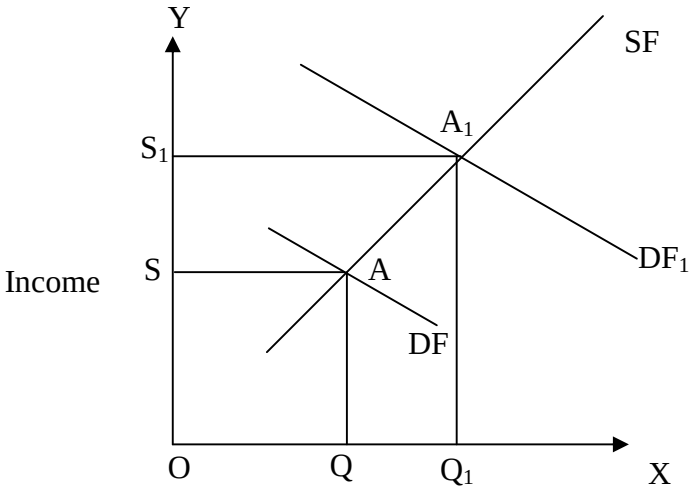
Dhankuta district is very progressive in terms of agricultural development in hilly region. All important area's of district has touched by road network and motorable roads have become a center for important economic activities in the country. Hence every agroforestry systems have bright future in Dhankuta district. The demand of food and wood is high in Dhankuta. Natural forests can not fulfill the demands of the district people so there is a dare need of agroforestry systems which make farmer self sustain for their requirements. These are the main reasons to feel agroforestry as a dare need in Dhankuta, which are given below.

7.1 Agroforestry Systems and Possibility of Timber Market Diversification

Changing the direction of supply from one market to another is called market diversification. Diversifying supplies from traditional or local limited markets to new and enlarged markets. Market diversification enables the producers or exporters to obtain better prices for their supply and also permits them to buy from cheap resources. Diversification gives supplier more flexibility and reduces dependence on a limited market. Diversifying the destination without expanding the production base may not be economically beneficial. So we assume that market diversification is the automatic function which expands the outputs or producing incentives of the producers. The incentives of the farmers can be based on the market prices, market facilities and so many other factors for the production of output.

Dhankuta district has centered for important of the eastern hilly district's economic activities. This district is connected to other big cities of eastern terai like Biratnagar and Dharan and even to Indian cities by better motorable roads. So every agricultural outputs have a possibility to export from Dhankuta. Timber is one of the

beneficial things produced in private form lands in Dhankuta so output concerning to forests products has a possible way to sell to other cities. So agroforestry is the dare need of these day in Dhankuta. For these possibility facts we can draw the figure and keep the knowledge bitterly.



Source: J. Denis and D Depelau Market Knowledge, Diversification and export expansion, Vol. 38. USA.

Where point A signifies the traditional local limited market of Dhankuta. Point A_1 shows the enlarge diversified big markets for timber. OS shows the income sold timber in traditional local market. But SS_1 shows the premium size of income to the producers or farmers kept from market diversification from point A (local market) to point A_1 (big market).

In this Figure, at point A there is a cross combination between the local demand of timber and local supply. At this point incentives or quantity of timber is OQ and income from that timber sold is OS. If there is a possibility of timber market diversification farmers keep SS_1 size of premium income from that diversification which raise QQ_1 size of incentives to grow the extra size or quantity of timber own their farmland. So there is a possible situation of timber production enlargement in Dhankuta, not by government forest depletion but by agroforestry systems application.

7.2 Agroforestry and Control of Flood and Soil Erosion

The growing of trees with agricultural crops will help in prevent soil erosion, landslides and flood havoc. Agricultural crops are short time durational where as tree acting as a miniature dam reduces the velocity of the winds rushing rain water. Tree is the rod for the minimization of flow velocity of floods. The canopy of the tree is able to reduce raindrop impact, therefore protecting the soil from splash erosion. The ground litter is also known to enhance water percolation into the ground and hence reduce run-off and rill erosion. Roots of trees along the terrace edges and embankment would bind soil together, which would enhance terrace stability.

Soil erosion and flood are the biggest problems for Dhankuta's farmers because of all farmining land situated in the hilly region. Soil erosion is most problematic for poor farmers working marginal lands at this area. In this area soil erosion is most critical during the pre monsoon season when vegetation cover is at a minimum. So for the conservation of flood and soil erosion there is a dare need of agroforestry systems in Dhankuta.

