DYNAMICS OF SHIFTING CULTIVATION IN CHURACHANDPUR DISTRICT OF MANIPUR

By

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THESIS SUBMITTED TO
ACHARYA N. G. RANGA AGRICULTURAL UNIVERSITY
IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF

MASTER OF SCIENCE IN AGRICULTURE
(AGRICULTURAL ECONOMICS)

DEPARTMENT OF AGRICULTURAL ECONOMICS
COLLEGE OF AGRICULTURE
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RAJENDRANAGAR, HYDERABAD-500 030.

JULY 2010

CERTIFICATE

Miss Jenny Kapngaihlian has satisfactorily prosecuted the course of research and that the thesis entitled "**DYNAMICS OF SHIFTING CULTIVATION IN CHURACHANDPUR DISTRICT OF MANIPUR"** submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that the thesis or part thereof has not been previously submitted by her for a degree of any university.

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CERTIFICATE

This is to certify that the thesis entitled "**DYNAMICS OF SHIFTING CULTIVATION IN CHURACHANDPUR DISTRICT OF MANIPUR"** submitted in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE IN AGRICULTURE** in The major field of **Agricultural Economics** of the **Acharya N. G. Ranga Agricultural University**, Hyderabad, is a record of the bonafide research work carried out by **Ms. JENNY KAPNGAIHLIAN** under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee.

No part of the thesis has been submitted by the student for any other degree or diploma. The published part has been fully acknowledged .All the assistance and help received during the course of investigations have been duly acknowledged by the author of the thesis.

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

It is by the lavish and boundless blessing of the LORD ALMIGHTY that I have been able to complete my studies successfully hitherto and present this humble piece of work for which I am eternally indebted.

Fervently and modestly, I extol the genuine cooperation, inspiration, advice and affection offered to me by my Advisor and Chairman of my Advisory Committee ***Dr. D.V. Subba Rao****, Professor, Department of Agricultural Economics, College of Agriculture, Rajendranagar, ANGRAU, Hyderabad, right from the initiation of the work to shaping of the manuscript. The present work at every stage bears his impression of his counsel and concrete suggestions, careful reasoned criticism and meticulous attention to details. Without which it would have been impossible to present this piece of work. It was indeed a rare privilege for me to work wider with his emending inspiration and indomitable spirit.*

I equally owe my deep sense of gratitude to member of my Advisory Committee ***Dr. C.V. Hanumanthaiah****, Professor Department of Agricultural Economics, College of Agriculture, Rajendranagar and* ***Dr. B. S Kulkarni****, Professor and University Head, Department of Statistics and Mathematics College of Agriculture, Rajendranagar for their invaluable guidance, suggestions and support during my course of study.*

I feel immense pleasure in extending my deep sense of gratitude to ***Dr. N. Vasudev****, Professor and Head, Department of Agricultural Economics for his generous cooperation, constructive criticism in the peroration of thesis.*

I humbly place on record my gratitude to ***Dr. K. Suhasini****, Professor, Department of Agricultural Economics, College of Agriculture, Rajendranagar and* ***Dr. R. Vijaya Kumari ,*** *Associate Professor, Department of Agricultural Economics, College of Agriculture, Rajendranagar, whose constant cooperation and constructive criticism helped me carry out my research effectively.*

I express my deep sense of gratitude to ***Dr. N. Ram Singh and Sri. St. Paulianvung****, for their constant help and co-operation throughout my data collection and inspiring encouragement to embellish the present study.*

I express my heartful love and affection from the inner core of heart to my beloved parents ***Sri L. Jamchinthang*** *and* ***Smt. Kaini****, for their blessings, inspiration, encouragement and moral support throughout my educational career. It remains less even if I say a lot about them.*

I owe much to my loving brothers, and sister, ***ULianboi, James Gogou*** *and* ***Dorothy*** *for their everlasting affection, co-operation and encouragement in my life. They have been my source of confidence and motivation all through my life.*

I avail this opportunity to express my deep sense of affection and gratitude to my friends ***Shaku, Shaila, Nenem, and Maria*** *for their constant encouragement, inspiration and unboundable affection shown on me.*

I affectionately acknowledge the help received from my classmates, seniors and juniors for their help extended during the course of my study.

I sincerely acknowledge the financial assistance provided by ***ICAR*** *in the form of stipend during the period of study.*

I convey my wholehearted thanks to many of my well-wishers and to other friends requesting their forgiveness for not mentioning them here by name.

(JENNY KAPNGAIHLIAN)

DECLARATION

I, JENNY KAPNGAIHLIAN hereby declare that the thesis entitled "**DYNAMICS OF SHIFTING CULTIVATION IN CHURACHANDPUR DISTRICT OF MANIPUR"** Submitted to the **Acharya N.G. Ranga Agricultural University** for the degree of Master of Science in Agriculture in the major field of **Agricultural Economics** is the Result of the original research work done by me. I also declare that any material contained in the thesis has not been published earlier in any manner.

Date: **(JENNY KAPNGAIHLIAN)**

Place: Hyderabad

LIST OF ABBREVIATIONS

%	:	Per cent
∑	:	Summation
@	:	At the rate of
et al.	:	And others
Fig.	:	Figure
i.e.,	:	That is
Etc	:	Other things
Viz.,	:	Namely
Yrs	:	Years
Kgs	:	Kilograms
Q	:	Quintal
Kms	:	Kilometres
Sq.kms	:	Square kilometres
Ha	:	Hectares
mm	:	Millimetre
cm	:	Centimetre
^{o}C	:	Celcius
T	:	Tonnes
MT	:	Metric Tonnes
MW	:	Mega Watt
KWH	:	Kilo Watt Horsepower
Rs	:	Indian currency Rupees
$	:	Dollar American currency
DF	:	Discount Factor
( )	:	Parenthesis or circular bracket
*	:	Asterism, call attention
>	:	Less than

Author	:	**JENNY KAPNGAIHLIAN**
Title of the thesis	:	**DYNAMICS OF SHIFTING CULTIVATION IN CHURACHANDPUR DISTRICT OF MANIPUR**
Degree	:	**MASTER OF SCIENCE IN AGRICULTURE**
Faculty	:	**AGRICULTURE**
Discipline	:	**AGRICULTURAL ECONOMICS**
Major Advisor	:	**Dr. D. V. SUBBA RAO**
University	:	**ACHARYA N.G. RANGA AGRICULTURAL UNIVERSITY**
Year of submission	:	**2010**

ABSTRACT

The present study entitled ‘‘Shifting cultivation in Churachandpur District of Manipur’’ was undertaken mainly to study the nature and extent of area under shifting cultivation, to estimate the environmental benefits and damages and to suggest policy measures. The study covered four blocks/mandals, 6 villages and 70 member households. The data pertains to the year 2009 – 10, and collected through survey method, with the help of specially designed schedule. Several case studies were also made use of to study for environmental costs and benefits. Simple tabular analysis were used for estimating cost of cultivation of different crops such as paddy, ginger, colocasia, maize etc. Percentages were worked out for the purpose of comparison. Regression analysis was carried out for identifying various factors influencing returns for different crops. To rank the problems faced by the farmers Garette ranking technique was employed.

To estimate the environmental damages and benefits**,** environmental services such soil erosion, biodiversity and carbon sequestration were valuated following several case studies. For estimation of returns to land, net present value (NPV) was adopted to evaluate each land-use system. Benefit cost analysis was adopted to indicate the performance of each land use. Replacement-cost method was adopted for valuation of soil erosion effects. Valuation of biodiversity services and carbon sequestration associated with each land-use system was estimated with the help of case studies and a proxy index of biodiversity was developed.

Jhuming (shifting cultivation) is an age-old practice in which there exists a system of hereditary of Chief ship (Hausa) as well as community ownership of village land. Shifting cultivation follows mixed cropping system of which paddy occupy 70 percent of the total cropped area. On an average the holding of the crop is one year with an average of 5 – 7 years of fallows.

About 11.5 per cent of the members were illiterate. Average family size of the sample member is five. Major proportion of the sample cultivators of shifting cultivation (54.3%) was in the age group of 50-70 years. About (69%) of sample cultivators were marginal farmers having an average size of holding of 0.9 ha. Total area cultivated by 70 shifting farmer families was 72.85 ha. Assets of shifting

cultivators include only jhum hut and their farm implements having value at Rs. 2723 and Rs. 1481 per hectare respectively. The distance of jhum land varies from 0.1 to 0.5 km from settlement area.

Comparision of paddy, maize, ginger and colocasia was made. Allocating more area under annual cash crops such as colocasia, ginger has more advantageous than that of cereal crops such as paddy and maize in terms of relative profitability.

The regression estimates of factors influencing gross income from different crops viz, paddy, maize, ginger and colocasia indicated significant impact on inputs such as seeds and labour. Increase in area in annual cash crops will give better gross returns. Increase in cultivated period has positive impact on ginger crop in the gross returns in terms of gross returns.

The practise of shifting cultivation as a source of livelihood for farmers, was the major reason as indicated by Garrette ranking test. Major problem faced by farmers practising shifting cultivation was land preparation. Providing other form of labour such as animal and machinery labour being difficult owing to its topography. Farmers practiced their cultivation mainly by owned labour. Shifting to subsidiary occupation and continuing jhum were the main future plans expressed by farmers practising shifting cultivation

The financial analysis (excluding environmental costs) under the three land-use systems demonstrates that the highest gross benefit (measured as Rs./ha/year) was obtained from horticulture followed by annual cash crop and lowest benefit by shifting cultivation. In terms of NPV, annual cash crops appear to be the best performer followed by horticulture and shifting cultivation has the lowest NPV. When the environmental costs are taken into account, annual cash crops appear to be the most costly land-use system, with horticulture becoming most profitable. Shifting cultivation lies in between these two land use systems.

Policy Implications that have emerged from the study includes

- Awareness on modern agriculture from primitive stages has to be created through various programmes. It should be technologically feasible, sociologically acceptable, ecologically sound and economically viable.
- Involve local people in decision-making processes.
- Understand farmers' livelihood needs.
- Urgent need to reform credit policy.
- An appropriate mechanism should be developed to compensate farmers for the environmental services that their practices generate.
- Government should develop appropriate mechanisms to provide remuneration to land users for more sustainable practices following the conservation programs developed elsewhere.
- Necessary support services, including long-term credit, knowledge transfer, and information on the adaptation of perennial crops may need to be provided, as the returns from tree plantations only come after many years.

Chapter I

Introduction

CHAPTER I

INTRODUCTION

Agriculture, the main occupation with more than 70% of workforce in India, has been in low ebb even after Independent India. With the advent of Green revolution in the later 60's, there has been a sea change in agricultural production particularly in cereals and oilseed crops. The quantum of grain production has led to self sufficiency though there was no surplus in the country. Scientific cultivation system of crops began during this era, though not to the status of other developed western and European countries. Shifting cultivation is still in vogue in several parts of the country. It is quite common practice in North Eastern states, more particularly in Manipur. In view of the serious nature of the problem, the present study has been taken up in Manipur state.

1.1 MANIPUR SCENARIO

Manipur is a small landlocked, hilly and mountainous state within the northeastern India. It has 22327 sq. km of area, which constitutes 0.7 per cent of the total land surface of India. It is a hill girt state of which 90% of the area i.e. 2.05 lakh ha are characterized by hilly regions surrounding a flat valley which constitute 10% of the area i.e. 0.64 lakh ha of the total geographical area. Out of the total hill area of 2.05 lakh ha, only 0.64 lakh ha are cultivated area. It is approximately 3 per cent of the total land area. Whereas in the valley, out of the total land area of 1.84 lakh ha, 0.87 lakh ha are under rice cultivation. It is more than 47 per cent of the total area of the valley. The valley has an average altitude of 872 meters above MSL and the climate is subtropical and warm in the summer season. This part is the "rice bowl" of the state. The hill areas are under temperate subtropical climate at the average altitude of 3000 metres above MSL. The state had distinct winter, warm humid and rainy seasons. The average rainfall is 1482 mm with heavy precipitation during the months of June, July and August. There is post and pre-monsoon shower during October and February. The state is very small but the agro-climatic conditions are different from one place to another because of different elevations. The inaccessible terrain made rapid industrialization in this region difficult. Therefore, agriculture has been the main livelihood amongst the hills and the plain tribes. Manipur agriculture in general could be classified as follows:

- Shifting cultivation
- Permanent agricultural systems
    - Smallholder plantation which is characterized by existence of diverse species in a multistrata arrangement.
    - Paddy systems
    - Annual vegetable crop system
    - Animal husbandry and fisheries
- A few areas under terrace cultivation.

Shifting cultivation is practiced usually in the hill slopes due to the natural topography or geographical situations which makes it impossible for settled cultivation though a few areas are under terrace cultivation. Farmers plant hill paddy based on the shifting cultivation method where jungles are slashed and burned down. This method of planting can only last for about one to three years after which weeds encroach beyond the ability of the cultivator to control and soil fertility drops as the soil surface is exposed to rain drops which leads to accelerated erosion. Farmers then move to other areas to open forest and farm on new piece of land for a few years. If the practice continues it turns more and more primary forest into grassland, including *Imperata cylindrica* grassland (Garrity *et al*. 1997).

Shifting cultivation, also known as ’slash-and-burn agriculture,’ ‘swidden’ or rotational bush fallow agriculture, and as ‘jhum’(Paamlou in Manipuri) cultivation in Northeast India is still being practiced in the Northeastern Hill Region (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura) and other parts of the country (Orissa, Andhra Pradesh, Madhya Pradesh, etc.).

Shifting cultivation is a system in which crops are generally grown on a piece of land or an area by the cultivators (jhumias) only once. After crop harvest, the land is left fallow and the jhumias move to a new land and return to the former area after about 10 to 15 years or more. In the process a cycle is formed which is referred to as ‘shifting cultivation’ (Mithu Paul and Partha Pratim Paul, 2009). This form of cultivation is practiced mainly in regions which have relatively high temperature and abundant rainfall and areas where the topography is not suitable to settle farming. But shifting cultivation has naturally come to disfavor because this form of cultivation is based on self – sustenance and question of trade in surplus do not arise (Debajyoti, 2006).

Jhuming (shifting cultivation) is an age-old practice in the hills of Manipur. But during the last 20 years there is a tremendous increase in the area of Jhum cultivation, mostly in the dense forest areas caused by rapid increase of population. Field preparation is done during December/January followed by dibbling, sowing during February/March, Weeding is done during June/ July, harvesting during September/October and threshing during September/ October. The field after harvest is abandoned for at least 5-10 years during which, the field regains its fertility due to various factors. The main factors for fertility restoration during this period are diverse. The leaves, twigs and other plant parts falling to the soil get decomposed which later acts as good feed to numbers of beneficial micro-organism thriving in the soil under a congenial soil environment. The earthworms, regarded as "friends of the farmers" are the major role players in regaining natural soil fertility by enriching the soil with their castings. Bird litters, animal droppings, biotic activities of flora and fauna, decomposed plant debris acting as natural mulch contribute to soil health building. Hence, the soil composition with fair amounts of major nutrients like nitrogen, phosphorus and potash besides, creating a good soil structure makes the soil virgin in a cycle of 5-10 years period.

The practice of shifting cultivation in part is aimed at claiming a right for land apart from making a living. The continuance of jhum in the state is closely linked to ecological, socio-economic, cultural and land tenure systems of tribal communities. Since the community owns the lands the village council or elders divide the jhum land among families for their subsistence on a rotational basis. As farmers' fields expand further and further away from their homesteads, ability to claim more land is limited by labor shortage and this results in shortened fallow period. Satisfactory soil rejuvenation becomes difficult under the traditionally no chemical input systems especially if the system is practiced on naturally infertile soils such as Ultisols or Oxisols. (Fahmuddin Agus and M. Oka A. Manikmas, 2003). The areas where shifting cultivation is still prevailing are the most under developed regions of the country. Therefore understanding shifting cultivation would help us in understanding not only one of the most primitive agricultural practice in the tropics but also the communities who are practicing this occupation.

1.2 PROBLEM STATEMENT

The highest percentage of geographical area where shifting cultivation is practiced is recorded in Tamenglong and Churachandpur district (accounting for 45 per cent of the total area under jhum cultivation in the state). Much of the area under rice in the hills, and about 40 per cent of it in the state as a whole is under jhum cultivation. Therefore, the present course of study is based on rice. Rice being the staple crop, this is alarming and has serious food security implications. Shortage of rice of about 1.5 lakhs tones, every year is the major problem of Manipur because of the rising population on the fixed area of cultivable land (Ram N. Singh, 2003). Most of the areas under jhum have low productivity and are in remote and isolated parts of the state without proper transport facilities, resulting in serious shortages. But in areas near the plains, interaction with the plain people has resulted into stability and advancement in agriculture (Ingty and Goswami, 1979). This study has been planned to address these issues.

1.3 PRESENTATION OF THE STUDY

The study is presented in six chapters. Chapter I gives an introductory note highlighting the rationale of the study and its specific objectives. Chapter II represents the reviews of the studies made in the past that are relevant to the objectives of the present investigation. The methodology adopted in the study, including delineation and description of the study area and crops, sampling frame, nature and sources of data, analytical tools and techniques used are presented in Chapter III. Chapter IV deals with Agro –economic features of the study – contains agroeconomic features of Manipur and Churachandpur. Detailed description of results and discussion of selected objectives are made in Chapter V. Summary and

Conclusions emerged from results and discussion is presented in Chapter VI. Some other relevant data and information concerning study is appended at the end.

Hypothesis:

- Shifting cultivation is relatively less productive. Therefore, we can produce more under settled cultivation than shifting cultivation.
- The environmental losses are more under shifting cultivation than the benefits'.

Objectives of investigation

- To assess the nature and extent of area of shifting cultivation under different crops with reference to relative advantages and disadvantages.
- To estimate the environmental benefits and damages of shifting cultivation.
- To suggest policy measures on the basis of results emerging from the study of shifting cultivation.

1.4 LIMITATION OF WORK

Churachandpur is taken as the present area under study. But owing to its topography, hilly regions and being located in isolated and remote areas without proper means of transport some parts of the area are accessible. Further, the necessary data and information collected through survey method by conducting personal interviews with sample farmers and inferences drawn are subject to recall bias, since the farmers did not maintain any proper records on cultivation. But utmost care had been taken in collection of relevant data. The study was carried out in a limited period of time and for limited size of sample and hence generalization of results needs careful attention. Environmental objectives are studied with the help of data available from the literature and therefore adopting the information from different periods makes the study not so precise and it is to be treated as an approximation

Chapter II

Review of literature

CHAPTER II

REVIEW OF LITERATURE

Shifting cultivation is a type of farming in which the land under cultivation is periodically shifted so that fields that were previously cropped are left fallow for different period and subject to the encroaching forest. The land is common property and is controlled by social groups, usually tribes. The chieftain or land priest designates land to the individual families for their use. The land is cleared by cutting down the trees and burning the land. This land is cropped for some years and then left forest fallow while another piece of land is cleared. The regeneration period maintains the fertility of the land if it lasts long enough. In other words, if the population is very small, such extensive usage suffices, with limited input, to enable a meager, self sufficient existence. In this chapter review made on different dimensions of shifting cultivation under the following sub headings:

2.1 Socio – economic dimension of shifting cultivation.

2.2 Environment costs of shifting cultivation

2.3 Conclusions

2.1 Socio – economic dimensions of Shifting Cultivation

Edwin Verrier (1960) opined that jhuming was the only practical method of cultivation on the steep slopes of the hills, which was closely linked with social customs, mythologly and religion of the people. Ganguli (1968) emphasized that the importance of shifting cultivation, the life and culture of people depending on it cannot be over – emphasized. It involves gearing of all activities to the same end. Agriculture plays an important part in the growth of culture not simply it provided food, but also because it knits and disciplines humanity itself more closely through the procedures it involves. Guha A (1973) found out that the jhum cycle was about 4 – 5 years in Meghalaya, 5 years in Mizoram and 10 years in Mikir hills of Assam. Stephen Tyler (1974) in his study on swidden or shifting agriculture in Andhra Pradesh, observed that it was not just an alternative for land – use or a set of agricultural practices, but it implies the whole nexus of people's religious belief, attitude, self image and tribal identity.

Saha (1973) mentioned that FAO undertook a survey in 1968, on the nature of shifting cultivation in different countries. It was found that shifting cultivation was carried on areas, 21 percent of which were virgin forests, 42 percent secondary growth, 19 percent shrubs and only 18 percent savanna grassland. The waste of timber on account of clearing and burning was estimated to cost per hectare was 18 dollars in Burma, 11 Dollars in Fiji, 10 Dollars in Guyana, 200 Dollars in Guinea and 107 Dollars in Columbia (FAO 1969). He also suspected that the costs of timber and bamboos that were destroyed might have brought more income to the jhumias than that from crops raised in jhums, if there was marketing facilities for timber and bamboos. Besides loss of timber and bamboos, shifting cultivation by way of such wanton destruction of forests, destroyed the ecosystem with harmful effects on flora and fauna in a given area.

Tripathy (1974) has identified that shifting cultivation was generally associated with the communal ownership of land. The cultivating households carry on their cultivation of plots selected by various means including deviation. It was not always that the same household would cultivate the same plot of land. Very frequently individual households do not have absolute ownership right over the land. Their rights were of nature of usufructs.

Majumdar (1976) stated that shifting cultivation being a part and parcel of socio- cultural life of the tribal people in North – East India; all its operations were inseparably linked with their religious rites and festivals.

Chutia (1977) indicated that the pre – requisites to change or replacing shifting cultivation were development of road communication and transport, intensive extention work, supply of goods and services with emphasis on organization of marketing for agricultural produce, provision for better soil amenities, diversification of farming towards horticultural and live – stock rearing along with development of terraces.

Dubey S N (1978) stated that shifting cultivation, with minor exceptions, was generally associated with communal ownership of land in North – East India. However, there are several land systems associated with jhuming but in most of the cases, land is owned by groups rather than individuals. Singh (1978) reported that through the various activities of jhum cultivation such as jungle cutting, burning, clearing and dibbling of seeds etc about 3.7 tonnes of soil material per hectare slide down the foot – hills.

Singh and Singh (1978) studied on the effects of various stages of Shifting cultivation on soil erosion from steep hill slopes found out that soil erosion due to splash and wash by water from hill slopes (60 – 70%) under first year, second year, abandoned jhum (first year fallow) and bamboo forest was estimated to be 146.6, 170.2, 30.2 and 8.2 tones per hectare per year respectively.

A Balu and D' Silva (1979) mentioned that the rationale behind the persistency of shifting cultivation system lies in its compatibility with the physico – social environment of sparse population, community land tenure system, undulating and steep topography, short crop cycle, rainy season and thereafter, acute moisture stress during post – monsoon period, as well as, meager resources with the farmers and also the only available means of provding moderate calories and protein for the sustenance of families with minimum risk and least income variability.

Bose (1980) opined that shifting cultivation was of life for the tribal people, any suggestion regarding suspension of shifting cultivation and introduction of terrace or permanent cultivation in its place was not accepted by the tribal people.

Ingty (1981) observed that the forest wealth was in danger of disappearing in short term, if nothing was done to arrest its degradation or destruction in area where agricultural crops were grown specially by way of shifting cultivation.

Toky and Ramakhrishnan (1981) state that, 'the version found in this region is that the cultivation is carried out on slopes of 30-40° angles; the climate is monsoonic with a high rainfall of over 2,200 mm followed by a dry winter and a brief warm summer, supporting a mixed sub-tropical humid forest. The normal jhum cycle is of three- four years, but rarely longer; and the forest is clear felled before planting'.

Malabika and Banerjee (1983) expressed the view that jhuming has been equated to the way of life of the jhumias because it was considered to be so important in their lives that all other activities of the group as well as their values, attitude and beliefs were supposed to revolves around it. It was claimed that their society, polity and culture were all based on these forms of agricultural practice.

Sachidananda (1983) made attempt to analyse how the tribal communities engaged in this practice have altered under forces of socio-economic change. It was concluded that shifting cultivation should not be condemned; instead, its methodology should be improved in a way that yields are increased and the damage done to the environment is minimized.

Rai (1984) suggested that since shifting cultivation was an age – old practice and the socio – cultural life of the tribal was intimately woven with it, the switch over to settled agriculture has to be gradual. The forces of change should preferably emanate from within the society, eventhough the role of external assistance to accelerate the pace of change cannot be underestimated. Location specific programmes based on climate, physiography, land – use and traditional occupation should be the pattern of settlement programme.

Sharma (1984) opined that it was necessary to provide the shifting cultivators continuinity with psychological security before they can afford to the risk of abandoning or even going slow on their jhum in favour of a tree culture or cattle rearing programme. He also argued that eventhough the problem of shifting cultivation has been well known, it has not found a prominient place in the overall planning framework of our country or even of the concerned regions or states. The overall effort was meager compared to the vast area under jhum and large population of jhumias who continue to depend on the system.

Agarwal A K (1985) opined that jhum has evolved over a centuries as a mixed land use pattern under the condition of physiographic remoteness which has forced the people to self contained system and raising of various crops together. The level of agrarian technique is exceedingly low and tools and implements are primitive in nature which results in low yield per acre with little or no surplus for investment.

Jehagirdar (1986) observed that even after a decade of anti – jhuming programme in the North – Eastern Region, no significant change has occurred. The prevaing land tenure system and the traditionally rooted habits of the hill people were the major obstacles for the success of developmental programmes in the region.

Maikhuri and Ramakrishnan (1990) opined that allotment of sites is done by village headman, who is in overall control of the village community, helps to promote kinship among members of the village and among many communities such as Garos and Mikirs. Borthakur (1992) Jhumming is one of the most ancient systems of farming, believed to have originated in the Neolithic period, around 7000 BC. It is intricately linked with the ethos of the social and cultural values of the tribal communities.

Ramakrishnan (1993) opined that jhum is the form of agriculture in which a piece of forest land is slashed, burnt and cropped without tilling the soil, and the cropped land is subsequently fallowed to attain pre slashed forest status through natural succession. Further he found out found out that since there are over different hundred tribal communities in the North – eastern region which are highly insulated because of language, topography and socio – cultural factors, one could reasonably expect over a hundred different variations in land use practice. Therefore, it is important to realize that there is variety of jhum system rather than a single homogenous system of shifting agriculture as often assumed in scientific literature.

Singh *et al* (1996) states that although shifting cultivation is primitive as well as labour intensive and ecologically imbalance farming system yet it is very difficult to change traditional shifting cultivators even if we provide all the modern farm inputs. Firstly it is very deep rooted and secondly it is a part of socio-cultural life of the tribal people which is linked to their religious rites and festivals. Thus to replace jhuming priority basis should be in areas where the jhuming cycle has come down to 3-5 years. In the areas where the cycle is 6 years and above, the improvement approach may be introduced immediately so as to gradually shift to alternate farming system which include terracing of the land, afforestation of the upper hill areas undertaking of plantation of each crop etc. and should also include three tier systems, viz, forestry, silvipasture/horticulture and agriculture.

Saikia and Das (1998) studied on the socioeconomic profile of the respondents and showed that a high percentage of the women were illiterate and belonged to the middle aged group. The majority of the respondents were from the poor income group and were marginal farmers. The extent of involvement of women in farm operations like the selection of seeds including hulling and inter-cultivation activities was high whereas in the case of land preparation, sowing activities, harvest and post-harvest activities respondents showed medium levels of involvement.

N Ram Singh (2003) opined that as per the customary law, the village boundaries of the tribal areas are strictly controlled by the village authorities; hence, there is no scope for expanding shifting cultivation across the individual village boundaries. Particularly, the Maring tribes of the district of Manipur emphasized on the conservation and protection of their inherited land for a sustainable food production and income generation.

Rasul G and Thapa G B (2003) in their paper concludes that the change from shifting to permanent cultivation does not take place automatically with increasing population pressure as postulated by Boserüp (1965). It takes place when the favourable condition created by population growth is reinforced by other appropriate measures, including ownership rights to land, development of infrastructure and provision of necessary support services and facilities.

Ya T and Tulachan P M (2003) conducted case study on community initiatives and innovations in response to the progressive marginalization and increased vulnerability of shifting cultivation areas in northeast India. In the first case (in Mokokchung district, Nagaland), farmers responded to the problem of declining productivity by implementing measures to lengthen the cycle of shifting cultivation. In the second case (in the Garo Hills district of Meghalaya), farmers responded to the problem through crop diversification and by shifting their staple production from swidden fields to terraces.

Das (2006) revealed the superimposition of an alternative model without any appreciation of the traditional system of the indigenous people or any effort towards improving existing method within their cultural framework. He suggested that shifting cultivation cannot be narrowed down only to econometrics and profitability but with the cultural know how attached to it that have been practiced since ages and lived in symbiosis with their surroundings.

Anonymous (2009) Briefing Paper, Bangkok UNFCCC Intersessional Meeting revealed that because shifting cultivation is so different from the forms of agriculture practiced in the lowlands and by the majority populations. It is one of the most misunderstood land use systems. Thus, in the name of forest conservation and development, colonial and post-colonial governments in Asia have since more than a century devised policies and laws seeking to eradicate shifting cultivation.

It is often overlooked that shifting cultivation for most people, and definitely for all indigenous peoples who practice it, is not simply a farming technique but a way of life. The popular prejudices against shifting cultivation common in these countries are conflated with other negative attributes ascribed to indigenous peoples throughout the region: that they are backward, primitive, a hindrance to national progress, disloyal to and a security problem for the state etc. With the official aim of protecting forests from what is seen as an ecologically harmful practice, of modernizing what is considered a backward form of agriculture, and of controlling and integrating into the nation a population that is viewed with suspicion due to its "nomadic" way of life, all of these policies seek to reduce or eradicate shifting cultivation in one way or another. Anonymous (2009)

Uriarte M *et al* (2010) made case studies in Southern Yucatan, Mexico and West Kalimantan, Indonesia to investigate the ecological and socioeconomic factors that affect forest resilience and thus determine whether or not shifting cultivation is sustainable. Detailed analyses for two case studies suggest that a purely ecological framework is of limited effectiveness in explaining variability in the effect of repeated shifting cultivation. Rather, socioeconomic factors such as migration, subsidies, roads, and settlement history can alter the outcome of shifting cultivation by limiting the accumulation and use of local knowledge.

2.2. Environmental costs of shifting cultivation

D.C. Kaith in 1958 conducted a study before the reorganization of states revealed that shifting cultivation constitute a vital part of economy in for 109 tribes in 12 states comprising a population of about 26.4 lakh excluding the tribal population of U.P. and Rajasthan, depended on shifting cultivation. Furthermore nearly 1.75 lakh hectare was being annually cleared by these tribes. These figures reveal the vastness of the problem. He further gave state wise breakup of the following 12 states. In Orrisa though that no exact data are available from this state but yet from the available information the total area of 0.13 lakh sq miles (0.34 lakh square km) involving a dozen tribes with a population of 11 lakh was affected in 1956. In Assam total area cut annually constitute 795 square miles involving around 9 tribes with a population of 9.79 lakh was affected. In Bihar total area cut annually constitute 176 hectare involving 2 major tribes namely Kharia in Singbhum and Maler in Santhal Paragas with a population of 1650 was affected. In Tripura out of total area of the state i.e. 0.41 square miles, 66 percent is covered with forest. Around 0.47 lakh hectares are under swidden involving a total population of 0.95 lakh distributed in 10 major tribes. In Bombay which also includes population and territory now under Gujarat state constitute 0.21 lakh hectare with a population around 0.34 to 0.38 lakh. In Madras which mainly consist of Coimbatore district, Malabar district and Nilgiri district constitute about 0.17 to 0.19 lakh hectare with a population of around 0.29 to 0.33 lakh.

In Madhya Pradesh area cut annually constitute 0.15 hectare with a population of 0.40 lakh was affected. In Uttar Pradesh only two small pockets one in Lalitpur subdivision of Jhansi district and Rupin and Supin Valley of the Tons valley in Tehri Garhwal district practised shifting cultivation constituting an area of 80 hectare. In Manipur shifting cultivation was largely practised in large scale mostly in Manipur south and Manipur East district. Total area annually cut for shifting cultivation constitute about 54181 hectare out of 2.05 lakh hectare hill area with a population of 182902. In Mysore now Karnataka total area under shifting cultivation constitute 88 hectare with a population of 116 families.In Rajasthan tribal people from hills and forest carry out two types of cultivation namely - Dandakast (in plain forest) and Daikast (In the Hills) though no accurate data are available, whatever information available, the extend of area constitute about 8720 hectare of area under cultivation.

Burman R and Sharma P S (1970) made a detailed study of different tribes practicing shifting cultivation in India.

Area covered under shifting cultivation in Assam constitute about 0.38 lakh hectare with a population consisting of 2 lakh depends on shifting cultivation. In Manipur area the area covered under shifting cultivation constitute about 0.21 lakh hectare with a population consisting of 1.83 lakh depends on shifting cultivation. In Tripura, area covered under shifting cultivation constitute about 0.46 lakh hectare with a population consisting of 0.94 lakh depends on shifting cultivation. In Orissa, area covered under shifting cultivation constitute about 1.6 lakh hectare with a population consisting of 9.4 lakh depends on shifting cultivation. In Bihar, area covered under shifting cultivation constitute about 174.4 hectare with a population consisting of 1.15 lakh depends on shifting cultivation. In Madhya Pradesh, area covered under shifting cultivation constitute about 3.8 lakh hectare with a population consisting of 0.33 lakh depends on shifting cultivation. In Karnataka, area covered under shifting cultivation constitute about 1000 hectare with a population consisting of 0.14 lakh depends on shifting cultivation. In Andhra Pradesh, area covered under shifting cultivation constitute about 0.38 lakh hectare with a population consisting of 2 lakh depends on shifting cultivation. In Tamil Nadu, area covered under shifting cultivation constitute about 1200 hectare with a population consisting of 2200 depends on shifting cultivation. In Kerela, area covered under shifting cultivation constitute about 0.21 lakh hectare with a population consisting of 0.10 lakh depends on shifting cultivation.

Goswami P C (1971) has estimated that the area cleared every year for jhuming in Assam and Meghalaya hills comes to about one lakh hectares. Mukerjee R K (1975) states that shifting cultivation is prevalent in less than 3 percent of the total area of North – East Region in any particular point of time. About 1/6th of the total geographical area of the North east region is affected by shifting cultivation whereas in Arunachal Pradesh and Manipur, it was practiced in less than 5 percent of the total territory. The number of dependent families on jhuming is about 5 lakhs comprising of 25 lakhs people in that region.

Majumdar (1971) opined that shifting cultivation cannot be avoided for a long time and hence efforts were needed to improve productivity of jhum cultivation and minimize soil erosion. He advocated that an important aspect duly recognized as a crucial strategy for development was the need to frame the programmes to suit the local conditions and values the people cherish.

Anonymous (1979) states on Rapporteur's Report on Farming System in Hill Areas stressed on the solution to the problem of shifting cultivation in the North – Eastern Region may be in tune with socio – religious conditions of the jhumias. It further stated that within the framework of the existing community ownership of land, it would be possible for individuals to obtain land for cultivation. With the involvement of village council and leaders it may be possible to allocate land individually and to replace jhuming by terracing the land by using new technology to improve and maintain productivity of the steep slopes. Food subsidy as a tool to motivate the jhumias to motivate the jhumias to take settled agriculture should be used judiciously.

Borthakur *et al* (1979) reported that the study conducted by ICAR Research Complex, Shillong has shown the input – output ratio of shifting cultivation at 1: 1: 28. They also reported that the reason of continuance of the practice was linked up with ecological, socio – economic and cultural factors including lack of communication leading to physiographical remoteness and isolation. Dutta and Sharma (1979) conducted a research on economics of shifting cultivation during 1977 – 78 and concluded that the staple food crop of jhum being paddy, its cultivation in mixture or alone was an unremunerative enterprise with low returns. Singh and Singh (1980) estimated that the net income of about Rs 700 was recorded after the labour charges are paid on the jhumias cultivated lands. Inpite of the less income they were mentally and emotionally attached to this type of farming that they refuse to opt to other type of farming.

Myers (1980) in Ramakrishnan, (1993) cited that a major portion of shifting cultivation area is confined to North – Eastern India, a narrow belt occurs along the Western Ghats and some in Andaman and Nicobar Islands. Anonymous (1987) found out that as much as 2 lakh hectare land area in Mizoram was affected by jhum, with approximately 63,000 ha being cultivated in a given year by 50,000 families. The average jhum land per family is about 1·3 ha and the present jhum cycle is four years.

Frithjof Kuhnen, (1982) states that in recent times, the population increases in many regions have made it necessary to clear land more and more frequently and cut down on the time when the land is left fallow and, thus, endangered the fertility of the soil. An adjustment through tribal wars between tribes controlling a lot of land and tribes with little land is hardly possible today. The continual shifting of the settlements and fields hinders building up an infrastructure. The growing cities' demand for foodstuffs can only be satisfied with difficulty as it is hardly possible to intensify production while using this system. The concept that has been most frequently discussed to date is the individualization of rights in land.

Mishra and Ramakrishnan (1983) states that at higher elevations of Meghalaya where the pine trees are sparsely distributed, slash and burn with clear felling of forest is not feasible because of slower forest regeneration capability of the site under sub – temperature climate. They further suggest the preparation of the higher elevations site into alternate ridges and compacted furrows running down the slope with the compacted furrows acting as water channels. This water channels would help in conserving nutrient losses through water without which, otherwise the nutrient loss due to water would be higher. This is particularly important because the soil fertility recovery is slower at these elevations.

Mahapatra and Patnaik (1985) reported that shifting cultivation takes advantage of native fertility build up in soil as a result of 5 – 10 years bush fallow in areas such as N. E. H. Region, Eastern Ghat Region and Plateau Region of Eastern and Western India, dominated by tribals, was the only way of cultivation of crops.

Datta (1986) studied on the land use and found that the three tiers – alternative system of cultivation (i.e. agro–silvi–pastoral system) was superior to all others including shifting cultivation in respect to both employment and income. He suggested an integrated land use system with the concept of mixed farming taking into consideration its topography, soil conditions and water resources.

Ramakrishnan (1993) studied the economics and efficiency of jhum cultivation and showed that jhum was a resourceful system of organic multiple cropping well suited to heavy rainfall areas. The economic and energetic efficiency of jhum was higher than alternative forms of agriculture, such as terrace and valley cultivation with respect to expensive inputs such as fertilizers, and was thus followed by the tribals.

Angelsen (1995**)** studied the recent changes in shifting cultivators' adaptations in a lowland rainforest area in Sumatra, Indonesia. Increased rubber planting and expansion into primary forest are seen as a response to increased rubber profitability and (expected) land scarcity, and as a race for property rights. Government land claims have had significant multiplier effects on forest clearing through changes in farmers' expectations and in initiating a self-reinforcing land race.

Tawnenga *et al* (1996) evaluated that if second year cropping is done on jhum fallows extent of the forest land required for slashing and burning could be reduced significantly. We tested this hypothesis in a young (6 yr) and an old (20 yr) jhum fallow. They also evaluated if the productivity during second year cropping could be alleviated by auxiliary measures such as tilling the soil or application of fertilizers (chemical or farm-yard manure or in combination of both). The results demonstrate that the ecosystem productivity (total dry matter production) and economic yield (rice grain production) decline with shortening of jhum cycle. Second year cropping causes a further decline in ecosystem productivity in old jhum field, but not in young jhum field. Economic yield from second year cropping in its traditional form (without any fertilizer treatment) was not much lower than that in the first year, and can be improved further by manuring the soil. Tilling of soil improves neither ecosystem productivity nor economic yield. Different fertilization treatments respond differently; while inorganic manuring enhances ecosystem productivity, a combination of inorganic and organic manuring improves economic yield.

Tomich *et al* (1998) This paper sets out a conceptual framework for comparing the impacts of different land use systems and agricultural practices at the margins of tropical rainforests in terms of the concerns and objectives of two key interest groups: small-scale farmers seeking livelihoods at the forest margins and the ‘international' interests in the global public goods and services supplied by tropical rainforests They identified data needs and analytical methods capable of supplying an empirical base for this conceptual framework, based on quantifiable indicators. It presents preliminary results of the application of this conceptual framework in Indonesia and Brazil in association with a global, collaborative, multidisciplinary research program. Even using preliminary order-of-magnitude estimates (to be replaced by more precise measurements as they become available), this conceptual framework presents results in ways that allow researchers and policymakers to select clear ‘best bets' for development, when they exist, and to assess tradeoffs and options for complementary policy action and research efforts.

Fischer A and Vasseur L (2000) opined that one of the principal causes of deforestation was the expansion of the agricultural frontier through extensive shifting cultivation systems. These land use systems are becoming increasingly unsustainable as population increase and the amount of agricultural land available declines, and are often associated with low crop productivity, and reduced soil fertility. Agroforestry has the potential of providing both socio-economic and ecological advantages to smallholders.

Tripura (2000) opined that traditional shifting cultivation with long fallows and short cropping periods was practised by tribal communities in the early 19th century. It did not affect the land and soil as the long fallow periods enabled soil and vegetation to regenerate. Thus, soil erosion remained minimal and the hydrological balance was maintained.

Gafur (2001) stated that shifting cultivation with short fallows has accelerated deforestation and soil erosion, and continuous soil loss has reduced soil fertility through nutrient leaching.

Nounamo L and Yemefack M (2001) conducted research in the area of the Tropenbos-Cameroon Programme between 1995 and 1997, to provide a comprehensive description on the farming systems applied in the TCP research area, with emphasis on shifting cultivation/natural fallow systems, and insight in soil (fertility) degradation related to such agricultural practices. To achieve sustainable management of the forest zone of southern Cameroon, solutions must be found to three main problems:

(i) the farmer's immediate socioeconomic and agronomic production constraints;

(ii) the shortening of the fallow length leading to soil productivity degradation; and

(iii) the unsustainable non-prosperous subsistence shifting cultivation destroying the forest ecosystems.

Singh (2001) quantified the short and long run impact of soil erosion on agricultural productivity and profitability on four different land management technologies in Bench terrace and Puertorican terrace, India. They were compared with each other and with traditional shifting cultivation systems in Byrnihat block in

Ribhoi district of Meghalaya state. He stated that under low population when yield penalty was not imposed, the 12 year cycle is found to be the most profitable. But when yield penalty was imposed, the conservation system such as Puertorican terrace and bench terrace becomes more profitable. These findings were in accordance with Boserup Hypothesis that there exist a positive correlation between population density and agriculture intensification.

Muller D and Zeller M (2002) paper investigates geophysical, agroecological, and socioeconomic determinants of past land use change in two districts of Dak Lak province in the Central Highlands of Vietnam and assesses the influence of rural development policies on land cover change. Results has suggested that the first period from 1975-92 was characterized by land-intensive agricultural expansion and the conversion of forest into grass and agricultural land. During the second period, since 1992, the rapid, more labour- and capital-intensive growth in the agricultural sector was enabled by the introduction of fertilizer, improved access to rural roads and markets, and expansion of the irrigated area. These policies, combined with the introduction of protected forest areas and policies discouraging shifting cultivation during the second period reduced the pressure on forests while at the same time increasing agricultural productivity and incomes for a growing population.

Agus F and Manikmas M O A (2003) review environmental positive and negative ‘externalities’ of Indonesian agriculture. Discussion were emphasized on major agricultural systems including lowland rice, annual upland farming, smallholder plantation, and monoculture farming systems. The main indicators discussed include soil erosion and sedimentation, flood mitigation role, carbon sequestration, and biodiversity in each of the selected systems. In general, as forest is converted to agricultural lands, some of forest environmental roles disappear. Further conversion of agriculture to industrial and settlement areas also results in subsequent disappearance of agricultural positive externalities. Lowland rice farming has an ability to filter sediment in a landscape and contribute to flood mitigation; two important roles in the upstream of flood-prone major cities of Indonesia. Smallholder plantations, characterized by complex agroforestry systems, sustain various positive roles including erosion control, flood mitigation, carbon sequestration, and biodiversity. Population pressure and poverty are the main driving forces of overuse of steep land for agriculture. Finally, there is a need for reinventing of the current national conservation program, the ‘regreening’, to a more accountable, more problem solving and people oriented approach such that it can contribute in increasing positive agricultural externalities while minimizing the negative ones.

Borggaard O K *et al* (2003) conducted an integrated socioeconomic and erosion study on the sustainability of traditional shifting cultivation(jhum) carried out in 1998 and 1999 in the Chittagong Hill Tracts (CHT) of Bangladesh showed the system to be non sustainable under the current conditions with fallow periods of only 3-5 years and lack of land rights. An estimated input (mainly labour) of US$ 380 ha^{-1} $year^{-1}$ results in only a total output of USD 360 ha^{-1} $year^{-1}$ and jhum cultivated areas suffer severe loss of soil and valuable plant nutrients along with runoff during the rainy season. To compensate these losses by commercial fertilizers will cost nearly USD 2 million $year^{-1}$ for CHT.

Ramakrishnan P S *et al* (2003) conducted a study to investigate the innovations adopted by shifting cultivators in Meghalaya, India, in response to increasing population, socioeconomic development, exposure to market economy and increasing communications. Results indicated that the system of cultivation practiced in the higher elevations of Meghalaya have undergone several changes. These changes have not only increased its economic efficiency but have also led to better land use and management as described below:

(1) partial shifting within the cultivated land enable efficient utilization of land as a result of which the period of cultivation on the land can be increased resulting in longer fallow periods;

(2) the non-usage of fire ('rep pull') results in lesser destruction of the soil system;

(3) allowing the slash to decompose naturally allows for better utilization of nutrients locked up in the plant biomass as they are not released in a single pulse;

(4) use of 'stong' reduces soil loss from the exposed surface due to runoff; and

(5) cultivation of nitrogen-fixing crops such as *Pisum* sp. enriches soil nitrogen content while the non-cultivation of *Raphanus sativus*until the later stages of the cropping cycle allows better utilization of land.

Satapathy K K and Sarma B K (2003) stated that the impact of these programmes in respect of weaning the people away from shifting cultivation and improving their socio-economic condition is yet to be assessed although the hill tribes were gradually becoming aware of the ill effect of this primitive form of agriculture.

Rasul *et al* (2004) using cluster analysis, the study identified three types of land use systems in Bandarban, a typical hill district of CHT, which are different from each other in intensity of use, degree of diversification and commercialization. Factors influencing the development of land use systems were explored through factor and discriminant analyses. Results showed that institutional support, productive resource base and distance to the market and service centre were the main factors responsible for the development of three different types of land use systems. Sustainable land use systems such as agro forestry, commercial plantation and horticulture have evolved in areas where such support and facilities were favorable. While in other areas with insecure land tenure, difficult access to market centres, and unavailability of credit and extension services shifting cultivation was the dominant type of land use.

Nath *et al* (2005) drawed on an empirical study in Khagrachari district of the CHT, examined how far the production from present shifting cultivation supports the tribal people's livelihood and what alternative livelihood strategies they have adopted for subsistence by using data on input/output and income/expenditures, and analyzing current government policies. The findings showed that productivity declined markedly, yields were almost equal to input values and farmers experienced food shortages for at least two to six months in a year. Reorientation of government policies, easy access to institutional support and the active participation of local people in development intervention are of the utmost importance in order to find alternative land uses for sustainable hill farming, to improve the farmer’s living standards and to conserve forests and protect watersheds

Pascual U (2005) evaluates another alternative i.e., the intensification of land use by improving technical efficiency in farming. These involves the reduction of land clearing while at the same time maintaining crop output levels and the local (and traditional) low-input technology. The potential for such land use intensification was empirically assessed with ecological and socioeconomic household data from

Yucatan (Mexico). The methodology was based on both parametric and nonparametric output and input distance functions. The results of the analysis suggested that on- and off-farm labour diversification can play a key role to help shifting cultivating households to improve their technical efficiency in farming and thus to help to intensify land use. Furthermore, while the empirical results point towards the positive effect of soil fertility, mainly determined by the length of forest fallows, on crop output levels, farmers appear to overcome the ecological constraint of farming in less fertile soils by being more technically efficient.

Rasul G (2005) studied on the impact of state policies on land use in the CHT over the past two centuries. It reveals that the process of degradation started during the British colonial period with the nationalisation of land and forests and the initiation of large-scale commercial logging. It was accelerated by the establishment of reserve forests which abolished tribal people's customary rights and forced them to reduce fallow periods in their farming. The construction of a hydroelectric dam and encouragement of lowland people to migrate to the CHT have increased pressure on the land still further. This has forced farmers to cultivate more marginal lands for growing food and annual cash crops, and to increase cultivation frequency.

Dalle *et al. (*2006) used a data set of 26 fields to examine the impact of shorter fallow periods on the availability of noncrop plant resources in shifting cultivation fields by the Yucatec Maya in Quintana Roo, Mexico. The findings indicated that the dynamics of noncrop plant resources and their implications for local livelihoods required for further consideration in the debate over improving the productivity of shifting cultivation systems.

Kerkhoff (2006) the study was designed to take a fresh and unbiased look at the practice, and especially at innovations introduced by farmers in response to modern pressures and restraints. The aim was to raise awareness about issues related to shifting cultivation, to establish a platform for exchange of ideas, and to develop detailed policy recommendations to support the work of governments. Shifting cultivation and the farmers' innovations in particular, were found to contribute to forest cover and biodiversity conservation, while at the same time maintaining agricultural and forest productivity. Commercial niche products and organic farming contribute to economic development that is adjusted to mountain circumstances and builds on existing potential. The local institutions developed by shifting cultivation communities were found to be relatively strong, and they enhance social security and cultural integrity.