7.3 Agroforestry Systems and Employment Potential in Dhankuta.

Tree production systems provides larger means of providing a higher level of employment particularly in rural area because tree farming systems are having a number of labour extensive activities. For instance in energy plantation programme a number of activities are carried out such as nursery development, diggings of pits and trenches, sowing of seeds, watering weeding transplanting, aftercare, harvesting, transportation handling and processing. It has been estimated that planting on one hectare of land generates employment of about 300 man days (Singh, 1994). Establishment of a change of biomass based industries will generate employment both for the skilled and non skilled and thus prevent outflow of income from village to cities and nation to out nation. Dhankuta is one of the advanced agricultural districts of hilly region over the country. About 75 percent of the people of this district rely on agriculture for their livelihood. The non agricultural sectors have not bitterly been able to provide attractive employment. Hence the highest numbers of labours are accommodated by the agriculture. Due to lack of alternative opportunities, farmers spend their time in agriculture or remain idle whether the labour – land ratio is very high. The small holding farmers do not avail of any off-farm employment's one side and other side their agriculture, production is insufficient, seasonal variation of employment is also the main problems. Hence, for the

permanent solution of the off-farm labours, there is a dire need of agroforestry systems in Dhankuta.

7.4 Agroforestry Systems and Problems of Ecology and Pollution Control

Forest is not just a stand of tree. Forests are essential to sustain ecology and human life. Trees play a vital role in ameliorating the deteriorating environment. They are helpful in reducing noise pollution, conserve soil moisture and improve the general environmental conditions.

Due to higher consumption of fuel energy today, the atmosphere and ecology of living creature is going to damage. If long terms measures for creating better living environmental conditions are not taken up the environmental hazards cannot be minimized in times to come.

Dhankuta has suitable location for industrial establishment among the hilly region because of strong road network. So, at present and in future, various problems due to acute pollution may be generated at this sense; there is a need to conserve ecology by controlling pollution agents in Dhankuta. To address the problems of environment comprehensively there is a need for appropriate policies and environmental action plan concerning to forest farming systems.

7.5 Fuelwood, Fodder and Timber Supply and Agroforestry

Forest is the main important natural resource for agricultural economy. Rural people depend on natural resources for their daily requirements of fuelwood, fodder, food and small timber. The increase in population has led to an inability of the forested lands to supply their needs on a sustainable basis. The demand for forest products is increasing in many areas while the resource base is deteriorating.

Fuelwood is the main energy source in Dhankuta. Farmers fulfill their fuelwood demand either from community forests or from their private farm lands. The per capita fuelwood consumption of Dhankuta is very high in compare to per capita supply of fuelwood. Now a day people of Dhankuta watching the alternative firewood source and biogas plants is about 1716 i.e. 813.9 m^3 but it is based on better size of livestock plantation which is not favorable for village poor. So agroforestry is only the solution to maintain firewood requirements to the rural poor.

Fodder is another one of the best feeding source for livestock. Especially in the village areas livestock is based on tree fodder livestock farming is one of the

fundamental and integral part of socio-economic life of the majority of rural farmers in Dhankuta, which constitutes a renewable resource providing a variety of benefits to the farmers, such as meat, milk, hides, draft power manure and fuel. As a result of heavy continuous grazing the pasture land at dry season of Dhankuta is only play ground for cattle. In the absence of proper diet the productivity of rural cattle is very poor. In this context it has become necessary to increase tree fodder plantation in the private agricultural lands to increase livestock feed in Dhankuta.

Tree fulfills the requirement of timber rural as well as urban population. Rural people have great demand for small timber for shelter making for constructional work, for farm implements and for the use in axe halves and handles. The demand of timber is increasing day by day so for the permanent fulfillment of this demand there is a dire need of forest farming in private farm land in Dhankuta.

7.6 Agroforestry Systems and Improvement of Soil

Agroforestry practices not only conserve the production base of the soil but also tend to improve it. Agroforestry trees particularly leguminous (peas and beans family) type, enrich soil through biological nitrogen fixation, addition of organic matter and recycling of nutrients. Agroforestry systems help in meeting the requirements of crops plants growing in association with trees thus reducing need of fertilizer application. Some tree species such as Leucaena leucocephala have been reported to fire as much as 400-500kgs nitrogen per hectare which may symbiotically benefit crops growing in its association and improve soil fertility.

Decline in soil fertility and the resulting impact on production is a major concern in Dhankuta district. Improving soil nutrients is becoming a formidable challenge for Dhankuta. Regular agricultural crops production on same piece of farm land, without using proper quantity of compost, the productivity of soil has decrease day by day. Due to this reason acidification process is also becoming a major problem chemical fertilizers is scarce during production period if available it is beyond the capacity of rural farmers due to its rocketing rate of price, in this situation agroforestry seems to be an approach in preventing soil acidification.