Thimmappa and Mahesh (2006) evaluated and compared different conservation or watershed-based farming systems that can be introduced to replace shifting cultivation in Meghalaya. The various system he suggested includes live – stock based, forestry, silvi – pasture, agri – pasture, agri – horti – silvi pasture, horticulture based, and timber forestry system. Among the different system evaluated horticulture based farming system registered the maximum annual net returns of Rs. 40,115 per hectare. Agri – horti – silvi pasture is the highly diversified farming (i.e., 51% of income from horticulture, 33% from agriculture, 9% from pasture and 6% from forestry) while the highest soil loss was registered in shifting cultivation. The findings indicated that shifting cultivation occupied the last position in soil loss, annual net returns, diversification, organic carbon enrichment and benefit – cost ratio among the different farming systems. Thus, he suggested that economically viable conservation based farming technology is available which have the combination of diversification addressing efficiency, sustainability and with proper funding will increased the pace in agriculture development.

Rahman *et al.* (2007) uses both quantitative and qualitative methods to analyze data. The financial analysis indicates that agro forestry systems give positive and much higher Net Present Value (NPV) than shifting cultivation. Efforts have been made by Paul V I (2008) to critically assess shifting cultivation as otherwise necessary social evil. The environmental impacts include irrepairable loss of biodiversity, soil erosion, loss of soil nutrients, and reduction in water retention capacity, water scarcity, massive landslides and contribution towards global warming. Irrespective of all these environmental backlashes, the slash and burn cultivation was practiced in thousands of hectares of forest every year, generation after generation because that was the only means of subsistence for the vast majority of the tribal folks in Nagaland.

Rasul G and Thapa G B (2007) evaluated five major land-use systems being practiced in CHT, namely jhum, annual cash crops, horticulture, agro forestry, and timber plantation. The results of the financial analysis revealed the annual cash crops as the most attractive land use and jhum as the least attractive of the five land-use systems considered under the study. Horticulture, timber plantation, and agro forestry, considered to be suitable land-use systems particularly for mountainous areas, held the middle ground between these two systems. Annual cash crops provided the highest financial return at the cost of a very high rate of soil erosion. When the societal cost of soil erosion is considered, annual cash crops appear to be the most costly land-use system, followed by jhum and horticulture. Although financially less attractive compared to annual cash crops and horticulture, agroforestry and timber plantation are the socially most beneficial land-use systems.

Contrary to the above studies, UNFCCC (2009) in Intersessional Meeting provides evidence on recent research that proves that

i) Shifting cultivation is not a major cause of deforestation.

ii) More carbon is being sequestered in areas under shifting cultivation than under other forms of land use, like permanent cropping of seasonal plants, or plantations.

iii) Shifting cultivation enhances bio-diversity and is crucial for in-situ conservation of crop genetic resources.

Brajakumar (2009) observed that Churachandpur with 34% of the total area covered by jhum was highest among the hill districts. The next one being Chandel with 25%. Out of the total area of Ukhrul 22% was affected by jhum practice while only 10% and 9% respectively in Senapati and Tamenglong district.

Rasul (2009) in his study estimated the environmental services including soil conservation, carbon sequestration, and biodiversity conservation provided by four agricultural land-use systems practiced in Chittagong Hill Tracts of Bangladesh using non-market valuation techniques. Net Present Value (NPV) was used as a criterion to assess their relative profitability from private and social perspectives. The result of the financial cost-benefit analysis revealed that annual cash crops were the most attractive option and agro forestry was the least. Horticulture and farm forestry held in between these two systems. When the environmental costs were taken in account annual cash crops appeared to be the most costly land use system and agro forestry and farm forestry become economically more attractive.

Th Dhamen (2009) said that the impact of jhuming are not felt by the masses for lack of awareness, it is evident that jhuming/deforestation is leading to a number of ecological catastrophes like frequent occurrence of landslides and mudslides in the hills of Manipur and causing major health hazards to the people of the state in particular and the north eastern region as a whole.

2.3 CONCLUSIONS

To conclude the above studies, it is observed that there are several cultural, technological, ecological and environmental consequences identified with the practice of shifting cultivation in North – Eastern Region of India. Tradition prevails in the activities of livelihood through shifting cultivation. The net income from shifting cultivation cultivation is as low as Rs. 700/ha. With improved cultivation practises, the income can be raised to Rs 40,115 ha from agri – horti – silviculture as reported by Thimmapa and Mahesh (2006). The alternative cropping system such as cropping multistaged pattern including horticulture and agroforestry based system proved to be superior to shifting cultivation. Inspite of the fact that the available technologies are not properly exploited to the advantages of tribal people in hill areas.

Added to low levels of productivity of shifting cultivation, large area of forest are cleared for shifting cultivation through deforestation activities, which in turn leads to loss of top soil to the extent of more than 150 t/ha. Radical changes in this regard is required in providing infrastructural facilities, which requires greater attention from the government. Awareness on modern agriculture from primitive stages has to be created through various programmes.

Chapter III

Methodology

CHAPTER III

METHODOLOGY

The present study was carried out in Manipur with special emphasis on Churachandpur. The specific objectives were pertaining to dynamics of shifting cultivation by evaluating nature and extend of area, their environment benefits and damages and its policy implications. This chapter presents the sampling design, nature and method of data collection and analytical tools being applied in attaining the objectives of the study. The chapter is presented under the following sub headings.

3.1 Sampling design

3.2 Collection of data

3.3 Methods of evaluation

3.4 Tools of analysis

3.1 SAMPLING DESIGN

Combination of purposive and random sampling techniques were used for selection of the district, blocks villages and farmers required for the study.

3.1.1 Selection of the district

Churachandpur district was purposively selected for the study because of fast growing area under shifting cultivation and occupying the second largest area under shifting cultivation in Manipur. Of the total shifting cultivated area (jhum) under paddy in the state, Churachandpur district occupy the largest area (i.e. 23190 ha) in 2006 – 07 (Statistical Abstract, 2007). Hence, it was justified to choose Churachandpur district for the present study.

3.1.2 Selection of mandal/Block

For selection of blocks in Churachandpur district, four blocks viz., Thanlon, Singhat, Tipaimukh and Saikot were selected as these happen to be the areas where shifting cultivation was done extensively. Thanlon and Singhat block occupy the first and second highest area followed by the other two blocks/mandals. The areas were reported to be highest and shifting cultivation was done extensively in these mandals. Hence, these blocks were purposively selected in view of area.

3.1.3 Selection of villages

In Thanlon block one village i.e., Joutung village was selected and in Saikot block one village i.e., Saidan village was selected respectively from the block. Two villages namely Panglen and Sumchinvum were selected in Singhat block. Two villages in Tipaimukh block namely Toulbung and Senvon were selected. Village practising shifting cultivation extensively were purposively selected for the study.

3.1.4 Selection of farmers

The farmers practising shifting cultivation from different regions were selected at random. Farmers in Churachandpur district were purposively identified and random sampling was used for selection of farmers and the total numbers of respondents constitute 70 for the study.

3.2 COLLECTION OF DATA

Primary data from the selected farmer were collected for the present study using schedules with pre – tested questionnaire which will be specially designed for the purpose. Relevant data from the farmer were collected pertaining to land holding size, assets, costs and returns, etc. Secondary data were collected from Directorate of

Economics and Statistics, Department of Horticulture and Soil Conservation, Forest and Ecology Department, Agricultural Offices, other published sources as well as through internet facilities. The period of study is pertaining an agricultural year 2009 – 10.

3.3 METHODS OF VALUATION

3.3.1 Inputs

Human labour generally consists of the labour contributed by men, women, owned or hired. Family labour was evaluated at the prevailing wage rates of hired labour for a man equivalent of 8 hrs. In case of permanent labour, payments made in kind and other perquisites were valuated at the prevailing market rates, to which the payments were made. Thus the average wage rate of permanent labour was valuated. Mainly labour was drawn from family labour. Machinery services and animal labour were not present.

The cost of seeds was valued at the actual purchase price. Farm Yard manure, chemical fertilizer, plant protection materials and irrigation were mostly not adopted in shifting cultivation. The interest on working capital was calculated @12 per cent per annum. Interest of fixed capital was calculated @10 percent per annum of total fixed costs, excluding land value. The interest was apportioned on crop average basis. Actual amount of land revenue paid by the farmers was taken into account and was apportioned on crop average basis. The depreciation was worked out for the farm implements and jhum hut. Depreciation was worked out at 10 per cent of the value of assets.

3.4 TOOLS OF ANALYSIS

For evaluating the objectives of the current investigation the analytical techniques used are presented below. Simple tabular analysis were used for estimating cost of cultivation of different crops such as paddy, ginger, colocasia, maize etc. Appropriate percentages were worked out for the purpose of comparison. The problems associated with marketing the products were also considered. Benefit cost analysis technique, regression and other techniques were employed to achieve the set of objectives stated in the study.

3.4.1 Concepts and definitions

Concepts and definition of terminology used in this study are presented below.

a. Operational holdings: It is the land operated by a single person or with the assistance of others irrespective of title or possession situated within the selected village limits.

b. Farm assets: Under farm assets land, buildings, wells, implements, machinery and working capital were included.

c. Manday: It is the work turned out by a male adult on a day for 8 hours. For standardation of female and child. Their work days were converted in mandays in the ratio of 1:1.5:2.

d. Cost of cultivation: All the costs incurred in the cultivation of selected crops viz., paddy, maize, ginger, colocasia etc. Variable and fixed costs were considered to arrive at total costs.

3.4.1.1 Cost Concepts

Fixed and variable costs together contribute to total costs. Fixed costs include rental value of owned land, depreciation, interest on fixed capital, land revenue and rental value of leased in lands. Variable costs include the cost of human labour, seed, manures and fertilizers, plant protection chemicals, irrigation and interest on working capital. The costs items included under various categories of cost concepts are given below:

Cost A_1

a) Hired human labour
b) Hired animal labour
c) Owned animal labour
d) Owned machinery labour
e) Hired machinery labour
f) Seeds
g) Pesticides
h) Manures
i) Fertilizers
j) Depreciation on implements and farm buildings
k) Irrigation charges
l) Land revenue
m) Interest on working capital
n) Miscellaneous expenses

Cost A_2 : Cost A_1 + rent paid for leased in land

Cost B_1 : Cost A_1 + interest on value of owned fixed capital assets excluding land

Cost B_2 : Cost B_1 + rental value of owned land and rent paid for leased – in land

Cost C_1 : Cost B_1 + imputed value of family labour

Cost C_2 : Cost B_2 + imputed value of family labour

Cost C_3 : Cost C_2 + 10 % of C_2 as management costs

(Source: Cost of cultivation Scheme GOI)

Imputed value of these costs, which are not really paid out by the farmer, but considered for accounting purpose only. These are interest on fixed capital assets, rental value of owned land, family labour charges etc.

Income measures

Gross returns : The value of crops produced on farm during the year at the market prices.

Net returns : These are worked out as the difference between gross returns and total costs. The excess of gross returns over cost C_3 is equivalent to net returns.

Productivity: It is yield per hectare of crop under consideration.

3.4.1.2 Procedure adopted in computing total costs

Human labour: Family labour was imputed at the average wage rate per day was evaluated at prevailing market prices. The actual wage rates were considered in case of hired labour. Payment were made in cash for hired labour.

Animal labour, machinery labour, manures and fertilizers, irrigation and pesticides were not used in shifting cultivation.

Seed : Cost of owned seed was charged according to the prevailing market prices at the time of sowing. A purchased rate was charged at the rates actually paid.

Transport costs: In case of own transportation, the wages for human labor was considered. Otherwise, rental costs paid to the same are included.

Interest on working capital: Interest on working capital was charged at 12 percent.

Rental value of owned land : Prevailing rent for leased – in land for different crops were considered as rental value for that particular crop.

Land revenue: The actual amount paid was charged with respect to land revenue.

Depreciation: It is worked out for the farm implements, farm hut and other implements. It was calculated at 10 percent of present value.

Interest on fixed capital: Interest was charged at a rate of 10 percent for half crop period.

3.4.2 Regression Analysis

In the present study multiple linear regression analysis was carried out for identifying various factors influencing gross returns under different crops. The model included seven variables, one dependent variable and six independent variables. The following linear model was used for gross returns under different crops in the following form.

$$Y = b_o + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + u_i$$

Where,

Y = gross returns of the farmers in Rs.

A = intercept

X_1 = Seeds in Rs.

X_2 = Labour in Rs.

X_3 =Area cultivated in hectares

X_4 = Fallow period in years

X_5 = No. of years cultivated

X_6 = Rent given for leased in land

Ui= disturbance term

Here b_o is the intercept term, giving average effect on Y when all the other variables were applied at their mean level. The stochastic term u_i is useful to reflect intrinsic randomness in the data. b_1 b_2… b_6 are partial regression coefficients. The meaning of partial regression coefficient is that b_i measures change in the mean value of Y per unit change in x_i, holding other variables constant.

Adjusted R^2 ($\bar{R}^2$)

It is good practice to use $\bar{R}^2$ (adjusted R^2) rather than R^2, because R^2 tends to give an overly optimistic picture of the fit of the regression, particularly when the number of explanatory variables is not very small compared with the number of observations.

Hence the present study also used the adjusted R^2 values calculated by utilizing the following formula

$$\bar{R}^2 = 1-R^2 (N-1/N-K)$$

Where

R^2 = original coefficient of multiple determination

N = sample size

3.4.3 Problems faced by farmers

To rank the problems faced by the farmers Garette ranking technique was employed. Problems or constraints faced by the farmers were arranged in order of merit assigned by the respondents were converted into ranks.

$$\text{Percent composition} = \frac{100(R_{ij} - 0.5)}{N_j}$$

R_{ij} = Rank given to the i^{th} factor by j^{th} individual

N_j = Number of factors ranked by j^{th} individual

3.4.4 Valuation of environmental services

Jhum(shifting cultivation) was the dominant type of agriculture in the Churachanpur region, but more financially attractive alternatives land use systems gain importance in the shifting cultivated area as the environmental are which includes reduced soil erosion, improving biodiversity and as well as carbon sequestration. In view of this, I tried to estimate the value of carbon sequestration, biodiversity conservation and the cost of soil erosion attached to each land use system. This will eventually enables the policymakers to promote land uses which are environmentally and economically sustainable.

Estimation of Returns to Land

The return to land was a criterion to evaluate each land-use system. Given the scarcity of land in the Churachandpur region, both private and social objectives aim to maximize returns from a unit of land. Returns to land are expressed by net present value (NPV) which discounts the streams of benefits and costs over a period of time.

The NPV of each land-use system over a period of five years was calculated using the following equation:

In calculating the net present worth the difference between the present value of the benefit streams and present value of cost streams at discount rate of 12 per cent was considered.

$$\sum_{j=1}^{n} \frac{B_j - C_j}{(1+i)^j}$$

Where B_j = Benefits in j^{th} year

C_j = Costs in j^{th} year

i = Discount rate

n = Number of years

3.4.4.1 Valuation of soil erosion

Soil erosion has both onsite and offsite effects. The onsite effects include soil-nutrient depletion and deterioration in the physical and biological structure of the soil that cannot be easily replenished in the short term (Alfsen & Franco, 1996). Offsite effects arise from the transport of soil sediment and run-off to another location, such as another farm or a waterway.

I considered productivity of two principal crops in the shifting cultivated region. Productivity of these crops was compared with the productivity of district, state and India. Reduced productivity will reflect in loss of fertility of the soil, soil erosion besides its low level of technology. A reduction of agricultural productivity due to soil erosion is not necessarily problematic from an economic perspective. However, there are a number of reasons why erosion induced productivity losses might be excessive from a social viewpoint in developing countries (Bishop 1992, and Bojö 1991)

Lack of data required for all sorts of on-site and off-site effects of soil erosion and inability of farmers to respond to environment related problems poses estimation problems. Besides, lack of markets and the presence of market imperfections and distortions which will display a higher rate of discount by the society. Quantifying the effects of erosion on crop production presents many difficulties as extent to which erosion affects crop production will vary depending on the type of crop, the type of soil, the micro-climate, local topography and the management system.

Long-term data are essential however, since the effects of erosion on productivity will change throughout the soil profile which is difficult as the data collected from the farmers was based only for one year period. Land in Manipur is not cadastrally surveyed to obtain this type of information. Even supposing that collecting vast quantities of location-specific data presented no problems, it is still extremely difficult to determine the influence of any single factor on crop yields. Hence, following several studies (eg. Rasul and Thapa, 2007; Rasul G, 2009) the replacement-cost method for valuation of soil erosion was employed.

Hamer (1982, cited in Salzer 1993) estimated the natural rate of soil formation in temperate climates to be about 10 ton/ha/yr. (Salzer 1993; Rasul G, 2009) estimated that the rate of soil formation was 15 ton/ha/yr. Since their study area lies in tropical climates to which is similar to Churachandpur in terms of climatic condition and topography, we assumed that the soil formation rate of 15 ton/ha/yr is applicable to our study area. To estimate the reliable value of soil loss, it is necessary to deduct the natural rate of soil formation from the rate of erosion.

3.4.4.2 Valuation of Biodiversity

In addition to soil conservation, the different land uses have varying impacts on many other environmental and social services. The monetary value of biodiversity services and carbon sequestration associated with each land-use system was estimated following Pagiola (2004) and Pagiola *et al.* (2007). While estimation of carbon sequestration is relatively straightforward (Huang & Kronrad, 2001; approximating the economic value of biodiversity is extremely difficult.

Realizing the difficulties, Pagiola *et al*. (2004) developed an index of biodiversity for different land uses that ranges from 0 to 1, with 0 for annual crops (e.g., grains, tubers) and 1 for primary forest. Other land uses reside between these two extremes. Although this index is a proxy measure and may vary considerably depending on biophysical conditions, it is used to estimate the value of biodiversity services and carbon sequestration as no other precise method is available within the confines of this study. Following the work of Pagiola and his colleagues, the values of carbon sequestration and biodiversity services were estimated with the following formulas.

Index of carbon sequestration services (ICSS) = Point of carbon sequestration in specific land use X Price of carbon (ton/year).

Index of biodiversity services (IBS) = Point of biodiversity in specific land use X Price of biodiversity services (ha/year)

Although these indices have been used in several studies to value environmental services, the rate of payment has varied. While Pagiola *et al*. (2004) estimated US$75 point/year payment for environmental services, Costa Rica's *pagos por servicios ambientales* (payments for environmental services) program pays

US$45 ha/year for environmental services (Zbinden & Lee, 2005) and (Rasul G,2009) pays US$33.75. ha/year for environmental services In the present study, we assume that value adopted by US$33.75 point/ha for environmental services, reflecting the sum of the carbon-sequestration and biodiversity – protection services. The sum, in fact, is equivalent to farmers' willingness to accept (WTA) to manage/supply environmental services in exchange for a given amount of remuneration. (Rasul and Thapa, 2007; Rasul *et al*, 2009).

Chapter IV

Agro economic Features

CHAPTER IV

AGROECONOMIC FEATURES OF STUDY AREA IN BRIEF

4. 1 AGROECONOMIC PROFILE

Manipur, lies between 23.03 ^{0} and 25.68 ^{0} N latitudes covering an area of 22,327 sq. km. The hill ranges are aligned in a series of parallel north-south ridges. The general elevation of the ranges along the eastern aspect varies between 1800 to 2500 m. above MSL whereas the western range gradually gets subdued from 1100 to 800 m above MSL. The central valley has an elevation ranging between 700 m and 800 m above MSL. The central valley along with the Jiribam valley situated at a lower altitude of 400 m in the southwest part of the state outside the western hill ranges of Manipur occupies 11.72 per cent of the total geographical area of the state. The rest of the state is hilly. Manipur is endowed with a wide range of climatic, physiographic and geological conditions resulting in the formation of different kinds of soils.

The state comes under the hot and warm humid/per-humid agro-eco region with a long growing period. However, at micro-level, it can be divided into three distinct sub-eco regions (zones) with thermic and hyper-thermic temperature regimes as follows:

1. Warm-humid agro-eco zone with thermic ecosystem
2. Hot-humid agro-eco zone with hyperthermic ecosystem.
3. Warm pre-humid agro-eco zone with thermic ecosystem.

4.1.1 Boundaries

The state is surrounded by Nagaland on the North, Cachar District of Assam and Chin Hills and Mizoram on the south and south – west and Surma tract and Upper Chinwin of Myanmar (Burma) on the East. The length of international border shared by the state is 352 kms accounting for 41.21% of the total length of the border. This peculiar location has been a visible handicap on the perceptible process of development of the state.

4.1.2 Climate

The impact of terrain diversity, altitudinal variation and river regime has become eloquent in the seasonal variatility of climate from one place to another. The Barak basin and lower foothills of Manipur Western hills have a warmer climate than the central valley and surrounding hills. Similarly, the western part of the state is more moist than the eastern because of its location on the windward slope of the hills. By and large the state has a fairly good climatic behaviour of less heat.

4.1.3 Demographic Features

Population of a country is its most important asset and demographic indicator. The population of Manipur as per 2001 census was indicated in the table as 22.9 lakhs comprising 11.6 lakhs of males and 11.3 lakhs of females. Population of Manipur constitute nearly 0.22 percent of the total population of India. The density of population of Manipur as per 2001 census was 103 persons per sq. km. The sex ratio for the state is 974 females per 1000 males in 2001.

The progress of urbanisation in the state is found to be very slow. The number of towns and cities has grown at a low rate. It rose from 1 (one) town in 1951 to 33 towns in 2001. But Manipur ranks second among the North – Eastern states of India in respect of urbanisation. The urban population has increased from 5.06 lakhs in 1991 to 5.76 lakhs in 2001. The rural population constitute 17.17 lakhs according to 2001 census. About 74.89% of the total population live in the rural areas whereas only 25.11% of the total population are found in urban areas.

The literacy rate for the rural areas is 67.30 percent and for urban areas it is 79.30 percent as per 2001 census. In terms of literacy, Manipur ranks second among the North – Eastern states of India as per 2001 census.

Table 4.1 : Demographic features of Manipur. (2001 census)

Sl. No.	**Particulars**	
1.	Total population (lakhs)	22.9
	Male Population	11.6
	Female population	11.3
2.	Rural population (lakhs)	17.17
	Urban population	5.76
3.	Percent of Rural population	74.89
	Percent of Urban population	25.11
4.	Population Density (persons/sq km.)	103
5.	Sex Ratio (Females / 1000)	974
6.	Total literacy rate	67.30

Source : Statistical Abstracts of Manipur (2007 - 08)

4.1.4 Land utilization

Land utilization statistics for the entire state of Manipur are not available because hill areas are not cadastrally surveyed. The plain of Manipur occupies about 2,238 sq. kms. which accounts for about 10 percent of the total geographical area. A firm information regarding the land utilization of the entire State cannot be built up since land records are available only for the cadastrally surveyed area of the Manipur Valley and very small pockets of the hills. As per the land utilization statistics of 2000 – 01, out of the total geographical area, the reporting area is about 1,90,446 hectares, 26,900 hectares of land are not available for cultivation. Fallow land covers 200 hectares and other uncultivated land excluding the fallow land covers 8055 hectares which account for about 4.23 percent of the total reporting area. The land use classification of valley areas of Manipur for the year 2000 – 01 according to 2001 census is presented in Table 4. 2.

Table 4. 2 : Land use classification of Manipur (Valley Areas), 2000 – 01

(Area in Hectares)

Sl. No.	Particulars	
1.	Geographical Area	2,23,000
2.	Reporting area for land utilization Statistics	1,90,446
3.	Classification of Reporting Area:	
a)	Forest	-
b)	Not Available for cultivation	
i)	Area under non – agricultural uses	25,960
ii)	Barren unculturable land	940
Total		**26,900**

c) Other uncultivable land excluding fallow lands	
i) Permanent pastures & other grazing	1,370
ii) Land under misc. Uses crops & groves (not included in the net area sown)	5,945
iii) Culturable wasteland	740
Total	**8,055**
d) Fallow land:	
i) Fallow land other than current fallow	60
ii) Current fallow	140
Total	**200**
4. Net area sown	1,55,287
5. Total cropped area	1,65,862
6. Area sown more than once	10,575
7. Cropping intensity	106.81

Source : Agriculture Officer (M.I. Deptt. of Agriculture, Manipur

4.1.5 Size of holding

The agricultural holding/land holding is the amount of land held by a farmer. It can be seen from the figures in Table 4.3 that the area of operational holding is about 1.72 lakh hectares operated by 1.51 lakh farmers as per the agricultural census 2005 – 06. In Manipur, arable land is limited and majority of the farming community have small and marginal land holdings which accounted for 59.74 percent in 2005 – 06.