7.7 Agroforestry and Wildlife Conservation

By wildlife, one generally means the animals and the birds of wild. Wildlife is the products of land forests provide a home or habitat for many kinds of wild life.

Hundreds kinds of plants make their home under the forest canopy and can not exist with out it. All farms of life are closely inter linked and inter dependent and disturbance is one affects the balance of the others. Plants and animals constitute the world living resources and the various food chains and cycles make life support systems essential for the survival of all including the human being.

To address the problems of disappearing wildlife and their natural habitats comprehensively we must work all together through an integrated approach (agroforestry system) dealing with the problems of the conservation of wildlife in Dhankuta. The best method is to search the bio-physical resource available in the district in the most productive manner without seriously damaging or depleting the wildlife and all natural resources.

Chapter – Eight

SUMMARY CONCLUSION AND RECOMMENDATIONS

This chapter deals with conclusions and recommendations based on the data and information traced for the study. The chapter is divided into two sections. The first section deals with conclusions derived from results and discussions, based on the analysis of responses received though household interviews. In the section second, recommendations are presented that could be useful for project planners, practitioners, researchers, field workers, policy markers and NGO workers as well as to the local farmers with regard to the agroforestry systems in the study sites.

8.1 Summary

The study examined the impact of agroforestry on rural development in Dhankuta district. Agroforestry is the most appropriate technique for promoting people's participation in afforestation. Farmers can easily adopt these systems on their agricultural lands without any risk of investment or crop yield reduction. There is no doubt to called agroforestry as a permanent income sources it should be able to generate substantial income while conserving soil and moisture in the field. It is major sources for livestock fodder at dry seasons, clothing of all the barren and wastelands of watersheds can be achieved through modern herald of scientific intervention call agroforestry systems. This system is one of the best for those farmers who are resource poor raised their economic standards. This appears to be a right way to mitigate poverty at grass root level. Hence this system is so effective in changing socio-economic conditions of the rural poor. A large rural farmers who have poor resources possesses the smallest area of potential arable land has the highest growth of population therefore there is a little scope to increase food production by increasing mare area under cultivation, hence food production is to be increased from land already under cultivation or farm land not conventionally considered to be arable. A management system therefore, needs to be devised which is capable of producing food form marginal land and also capable of maintaining and improving quality of the producing environment. This study is developed to address the forest resource depletion and loss of land productivity and rural

farmer's weak economic conditions and its scientific solution from applying better land management.

8.2 Conclusion

The present study reveals that there is a complex system of agroforestry management practices in Dhankuta District. The mode of management is however indigenous. Local knowledge accumulated for the last hundreds of years, have played crucial role for the present system of agroforestry management practices in Dhankuta District. By and large indigenous practices have been found in this regard. This study has identified different factors associated to agroforestry management practices.

Fodder trees and some other trees are planted in the edges of agricultural land to meet needs of agricultural equipments, fodder, fuelwood, jute, religious requirements and timber. But the researcher has found that such trees absorb manure from agricultural land and also present shadow over the agricultural crops because of the large volume of fodder and some other tree's canopy, which has resulted low crop productivity.

There is no management of biogas and improved over in all rural areas in the study area. The rural practices are gathering large quantity of fuelwood and cut down large number of crude trees for fuelwood. The researcher means that there is problem of sustainable agroforestry management mainly because of uncontrolled cutting of crude trees in the study area.

Agroforestry and soil conservation techniques if combined together can help stabilize the fragile wasteland. It is logical to assume that if agricultural crops are to be grown in connection with forest crops and if forestry is to be the dominant land use form the inception of the plantation, the tree species, that are used should preferably be chosen because they display silvicultural characteristic that would permit them to compete effectively with the agricultural crops. The farm size holding are small for afforestation plots and that there is no income incentive for tree planting as there is little possibility of timber market in the remote village area.

Land ownership is mostly inherited from parents. Farmland is basically of two types ,i.e., Khet land and Bari land. Khet land generally lacks trees and is dominated by paddy cultivation. Likewise, bari land contain tree species and maize and millet crops are generally grown on them. The average land holding size of the study sites is less than the national average. The majority of the households opine that the quality of Khet land is comparatively good and that of bari land is medium. The majority of the household have

multi-purpose tree species, mainly grown on bunds, terrace risers, edges of bari land and frontiers at other farmer's land. The majority of the households grown vegetables either in kitchen garden or in bari land and paddy in khet land. Similarly, they grown potatoes, tomatoes, cabbage and others (bitter gourd, brinjal, bean, pea, cucumber, cauliflower and capsicum) in their farmland. The majority of the households produce food sufficient for 6-9 months.

Regular income, which refers to the income from agriculture and regular jobs is the dominant source of income. Timber fruits, fuelwood, agricultural produce (cereals, and vegetables) and milk are the common commodities that the producers sell to earn cash. The income of the majority of the households comes from the sale of agricultural crops, followed by milk.

Trees of different species grown in private land not only fulfill the demand for timber, fuelwood, fodder of the household, but also significantly contribute in the management of community forests. Most part of the farm household income is expensed on foodstuff, followed by education, health and NRM and CFM. The majority of the households need to travel 30 minutes, followed by 30-45 minutes distance to reach community forests. It is found that after the introduction of agroforestry the saved time is being utilized for children's education and women's alied production activities. The majority of the household believed that agroforestry has substantially reduced the deforestation and denudation. They perceived that there is a directly proportional relationship between agroforestry and the control of soil erosion.

8.2 Recommendations

Based on the findings study of the some recommendations, which would be helpful, are made for future agroforestry models.

8.2.1 Recommendations for GOs:

- The productivity and other overall benefits of agroforestry systems should be informed to the rural uneducated farmers through result demonstration. Simple mass media and direct contact. There activities should be provided by the Department of Forest, Nepal Government. Private sector as well as banks that are providing credit should also play a role. There should be a free flow of information and the Department of Forestry should co-ordinate and takes the lead.

- There is a need for strong political commitment to forest based energy programme and careful evaluation of energy policies form the government of Nepal.
- A clear and effective government policy on private planting is crucial because the farmer's still fear that if trees are planted on private land, the whole plantation will be reclassified as a government forest as happened during the nationalization of private forest in 1951.
- The majority of hills farmers farm and live at subsistence level and hence cannot afford to undertake conduct private planting and protection schemes on their own. To encourage private planting, a group approach, with some subsidy for planting and protection, should be introduced. Group private plantings can also be considered as community plantings.
- Preparation of management plan for private planting is important to make the forest sustainable. In addition, rules and regulation governing the sale of forest products from private forest should be simplified. Training farmers in simple nursery and silivicultural techniques will assist private plantings.
- A change in the community forestry guidelines needs to be carried out so that private group planting can be accommodated and equal emphasis given to community planting. An adequate number of full time extensions should be employed to provide assistance to farmers.
- Marketing seems to be the greatest challenge for the farmers who have adopted agroforestry in a big way. So there should be efforts to market diversification from the governmental level. The influence and utilization of renewable energy (Biogas, solar and ICs) seems to be negligible in the study sites. So, promoting and enhancement of renewable energy use should be encouraged at the earliest. Installation of biogas plants would encourage farmers to keep more livestock and to grow more fodder trees on their private land, which eventually would help to reduce pressure on community forests, and ameliorate the ambient aura too.
- Government must make effective plan and policy abut micro credit to uplift the rural poor and promote the slogan "not aid but trade". Rangers are the rey factors to implement plans and policies adopted by government about forests in grassroots level. So that the role of rangers are so important in promoting agroforestry system. Given below are some important roles to be adopted and played by the Rangers so that they can be able to transfer the technology related to agroforestry in an efficient and effective way.

1. Start where the people are:

   Don’t move quickly on the technical aspects of agroforestry until the people’s understanding and support have matured. People respond to changes more readily if they are associated with felt needs.
2. Involve leading farmers in the beginning:

   Start with the leading farmers having a considerable level of knowledge and a positive attitude for accepting challenge for change and development. They always look forward for something new which can generate additional income in any form.
3. Work through the community institutions:

   It is always better to work through the existing community institutions to make them economically more dynamic and competing.
4. Government policies and programmes increase the chances of success:

   Even where the existing policies and regulations support and encourage agroforestry these may not be well known to the people. Therefore, it becomes necessary for forest rangers to create awareness to the government policy and regulations.
5. Agroforestry practice must show quick results to gain the public confidence:

   Farmers watch every change activity very eagerly. Positive changes and quick results are the public concern. Hence it is of utmost importance that any agroforestry system started by an individual farmer or as a demonstration activity by the government brings about expected quick result(s).
6. Technical and/or other committed support should be made available in time:

   To build faith in the farmers towards government’s commitment it is necessary that the rangers provide all the support needed by the farmers practicing Agroforestry. The farmer should be able to get technical as well as other supports agreed upon by the ranger.
7. Last but not the least; Rangers can do all the above activities only if they have a positive altitude towards the farmers. In this way they will be able to generate respect and trust amongst the farmers. When this is done, it becomes easier to make agroforestry a farmer’s programme, and a successful one, too.