Table 4.3 : Distribution of operational holdings in respect of Manipur State (2005 – 06)

Size of holding	Category of farmer	No of operational holding('000)	Area operated ('000 ha)	Average size of operational holding (ha.)
Below 1.0	Marginal	77.00	40.00	0.52
1.0 – 2.0	Small	49.00	63.00	1.29
2.0 – 4.0	Semi –	22.00	55.00	2.48
4.0 – 10 .0	Medium	3.00	14.00	4.86
10.0 and above	Medium	Neg.	Neg.	11.12
All Holdings	Large	151.00	172.00	1.14

Neg. : Negligible
Source : Agricultural Statistics At – A – Glance, 2006. Agricultural Census Division Ministry of Agriculture, Government of India.

4.1.6 Utilization of human resources

Total working population in the state is 9.45 lakh comprising of 5.90 lakhs in agriculture and 3.54 lakhs in non – agriculture sector. It shows that 62.43 percentage of labour depends on agriculture while the remaining labour force depends on non – agricultural sectors.

Table 4. 4 : Human resource utilization in Manipur (2001 census)

Sl. No.	Particulars	Population (lakhs)	Percentage in total
1.	Workers in agriculture sector	5.90	62.43
2.	Workers in non – agriculture sector	3.54	37.57
3.	Total working population	9.45	100

Note: Excludes Mao Maram, Paomata and Purul sub – division of Senapati district of Manipur
Source: Registrar General and census commissioner of India, New Delhi.

4.1.7 Area and production particulars of field crops

Rice is the staple food of Manipur and is grown in both hills and plain areas. Cultivation is almost entirely mono – crop with rice accounting about 98% of food grain production and about 72% of the total crop area is grown with paddy. Area and particulars of various field crops are presented in Table 4.5. Total area under food grains is 1.69 lakh hectares and production is 4.19 lakh tonnes. In case of pulses the estimated area is recorded as 6970 hectares and production for the agricultural year 2007 – 08 is estimated at 4640 tonnes. Total area under fruits is estimated to 27320 hectares with a production of 2.74 lakh MT. Total area under spices is 14170 hectares with a production of 0.75 lakh MT.

Table 4.5 : Area and production particulars of field crops in Manipur (2007 – 2008):

Sl. No. Crop	Area (lakh hectares)	Production (lakh tonnes)
1. Paddy	1.67	4.06
2. Maize	0.029	0.08
Total major cereals	1.69	4.19
3. Pulses	0.07	0.05
4. Fruits	0.27	2.74
5. Spices	0.14	0.75

Source: Economic Survey of Manipur (2007 – 08)

4.1. 8 Cropping pattern of manipur

Rice continues to dominate acreage of all the crops with 166.15 thousand hectares (68.77 percent of cropped area in the State) in 2007-08 as against 165.37 thousand hectares (70.22 percent) in 2006-07. Area under cereals was 169.11

thousand hectares (70.00 percent) in 2007-08 as against 168.71 (71.64 percent) in 2006-07. The area under pulses was 12.51 thousand hectares or 5.18 percent of the cropped area of the State in 2007-08 as against 10.57 thousand hectares or 4.49 percent in 2006-07. The foodgrains alone accounted for 75.18 percent of the sown area during the year 2007-08. While 0.86 percent area was occupied by oilseeds and the remaining 23.96 percent area was occupied by Cotton, Sugarcane and others. The details of cropping pattern of Manipur are presented in Table No 4. 6.

Table No 4. 6 Cropping Pattern of Manipur

(Area in '000 hectares)

Year	Name of Crops						
	Cereals	Pulses	Oilseeds	Cotton	Sugarcane	Other Misc. Crops	Total
1999– 00	161.39 (77.73)	6.33 (3.05)	3.09 (1.49)	0.05 (0.02)	0.65 (0.31)	36.13 (17.40)	207.64 (100.00)
2000-01	161.66 (77.46)	6.19 (2.97)	3.24 (1.55)	0.06 (0.03)	0.74 (0.35)	36.81 (17.64)	208.70 (100.00)
2001-02	167.63 (77.55)	5.96 (2.76)	1.66 (0.77)	0.09 (0.04)	0.65 (0.30)	40.17 (18.58)	216.16 (100.00)
2002-03	156.65 (72.79)	7.80 (3.62)	2.62 (1.22)	* *	0.32 (0.15)	47.81 (22.22)	215.20 (100.00)
2003-04	160.17 (69.68)	5.06 (2.20)	1.15 (0.50)	* *	0.33 (0.14)	63.16 (27.48)	229.87 (100.00)
2004-05	179.53 (74.29)	9.23 (3.82)	2.13 (0.88)	* *	0.30 (0.13)	50.47 (20.88)	241.66 (100.00)
2005-06	169.11 (72.35)	8.31 (3.55)	1.36 (0.58)	* *	0.06 (0.03)	54.90 (23.49)	233.74 (100.00)
2006-07	168.71 (71.64)	10.57 (4.49)	1.94 (0.82)	0.21 (0.09)	0.50 (0.21)	53.56 (22.75)	235.49 (100.00)
2007-08	169.11 (70.00)	12.51 (5.18)	2.08 (0.86)	0.21 (0.09)	0.51 (0.21)	57.17 (23.66)	241.59 (100.00)

* Nil

Note : (1) For the years from 1999-2000 onwards, soyabean is excluded from pulses and oilseeds included in oilseeds according to the CSO's classification of agricultural items.

(2) Figures in brackets are percentage shares to the respective total.

Source : Directorate of Economics & Statistics, Manipur (2007 – 08).

4.1.9 Rainfall

The irrigation system in Manipur is not fully developed and therefore the main source of water for agricultural purpose is rainwater. The prospects of agriculture in the state depend largely on timely occurrence of rains. It is particularly so in the case of Kharif season where production and productivity of crops are dependent not only in the quantum of rains, but also its equitable distribution over the days/months of the seasons. The distribution of rainfall over months in 2007 in absolute terms for some selected centres are shown in Table 4. 7.

Table 4.7 : Monthly Rainfall recorded in the districts of Manipur in 2007

(in cm.)

Months	District					
	Senapati	Tamenglong	Churachandpur	Ukhrul	Bishnupur	Thoubal
January	2.00	2.00	-	2.00	6.00	1.00
February	12.00	10.00	-	8.00	10.00	9.00
March	1.00	3.00	-	1.00	1.00	1.00
April	14.00	10.00	-	16.00	30.00	18.00
May	14.00	16.00	-	21.00	25.00	19.00
June	13.00	14.00	-	19.00	21.00	20.00
July	16.00	-	9.48	31.20	16.44	18.42
August	20.71		0.89	14.42	18.38	5.76
September	21.85	-	3.93	18.31	23.60	11.88
October	12.38	-	1.34	-	17.67	9.00
November	4.04	-	0.34	-	8.59	6.44
December	-	-	0.00	-	0.05	0.00

- Nil
Source : District Statistical offices, Manipur.

4.1.10 Particulars of utilization of power

Installed capacity of power is 46,212 (KW) against electricity generated (in lakh kWh) is 17.304. The requirement of power for all categories of consumers viz., domestic, commercial, industrial, water works and public lighting has been gradually increasing year after another. It can be seen from the table 4. 8 that the demand of power has always surpassed the supply. In 2007-08, the demand was 145 MW. The 17th EPS has assessed the requirements of power for Manipur as shown below:

Table 4. 8 : Requirement of Power & Energy in Manipur during 2007-08 to 2011-12

Year	Peak load (MW)	Energy requirement (MU)
2007 – 08	145	641
2008 – 09	157	702
2009 – 10	170	766
2010 – 11	184	838
2011 – 12	203	932

Source: 1. Electricity Department, Government of Manipur.
2. Annual Administrative Report, Power Department, Manipur, 2001-02 to 2007-08.
3. Department of Economics & Statistics, Manipur

The pattern of consumption of power in the state shows that the domestic consumption accounts to 1179.16 (lakh kwh) and agriculture accounts to 0.94 (lakh kwh). The per capita consumption of electricity (in kwh) is 75.36.

4.1.11 Roads and Communication

Road is the major means of transport in Manipur. The main source of communication is the National Highway No. 39 connecting Imphal to Dimapur in the Neighbouring state of Nagaland. It runs through Mao in the extreme north of Manipur to the international border town of Moreh in the south – east. The road pass through the hilly areas of Senapati district and a part of Nagaland Hill touching Kohima in between.The transport costs of this road is very high in view of frequent landslides on the hill tracts, restriction of transport services during night time due to unexpected events and one way trade movements because of little exports from Manipur.

Another road of considerable importance is the 225 kms long National Highway No. 53 connecting Imphal with Jiribam in Manipur and Assam border. It passes through dense forest and difficult terrains of Tamenglong District which remained, by far, the most inaccessible district in the state. The state of Manipur thus need further development of roads to be the main life line.

The length of the road maintained by the Public Works of Department (PWD) and Zilla Parishad (ZP) was 8.648 thousand kms. as on 31st March 2005. The classification of road length is given in Table 4.9.

Table 4. 9 : Length of Road in Manipur

(in kms.)

Classification of road	**2005**
National Highways	967
State Highways	668
Major District Roads	964
Other District Roads	1013
Inter Village Roads	5036
Other minimum needs programme (OMNP)	-
All Roads	8648
Surfaced	4537
Un – surfaced	4075

- Not available

Source: P.W.D. Manipur

The length of National Highways, State Highways, Major District Road and Inter village Road as on 31st March 2005 were 967 kms, 668 kms, 964 kms, 1013 kms, and 5036 kms. respectively. Of the total length the surfaced and unsurfaced road length were 52.88 percent and 47.12 percent respectively.

There has also been a steady growth in postal and telecommunication facilities in the state. There were 697 post offices and 2 telegraph office in the state at the end of March 2007. The population served per post office was 3643.

4.2 A BRIEF DESCRIPTION CHURACHANDPUR DISTRICT

4.2.1 Topography and socio economic profile

Churachandpur District, in the south-western corner of Manipur, covers an area of 4570 sq.km. and lies between 23° 55' and 24° 30' North Latitudes and between 92° 59' to 93° 50' East longitudes and altitude of 914 metres above main sea level. It is home to 2,23,866 people, as per 2001 census, dominated by 15 ethnic groups like the Chin, Kuki, Mizo, Naga, Paite, Simte and Zomi. Each tribe has a distinct social order as well as community laws .The system of hereditary chiefship as well as community ownership of village land is prevalent in the district. In case of hereditary chiefship the chief is all-powerful as he controls not only the economy of the village through his ownership of the land but exercises social control over the households in the village.

An overwhelming majority of the tribal population has converted to Christianity. Christianity has not materially changed the social order but was the critical faith in bringing to an end the head-hunting wars and savagery that characterized early tribal societies. Education rapidly spread through English medium schools. In the last hundred years the society has undergone radical change from the past.

Churachandpur District, an administrative district of Manipur has its headquarters located at Lamka. This town of Churachandpur District is considered as a broad – based cosmopolitan hill town of the state. Churachandpur mainly follows a mono-crop economy during the non-monsoon months. Apart from agriculture, animal husbandry and weaving provides the livelihood. It is surrounded by Tamenglong district in the north, Bisnupur district in the North – east, Chandel district in the East, Assam in the west, Mizoram state in the south and also shared an international border with Myanmar in the south.

4.2.2 DEMOGRAPHIC FEATURES

Demographic features of the district are given in Table. It is seen from the table 4.10 that the total population in the district was 227905 comprising 117232 males and 110673 females. Literacy rate was only 70.6 percent of which 77.7 percent are male and 63.1 percent are female. Density of population is worked out to be 50 per sq. km. Sex ratio indicates that there are 962 females for every 1000 males.

Table 4.10 : Demographic features of Churachandpur District (2001)

Sl.No.	Particulars	Population
1.	Total population	227905
	Males	117232
	Females	110673
2.	Literacy rate	70.6
	Males	77.7
	Females	63.1
3.	Density of population (per sq. km)	50
4.	Sex ratio (Females per 1000 males)	944

Source: Statistical Handbook of Churachandpur (2007)

4. 2. 3 Land utilization

Churachandpur District includes primary forest and secondary forest including mixed bamboo forest, covers an area about 118092 hectares. The area under wasteland is 98424 hectares and the total area of water bodies is 2144 hectares.

Table 4.11 Land Utilization in Churachandpur district (2005 -06):

Sl. No.	Description	Area (in ha.)
1.	Agricultural land	
	Crop land Kharif crop	9955.12
2.	Built up –	
	Built up area (Rural)	6042.76
3.	Forest	
	Evergreen / Semi – evergreen – Dense / Closed	6331.92
	Evergreen / Semi – evergreen – Open	2248.20
4.	Forest Tree Clad Area	2735.8
5.	Others	
	Shifting cultivation Current	1773
	Wastelands – Scrub land – Dense scrub	8784.4
	Wastelands – Scrub land – Open scrub	3153.83
6.	Water bodies	
	Rivers / Streams – Perennial	1481.77
	Total	42506.8

Source: Manipur Remote Sensing Application Centre (MARSAC) 2005 – 06.

4.2.4 Size of holding

The size of operational holding is 13.75 thousand hectares operated by 15.40 thousand farmers as per agricultural census data 2005 – 06. The average operational size of holding accounts to 0.89 hectares.

Table 4.12: Distribution of operational holdings of Churachandpur district (2005 – 06)

Size of holding	Category of farmer	No of operational holding('000)	Area operated ('000 ha)	Average size of operational holding (ha.)
Below 1.0	Marginal	9.15	4.72	0.52
1.0 – 2.0	Small	5.03	6.20	1.23
2.0 – 4.0	Semi –	1.20	2.72	2.27
4.0 – 10 .0	Medium	0.02	0.11	5.25
10.0 and above	Medium	Neg.	Neg.	Neg.
All Holdings	Large	15.40	13.75	0.89

Neg. : Negligible

Source : Agricultural Census Division, Ministry of Agriculture, Government of India.

4.2.5 Occupational pattern

The details regarding occupational pattern of Churachandpur District are presented in the Table 4. 13.

Table 4.13 : Human resource utilization in Churachanpur (2001 census)

Sl. No. Particulars	Population	Percentage in total
1. Cultivators	42438	18.62
2. Agricultural labourers	5316	2.33
3. Other workers	4485	1.97
4. Marginal Workers	27430	12.03
5. Marginal cultivators	13669	5.87
6. Marginal agricultural labour	3156	1.38
7. Total main workers	99363	43.59
8. Total population	227905	100.00

Source : Census of Churachandpur District, Directorate of Census (2000 – 2001)

From the table 4. 13 it can be observed that 43.59 percent were the total main workers in the district. Cultivators account for 18.62 percent of the total population and agricultural labourers account for 2.33 percent and other workers occupying 1.97 percent only. Also marginal workers accounts for 12.03 percent of the total population and marginal cultivators accounts for 5.87 percent and marginal agricultural labourers accounts for 1.38 percent only.

4.2.6 Climate and rainfall

The maximum temperature is 37^0 C while the minimum is 0.5^0 C. The highest rainfall is 3080 mm (Tinsong) and the lowest is 597 mm (Geljang). The maximum humidity is 100 % and the minimum 24 %. The beauty of the landscape is supplemented by the climate which is temperate and salubrious. The winter extending from November to February is cold, particularly in the hills but days are bright and sunny. The monsoon months stretch from May-June to September with heavy showers almost throughout the period. The spring and summer months are mildly pleasant despite high humidity. However, the low temperatures (ranging from 30^0-35^0 C) prevents sultriness that is so common in eastern India.

Table 4. 14 : Annual Rainfall in Churachandpur District

(in mm.)

Sl. No.	District/Centre	1998	1999	2000	2001	2002	2003
i.	Tuibuang	2012.2	2351.3	2324.0	-	-	-
ii.	Tinsong	3080	2765.5	3383.9	2639.0	3068.0	3212.8
iii.	Thanlon	2224.4	3030.7	2357.0	2488.9	2289.1	-
iv.	Geljang	597.0	600.0	1279.0	2448.7	2893.0	2888.0

- Not available

Source: 1. IFCD, Manipur.
2. Directorate of Agriculture, Manipur.
3. Directorate of Horticulture, Manipur.

Table 4.15 : Annual temperature of Churachandpur District

(in celcius degree)

District/Centre	2001				2002			
			Mean				Mean	
	Min.	Max.	Min.	Max	Min.	Max.	Min.	Max.
Churachandpur								
i. Tuibuang	*	*	*	*	*	*	*	*
ii.Tinsong	10.0	39.0	13.2	34.1	7.0	37.0	14.5	29.1
iii.Thanlon	*	*	*	*	*	*	*	*
iv.Geljang	0.5	37.0	11.8	30.3	4.0	34.0	15.2	28.7

*Not recorded due to defect of machine Min – Minimum, Max – Maximum

Source: 1. IFCD, Manipur.
2. Directorate of Agriculture, Manipur.
3. Directorate of Horticulture, Manipur.

Table 4. 16 : Annual Humidity at Churachandpur District.

(in percentage)

District/Centre	2001				2002			
			Mean				Mean	
	Min.	Max.	Min.	Max	Min.	Max.	Min.	Max.
Churachandpur								
i.Tuibuang	-	-	-	-	*	*	*	*
ii.Tinsong	50	100	71	100	28	100	66	92
iii.Thanlon	*	*	*	*	*	*	*	*
iv.Geljang	43	100	70	92	24	90	41	95

- Not available Min – Minimum, Max – Maximum

*Not recorded due to defect of machine

Source: 1. IFCD, Manipur.

2. Directorate of Agriculture, Manipur.

3. Directorate of Horticulture, Manipur.

4.2.8 Cropping pattern

Rice is the main crop of the region with some other crops such as maize, pulses, oilseed, sugarcane are grown together in the shifting cultivated areas. The total gross cropped area is 43880 hectare. From the table 4. 17, it is clear that rice is the major crop accounting for 70.72 % of the grossed cropped area followed by maize which is 11.62%. Kharif and rabi oilseeds which combined together accounts to 7.34. Sugarcane accounts to 4.40 %. Potato accounts to 1.25 % and wheat accounts to 0.42 % of the total gross cropped area.

Since rice occupies the major share in the district, estimated area under rice during the Agricultural years 2000 – 01 to 2006 – 07 is given in the table with special reference for rice. The estimated area for rice shows that the area under shifting cultivation occupies a major area. The trend from 2000 – 01 to 2006 – 07 shows that area under jhum rice increases except for the year 2002 – 03.

Table 4.17 Cropping wise percentage distribution of Churachandpur district (2001– 02)

Crop	% distribution of the crops
Kharif	
Paddy	70.72
Maize	11.62
Pulses	1.66
Oilseeds	0.84
Sugarcane	4.40
Rabi	
Wheat	0.42
Pulses	2.58
Oilseeds	6.50
Potato	1.25

Source : Agricultural Census. Department of Agriculture, Government of Manipur.

Table 4.18 : Estimated area under rice during the Agricultural years 2000 – 01 to 2006 – 07

(Area in '000 hectares)

Year	Area under permanent (including terrace) cultivation	Area under jhum cultivation	Total area in '000 hectares
2000 – 01	2.15	10.45	12.60
2001 – 02	3.23	10.45	13.78
2002 – 03	2.38	20.50	22.88
2003 – 04	3.55	16.53	20.08
2004 – 05	3.50	17.58	21.04
2005 – 06	1.58	18.79	20.37
2006 – 07	-	23.19	23.19

- Not available

Source: Directorate of Economics and Statistics, Manipur.

4.2.9 Production

Rice is the major crop grown in the district and accounts major percent of food grains and 70.02 percent of the total gross cropped area. Tables on area, average yield and production are given below.

Table 4.19 : Production, area and average yield of cereal crops (2007 – 2008)

Area: '000 hectares
Yield rate: Kg/hectare
Production: '000 tonnes

District	Rice			Maize		
	Area	Yield rate	Production	Area	Yield rate	Production
Churachandpur	19.72	1795.64	35.41	0.17	2647.06	0.45

Source: Economic Survey Manipur 2007-08

It is seen from the table 4. 19 that total area under rice is found to be 1720 hectares, yield rate is 1795.64 kg/hectare and production is 35410 tonnes. In case of maize area cultivated is 170 hectares, yield rate is 2647.06 kg/hectare and production is 450 tonnes.

4.2.10 Power

It is seen from the table 4. 20 that Installed capacity of power is 0.448 (MW) which is generally operated diesel. Again from the table no,4. 21. It is shown that out of 518 number of villages 399 villages are electrified accounting for 77.03 % of electrified village. Number of non – electrified villages is 119 which accounts for 22.97 % of non – electrified villages.

Table 4.20 : Installed Capacity and Electricity Generated during 2006-2007

Installed Capacity (MW)			Generated (Million KWH)		
Total	Hydro	Diesel	Total	Hydro	Diesel
0.448	-	0.448	-	-	-

Source: Economic Survey Manipur 2007-08

Table 4.21 : Rural Electrification as on 31st March 2007

No. of Village	No. of villages Electrified	% of village Electrified	No. of Non-Electrified Villages	% of Non-Electrified Villages
518	399	77.03	119	22.97

Source: Economic Survey Manipur 2007-08

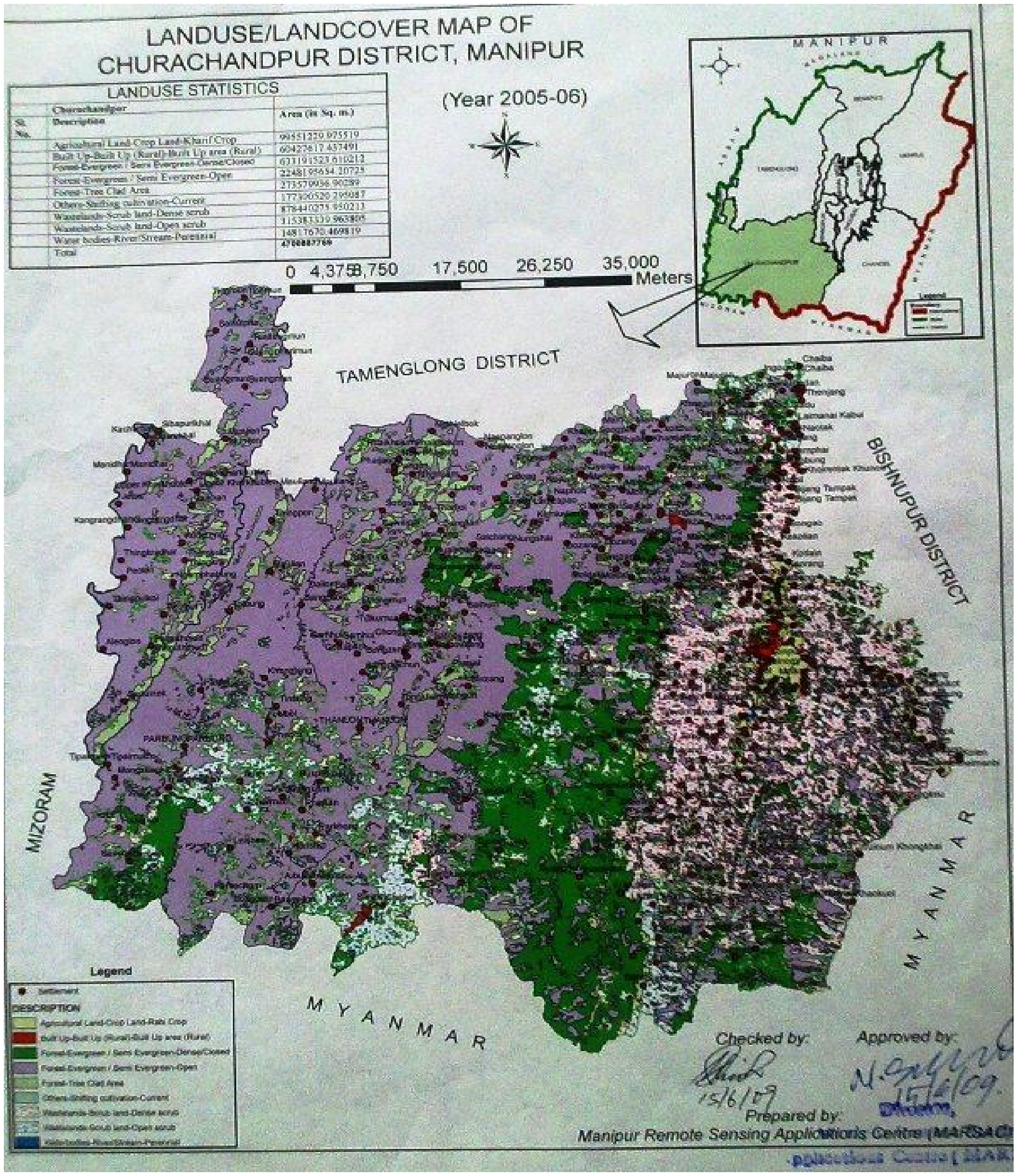

Fig 1: Map of Churachandpur District

Chapter V

Results and Discussion

CHAPTER V

RESULTS AND DISCUSSION

In accordance with the pre-determined objectives of the study, this chapter deals with the presentation and description of results emerged from the research work. For easy understanding and convenience this chapter was presented under the following sub-heads:

5.1 Socio economic characteristics of the selected respondents

5.2 Nature of shifting cultivation.

5.2 Cost of cultivation and factor affecting gross returns under different crops.

5.4 Garette Ranking

5.5 Environment costs and Benefits

5.1 SOCIO ECONOMIC CHARACTERISTICS OF THE RESPONDENTS

The socio- economic characteristics of the respondents include educational status, social status, age, dependents and working members, religion, family size, type of family, distribution of size of the holdings, pattern of assets, etc. Socio economic analysis is required to have a clear-cut comprehensive idea of the socio-economic characteristic features of the study region so as to execute the research in a proper way and for better comprehension to policy makers.