8.2.2 Recommendations for NGOs:

- Tea planting is a good source of cash income in the study sites. But so far only few households have planted them in their private land. So, further extension of tea plantation in private as well as community forests is important to generate cash income.
- It is noteworthy that the local farmers are managing their forests in a wholesome manner. For further strides regarding the management, reducing pressure on community forests and making sustainable utilization of forest products are crucial. Therefore, the users should be made aware of planting multipurpose tree species in the private lands.
- A development intermediary to establish nursery for nutritional fodder trees to encourage farmers for milk production is required. The condition and size of seeding is very important for the success plantings. They should be of good standard so that seeding can withstand adverse conditions in the field.
- Refresher training course should be offered to nursery raisers so that they can provide seedlings of many species that the farmers require.

8.2.3 Recommendations for Future Researchers

The main objective of agroforestry research is to optimize production and economic return per unit area especially in rural communities.

Factors to be considered in further research

- It must be based on a multidisciplinary land use diagnosis so that they are logically derived for given opportunities and constraints.
- It should be based on socioeconomic issues because it plays a past in identifying research needs and designing appropriate methods.
- It must be based on production needs at both macro and micro levels to increase and stabilize the income of the farmer.

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APPENDIX 1

QUESTIONNAIRE FOR THE COMMUNITY FOREST USER.

1. Name: ……. District: ……..
   Address: ……. Ward no.: ……
   Age: …… Sex: ……
   Religion: …… Occupation: ……
   Educational status: ……

2. Introduction of family's: ……...
   Number of family members: female: …….. Male: ……. Total: …….
   Educational status (literate): female: …….. Male: ……. Total: …….
   Total employed population (except farming):…… below the age of 15:……

3. Do you have your own land?

   A. Yes B. No

3.1 If so, how much do you have?
   ……. Ropani.

3.2 If not do you cultivate other's land?
   A. Yes B. No

4. Does the income from farming is sufficient to your family?
   A. Yes B. No C. Surplus

4.1 If not sufficient how would you manage?
   A. Purchasing B. Wages C. Others

4.2 If surplus arise what do you do?
   A. sales in local market
   B. given to labor as wages.
   C. sales to neighbors
   D. others

5. What types and how much land do you have? (Fill in the table 1)

Table 1

Land types	Area (Ropani)	Types of livestock	Total
Khet		Cow	
Bari		Buffalo	
Kharka		Goat	
Forest		Ox	
		Pig	
others		others	

6. Do you have livestock?
A Yes B. No

6.1 If so, how many?
Fill in the table 1

7. Do you have milk providing livestock?
A. Yes B. No

7.1 If so, how many?
A. cow…….……..Lrt. B. Buffalo……..Lrt.

8. How much milk do you get from livestock?
A. B. C.

8.1 If surplus what do you do?
A. sales milk in local market
B. sales curd in local market
C. sales ghee in local market
D. others

9. How do you sales goat?
A. sales goat in local market
B. sales in form of meat
C. others

10. How do you keep your cows?
A. keeping at home B. grazing at outside

10.1 Where do you graze, if grazing at outside?
A. at own land.
B. at forest/kharka.
C. community forest.
D. government forest.

11. How much grass/fodder do you want daily?
A. green food…… Mutha/bhari. B. dry food ……. Mutha/bhari.

12. Do you provide crops to livestock?
A. Yes B. No

12.1 If so, how much do you provide daily?
……Lrt/kilo.

13. What are the sources of grasses and how much do you have those sources?
A. own land ……. Bhari.
B. own forest …… Bhari.
C. forest ……bhari.

D. buying ……..bhari.
E. others ……bhari

14. What are the main sources of energy which you are using?
A……. B……. C…….. D……

15. How many bhari do you use annually?
……. Bhari.

16. What are the main sources for firewood and how?
A. from own land …….. bhari.
B. own forest ……. bhari.
C. community forest……bhari. Wheat
D. government forest…… bhari.
E. buying ……bhari.
F. others…… bhari.

17. What are the main crops which you plant in your land? (Fill in the table 2)

Table 2

Crops	Season	Production unit
Paddy		
Maize		
whate		
Millet		
Potato		
Buck-wheat		
Others		

18. With considering all things, which crop is better for you?
……..

19. In your land, what types of crops are planted and how much they are?

Table 3

Types	Quantity
Large tree	
Fruits tree	
Grass	
Bee hive	
Firewood	
Vegetables	
Cereal crops	
Others	

20. Do use fertilizer in your field?
A. Yes B. No

20.1. If so, which and how much?
A. Compost……
B. Chemical. * Urea……..kilo. DAP …… kilo. Potash …… kilo.

21. Are you a member of community forest?

A. Yes B. No C. How many …….

21.1 If so how far is it?

A. Maximum 15 minuets B. Maximum 30 minuets C. Maximum 1 hour

D. Maximum 1.15 hours and more than it.

22. What are the forest product do you bring from your community forest and how much? (Fill in the table 4)

Table 4

Types	Quantity
Firewood	
Timber	
Grass	
Medicinal herbs	
Fodder/loose leaf	
Non timber forest product	
Others	

23. How many times do you go to forest?

A. Weekly/ monthly …… B. Seldom…….

24. How much benefit is given by community forest to you?

A. Very much B. little bit C. Not benefited.

25. Generally, who is the member often go to forest?

…….

26. Generally, who is the member often going to take part in the discussion of community forest?

……

27. Do you know about agroforestry?

A. Yes B. No

28. Have you practice agroforestry in your own land?

A. Yes B. No

28.1 If so, how much benefit have you got?

A. Very much B. Satisfactory C. Not

29. What are the limitations while practicing agroforestry?

A. Grazing

B. Irrigation problem

C. Different types of diseases

D. Others

30. What types of benefit do you get form agroforestry?

A. Easily available of grass, loose leaf.

B. Easily available of firewood.
C. Easily available of timber.
D. Protect form landslide.
E. Contribution in income level.
F. Others.

31. Are there any major drawbacks while practicing agroforestry?
A. Yes B. No

31.1 If so, what are they?
A. disturbance of shadow to crops.
B. disturbance of disease/bacteria/animals.
C. fertility power of land become low.
D. low productivity in crops.
E. others.

32. Is information's about agroforestry are sufficient to you?
A. Yes B. No

32.1 If not, what is the option to know about it?
……..

33. Have you ever taken any training about agroforestry?
A. Yes B. No

33.1 If so,
A. government.
B. NGO_S
C. $INGO_S$
D. others

34. Is agroforestry an alternative source of income to you?
A. Yes B. No

34.1 If so how much?

Table 5

Types	Quantity	Price(Rs)

35. Have you contributed any economical supports is society development program?
A. Yes B. No

35.1 If so, how much? (Within 1 year)

Table 6

Work	Contributed amount(Rs)

36. Are there any organizations, which have supported economically to you for income generating activities?

A. Yes B. No

36.1 If so, by which and how much contributed?

A. NGO_S
B. $INGO_S$
C. government
D. others

37. If supported, what types of income have you got?

……..

37.1 How much benefit have you got from their support?

A. very much B. satisfactory C. not

37.2 If benefited, which and how much?

Table 7

Types	Quantity	price

38. How much is the contribution of agroforestry system in rural development?

A. very much B. satisfactory C. not

39. Can agroforestry be helpful in rural development?

…….

APPENDIX 2

Check list

1. What types of helps have your organization provided for agroforestry?
2. What are the attitudes of farmers towards the agroforestry?
3. What sorts of agroforestry practices is preferred by farmers?
4. What types of agroforestry has practiced on the basis of your observation?
5. Members of community forest are capable for management? Or not how and why?
6. Are farmers benefited by agroforestry system? What sorts of agroforestry product are selling in high quantity? How and why?
7. What are the positive and negative impacts of agroforestry system in the community forest management? Why and how?
8. Are farmers come to your forest for getting advice? If so what sorts of advice they want?
9. What sorts of seeds farmers want?
10. Has farmer formulated separate group for agroforestry? If so what are the types?
11. Are there any conflict between management committee of agroforestry and community forest's farmers? If so what is the solutions?
12. What types of helps are expected by farmers regarding to the agroforestry?
13. Has agroforestry contributed positive impact in the life of farmers and rural development? Yes/No, How?
14. Can agroforestry be a part of rural development? Yes/No, How?