5.1.1 Educational status of the respondents

Particulars regarding the educational status are presented in Table 5.1. It is observed from the figures that only 8 respondents out of 70 respondents were illiterate, which constitute only 11.4 per cent. The number of respondents having education up to 7th standard was 12 (32.9 per cent), while the number of respondents having secondary school education between 8th and 10th was 34 (about 48.5 per cent). The number of respondents having intermediate qualification was 2 (about 2.9 percent). The number of respondents having degree qualification was 3 (about 4.2 per cent). It is very much clear from the table that only 11.4 per cent of the respondents were illiterates and remaining 89 per cent of the respondents were literates. Majority of the respondents studied up to 8th to 10th standard accounting for nearly 50 per cent of the total number of the respondents.

Table 5.1 : Educational status of the respondents

S.No	Education Status	No of Respondents	Per cent
1	Illiterates	8	11.4
2	1st to 7th	23	32.9
3	8th to 10th	34	48.5
4	Inter	2	3.0
5	Degree	3	4.2
	Total	**70**	**100.00**

5.1.2 Age group of the respondents

It is observed from the figures in Table 5.2, that the number of the selected respondents categorized into different age groups are presented in Table 5.2. Farmers within the age group of less than 30 years were 4 in number which accounts for about 5.7 per cent and the average age in this group is 27 years. The respondents having the age between 31 – 40 years were 11 in number which is nearly 36 per cent having an average age of 36 years. The respondents having the age between 41 – 50 years were 15 in number which is nearly 21.4 per cent having an average age of 46 years. Besides, the respondents having the age between 71 – 80 years were 2 in number which is nearly 2.9 per cent having an average age of 76 years. From the above table it can be clearly observed that the farmers in the age group of 51 and 70 years were more and constituted more than 50 per cent i.e., 54.3 per cent having an average of 58 years.

Table 5.2: Age group of the respondents

Sl. No	Age Group (Yrs)	No of Respondents	Per cent	Average age
1	<30	4	5.7	27
2	31 – 40	11	15.7	36
3	41 – 50	15	21.4	46
4	51 – 70	38	54.3	58
5	71 – 80	2	2.9	76
	Total	70	100	

5.1.3 Family size

Particulars regarding the family size are presented in Table 5.3. It can be observed from Table 5.3 that the average family size of the respondents is five constituting about 48.9 percent. Large families ranging from 15 – 20 constitute about 4.2 per cent.

Table 5.3 : Family size of the respondents

S.No	Family Size	No of Respondents	Per cent
1	Less than 5	34	48.7
2	6 to 10	26	37.1
3	11 to 14	7	10
4	15 to 20	3	4.2
	Total	70	100.00

5.1.4 Size of holdings and area

Land holding is the basic unit for agricultural production. The size of the holding influences the economic returns of the farmers significantly. The holding particulars of the selected respondents are presented Table 5.4.

Table 5.4 : Distribution of average size of holdings and area

Size of holding	Category of farmer	No of respondents	% of respondents	Total area (ha)	% to total area	Average size(ha)
Below 1.0	Marginal	48	68.58	33.85	46.47	0.70
1.0 – 2.0	Small	18	25.71	29.40	40.35	1.58
2.1 – 4.0	Semi-Medium	4	5.71	9.60	13.18	2.5
Total		70	100.00	72.85	100.00	0.9

NB: There were no medium (4-10) and large farmers (>10) were not available.

It is observed from the table 5.4 that the average size of holding was only 0.9 ha. From the figures in table it is clear that majority of the respondents i.e. 48 members which constituted 68.57 per cent were having land less than 1 hectare and belong to marginal category of farmer. Small farmers account for 26% of total respondents with average farm size of 1.58 ha. Semi – medium farmers constitute for 5.71 % of the total respondents with average farm size of 2.5 ha. From Table 5.4, it clear that from the selected respondent farmers that majority of the area is under marginal farmers i.e., 33.85 ha which accounts to 44.63 % of the total area. Small farmers have an area of 29.40 ha which accounts to 40.35 % of the total area. Semi – medium farmers constituted an area of 9.6 ha which accounts to 13.18% of the total area.

5.1.5 Working and Non – working members

Particulars regarding working and non – working members of the families are presented in Table 5.5. It is observed from Table 5.5 that majority of the working members i.e., 148 members of working members are from marginal farmer families which constituted 52.85 per cent of the total working members. Small farmer families constitute 101 members of working members accounting to 36.07 per cent of the total working members. Semi – medium farmer families constitute to about 31 members of working members which constitute to about 11.07 per cent of the total working members.

Table 5.5 : No of working and non – working members according to size groups.

S.No	Size Groups	Working members		Non – working members	
		No. of Members	%	No. of Members	%
1	Marginal	148	52.86	153	53.12
2	Small	101	36.07	101	35.07
3	Semi – medium	31	11.07	34	11.81
	Total	280	100.00	288	100.00

From Table 5.5 it is clear that majority of the non – working members 153 members of the non working members were from marginal farmers families constituting 53.13 percent. Small farmer families constituted about 101 members non – working members accounting to 35.07% of the total non – working members. It is observed that semi – medium farmers families constituted about 34 members of non – working members which accounts to 11.81 percent of the total non – working members.

5.1.6 Farm Assets of selected cultivators

The risk bearing ability of the farmers largely depends on the value of assets owned by the farmers. The value of farm assets possessed by the sample farmers are presented in Table 5.6. It is observed that land is the major item of the total assets. But the ownership rights of the land belongs to the Chief (Hausa), Headman of the village. The assets owned by the farmers practising shifting cultivation are simple farm implements which are mostly of traditional type. Farm assets used were axe, hand hoe, sickle, spade, dao, hoe, lever etc.

Table 5.6 : Assets of selected shifting cultivators

Sl. No	Particulars	per hectare Value in Rs
1	Value of jhum hut	2,723
2	Value of farm implements	1,481

It is observed from the figures in Table 5.6 that the value of jhum hut was Rs. 2723 and that of the value of farm implements costed Rs. 1481. Hence, assets of shifting cultivators include only jhum hut and their farm implements.

5.1.7 Distance of Jhum land from Settlement Area (Village)

Jhum cultivation is practiced at a distance ranging from 0.1 km to 2.5 km from the settlement area. The land settlement area is fixed but the jhum area keeps on changing after cultivation. The cycle continues on and the distance of the jhum area may also vary according to the change in topography. It is observed from Table 5.7 that majority of the respondent members i.e. 59.4 percent were having distance of jhum land of 0.1 – 0.5 km from settlement area. It is observed from the Table 5.7 that 1.1 – 1.5 km distance from the jhum land accounts for 11.5 percent constituting about 8 members of the respondents. Further, 18 respondents accounting about 26.08 percent were having distance of 1.6 – 2.0 km distance of jhum land from settlement area and 2.1 – 2.5 km distance of jhum land from settlement area constitute about 2 members of respondents accounting to 2.9 percent.

Table 5.7 : Distance of jhum land from settlement area

Distance of jhum land	No. of respondents	Percentage
0.1 – 0.5 km	42	60.00
1.1 – 1.5 km	8	11.42
1.6 – 2.0 km	18	25.71
2.1 – 2.5 km	2	2.85
Total	70	100.00

5.2 NATURE OF SHIFTING CULTIVATION

Shifting cultivation is the important land use practice in the hill district of Manipur. Land is under the full control of chief (Hausa) and village authorities. These village authorities manage community lands and resources, do the yearly planning and allocation of plots for shifting cultivation, provide council regarding customary rules and regulations, and often have political power in the community. The advantage that these customary institutions have as opposed to introduced institutions is that they have the knowledge and political power required to manage the shifting cultivation as well as provide governance to the communities that is in line with the existing culture and requirements. Most of them have been functioning for a long time, and do not face the problems of new groups and village level councils.

Majority of the cultivators cultivate the crop for 1 year and left it fallow to regenerate the vegetation. The jhum cycle was more than 20 years until recently (Ramakrishnan and Toky, 1978) but now it has come down to an average of 5 – 7 years. Long cycles were possible earlier because population was not heavy and land availability did not limit the cycle. Human labour was used as the important input and there was non-employment of animals, implements or machinery.

Table 5.8 : Year of holding and fallow cycles

Year of holding	No. of respondent	Year of fallow	No. of respondent
1	60(85.7)	5 – 7	50(71.42)
		8 – 9	10(14.29)
2	10(14.3)	10 – 12	10(14.29)
	70(100)		70 (100.00)

Note: Figures in the parentheses indicate percentages to the total respondents in selected shifting cultivation area

During the winter months (December – January) the undergrowth is slashed, and small trees and bamboos are cut. Short tree stumps and large tree boles are left intact. The laborious process of cutting of the jungle, clearing, burning of the cut undergrowth, etc., is done by men. There exists reciprocal labour sharing and mixed cropping system. There are several benefits to this communal labour practice, including reduction in drudgery and increase in productivity. Farmers can exchange experiences and look at each other's innovations as they work. It is the duty of the host family to provide food and drink to the group.

Furthermore, exchanging work can fill gaps in labour or skills. Crops such as rice, maize, beans, colocasia, ginger, chilli, turmeric, sesamum, leafy mustard, snake gourd, pumpkin, brinjal, sweet potato, etc are grown together as mixed crops. Towards the end of March or beginning of April before onset on monsoon the debris is burnt. Unburnt material are collected in heaps and burnt again. A bamboo hut is built for temporary living and the family presence protects the field from wild animals. Sowing, dibbling and planting are done after first monsoon season.

Women predominate in seed selection and planting, weeding, and other operations. Seeds of pulses, cucurbits, vegetables and cereals are mixed together and mostly broadcasted. Throughout the cropping season weeds poses a problem. Two – three hand hoe weeding was mostly done during the month of June – July. Both men and women participate in harvesting and threshing which are done during September and October. The produce is transported from the jhum land to the village by head-loading.

Table 5.9 : Crop calendar for different operations under jhum cultivation

Items	**Period**
Completion of field preparation (Forest cutting, burning and clearance of forest growth Burning of unburnt debris	Dec/Jan Mar/April

Dibbling, Sowing ,Planting etc	May/June
Weeding	Jun/July
Harvesting	Sept/Oct
Threshing	Sept/Oct

5.10: Cropping Pattern followed by respondent farmers

Crops	Area(ha)	Percentage (%)
Paddy	50.90	70.00
Maize	4.82	6.62
Roots and tuber crops	8.94	12.28
Legumes	2.24	3.10
Fruits and vegetables	4.47	6.14
Others	1.35	1.86
Total	72.85	100.00

5.1.9 Forms of land tenureship

The system of hereditary is Chief ship (Hausa) as well as community ownership of village land is prevalent in the district. In case of hereditary Chief ship the Chief is all-powerful as he controls not only the economy of the village through his ownership of the land but exercises social control over the households in the village.

Giving rent for use of land by cultivator farmer was practised during olden days but it was observed in Table 5.11 that majority of them shows a decline in this practised. Same amount of rent was stated for all shifting cultivators for use of land which was flexible according to their production. During low yield, the rent may be decrease or may totally be omitted if there is drastic decline in the yield and production. The farmer has no ownership of the land but majority of the farmers practised their cultivation without giving any form of land rent to Chief (Hausa).

It can be observed from Table 5.11 that 30 members of the respondent accounting to 42.9 percent give land rent in kind i.e., 24kgs of rice. The form of land rent if converted into monetary terms constituted about Rs. 240 only. Again from Table 5.11 it is clear that giving land rent was not practised in 40 members of the respondents accounting to 57.1 percent of the total respondents.

Table 5.11 : Pattern of lease system of shifting cultivation in Manipur

Form of land rent	No. of respondents	Yield (kgs)	Amount (Rs.)
Kind	30 (42.9)	24	240
Nil	40 (57.1)	-	-
Total	70 (100)	24	240

Note: Figures in the parentheses indicate percentages to the total respondents in selected shifting area

5.1.10 Number of years in which jhum was practiced

Jhuming (shifting cultivation) is an age-old practice in the hills of Manipur. It was the main occupation of the farmers in the hill district of Churachandpur. It was observed from the figures table 5.10 that majority of the respondent farmers continue shifting cultivation for the last 20 – 30 years accounting to 58.5 percent. Further it is noticed that, 11 respondents practised shifting of cultivation for less than 20 years accounting to about 15.7 per cent. It is seen from Table 5.12 that 14 members of the respondents practised this form of cultivation for the last 31 – 40 years account to 20 percent and 4 members of the respondents practised shifting of cultivation for the last 41 – 50 years accounting for 5.7 percent.

Table 5.12 : Number of years of jhum cultivation followed by respondent farmers.

Number of year in which jhum was practised.	Number of respondents
<20	11 (15.72)
20 – 30	41 (58.57)
31 – 40	14 (20.00)
41 – 50	4 (5.71)
Total	70 (100.00)

Note: Figures in the parentheses indicate percentages to the total respondent in selected shifting area

5.2 COSTS AND RETURNS OF CULTIVATION OF PADDY

The results of cost of cultivation of paddy in study area have been discussed below in terms of labour use and various cost concepts. In the jhum land it is difficult to estimate the production per unit of area due to absence of proper cadastral survey. Generally, the land area under shifting cultivation has a reference to seed rate of paddy i.e., the amount of seed rate used say 1 tin (12 kgs) will indicated the shifting cultivated area as 0.25 ha. Further, because of the mixture of crops, yield of individual crops separately may be difficult but with response from of respondents the cost of cultivation and production of individual crops were built up.

5.2.1 Labour utilization

Labour is an important input in production process. The labour employed on the farm depends on nature of operation, type of enterprise and availability of labour.

In general the labour consists of three types i.e., human, cattle and machine labour. The human labour has three different components viz., family, permanent and casual labour. However, there is non-employment of animals, implements or machinery labour. Paddy requires more labour as all the operations are labour oriented operations. Majority of the labour constitute from owned labour and costs of owned labour amount accounts to 62.75 percent of the total costs.

In operation wise of cultivation, land preparation component occupy major component with 32.85 percent in total in total labour costs i.e., 1/3th of the cost goes to land preparation only. Cost of land preparation occupies next to weeding. It was followed by harvesting and threshing, transportation watching and protecting, dibbling and planting etc, and other operations. Seed treatment was not adopted but they are sundried and stored for the next agricultural year. All together 84.48 per cent of labour cost was incurred by the farmer in over all variable cost. Total amount spent on labour was about Rs. 19829.43 per hectare presented in Table 5.15.

Table 5.13 Components of cost of labour for preparation of land for shifting cultivation (Rs./ha)

Particular	Mandays	Labour Cost	Percentage to total
Forest cutting	36.8	3680.00	56.50
Burning and clearance of forest growth	11.71	1171.43	17.98
Formation of soil guard	2.64	264.29	4.05
Construction of farm hut	13.98	1398.57	21.47
Total	65.14	6514.29	100.00

Table 5.14 : Operation wise labour utilization in paddy (Rs./ha)

Particulars	Mandays	Labour costs	% to total labour costs
Land preparation	65.14	6514.29	32.85
Dibbling, planting etc	3.45	345.30	1.74
Weeding	47.45	4745.85	23.93
Other operations	4.89	488.57	2.46
Watching and protecting	22.93	2292.85	11.56
Harvesting and threshing	29.44	2944.00	14.85
Transportation	25.00	2500.00	12.61
Total	198.3	19830.00	100.00

5.2.2 Item wise cost of cultivation

Data pertaining to the item wise cost of cultivation of paddy per hectare was presented in table 5.15. Human labour accounts to major share in the cost of cultivation with 84.48 per cent in the total cost of cultivation. Of which 62.75 per cent i.e., Rs. 14723.14 of human labour is owned labour and the cost is imputed at prevailing wage rate price. Labour cost of Rs. 5106 of human labour are in the form of hired labour accounting to 21.76 per cent of the total cost of cultivation. Seed cost is Rs 470.31 per hectare which accounts to 2 per cent of the cost of cultivation. Farmer spends little on seed. Most of the farmer uses their own seed. The interest on working capital amounted to Rs. 2435.97 i.e., 10.38 per cent and the interest of fixed costs accounted to Rs.66.4 i.e., 0.28 per cent of the total cost of cultivation respectively.

Table 5.15 : Break up of item wise cost of cultivation of paddy in Jhum cultivation in Manipur (Rs./ha)

Operational costs	Rs.	% to total cost
1. Human labour		
Owned	14723.14	62.75
Hired	5106.29	21.76
2. Bullock labour		
Owned	0.00	0.00
Hired		
3. Machine labour	0.00	0.00
Owned		
Hired		
4.Seeds	470.31	2.00
5. Manures and fertilizers	0.00	0.00
FYM		
Fertilizers		
6. Plant protection chemicals	0.00	0.00
9. Interest on working capital (12%)	2435.97	10.38
10.Total operational costs	22735.71	**96.90**
Fixed costs		
1. Depreciation (10%)	420.40	1.79
2.Land revenue	240.00	1.02
3.Rental value of owned land	0.00	0.00
4. Interest on fixed capital (10%)	66.44	0.28
5.Total fixed costs	726.44	3.09
6.Total costs	**23462.01**	**100**

It is revealed from the table that the total costs incurred on paddy cultivation in shifting area for one agricultural year is Rs. 23462 of which fixed costs amounted to Rs. 726 (3.09 per cent) and variable costs amounted to nearly Rs 22735.71 (96.90 per cent). The major expenditure on fixed costs is farm hut and farm implements.

Since land ownership rights does not belong to cultivator farmer, so imputed value of owned land is not taken into account. Fixed costs are land revenue, depreciation, interest on fixed capital was observed as Rs. 240, Rs. 420.40 and Rs. 66.4. In the variable costs it was the owned labour cost that constituted nearly 64.77 per cent of total variable costs, and 62.75 per cent of the total costs. However, there is non-employment of animals, implements or machinery labour. Use of plant protection chemicals, manures and fertilizers are mostly not adopted in shifting cultivated area. The burning of stubbles during land preparation served as manures and nutrients to the crop.

Cost of cultivation according to cost concepts

The cost of cultivation of paddy is also computed by adopting the procedure used in the cost of cultivation scheme Government of India. Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_2 and Cost C_3 were adopted. The various production cost according to cost concept in terms of rupees per hectare are presented in Table 5.16.

Table 5.16 : Cost of cultivation of paddy as per costs concepts

Cost Concepts	**Rs. Per hectare**
Cost A_1	6237.00
Cost A_2	6543.44
Cost B_1	6303.44
Cost B_2	6543.44
Cost C_1	21026.58
Cost C_2	21266.58
Cost C_3	23393.24

It is observed from the figures in Table 5.16 that Cost of A_1 of paddy farms accounted to Rs. 6237 indicates all variable costs. This gives the cost of cultivation excluding rental value of owned land, imputed value of family labour and interest on fixed capital. Cost A_2 is Cost A_1 plus rent paid for leased in land accounted to Rs. 6543.44. Cost B_1 is Cost A_1 plus interest on fixed Capital excluding land and rental value of owned land accounted to Rs. 6303.44. Cost B_2 is Cost B_1 plus rental value of owned land and rent paid for leased – in land accounted to Rs. 6543.44. Cost C_1 is Cost B_1 plus imputed value of family labour accounted to Rs. 21026.58. Cost C_2 is Cost B_2 plus imputed value of family labour accounted to Rs.21266.58. Finally, cost of cultivation scheme also includes management cost as 10 per cent of total cost of cultivation. So, Cost C_3 is Cost C_2 plus 10 % of C_2 as management costs which accounted to Rs. 23393.24.

Productivity and income of paddy

Production of output per unit area of land indicates the productivity of a particular crop. The data pertaining to average yield of the paddy per hectare is 18.31 quintal presented in Table 5.29. The cost of production per quintal is Rs. 1277.62. The net returns give negative results which show that cultivation of only paddy is not profitable. These results are corroborated with Dutta and Sharma (1979).

Gross returns (18.39 Qtl X Rs. 1200) = Rs. 22080

Net returns = Gross income – Cost C

= Rs. 22080 – 23393.24

= Rs. – 1313.24.

If the paid out cost are taken into account excluding imputed cost of human labour, depreciation, cultivation of paddy become profitable.\

Factors influencing profitability of paddy

The factors influencing the gross returns of paddy are examined through multiple regression and the results are presented in Table 5.17. The result showed that out of five variables included in the model only three variables significantly explained the variation in gross returns in. Seed, labour and fallow period were found significantly influencing gross returns (Table 5.17).

Table 5.17 Factors affecting Paddy cultivation under jhum in Manipur

Dependent variable = Gross income from paddy(Y)

R^2 = 68%, $\bar{R}^2$ = 65% F = 27.4 N = 70

Sl. No.	Variable	b – value	Standard Error	t – value
1.	Constant	-27090.70	9666.981	-2.80
2.	Seed in Rs.(X_1)	78.95	21.638	3.65*
3.	Labour in Rs.(X_2)	1.76	0.646	2.73*
4.	Area in ha.(X_3)	-900.30	2810.08	-0.32
5.	Fallow period in yr (X_4)	-5711.60	3232.93	-1.76**
6.	Cultivated period in yr (X_5)	-191.50	771.17	-0.24

** = Significant at 5% level of probability
* = Significant at 1%. Level of probability

The result showed that, for instance, a Rupees increase of seed will increase the gross returns by Rs. 78.95 from its mean value at 1% value of significance. An additional expenditure of Rupees one will result in increase of labour by Rs.1.76 from its mean value at 1% value of significance. Decrease in fallow period by one year will increase the gross returns by Rs. 5711.60 from its mean value at 5 % level of significance. Hence increased in use of better inputs and decreased in fallow period will give better gross returns to the farmers practising shifting cultivation.

5.3 COST AND RETURNS OF GINGER CULTIVATION

The results of cost of cultivation of ginger in study area have been discussed below in terms of labour use and various cost concepts.

5.2.1 Labour utilization

In operation wise of cultivation land preparation components has occupies major component with 36.49 per cent in total in total labour costs i.e., Rs. 6514.29 of the cost goes to land preparation only. Cost of weeding occupies next to land preparation. It is followed by harvesting, transportation, watching and protecting, dibbling and planting etc, and other operations. All together 52.40 per cent of labour cost was incurred by the farmer in over all variable cost. Total amount spent on labour is about Rs. 17854.51 per hectare presented in Table 5.19.

Table 5.18 : Break up of labour utilization in ginger cultivation under jhum cultivation in Manipur (Rs./ha)

Particulars	Mandays	Labour costs	% to total labour costs
Land preparation	65.14	6514.29	36.49
Dibbling, planting etc	10.40	1040.00	5.82
Weeding	31.11	3110.88	17.42
Other operations	4.80	480.00	2.70
Watching and protecting	17.59	1759.00	9.85
Harvesting	25.00	2500.04	14.00
Transportation	24.50	2450.00	13.72
Total	178.58	17854.51	100.00

5.2.2 Item wise cost of cultivation

Data pertaining to the item wise cost of cultivation of ginger per hectare was presented in table 5.19. Human labour accounts to major share in the cost of cultivation with 52.40 per cent in the total cost of cultivation. Of which 39.34 per cent i.e., Rs. 13393.19 of human labour is owned labour and the cost is imputed at prevailing wage rate price. Labour cost of Rs. 4461.32 of human labour are in the form of hired labour accounting to 13.10 per cent of the total cost of cultivation. Seed cost is Rs 12124.87 per hectare which accounts to 35.62 per cent of the cost of cultivation. The interest on working capital amounted to Rs. 3597.53 i.e., 10.57 per cent and the interest of fixed costs accounted to Rs. 42.04 i.e., 0.12 per cent of the total cost of cultivation respectively.