Appendix 3

List of species of trees, grasses, fruits, cereals and vegetables

Trees

Scientific name	Local name	Family	Uses
Adhatoda vasica	Ashuro	Acanthceae	Fuelwood
Aesandra butyraces	Chiuri	Sapotaceae	Fruits, Fuelwood
Albizzia spp	Siris	Seguminoceae	Fodder, Fuelwood
Alnus nepalensis	Utis	Betuaceae	Fuelwook, Timber
Artocarpus lakoocha	Badhur	Moraceae	Fooder, Fuelwood
Azadirachta indica	Nim	Meliaceae	NTFP
Bambusa spp	Bans	Gramineae	Fooder, Timber
Bauhinia pururea	Tanki	Leguminosae	Fodder, Fuelwood
Bauhnia variegata	Koiralo	Leguminosa	Fodder, Fuelwood
Choerospondia axillaries	Lapsi	Anacardiaceae	Fodder, Fuelwood
Cinnamomum glaucescens	Sugandhakokil	Lauraceae	NTFP
Cinnamomum tamala	Tejpat	Lauraceae	NTFP
Dalbergia	Sissoo	Leguminoceae	Timber, Fuelwood
Eucalyptus spp	Masala	Myrtaceae	Fuelwood
Ficus lacor	Kabro	Moraceae	Fodder, Fuelwood
Ficus semicordata	Khanayo	Moraceae	Fodder, Fuelwood
Leucaena leucocephala	Iplil Iplil	Leguminosae	Fuelwood, Fodder
Litsea polyantha	Kutmiro	Laurraceae	Fodder, Fuelwood
Melia azedarach	Bakainu	Meliaceae	Fodder, Fuelwood
Michelia champaca	Champ	Magnoliaceae	Timber
Morus alba	Kimbu	Moraceae	Fodder, Fuelwood
Phyllanthus embilica	Amala	Eupohorbiaceae	Fruits, Fuelwood
Pinus roxburghii	Salla	Pinaceae	Timber, Fuelwood
Prunus cerasoides	Painyun	Rosaqceae	Fuelwood
Sapium insigni	Khirra	Euphorbiaceae	Fodder, Fuelwood
Shicma wallichii	Chilaune	Theaceae	Fuelwood, Fooder
Shoera robusta	Sal	Dipeterocarpaceae	Timber, Fuelwood
Swertia chiraita	Chiraito	Gentianaceae	NTTFP

Syzgium cumuni	Jamuna	Myrataceae	Fuelwood, Fodder
Syzgium operculata	Kyamuna	Myrataceae	Fodder, Fuelwood
Tectona grandis	Teak	Verbinaceae	Timber
Terminalia bellirica	Barro	Combretaceae	Fuelwood, Fodder
Terminilia chebula	Harro	Combretaceae	Fodder, Fuelwood
Woodfordia fruiticosa	Dhairo	Lythraceae	Fuelwood

Fruits

Carica papaya	mewa	caricaceae
Citrus limon	Kagati	Rubiaceae
Coffea arabica	Kaphee	Rubiaceae
Litchi chinensis	Litchi	Sapnidaceae
Maesa macrophylla	Bhogate	Myrsinaceae
Magnifera indica	Amnp	Anacardiaceae
Persica americana	Avocado	Lauraceae
Prunus domestica	Arubakhara	Rosaceae
Punica granatum	Anaar	Rosaceae
Pyrus communis	Naspani	Rosaceae

Cereal Crops

Brassica rapa	Mustard	Cruciferae
Eleusine coracana	Millet	Gramineae
Glycine max	Soyabean	Leguminoceae
Oryza sativa	Paddy	Gramineae
Triticum aestivum	Wheat	Gramineae
Visna mungo	Blackgram	Leguminoceae
Zea mays	Maize	Gramineae

Vegetables

Brassica oleracea	Cauliflower	Crucifereae
Capsicum annum	Chilli/Sweet Pepper	Solanaceae
Capsicum frutescens	Chilli/Hot Pepper	Solanaceae
Lycopersicum esculentum	Tomato	Solanaceae
Momordica charantia Bitter	Gourd	Crucifereae
Solanaum tuberosum	Potato	Solanaceae
Solanum melongena	Brinjal	Solanaceae

Appendix – 4

The Income Generation Activities (2004/05/06) of LFP. Dhankuta

S. No.	Date	FUG_S Name	Amount (Rs)
1	Jan 2005	Satpatre Fug	16492.00
2	Jan 2005	Panchakanya	19000.00
3	Jan 2005	Thumki Raniban	15865.00
4	Jan 2005	Alenipakha	750.00
5	Jan 2005	Pungimapakha	16009.00
6	Jan 2005	Chulachuli Bagale	20000.00
7	Jan 2005	Karambote	20000.00
8	Jan 2005	Iname Thalakham	20000.00
9	Jan 2005	Arun Valley	18355.00
10	Jan 2005	Singhdevi Tarebhir	8000.00
11	Jan 2005	Ratemate Suiretar	8486.00
112	Feb 2005	Mudeyuba Fug	10,933.00
13	Feb 2005	Limbuni Dada	20000.00
14	Feb 2005	Ramit Dada	20000.00
15	Feb 2005	Ghante Dada	20000.00
16	Mar 2005	Saptakoshi Fug	14,322.00
17	Mar 2005	Salghari	11389.00
18	Mar 2005	Chetmala	20000.00
19	Mar 2005	Sakenuwa	15663.00
20	Mar 2005	Bungkhai	20000.00
21	Apr 2005	Yaksurung Lamuhiti	20000.00
22	Apr 2005	Tatopani	13728.00
23	Apr 2005	Gairi	20000.00
24	Apr 2005	Salleri Chyandada	14590.00
25	Apr 2005	Phawakhola	20000.00
26	Apr 2005	Bhutiya Kummetar	11427.00
27	May 2005	Kalika Singhdevi	20000.00
28	May 2005	Barne Belayate	9230.00
29	May 2005	Lakure Singhdevi	20000.00
30	May 2005	Gadhi Singhdevi	19663.00
31	May 2005	Mandalidevi	20000.00

32	May 2005	Durme Panchami	20000.00
33	May 2005	Jaymangal	19393.00
34	May 2005	Bhudhunga	20000.00
35	May 2005	Summinima	18890.00
36	Jun 2005	Chyandanda Fug	20,000.00
37	Jun 2005	Kokaha Fug	20000.00
38	Jun 2005	Khaneubas	17500.00
39	Jun 2005	Samlalunghung	13111.00
40	Jul 2005	Diplungma Fug	20000.00
41	Jul 2005	Jogi Thumka	19000.00
42	Jul 2005	Majuwa Pakha	10500.00
43	Jul 2005	Mait Devi	14000.00
44	Jul 2005	Khaireni	17500.00
45	Jul 2005	Sirise Salleri	18890.00
46	Jul 2005	Rudra Bari	20100.00
47	Jul 2005	Bagha Khor	4390.00
48	Jul 2005	Bluwabani Paripakha	19545.00
49	Jul 2005	Paripakha Balbani	15436.00
50	Jul 2005	Singhdevi	15000.00
51	Jul 2005	Jlkini Koltar	19545.00
52	Jul 2005	Bhimdhunga	15000.00
53	Jul 2005	Dhap	20000.00
54	Jul 2005	Mangdhang	15000.00
55	July 2005	Yasurung Pakha	16500.00
56	Aug 2005	Rajathan Chiliban	15000.00
57	Aug 2005	Tinkateri Phusre	16500.00
58	Aug 2005	Baikini	17500.00
59	Aug 2005	Dhapsinggh	15000.00
60	Sep 2005	Sunkhni Chanaute	19000.00
61	Sep 2005	Bhalupani Hyakule	17500.00
62	Sep 2005	Saphalang	18700.00
63	Sep 2005	Salghari Thalakham	17500.00
64	Sep 2005	Dabjongbhir	15000.00
65	Sep 2005	Arun Piple	18700.00
66	Sep 2005	Sanu Sallari	14400.00

67	Sep 2005	Banpala	20000.00
68	Sep 2005	Sawolbate	20000.00
69	Sep 2005	Totilakokma	16000.00
70	Sep 2005	Aahal Danda	18000.00
71	Sep 2005	Ranke Guranse	18700.00
72	Sep 2005	Jarlanga Devi	15000.00
73	Oct 2005	Gheple Patangwa	15000.00
74	Oct 2005	Santal	20000.00
75	Nov 2005	Dhadkhark	17774.00
76	Nov 2005	Pathivara	17500.00
77	Dec 2005	Dhanehi	17500.00
78	Dec 2005	Akltar	18700.00
79	Dec 2005	Goganu	15000.00
80	Dec 2005	Khaireni	16000.00
81	Dec 2005	Khakhukhani	16000.00
82	Dec 2005	Lampale	18700.00
83	Dec 2005	Sitala Devi	12500.00
84	Dec 2005	Khani Danda	17500.00
85	Jan 2006	Shivaratri Phaka	20000.00
86	Jan 2006	Sirise	15000.00
87	Jan 2006	Chisopani	17500.00
88	Jan 2006	Pathak Pakha	19000.00
89	Jan 2006	Chisaune	12500.00
90	Jan 2006	Andheri	18700.00
91	Jan 2006	Tin Dovan	16000.00
92	March 2006	Gurung Khop	16000.00
93	March 2006	Wog Pangwari	17500.00
94	March 2006	Chakcheck Pakha	15000.00
95	Apr 2006	Khurpe Pakha	18700.00
Total			1575827.00

Photographs

P.1: Labour Loading Cabbage on Truck.

P.2: Farmers are selling Oranges on footpath.

P.3: Labours loading timber on the truck.

P.4: An orange Garden at Dhankuta.

P.5: The Researcher on the field survey visit.

P.6: Cardamom plantation in forest.