Table 5.19 : Break up of item wise cost of cultivation of ginger under jhum in Manipur (Rs./ha)

Operational costs	**Rs.**	**% to total cost**
1. Human labour		
Owned	13393.19	39.34
Hired	4461.32	13.10
2. Bullock labour	0	0.00
Owned		
Hired		
3. Machine labour	0	0.00
Owned		
Hired		
4.Seeds	12124.87	35.62
5. Manures and fertilizers	0	0.00
FYM		
Fertilizers		
6. Plant protection chemicals	0	0.00
7. Interest on working capital (12%)	3597.53	10.57
8.Total operational costs	**33576.91**	**98.64**

Operational costs	Rs.	% to total cost
Fixed costs		
1. Depreciation (10%)	420.40	1.23
2.Land revenue	0	0.00
3.Rental value of owned land	0	0.00
4. Interest on fixed capital (10%)	42.04	0.12
5.Total fixed costs	462.44	1.36
6.Total costs	**34039.35**	**100.00**

It is revealed from the table that the total costs incurred on ginger cultivation in shifting area for one agricultural year is Rs. 34039.35 of which fixed costs amounted to Rs. 42.04 (0.14 per cent) and variable costs amounted to nearly Rs 33577 (98.64 per cent). The major expenditure on fixed costs are farm hut and farm implements. Fixed costs are depreciation, interest on fixed capital was observed as Rs. 420.40 and Rs. 47.04. In the variable costs it was the owned labour cost that constituted nearly 39.34 per cent of total variable costs, and 98.64 per cent of the total costs.

Cost of cultivation according to cost concepts

The various production cost according to cost concept in terms of rupees per hectare are presented in Table 5.20.

Table 5.20 : Cost of cultivation of ginger as per costs concepts

Cost Concepts	Rs. Per hectare
Cost A_1	16586.19
Cost A_2	16826.19
Cost B_1	16628.23

Cost B_2	16868.23
Cost C_1	30021.42
Cost C_2	30261.42
Cost C_3	33287.56

It is observed from the figures in Table 5.20 that Cost of A_1 of ginger accounted to Rs. 16586.19 which indicates all variable costs. Cost A_2 accounted to Rs. 16826.19. Cost B_1 accounted to Rs. 16628.23. Cost B_2 accounted to Rs. 16868.23. Cost C_1 is Cost B1 plus imputed value of family labour accounted to Rs. 30021.42. Cost C_2 is Cost B_2 plus imputed value of family labour accounted to Rs. 30261.42. Finally, cost of cultivation scheme also includes management cost as 10 per cent of total cost of cultivation. So, Cost C_3 is Cost C_2 plus 10 % of C_2 as management costs which accounted to Rs. 33287.56.

Productivity and income of ginger

Production of output per unit area of land indicates the productivity of a particular crop. The data pertaining to average yield of the ginger per hectare is 63 quintal presented in Table 5.29. The cost of production per quintal is Rs. 528.37.

Gross returns (63 Qtl X Rs. 2000) = Rs.126000

Net returns = Gross income – Cost C

= Rs. 126000 – 33287.56

= Rs. 92712.44

Factors influencing profitability of ginger

The factors influencing the gross returns of ginger are examined through multiple regression and the results are presented in Table 5.21. The result showed that out of six variables included in the model only three variables significantly explained the variation in gross returns in. Seed, area and cultivated period were found significantly influencing gross returns (see Table 5.21).

Table 5.21 Factors affecting ginger cultivation under jhum in Manipur

Dependent variable = Gross income from ginger(Y)

R^2 = 72.6%, $\bar{R}^2$ = 70.0%. F =27.89 N = 46

Sl. No.	Variable	b – value	Standard Error	t – value
1.	Constant	-9810.31	20878.19	-0.470
2.	Seed in Rs.(X_1)	7.742	1.505	5.145*
3.	Labour in Rs.(X_2)	0.930	1.088	0.855
4.	Area in ha(X_3)	23017.4	6709.619	3.431*
5.	Fallow period in yr(X_4)	-666.767	2193.409	-0.304
6.	Cultivated period in yr(X_5)	24661.060	10743.260	2.295**
7.	Rent in Rs.(X_6)	5020.654	7741.104	0.649

** = Significant at 5% level of probability
* = Significant at 1% level of probability

The result showed that, an additional increase of Rs one in seed will increase the gross returns by Rs. 7.742from its mean value at 1% level of significance. Increase in shifting cultivated area by 1 year will increase the gross returns by Rs. 23017.40 from its mean value at 1% percent value of significance. Continuing the cultivated period by 1 more year will increase the gross returns by Rs. 24661.06 from its mean value at 5% level of significance. Hence increased in input seeds, area and cultivated year will give better gross returns to the farmers practising shifting cultivation.

5.4 COST OF CULTIVATION OF MAIZE

The results of cost of cultivation of maize in study area have been discussed below in terms of labour use and various cost concepts.

5.2.1 Labour utilization

In operation wise of cultivation land preparation components has occupies major component with 37.30 per cent in total to total labour costs i.e., Rs. 6512.30 of the cost goes to land preparation only. Cost on weeding occupies next to land preparation. It is followed by transportation, harvesting, watching and protecting, dibbling and planting etc, and other operations. All together per cent of labour cost was incurred by the farmer in over all variable cost. Total amount spent on labour is about Rs. 17460.38 per hectare presented in Table 5.20.

Table 5.22 : Break up of operation wise labour utilization in maize in jhum cultivation in Manipur (Rs./ha)

Particulars	Mandays	Labour costs	% to total labour costs
Land preparation	65.12	6512.30	37.95
Dibbling, planting etc	5.40	540.00	3.15
Weeding	32.45	3245.00	18.91
Other operations	4.80	480.00	2.80
Watching and protecting	12.70	1270.00	7.40
Harvesting	25.45	2545.65	14.83
Transportation	25.67	2567.43	14.96
Total	171.60	17160.38	100.00

5.2.2 Item wise cost of cultivation

Data pertaining to the item wise cost of cultivation of maize per hectare was presented in Table 5.23. Human labour accounts to major share in the cost of cultivation with 85.17 per cent in the total cost of cultivation. Of which 69.77 per cent i.e., Rs. 14320 of human labour are owned labour and the cost is imputed at prevailing wage rate price. Seed cost is Rs 114.68 per hectare which accounts to 0.55 per cent of the cost of cultivation. The interest on working capital amounted to Rs. 2109.89 i.e., 10.28 per cent and the interest of fixed costs accounted to Rs.66.04 i.e., 0.32 percent of the total cost of cultivation respectively.

Table 5.23 : Break up of item wise cost of cultivation of maize under jhum in Manipur (Rs./ha)

Operational costs	Rs.	% to total
1. Human labour		
Owned	14320.00	69.77
Hired	3140.38	15.30
2. Bullock labour	0	0
Owned		
Hired		
3. Machine labour	0	0
Owned		
Hired		
4.Seeds	114.68	0.55
5. Manures and fertilizers	0	0
FYM		
Fertilizers		
6. Plant protection chemicals	0	0
9. Interest on working capital (12%)	2109.89	10.28
10.Total operational costs	**19797.63**	**96.46**
Fixed costs		
1. Depreciation (10%)	420.04	2.05

2.Land revenue	240.00	1.17
3.Rental value of owned land	0	0
4. Interest on fixed capital (10%)	66.04	0.32
5.Total fixed costs	726.04	3.54
6.Total costs	**20523.67**	**100.00**

It is revealed from Table 5.23 that the total costs incurred on maize cultivation in shifting area for one agricultural year is Rs. 20523.67 of which fixed costs amounted to Rs. 726.04 (3.54 per cent) and variable costs amounted to nearly Rs. 19796.63 (96.46 per cent). Fixed costs are land revenue, depreciation, interests on fixed capital was observed as Rs. 240, Rs. 420.04 and Rs. 66.04. In the variable costs it was the owned labour cost that constituted nearly 72.33 per cent of total variable costs, and 69.77 per cent of the total costs.

Cost of cultivation according to cost concepts

It is observed from the figures in Table 5.24 that Cost of A_1 of maize farms accounted to Rs. 3915.10 which indicates all variable costs. This gives the cost of cultivation excluding rental value of owned land, imputed value of family labour and interest on fixed capital.

Table 5.24 : Cost of cultivation of maize as per costs concepts

Cost Concepts	**Rs. Per hectare**
Cost A_1	3915.10
Cost A_2	4155.10
Cost B_1	3981.14
Cost B_2	4221.14

Cost C_1	18301.14
Cost C_2	18541.14
Cost C_3	20395.25

Cost A_2 is Cost A_1 plus rent paid for leased in land accounted to Rs. 4155.10. Cost B_1 is Cost A_1 plus interest on fixed Capital excluding land and rental value of owned land accounted to Rs. 3981.14. Cost B_2 is Cost B_1 plus rental value of owned land and rent paid for leased – in land accounted to Rs. 4221.14. Cost C_1 is Cost B_1 plus imputed value of family labour accounted to Rs. 18301.14. Cost C_2 is Cost B_2 plus imputed value of family labour accounted to Rs. 18541.14. Finally, cost of cultivation scheme also includes management cost as 10 per cent of total cost of cultivation. So, Cost C_3 is Cost C_2 plus 10 % of C_2 as management costs which accounted to Rs. 20395.25.

Productivity of maize

Production of output per unit area of land indicates the productivity of a particular. The data pertaining to average yield of maize per hectare is 14 quintal which presented in Table 5.30. The cost of production per quintal is Rs. 1456.80.

Gross returns (14 Qtl X Rs. 1500) = Rs. 21000
Net returns = Gross income – Cost C
= Rs. 21000 – 20395.25
= Rs. 604.75.

Factors influencing profitability of maize

The factors influencing the gross returns of maize are examined through multiple regression and the results are presented in Table 5.25. The result showed that out of six variables included in the model only one variable significantly explained the variation in gross returns. Seed, area and cultivated period were found significantly influencing gross returns (see Table 5.25).

Table 5.25 : Factors affecting maize cultivation under jhum in Manipur

Dependent variable = Gross income from maize(Y)

R^2 = 91.9%, $\bar{R}^2$ = 91.1%. F = 20.87 N = 21

Sl. No.	Variable	b – value	Standard Error	t – value
1.	Constant	12063.32	3358.278	3.592
2.	Seed in Rs.(X_1)	106.3459	10.629	10.005*
3.	Labour Rs.(X_2)	-0.01486	0.015	-1.013
4.	Area in ha(X_3)	701.0814	1221.420	0.574
5.	Fallow period in Yr(X_4)	-313.243	400.067	-0.783
6.	Cultivated period in yr (X_5)	-2738.32	1908.075	-1.435
7.	Form of rent in Rs. (X_6)	443.854	1319.896	0.336

** = Significant at 5% level of probability
* = Significant at 1% level of probability

Seed was found significantly influencing gross returns (see Table 5.25). The result showed that, for instance, an additional increase of Rs one in seed will increase the gross returns by Rs. 106.35 from its mean value at 1% value of significance.

5.3 COST OF CULTIVATION OF COLOCASIA

The results of cost of cultivation of rice in study area have been discussed below in terms of labour use and various cost concepts.

5.2.1 Labour utilization

In operation wise of cultivation land preparation components has occupies major component with 40.92 percent in total in total labour costs i.e., Rs. 6514.29 of the cost goes to land preparation only. Cost of weeding occupies next to land preparation. It is followed by, transportation, harvesting dibbling and planting etc, other operations and watching and protecting. All together 87.90 percent of labour cost was incurred by the farmer in over all variable cost. Total amount spent on labour is about Rs. 15919.99 per hectare presented in Table 5.26.

Table 5.26 : Break up of operation wise labour utilization in colocasia under jhum in Manipur (Rs./ha)

Particulars	Mandays	Labour costs	% to total labour costs
Land preparation	65.14	6514.29	40.92
Dibbling, planting etc	6.54	654.00	4.11
Weeding	28.79	2879.00	18.08
Other operations	4.80	480.00	3.02
Watching and protecting	2.00	200.00	1.25
Harvesting	24.47	2447.00	15.37
Transportation	27.45	2745.70	17.25
Total	159.19	15919.99	100.00

5.2.2 Item wise cost of cultivation

Data pertaining to the item wise cost of cultivation of colocasia per hectare was presented in Table 5.27.

Table 5.27 : Break up of item wise cost of cultivation of colocasia (Rs./ha)

Operational costs	Rs.	% to total
1. Human labour		
Owned	12450.00	66.09
Hired	3469.34	18.41
2. Bullock labour		
Owned	0	0.00
Hired	0	0.00
3. Machine labour		
Owned		
Hired	252.00	1.33
4.Seeds		

5. Manures and fertilizers FYM Fertilizers	0	0.00
6. Plant protection chemicals	0	0.00
7. Interest on working capital (12%)	1940.56	10.30
8.Total operational costs	**18111.90**	**96.15**
Fixed costs		
1. Depreciation (10%)	420.04	2.23
2.Land revenue	240.00	1.27
3.Rental value of owned land	0	0.00
4. Interest on fixed capital (10%)	66.04	0.35
5.Total fixed costs	726.08	3.85
6.Total costs	**18837.98**	**100.00**

Human labour accounts to major share in the cost of cultivation with (84.50) per cent in the total cost of cultivation. Of which 66.09 per cent i.e., Rs. 12450 of human labour are owned labour and the cost is imputed at prevailing wage rate price. Labour cost of Rs. 3469 of human labour are in the form of hired labour accounting to 18.41 per cent of the total cost of cultivation. Seed cost is Rs 252 per hectare which accounts to (1.33) per cent of the cost of cultivation. The interest on working capital amounted to Rs. 1940.56 i.e., 10.30 per cent and the interest of fixed costs accounted to Rs. 66.04 i.e., 0.35 percent of the total cost of cultivation respectively. It is revealed from Table (5.27) that the total costs incurred on colocasia cultivation in shifting area for one agricultural year is Rs. 18837.98 of which fixed costs amounted to Rs. 726.08 (3.90 per cent) and variable costs amounted to nearly Rs. 18111.90 (96.09 per cent). The major expenditure on fixed costs is farm hut and farm implements. Fixed costs are land revenue, depreciation, interest on fixed capital was observed as Rs. 240, Rs. 420.04 and Rs. 66.04. In the variable costs it was the owned labour cost that constituted nearly 68.74 per cent of total variable costs, and 66.09 per cent of the total costs.

Cost of cultivation according to cost concepts

It is observed from the figures in Table 5.28 that Cost of A_1 of paddy farms accounted to Rs. 6321.94 indicates all variable costs. This gives the cost of cultivation excluding rental value of owned land, imputed value of family labour and interest on fixed capital. Cost A_2 is Cost A_1 plus rent paid for leased in land accounted to Rs. 6561.94. Cost B_1 is Cost A_1 plus interest on fixed Capital excluding land and rental value of owned land accounted to Rs. 6387.98. Cost B_2 is Cost B_1 plus rental value of owned land and rent paid for leased – in land accounted to Rs. 6454.02. Cost C_1 is Cost B_1 plus imputed value of family labour accounted to Rs. 18837.98. Cost C_2 is Cost B_2 plus imputed value of family labour accounted to Rs. 18904.02. Finally, cost of cultivation scheme also includes management cost as 10 per cent of total cost of cultivation. So, Cost C_3 is Cost C_2 plus 10 % of C_2 as management costs which accounted to Rs. 20794.42.

Table 5.28 : Cost of cultivation of Colocasia as per costs concepts

Cost Concepts	**Rs. Per hectare**
Cost A_1	6321.94
Cost A_2	6561.94
Cost B_1	6387.98
Cost B_2	6454.02
Cost C_1	18837.98
Cost C_2	18904.02

Cost C_3	20794.42

Productivity of Colocasia

Production of output per unit area of land indicates the productivity of a particular. The data pertaining to average yield of the colocasia per hectare is 95.68 quintal. The cost of production per quintal of colocasia is 217.33 are presented in Table. 5.30.

Gross returns (95.68 Qtl X Rs. 1000) = Rs. 95680

Net returns = Gross income – Cost C

= Rs. 95680 – 20794.42

= Rs. 74885.58.

Factors influencing profitability of colocasia

The factors influencing the gross returns of colocasia are examined through multiple regression and the results are presented in Table 5.29. The result showed that out of six variables included in the model only three variables significantly explained the variation in gross returns. Area, fallow period, form of rent was found significantly influencing gross returns (see Table 5.29).

Table 5.29 : Factors affecting colocasia cultivation under jhum in Manipur

Dependent variable = Gross income from colocasia(Y)

R^2 = 66.7% $\bar{R}^2$ = 63.4% N = 70

Sl. No.	Variable	b – value	Standard Error	t – value
1.	Constant	41114.21	33804.83	1.21
2.	Seed in Rs.(X_1)	28.96	62.82	0.46
3.	Labour in Rs.(X_2)	0.04	0.25	0.151

4.	Area in ha(X_3)	47225.13	11454.93	4.12*
5.	Fallow period in yr(X_4)	-60320.2	17443.59	-3.4*
6.	Cultivated period in yr(X_5)	2812.14	3628.94	0.775
7.	Form of rent in Rs.(X_6)	-351.99	118.50	-2.97*

** = Significant at 5% level of probability
* = Significant at 1% level of probability

The result showed that, for instance, rent if given for used of land will decrease the returns by Rs. 351.99. Increase in 4 units of labour will increase the returns by Rs. 47225.13 Rupees. Decrease in fallow period by 3.4 units will decrease the returns by Rs. 60320. Continuing the cultivated period by 4 units will increase the gross returns by Rs. 13653.49. Hence, having longer fallow and increase in area will give better returns to the farmers practising shifting cultivation.

The crop wise comparisons indicating their yield, gross returns, cost C, cost of production and net returns. From Table 5.30 it is clear that growing of rice or maize alone in jhum area will not yield adequate returns. Colocasia and ginger yield a comfortable margin where ginger yields the highest margin.

Table 5.30 :Crop wise comparisons indicating their yield, gross returns, cost C, cost of production and net returns

Crop	Average yield (qt)	Gross returns (Rs/qt)	Cost C	Cost of production (Rs./qt)	Net returns
Rice	18.31	21972	23393.24	1263.7	– 1313.24
Maize	14.00	21000	20395.25	1476.20	333.08
Ginger	63.00	126000	33287.56	535.80	92244.50
Colocasia	95.68	95680	20794.42	217.33	74424.88

Hence, the farmer should allocate more area, labour and capital on ginger followed by colocasia to enhance farm income. Hence, allocating of more area under annual horticultural cash crops such as colocasia, ginger etc has more advantages than that of cereal crops such as rice and maize in terms of profitability.

Garrette Ranking

To rank the problems faced by the farmers practising shifting cultivation Garette ranking techniques was used and their results were presented in Table 5.30.

Table 5.31 : Score value and rank for reasons for practising shifting cultivation

Particular	Score	Rank
No other form of cultivable land	57	II
Lack of capital	52	IV
Lack of inputs	53	III
Comfortable for practising jhum	29	VI
Livelihood	70	I
Tradition	39	V

It was clear from Table 5.31 that shifting cultivation being the source of livelihood was the major reason for practising shifting cultivation by farmers as indicated by its highest value of 70, this was followed no other form of land and lack of inputs with scores value of 57 and 53 respectively. Shifting cultivation thus is a necessary evil. Hence, it is suggested that suitable policy should be evolved to solve these problems keeping the welfare of farming community in view. One of the major reasons was lack of capital. Farmers with their meager income and being subsistence type, they lack capital for further improvement of cultivation practices. Unavailability of credit disencourage the farmers to further improve their systems of farming.

The ranks and scores value of constraints of shifting cultivation are presented in Table 5.32. From Table 5.32, it shows that the major problem faced by farmers practising shifting cultivation was land preparation which is indicated by its highest score value of 79.

Table 5.32 : Score value and rank for problems/constraints for practising shifting cultivation

Particulars	Score	Rank
Topography	64	II
Low yield	61	III
Lack of proper irrigation	44	VII
Land preparation	79	I
Labour problems	60	IV
Loss of fertility	45	VI
Non - availability of inputs	46	V
Decrease in forest area/deforestation	41	IX
Rodents	42	VIII
Tradition	28	X

Land preparation was laborious as it involves cutting and clearing of a patch of forest. Majority of the labour was spend on land preparation. The next highest score is associated with land topography. Owing to its uneven topography, only human labour was feasible for this type of cultivation. Low yield discourage the farmer to continue this type of cultivation but as stated earlier in Table 5.31, since in majority of the areas no other form of cultivable land is available and being practiced in tradition, they were forced to follow this type of cultivation. Majority of the farmers want to move away from this type of cultivation but since no other form of land being available, they were forced to practice this type of cultivation for livelihood.

Scope to move away from shifting cultivation on persuasion, there is possibility of making people to practice other forms of occupation. But the question is what type of occupation will suit the shifting cultivators according to their topography. Majority of the respondents' farmers don't want their children to practice shifting cultivation. Hence they encourage education inspite of their meager income, and subsistence level of farming. Another major problem was labour problems with majority of the labour as owned labour. Providing other form of labours such as animal and machinery labour being difficult owing to its topography, farmers practiced their cultivation mainly by their laborious hard earned labour.

Table 5.33 : Future plans of respondent farmers practising shifting cultivation in Manipur

Particulars	Score	Rank
Same as present	53	III
To increase jhum area	41	IV
To increase subsidiary occupation and leave jhuming	56	II
To increase subsidiary occupation but continue jhuming also	64	I
Look for new occupation	33	V

Stating from the above tables , farmers future plans were expressed in terms of scores in Table 5.33. It was found from Table 5.33 that increasing subsidiary occupation and continuing jhum was the main future plans made by the farmers practising shifting cultivation as indicated by its highest score value of 56. This was followed by increasing subsidiary occupation and leave jhuming and practising the same form of cultivation with score values of 56 and 53 respectively.

Some farmers opted for increasing jhum area and produce more inspite of many problems and constraints faced by them. Hence, it is important to suggest a better policy options to solve these problems but also keeping in mind their perpectives, way of living and their welfare.

5.4 ESTIMATION OF ENVIRONMENTAL BENEFITS AND DAMAGES DUE TO SHIFTING CULTIVATION

Differential productivity of crops is one way of estimation of environmental costs as a proxy of decline in land quality. The real cost of degradation are felt in terms of declining productivities of interlinked natural resources such as land, water, grassland. Though the impacts in terms of loss of production are not realized at micro level, the problem is very serious at regional level.

Table 5.34 : Comparision of productivity levels of paddy and maize of sample farmers with District, State and National level.

Crops	Manipur			India
	Sampled farmer	District[1]	State[1]	
Paddy (kg/ha)	1831.00	1795.64	2444.48	3370[2]
Maize (kg/ha)	1465.70	2851.35	2851.35	2337[3]

Source: 1 – Economic Survey of Manipur (2008 – 09)
2. IRRI,
3.Directorate of Maize Research.

From the Table 5.34, comparison of productivity of two crops in Churachandpur district, State and India is done with the selected farmers. Less productivity is observed in District level i.e., 1795.64 kg/ha than the survey area i.e., 1831.00 kg/ha. At state level productivity i.e., 2444.48 is higher than the district level. At state level both shifting and settled cultivation are practised which contribute to higher productivity. Highest level of productivity is found at National level which is the combined value of all the states. Less productivity may be due to several factors associated with land quality, loss of erosion, loss of soil fertility due to shifting cultivation besides low level of technology. Hence, from the simple comparisons of above data it was clear that shifting cultivation was detrimental and continuing this method will yield less.

Farmer started adopting ginger cultivation as cash crop and pineapple as horticultural crops hence the environment cost and benefits with this changing system are compared with jhum system. Since horticulture crop is for 5 years, to compare the costs and benefits of land-use systems, a 5 year time horizon was considered in an analysis based on inputs and outputs. A discount rate of 12 % was taken into consideration. Shifting system and annual ginger crops were cultivated only once during the 5 year time horizon and the remaining years were left fallow. Pine apple was harvested thrice as the crop period ranges from 15 – 18 months during 5 year period.

Financial Performance of Alternative Land-Use Systems vis a-vis shifting cultivation: Private Perspective

The financial analysis (excluding environmental costs) to estimate the discounted costs and benefits of products produced under the three land-use systems demonstrates that the highest gross benefit (measured as Rs./ha/year) are obtained from horticulture followed by annual cash crop (Table 5.35). Gross benefit is lowest for shifting cultivation system. Although the gross benefit reflects the relative size benefit, it does not indicate the financial performance of the respective land-use systems because costs are not considered. The NPV is the common indicator of financial performance as it takes into accounts both costs and income of different activities (Tomich *et al*. 1998). In terms of NPV, annual cash crops appear to be the best performer followed by horticulture. Shifting cultivation has the lowest Net present value (NPV) as shown in Table 5.35 and Fig. 2.

The cultivation of annual cash crops also provides relatively quick returns and horticulture requires the longest time to begin generating an income stream. As discussed above, this situation has serious implications for the adoption of more sustainable land-use practices. The smallholders, who have limited capital and need to realize immediate returns, may not be able to alter current cultivation patterns without external support. Cultivation of annual cash crop is more profitable than traditional methods of shifting cultivation. Hence, it is advisable for the farmers to cultivate annual cash crop from the financial point of view.

Table 5.35: Comparison of Financial performance of alternative land use systems with shifting cultivation

(Rs./ha)

	Shifting cultivation	**Annual crops[a]**	**Horticultural crops[b]**
Costs	37579.70	33755.50	140625
Labour costs[c]	29829.14(79.38)	17687.88(52.40)	76781.25(54.60)
Non – labour costs[d]	7750(20.62)	16067.62(47.6)	64000(45.40)
Initial establishment cost	0	0	31680

Benefits	45198.00	126000	225000
Net Revenue	7618	92244.5	84375
Financial performance			
Net present value(NPV)	6802.11	82365.11	75338.43
Benefit cost ratio(BCR)	1.2	3.73	1.6

[a] Ginger is taken as representative of annual cash crop
[b] Pineapple is taken as representative of Horticulture crop
[c] Labour costs includes all the farm operations such as cutting of forest, burning and clearing, formation of soil guard, sowing, weeding, etc.
[d] Non – labour cost includes non – farm operations
[e] DF – 12%

Economic Performance of Alternative Land-Use Systems: Social Perspective

Soil losses are considerably higher than the soil formation rates under annual cash crop, jhum system and horticulture. Net soil loss under annual cash crops and jhum system is around 84 t/ha/yr. However, it is 28t/ha/yr under horticultural system (Table 5.36). The economic value of soil nutrient depletion is therefore as high as Rs. 18,323 ha/yr under annual cash cropping system and that of jhum is Rs. 17,471(Table 5.36). Such cost would substantially increase farmers' production costs in order to replenish soil fertility. However, under horticulture system farmers have lower nutrient depletion in monetary terms to Rs. 5,882 ha/y (Table 5.36). When these external costs and benefits are taken into account, the profitability of different land use systems is changed substantially (Table 5.36). Due to high rates of soil erosion, profitability under cash crops decreases substantially as compared to horticulture. As a result, differences in profitability between cash crop and horticulture shrink.

However, this approximation may still understate the real impact of erosion. In this analysis, costs such as loss of organic matter, loss of yield, and off-site are not considered. Soil erosion may thus lead to more serious damage than just loss of nutrients such as changing soil structure by reducing soil organic matter. When topsoil is lost, the subsoil is exposed, which has a poorer structure and is more compact that reduces water infiltration capacity and increase surface runoff (Miller *et al.*, 1985; Pimentel, et a., 1995; Alfsen *et al.*, 1996). Soil provides the growth medium for the plant. When soil and nutrients are removed, rooting depth for plants is reduced. Moreover, erosion increases the frequency and intensity of drought (Lal, 1987; Miller *et al.*, 1985; Alfsen *et al.*, 1996).

Table 5.36 : Soil erosion under different land use systems

(t/ha/yr)

Land use	Average soil loss
Shifting cultivation (cultivated jhum)	99.05[a]
(Abandoned jhum)	30.2[b]
Annual crops(ginger, colocasia,	99.15[c]
turmeric) Conventional tillage	43.3[d]
Pineapple cultivation	18.05[e]

[a] R.K. Yadav, D.S. Yadav, N. Rai and S.K. Sanwal(2006), Soil and water conservation through horticultural intervension in hilly areas.

[b] NBSS publication 56, Soil of India series, Nagpur.

[c] Chowdury (2001); [d] Ghosh (1976); [e] Quader *et al.*,1990-91.

Table 5.37 Economic valuation of soil loss.

		Jhum	**Annual cash crop**	**Horticulture**
Soil loss(t/ha/yr)		99	99	43
Natural rate of soil formation(t/ha/yr)		15	15	15
Net soil loss(t/ha/yr)		84	84	28
Loss equivalent to inorganic fertiliser(kg/t/eroded material)[a]	N	567	594	20
	P	10	10	0.34
	K	29	31	1
	OM	5364	5625	191
	Ca	185	195	7
	Total	6155	6455	219.34
Economic loss or gain (Rs/ha)[b]	N	4419	4635	156
	P	90	94	3
	K	197	206	7
	OM	12337	12939	439

	Ca Total	427 17471	448 18323	16 621

[a]Loss equivalent to inorganic fertilizers = Net soil loss X nutrient loss/ton eroded soil X Nutrient: Conversion Factor.
[b]Rasul G (2009), Economic loss was calculated from the border price of inorganic fertiliser : Urea =Rs. 7.8, P = Rs. 9.3, K = Rs. 6.7, OM = Rs. 2.3, Ca = Rs. 2.3.
1.According to Gafur *et al.* (2002), nutrient loss (kg/ ton of eroded soil) is: Ca = 1.58, and OM = 63.82.
2.Singh A and Singh M D (1980) nutrient loss (kg/ ton of eroded soil) is: N (total) = 3.15; P (available) = 0.05; K (exchangeable) = 0.29.
3.Dobermann A and Fairhurst T (2000),Nutrient fertiliser converter factor: N – Urea = 2.14, P – P_2O_5 = 2.292, k – K_2O, = 1.205, Ca – Lime = 1.399.

Economic performance of different land use is done by valuation of soil loss. Economic loss due to soil loss is found to be highest in annual cash crops accounting to Rs. 18323 followed by shifting cultivation amounting to Rs. 17471. Lowest economic loss due to soil loss is found to be lowest in horticulture land use system amounting to Rs. 621 is shown in Table 5.37 and Fig. 3. Thus, from environment point of view horticulture gives the highest performance followed by shifting cultivation and annual cash crop occupies the lowest position. This findings is in accordance with (Rasul G, 2009; Rasul and Thapa, 2007) When both soil erosion effects and financial performance are taken into account, it indicate that highest benefit is obtained from horticulture i.e., its Net economic benefits accounts to Rs 74717 per hectare which is followed by annual cash crop amounting to Rs 64043. Lowest economic performance is found in shifting cultivation i.e., Rs. 10669 is shown in Table 5.38 and Fig.4.

Table 5.38 : Economic Performance of alternative land use systems

	Shifting cultivation	Annual cash crop	Horticulture
Gross Benefit(Rs./hs)	45198.00	126000	225000
Net Financial Benefit(Rs./ha)	6802.11	82365.11	75338
Net soil loss or gain(t/ha/yr)	84	84	3
Economic loss or gain due to soil loss(Rs./ha)	17470.84	18322.54	621
Net Economic Benefits(NEB)	10669	64043	74717

Carbon Sequestration and Biodiversity Benefits

Manipur consist of one of the hot spot for gene pool. Shifting cultivation is an age old practice. It involves felling of trees and clearing of a patch of land. This affects the tree species, due to deforestation, the plant species in that area, the animal species are too deprived of their habitat. With large scale deforestation in shifting cultivation there occurs undesirable changes. Further since the hill tops, particularly the catchment area are source of water, deforestation in the hills has led to elimination of water due to consequent inability of the soil to retain the water. In Manipur there are more than 104 species of animals (fauna) used as age old medicine and more than 5000 Sacred Groves have been reported. Many of these animals of ethno zoological importance are in threat due to over exploitation. Loss of biodiversity, deforestation and encroachment on forest lands has a number of impacts on the environments. But, unfortunately no authentic data are available in this regard. However, details concerning environmental benefits are presented in Table 5.39.

Table 5.39: Performance of alternative land use system with biodiversity and carbon sequestration

	Jhum	Annual Cash Crop	Horticulture
Net Financial Benefit (Rs./ha)	6802	82365	75338
Net soil loss or gain(t/ha/yr)	84	84	3

Net Economic Benefit	10669	64043	74717
Biodiversity Index	0	0	0.30
Biodiversity services (Rs./ha)	0	0	5645
Carbon sequestration	0	0	0.4
Carbon sequestration services (Rs./ha)	0	0	7533
Total Economic benefit(TEB) (Rs./ha)	10669	64043	87900

*Indices from Pagiola (2004) and Pagiola *et al.* (2007)

The value of biodiversity services varies considerably across the land-use systems. In terms of species conservation, jhum do not provide any positive environmental services. Horticulture generates the largest environmental services such as biodiversity services, carbon sequestration services and other benefits. When the benefits of environmental services are taken into account, jhum become the least profitable land-use practice. The analysis reveals a tradeoff between short-term profitability in terms of net financial benefit. For the individual farmer who wants to maximize his returns, the cultivation of annual cash crops is the preferable option. Since the tradeoff is lowest in horticulture and cash crops, a combination of horticulture and annual cropping system is preferred option from the society as well as individual point of view.

Conclusions

The regression estimates of factors influencing gross income from different crops viz, paddy, maize, ginger and colocasia indicate significant impact on inputs such as seeds and labour. Increase in area in annual cash crops will give better gross returns. Increase in cultivated period has positive impact on ginger crop in terms of gross returns.

The practise of shifting cultivation as a source of livelihood for farmers, was the major reason as indicated by Garrette ranking test. Major problem faced by farmers practising shifting cultivation was land preparation. Providing other form of labour such as animal and machinery labour being difficult owing to its topography. Farmers practiced their cultivation mainly by owned labour. Shifting to subsidiary occupation and continuing jhum were the main future plans expressed by farmers practising shifting cultivation

The financial analysis (excluding environmental costs) under the three land-use systems demonstrates that the highest gross benefit (measured as Rs./ha/year) is obtained from horticulture followed by annual cash crops and lowest benefit by shifting cultivation. In terms of NPV, annual cash crops appear to be the best performer followed by horticulture and shifting cultivation has the lowest NPV. When the environmental costs are taken into account, annual cash crops appear to be the most costly land-use system, with horticulture becoming most profitable. Shifting cultivation lies in between these two land use systems.

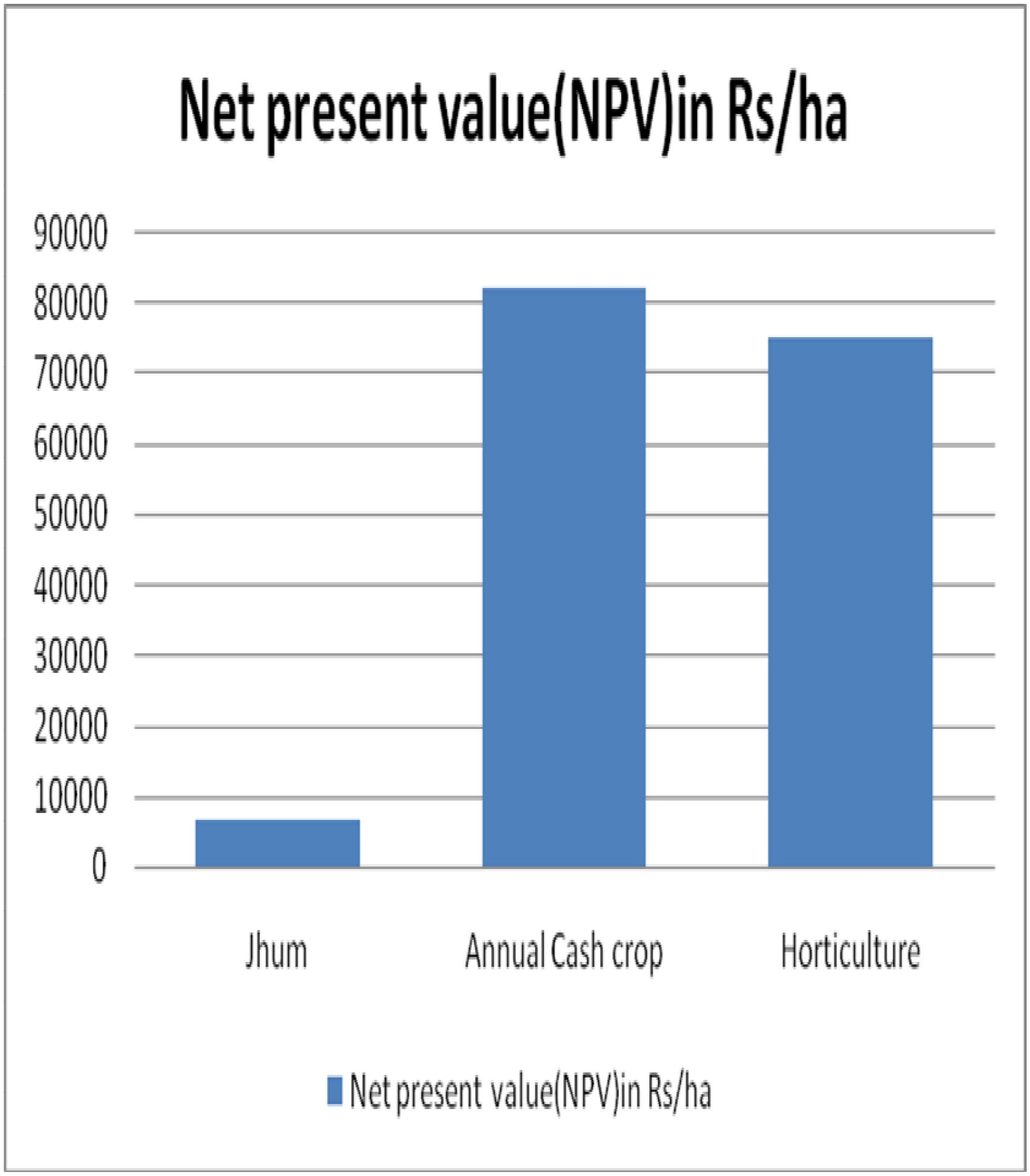

Figure 2: Financial performances of three land use systems NPV in (Rs./ ha)

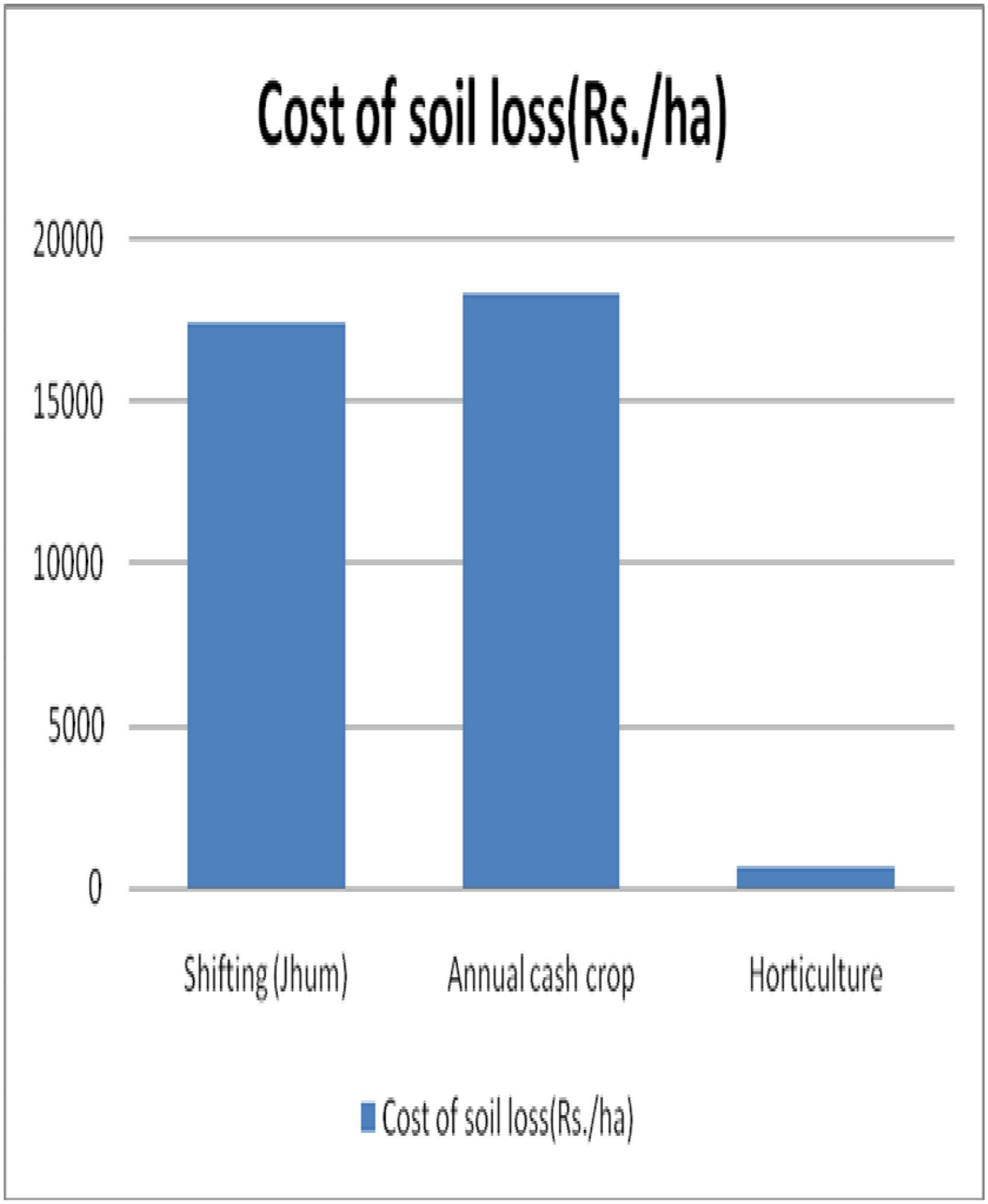

Fig 3: Cost of soil erosion under different land use systems.(Rs./ha)

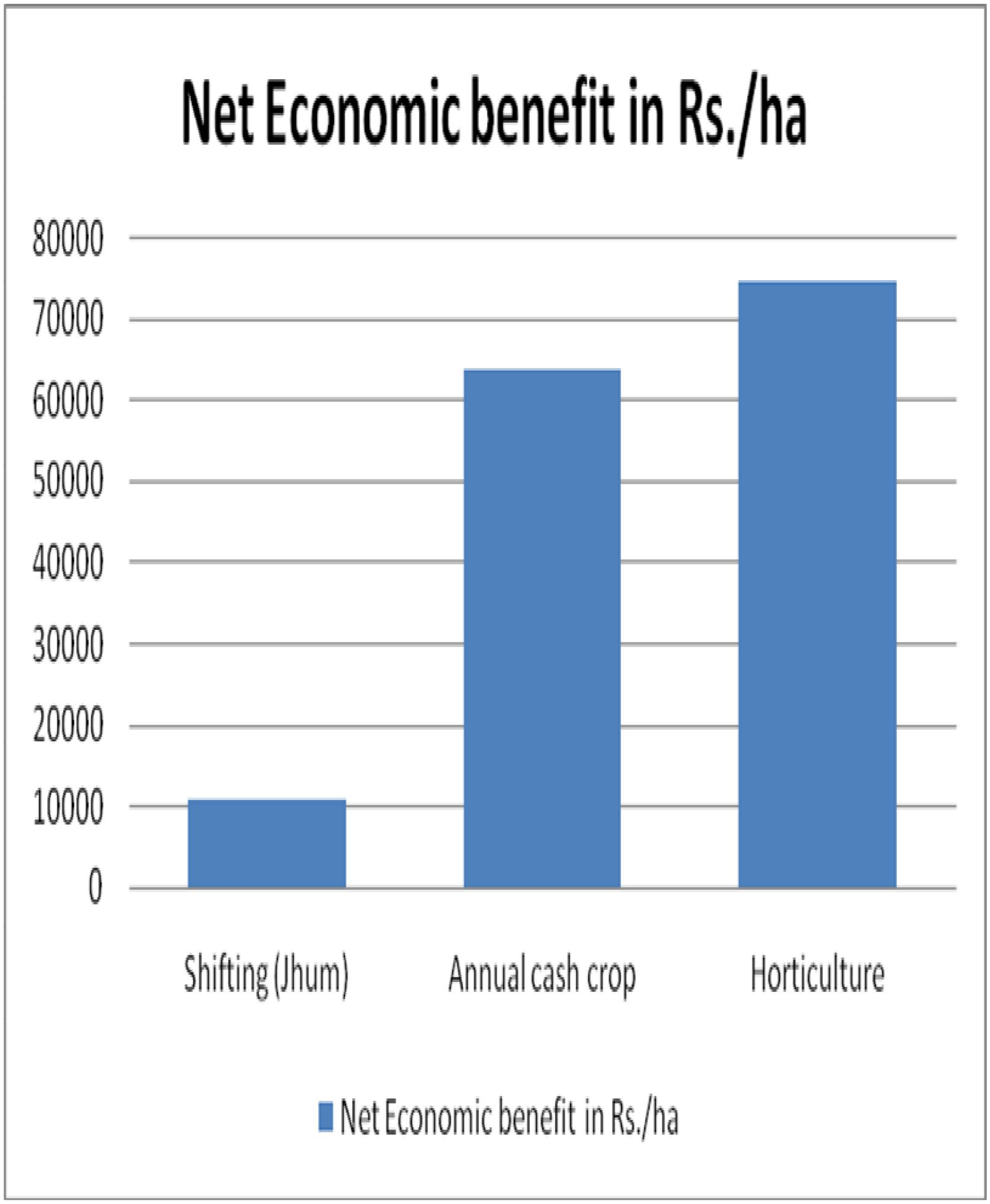

Fig 4: Economic performance of different land use systems.(Rs./ha)

Chapter VI

Summary and Conclusions

CHAPTER VI

SUMMARY AND CONCLUSIONS

Manipur is a small landlocked, hilly and mountainous state in the North Eastern India. It has 22327 sq. km of area, which constitutes 0.7 per cent of the total land surface of India. It is a hill girt state of which 90% of the area i.e. 2.05 lakhs ha are characterized by hilly regions surrounding a flat valley which constitute 10% of the area i.e. 0.64 lakhs ha of the total geographical area. Out of the total hill area of 2.05 lakhs ha, only 0.64 lakhs ha are cultivated area. It is approximately 3 per cent of the total land area. Whereas in the valley, out of the total land area of 1.84 lakhs ha, 0.87 lakhs ha are under rice cultivation. It is more than 47 per cent of the total area of the valley. The valley has an average altitude of 872 meters above MSL and the climate is subtropical and warm in the summer season. Manipur agriculture in general could be classified as shifting cultivation, Permanent agricultural systems and terrace cultivation. Permanent systems includes smallholder plantation which is multistrata arrangement, paddy systems, annual vegetable crop system and animal husbandry and fisheries

Jhuming (shifting cultivation) is an age-old practice in the hills of Manipur. Shifting cultivation, also known as ’slash-and-burn agriculture,’ ‘swidden’ or rotational bush fallow agriculture, and as ‘jhum’(Paamlou in Manipuri) cultivation in Northeast India is still being practiced in the Northeastern Hill Region (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura) and other parts of the country (Orissa, Andhra Pradesh, Madhya Pradesh, etc.).

The highest percentage of geographical area where shifting cultivation is practiced is recorded in Tamenglong and Churachandpur district (accounting for 45 per cent of the total area under jhum cultivation in the state). Much of the area under rice in the hills, and about 40 per cent of it in the state as a whole is under jhum cultivation. Therefore, the present course of study is based on rice. Rice being the staple crop, this is alarming and has serious food security implications. Shortage of rice of about 1.5 lakhs tones, every year is the major problem of Manipur because of the rising population on the fixed area of cultivable land (Ram N. Singh, 2003). Most of the areas under jhum have low productivity and are in remote and isolated parts of the state without proper transport facilities, resulting in serious shortages. But in areas near the plains, interaction with the plain people has resulted into stability and advancement in agriculture (Ingty and Goswami, 1979). This study has been planned to address these issues.

6.1 OBJECTIVES

The study was under taken with the following specific objectives:

- Assess the nature and extent of area of shifting cultivation under different crops with reference to relative advantages and disadvantages.
- Estimate the environmental benefits and damages of shifting cultivation, and
- Suggest policy measures on the basis of results emerging from the study of shifting cultivation.

6.2 METHODOLOGY

The present study was carried out in Manipur with special emphasis on Churachandpur to fulfill the stated objectives. The present study pertains to the agriculture year 2009 – 10. Random sampling techniques has been employed for selecting the sample. Relevant data from the farmer will be collected pertaining to land holding size, assets, costs and returns, etc. and secondary data was collected.

For evaluating the objectives of the current investigation the analytical techniques used are presented below. Simple tabular analysis were used for estimating cost of cultivation of different crops such as rice, ginger, colocasia, maize etc. Appropriate percentages were worked out for the purpose of comparison. Regression Analysis was carried out for identifying various factors influencing gross returns under different crops. To rank the problems faced by the farmers Garette ranking technique was used.

To estimate the environmental damages and benefits**,** environmental services such soil erosion, biodiversity and carbon sequestration were valuated following several previous studies. For Estimation of Returns to Land, net present value (NPV) was adopted to evaluate each land-use system. Benefit cost analysis was adopted to indicate the performance of each land use. Replacement-cost method was adopted for valuation of on soil erosion. Valuation of biodiversity services and carbon sequestration associated with each land-use system was estimated following previous studies and a proxy index of biodiversity was developed. Rates of previous studies use in similar land use system was adopted to rate the payment for managing/supplying of environmental services.

6.2 MAJOR FINDINGS OF THE STUDY

It was observed that only 11.5 per cent of the total respondents were illiterates. About 54.3 per cent of the farmers were having an average age of 50 – 70 years. Here, the average family size of the respondents is five constituting about

49 percent. Majority of the respondents i.e. 48 respondents which constituted 68.57 per cent were marginal farmers having an average size of holding of 0.9 ha. Total area cultivated by 70 shifting farmer families was 72.85 ha. Marginal farmer families have majority of the working members i.e., 148 members of working members which constituted 52.85 per cent of the total working members. Assets of shifting cultivators include only jhum hut and their farm implements with a value of Rs. 2723 and Rs. 1481 respectively. Majority of the respondent members i.e. 59.4 percent were having distance of jhum land of 0.1 – 0.5 km from settlement area.

Period of holding the crop is one year with an average of 5 – 7 years fallow. Field preparation was done from the month of December/January, sowing, planting, dibbling etc on May/June and harvesting on September/October. Shifting cultivation follows mixed cropping system of which rice which occupy 70 percent of the total cropped area. There exists a system of hereditary is Chief ship (Hausa) as well as community ownership of village land. It is observed that 30 members of the respondent accounting to 42.9 percent lease out land to Chief in kind i.e., 24kgs of rice for use of land. Jhuming (shifting cultivation) is an age-old practice in which majority of the respondent farmers continue shifting cultivation for the last 20 – 30 years accounting to 58.5 percent.

Mixed cropping was adopted in shifting cultivated region but with response from respondents the cost of cultivation and production of individual crops were built up. The study was taken up for four crops where 70 shifting families grows paddy, 46 families grows ginger, 21 families grows maize and 70 families grows colocasia.

In operation wise of cultivation of paddy land preparation components has occupy major component with 32.85 percent in total labour costs ie $1/3^{th}$ of the cost goes to land preparation only. Human labour accounts to major share in the cost of cultivation with 84.48 per cent in the total cost of cultivation. Of which 62.75 per cent i.e., Rs. 14723.14 of human labour are owned labour. Overall variable costs amounted to nearly. Rs 22735 (96.90 %) of the total cost of cultivation. Cost of cultivation of rice is Rs. 23393 giving negative net returns of Rs. – 1313.24. The yield and cost of production are 18.31 quintal/ha Rs 1278 respectively. The variables such as seed, labour were found to be positively significant and fallow period was found to be negatively significant in influencing gross returns.

Similarly in case of maize, land preparation components has occupied a major share with 37.30 per cent in total labour costs i.e. Rs. 6512.30 of the cost goes to land preparation only. Human labour accounts to major share in the cost of cultivation with 85.15 per cent in the total cost of cultivation. Of which 69.77 per cent i.e., Rs. 14320 of human labour are owned labour. Overall variable cost amounted to nearly Rs.19797.63 (96.46%) of the total cost of cultivation. The total cost of cultivation of maize is Rs. 20395 with a net return of Rs. 605 per hectare. The yield is 14 qt/ha with a cost of production worked out to Rs. 1457. The higher cost per quintal is mainly due to average yield. Therefore, there is every need to upgrade the technology. Only seed was found to be significantly influencing gross returns. It implies that improved varieties of maize need to be supplied and popularized.

Similar to other crops, land preparation has occupied major share with 36.49 per cent in total labour costs i.e., Rs. 6514.29 in ginger. Human labour accounts to major share in the cost of cultivation with 52.40 per cent in the total cost of cultivation. Owned labour accounts for 39.34 per cent i.e., Rs. 13393/ha. The average variable costs amounted to Rs. 33577 (98.64%) of the total cost of cultivation . The total cost of cultivation of ginger is Rs. 33288 with a net returns of Rs. 92712. The yield is 63 qt/ha with a production cost of Rs 528/qt. Seed, area, cultivated period were found to be significantly influencing gross returns.

The total cost of cultivation of Colocasia is Rs. 20794 with a net return of Rs. 74885. Human labour accounts to major share in the cost of cultivation with (84.50) per cent in the total cost of cultivation. Of which 66.09 per cent i.e., Rs. 12450 of human labour are owned labour. The productivity of colocasia is 95.68 qt/ha and the cost of production is as low as Rs 217. Area was found to be positively significant and fallow period and rent given for use of land were found to be negatively significant in influencing gross returns.

A comparision of Rice, maize, ginger and colocasia is made in terms of cost and returns. Allocating more area under annual cash crops such as colocasia and ginger have more advantages than growing of cereal crops such as paddy and maize in terms of relative profitability. In terms of environment sustainability growing of horticulture crops is beneficial.

6.3 Garrette Ranking

Shifting cultivation being the source of livelihood was the major reason for practising shifting cultivation by farmers. Major problem faced by farmers practising shifting cultivation was land preparation. Using of other forms of labour such as animal and machinery labour being difficult owing to its topography. Farmers mostly used family labour. Adopting subsidiary occupation and continuing jhum are the main future plans expressed by the farmers.

6.4 ESTIMATION OF ENVIRONMENTAL BENEFITS AND DAMAGES DUE TO SHIFTING CULTIVATION

Productivity comparision are made with respect to paddy and maize at district, State and National Level is done vis – a – vis with the selected farmers. Less productivity of paddy is observed at District level i.e., 1795.64 kg/ha than the survey area i.e., 1831.00 kg/ha. Productivity of maize in survey area is very low i.e., 1465.70 kg/ha as compared to district level i.e., 2851.31kg/ha. Less productivity may be due to several factors associated with land quality, loss of erosion, loss of soil fertility due to shifting cultivation besides low level of technology.

Farmer started adopting ginger cultivation as cash crop and pineapple as horticultural crops hence the environment cost and benefits with this changing system are compared with jhum system. The financial analysis (excluding environmental costs) to estimate the discounted costs and benefits of products produced under the three land-use systems demonstrates that the highest gross benefit (measured as Rs./ha/year) is realized from horticulture followed by annual cash as compared to shifting cultivation. The NPV is the common indicator of financial performance as it takes into account both costs and income of different activities (Tomich et al. 1998). In terms of NPV, annual cash crops appear to be the best performer followed by horticulture and shifting cultivation has the lowest NPV. Estimating the NPV incorporating the environmental cost assumes importance from the society point of view.

Replacement cost Approach was adopted to value soil erosion. Valuation of biodiversity and carbon sequestration was done by assuming market prices as well as the data published by scholars.

The alternative land use which is the most profitable performer obtained from financial analysis i.e., annual cash cropping lead to higher environmental costs such as soil erosion, forfeited carbon sequestration, and biodiversity loss. When the environmental costs are taken into account, annual cash crops appear to be the most costly land-use system, with horticulture becoming most profitable alternative. Shifting cultivation lies in between these two land use system.

6.5 CONCLUSIONS

The study concluded that shifting cultivation is an age old system with traditional and low level of technology resulting in low yields. The practice cannot be improved overnight but they can, however, be spontaneously modified with persuasion of the farmer to minimize the ecological ill effects. Increasing the area under cultivation contributes to better income to the shifting cultivators. But this is offset by labourious land preparation owing to the undulating topography. Most of the owned labour goes to preparation of land. Further, the land is under the ownership of Chief (Hausa) and communities. The village authorities manage community lands and resources, do the yearly planning and allocation of plots for shifting cultivation, design the rules and regulations, and often political power prevails in the decision making.

Shifting cultivation follows mixed cropping system of several crops grown together of which rice, maize, tuber crops, fruits and vegetable, legumes and other crops in the ratio of 70:7:12:6:3:2. This somehow helps in maintaining the soil rather than single annual cash crops. The higher financial benefits associated with annual cash crops, however, are offset by high environmental costs, specifically in terms of soil erosion, carbon emissions, and biodiversity loss, which are major social concerns. When environment services are taken into account horticulture is the most profitable form of land use. There is no market exists for environmental services. Farmers do not receive any monetary reward for engaging in the production of positive environmental services and so they do not take into account these services when making land-use decisions. It is, therefore, important to create a market for environmental services or to develop mechanisms that compensate land users for them.

6.7 POLICY IMPLICATIONS EMERGING FROM THE STUDIES

The commercial agriculture and the Green Revolution could not touch the NE region. This was mainly due to the region's inaccessibility. Keeping this in mind, we should refocus our strategy. Awareness on modern agriculture from primitive stages has to be created through various programmes. It should be technologically feasible, sociologically acceptable, ecologically sound and economically viable without which the sustainable use of resources is unlikely to occur. The following policy implications that emerged from the study are discussed.

Involve local people in decision-making processes. Sustainable land use and management require the participation of the people who directly depend on those resources. The available technologies are not properly exploited to the advantages of tribal people in hill areas. Awareness should be raised among policy makers and the general public on how to see things from the perspective of people with a different culture than the mainstream.

Understand farmers' livelihood needs. On average, jhum produced alone is not sufficient to meet their needs. Farmers have to depend on bamboo, trees and non-timber forest products for survival. Added to low levels of productivity of shifting cultivation, large area of forest are cleared for shifting cultivation through deforestation activities on a continuing basis, which in turn leads to loss of top soil to the extent of more than 150 t/ha. Radical changes in this regard is required in providing infrastructural facilities, which requires greater attention from the government.

It is necessary to reform the credit policy as most of the farmers are marginal and small with no assets. Alternative land use requires substantial investment. Moreover, the bank requires collateral before giving credit, something which most hill tribes cannot supply without permanent land titles. A new policy is needed which would provide both short-term and long-term credit for all types of agricultural enterprises Such a policy would remove farmers' capital constraints and enable them to afford the initial investments and the operational costs of crop cultivation and its alternative land use. Credit should be provided to farmers without land certificates on the basis of a group guarantee.

An appropriate mechanism should be developed to compensate farmers for the environmental services that their practices generate. If such mechanisms are not developed farmers in the Churachandpur region (as well as in other mountainous areas of developing countries) are likely to continue to respond to the existing financial incentives and perpetuate unsustainable land-use practices. Awareness of environmental problems should also be incorporated to the farmer cultivator through extension activities such as Transfer of Technology(TOT), KVKs etc apart from the state Agriculture department.

While some environmental services are site specific, others such as carbon sequestration and biodiversity protection are public goods. Government should develop appropriate mechanisms to provide remuneration to land users for more sustainable practices following the conservation programs developed elsewhere.

Financial incentives alone may not be enough to motivate farmers to move from annual crops to perennial crops due to the long phase-in period and the relatively high initial investment costs as most of the farmers are at subsistence level. Necessary support services, including long-term credit, knowledge transfer, and information on the adoption of perennial crops may need to be provided, as the returns from horticulture and other alternative land use only come after some years.

To sum up, property rights to the land must be granted urgently to shift away from shifting cultivation. Transfer of Technology through various extension activities need to be strengthened. Further, input delivery system must be developed with appropriate incentives as extended to other states. This in turn helps to transfer the new technology and the productivity of various crops. Horticulture need to be developed on a large scale. The horticulture based cropping system such as pineapple with silviculture must be given greater support not only to improve incomes but also protect soil and enables to utilize water resources most efficiently. All this happens only if new institutional arrangement is made to solve the specific problems in hill areas.

LITERATURE CITED

A Balu and D' Silva (1979) Socio – economic analysis of existing farming systems and practices in Northern Nigeria. Proceedings of International Workshop on socio – economic constraints to development of semi – arid topical agriculture, Hyderabad, India. 19 – 29 Feb.

Agarwal A K (1985) North – East India (An Economic Perspective). Chugh Publications, Allahabad. p 119.

Agus Fahmuddin and Manikmas M Oka A (2003) Environmental roles of agriculture in Indonesia**:** Presented in Roles of Agriculture in Development Symposium at the 25th Conference of the International Association of Agricultural Economists, in Durban, South Africa, August 17-22.

Alfsen K and Franco M (1996) The cost of soil erosion in Nicaragua. Ecological Economics16 (2): pp 129–145.

Angelsen Arild (1995) Shifting cultivation and "deforestation": A study from Indonesia: World Development. 23 (10). pp 1713-1729.

Anonymous (2008 – 09) Economic Survey of Manipur. Directorate of Economics and Statistics, Government of Manipur, India.

Anonymous (2009) Shifting Cultivation and Climate Change: Briefing Paper UNFCCC Intersessional Meeting, Bangkok.(http:// www.ikap-mmsea.org / documents/ shiftcult.pdf)

Anonymous (2007) Statistical Abstract of Manipur. Directorate of Economics and Statistics, Government of Manipur, India.

Anonymous (2007) Statistical Handbook of Churachandpur. Department of Statistics, Government of Manipur, India.

Borggaard O K, Abdul Gafur and Petersen L (2003) Sustainability appraisal of shifting cultivation in the Chittagong Hill Tracts of Bangladesh. Ambio. 32 (2): pp 118-123.

Borthakur D N (1992). Agriculture of the North - Eastern Region. Bee Cee Prakashan, Guwahati (Assam), India.

Borthakur D N, Prasad R N, Ghosh S P, Singh A, Awasthi R P, Rai R N, Verma A, Datta H H, Sachan J N and Singh M D (1979) Agro – forestry as an alternative to shifting cultivation. Paper presented at the National Seminar on Agro – forestry held at Imphal 16 – 18 May. pp 109 – 131.

Bose S (1980) Development and change in area under shifting cultivation. Shifting cultivation in North – East India. North – East India Council for Social Science Research, Shillong. p 122.

Brajakumar (2009) Jhum: Main cause of weather change in Manipur. (http://zolengthe.net/2009/07/19/jhum-main-cause-of-weather-change-in-m'pur/)

Burman R and Sharma P S (1970) Land and people involved: pp 32 – 37 in Sachidananda Shifting cultivation in India: Concept Publishing Company, New Delhi.

Chutia T R (1977) A study of the socio – economic Aspects of Jhum, Shifting cultivation in the Siang District of Arunachal Pradesh, Unpublished M. Sc. (Ag.) Thesis. Acharya N. G. Ranga Agricultural University, Hyderabad.

Chowdhury M (2001) Minimization of Soil Loss, Fertility Development and Upliftment of Farmer's Economy in the Hilly Region. Bangladesh Agriculture Research Council Report. Joydevpur, Dhaka: Hill Tract Agriculture Research Station, Ramgarh Bangladesh Agriculture Research Institute.

Datta H H and Sharma B S (1979) Studies on costs and return analysis of major crops in hilly areas of North – Eastern Region, Division of Agricultural Economics, Annual Reports of ICAR Research Complex for N. E. H. Region, Shillong.

Dalle, S P, Blois and S de (2006) Shorter fallow cycles affect the availability of noncrop plant resources in a shifting cultivation system: Ecology and Society 11: 2, article 2.

Das D (2006) Demystifying the Myth of Shifting Cultivation, Agronomy in the North – East: Economic and Political Weekly November 25, pp 4912 – 4917.

Datta B B (1986) Land Use Pattern in North – East India: Gagan publishers. pp 55 – 63.

D C Kaith (1958) Land and people involved: pp 20 – 31 in Sachidananda Shifting cultivation in India: Concept Publishing Company, New Delhi.

Dubey S N (1978) North East India (A Sociological Study), Concept Publishing Company. New Delhi. p – 336.

Dobermann A and Fairhurst T (2000) Rice: nutrient disorders & nutrient management. Potash and Phosphate Institute (PPI), Potash and Phosphate Institute of Canada (PPIC), International Rice Research Institute (IRRI): pp 169 – 170.

Edwin Verrier (1960) A philosophy for NEFA. Published by the adviser to the Govornor of Assam, Shillong. pp 130 – 131.

Engel S, Pagiola S and Wunder S (2007) Designing payments for environmental services in Theory and practice: An overview of the issues. Ecological Economics 65(4): pp 663 –674.

Fischer A and Vasseur L (2000) The crisis in shifting cultivation practices and the promise of agroforestry: a review of the Panamanian experience. Biodiversity and Conservation. 9(6): pp 739-756.

Frithjof Kuhnen, (1982) Man and land: An introduction to the problems of agrarian structure and agrarian reform: Verlag breitenbach Publishers. pp 23 – 25.

Gafur A (2001) Effects of Shifting Cultivation on Soil Properties, erosion, Nutrient Depletion and Hydrological Responses in Small Watershed of the Chittagong Hill Tracts of Bangladesh. Doctoral thesis, The Royal Veterinary and Agricultural University, Copenhagen,

Ganguli J B (1968) Economic problems of the jhumias of Tripura (A socio – economic study of the System of Shifting Cultivation of Transitition) Bookland Private Ltd., 1, Shanker Gosh Lane, Calcutta – 6: pp 6 – 31.

Ghosh S P (1976) Development of suitable planting technique of pineapple in hill slope. Annual Report of ICAR Research Complex for NEH Region, Shillong.

Goswami P C (1971) Status Paper on Shifting Cultivation and Soil Conservation in North – East India.

Guha A (1973) Geography Behind History, North Eastern Affairs, Vol 2. p 1.

IJAE (1979) Rappoteur's Report on Farming System in Hill areas – summaries of Group discussion. Indian Journal of Agricultural Economics 34 (1): pp 19 – 21.

Ingty P S (1981) Soil conservation Forestry. North Eastern Regional Seminar on Productivity in Forestry Operations. National Productivity Council, Guwahati.

Ingty P S and Goswami N (1979) Shifting Cultivation in North Eastern Hills – An Approach to the Solution of Problem: Proceedings of Agro – forestry seminar held at Imphal, 16 – 18 May. Indian Council of Agricultural Research (ICAR).

Jehagirdar M P (1986) Problems of Rural Development in North – Eastern Region. Kurukshetra, May 1986, XXXIV(8). pp 30 – 32.

Kerkhoff Elisabeth and Sharma Eklabya (2006) Debating shifting cultivation in the Eastern Himalayas: Farmers' innovations as lessons for policy: International Centre for Integrated Mountain Development (ICIMOD). http://books.icimod.org

Mahapatra P and Patnaik B (1985) Rice soil and their management: Indian Journal of Agronomy. 30 (1) 1985 XXIII.

Majumdar, D N (1976) Shifting cultivation. Is it a way of life? An Analysis of Garo data. Shifting cultivation in North – East India. North – East India for Social Science Research, Shillong. pp 14 – 18.

Majumdar P S (1971) Plant programmes of Hill Development in North – Eastern India. Indian Farming 30 (5): pp 5 – 9.

Malabika Das Gupta and Asis Banerjee (1983) Jhuming as the way of life of Jhumias. An analysis of data from Tripura. Journal of North East India Council for Social Science Research, Shillong, April 1983. p 21.

Maikhuri and Ramakrishnan (1990) PS Ramakrishnan op.cit. pp 14 – 18.

Mishra and Ramakrishnan (1983) in Ramakrishnan P S (1993): Shifting Agriculture and Sustainable Development. Man and the Biosphere Series, 10. Paris/ New Delhi: UNESCO/Oxford University Press. pp 29 – 30

Mukerjee R K (1975) Some special constraints to Agricultural Development in North – East India, North Eastern Affairs, Annual Issue. p 45.

Muller D and Zeller M (2002) Land use dynamics in the central highlands of Vietnam: a spatial model combining village survey data with satellite imagery interpretation. Agricultural Economics. 27 (3), pp 333-354.

Myers (1980) in Ramakrishnan P S (1993): Shifting Agriculture and Sustainable Development. Man and the Biosphere Series, 10. Paris/ New Delhi: UNESCO/Oxford University Press. p 2.

Nath T K, Inoue M and Chakma S (2005) Shifting cultivation (*jhum*) in the Chittagong Hill Tracts, Bangladesh: examining its sustainability, rural livelihood and policy implications: International Journal of Agricultural Sustainability. 3 (2): pp 130-142. 43 ref.

Nounamo L and Yemefack, M (2001) Farming systems in the evergreen forest of Southern Cameroon: shifting cultivation and soil degradation. Tropenbos-Cameroon Documents. 8(xi) + 62: pp.

Pagiola S, Agostini P, Gobbi J, Hann C, Ibrahim M, Murgueitio E, Ramerez E, Rosales M and Ruíz J (2004) Paying for Biodiversity Conservation Services in Agricultural Landscapes. Environmental Economics Paper 96. Washington, DC: World Bank. http:// 129.3.20.41/ eps/othr/ papers/ 0405/ 0405005.pdf.

Pascual U (2005) Land use intensification potential in slash-and-burn farming through improvements in technical efficiency. Ecological Economics. 52 (4), pp – 497-511.

Paul M and Paul P P (2009) Beneficial effects of shifting cultivation (jhum): Current Science. 96(1): p 10.

Paul V I (2008) Shifting cultivation: a means of subsistence among the *Naga* tribes of India and the associated environmental impacts. Journal of Experimental Zoology, India. 11(2): pp – 325-330. 35 ref.

Rahman S A, Rahman M F, Codilan A L and Farhana K M (2007) Analysis of the economic benefits from systematic improvements to shifting cultivation and its evolution towards stable continuous agro forestry in the upland of Eastern Bangladesh: International Forestry Review. 9(1): pp 536-547.

Rai R N (1984) Jhum Control Efforts in North – Eastern Hill Region. A Review. Proceeding of Seminar on Socio – economic Aspects in Soil Conservation Activities with Special Reference to North – Eastern Region, Soil Conservation Department, Government of Meghalaya, Shillong: pp 70 – 76.

Ramakrishnan P S (1993): Shifting Agriculture and Sustainable Development. Man and the Biosphere Series, 10. Paris/ New Delhi: UNESCO/Oxford University Press. pp 39-42.

Ramakrishnan P S, Saxena K G, Patnaik S and Singh S (2003) Innovations in shifting cultivation, land use and land cover change in higher elevations of Meghalaya, India. Methodological issues in mountain research: a socio-ecological systems approach. Oxford & IBH Publishing Co. Pvt. Ltd. pp 163-175.

Rasul G and Thapa G B (2003) Shifting cultivation in the mountains of South and Southeast Asia: Regional patterns and factors influencing the change: Land Degradation & Development. 14(5). pp 495-508.

Rasul G (2005) State Policies And Land Use In The Chittagong Hill Tracts Of Bangladesh. The Gatekeeper Series 119: International Institute for Environment and Development (IIED). Russell Press, Nottingham, UK. pp 1 – 22.

Rasul G and Thapa G B (2007) The Impact of Policy and Institutional Environment on Costs and Benefits of Sustainable Agricultural Land Uses: The Case of the Chittagong Hill Tracts, Bangladesh: Environmental Management 40(2). pp 272 – 283.

Rasul G (2009) Valuing Ecosystem Services for Promoting Sustainable Agricultural Land Use Systems in Hills and Mountains: Forthcoming Journal of Sustainability Science: Practice and Policy. (http:// ejournal.nbii.org/ archives / progress.html)

Rasul G, Thapa G B and Zoebisch M A (2004) Determinants of land-use changes in the Chittagong Hill Tracts of Bangladesh: Applied Geography.24 (3): pp 217-240.

Sachidananda (1983) Shifting cultivation in India: Concept Publishing Company, New Delhi: pp 3 – 5.

Saha N (1973) The Economics of Shifting cultivation in North – East India: Adhoc Study No. 22: Agro Economic Research Centre for NEH, India, Assam Agricultural University.

Saikia R and Das L (1998) Tribal women in agriculture: a study on involvement of Karbi women in *jhum* cultivation and their perceived drudgery in performance of farm operations. Indian Journal of Hill Farming. 11 (1/2), pp 13-18.

Salzer W (1993) Eco-economic Assessment of Agricultural Extension Recommendations for Shifting Cultivators in Northern Thailand. Unpublished Doctoral Dissertation. Department of Geography. University of Hohenheim, Stuttgart, Germany.

Satapathy K K and Sarma B K (2003) Shifting cultivation control programmes and trends of their adoption: some action oriented studies. Indian Journal of Hill Farming. 16 (1/2): pp 9-16.

Southgate D F, Hitzhusen and R Macgregor (1984) Remedying Third World Soil Erosion Problems. American Journal of Agricultural Economics 66: pp 879 – 884.

Singh A and Singh M D (1978) Effect of various stages of Shifting Cultivation on soil erosion from steep hill slopes. Indian Forester. 106(2): pp 115 – 121.

Singh G B and Singh A (1980) Shifting cultivation in North – Eastern Region, Indian Farming. Jan. pp 17 – 38.

Singh A and Singh M D (1981) Soil erosion hazards in North Eastern Hill region. Research bulletin No.10.ICAR Complex, Shillong.

Singh J, Borah I P, Barua A,and Barua K N (1996) Shifting Cultivation In North-East India- An Overview. Divn. of Shifting Cultivation. (http://rfri.icfre.gov.in/rpap23.htm)

Singh N R (2003)http://www.ncap.res.in/upload_files/workshop/wsp10/html/chap... "Shifting Cultivation Practices in Manipur".

Singh S B (2001) Valuation of soil erosion effects in bench terrace, Puertorican terrace and shifting cultivation systems in Meghalaya State: Indian Journal of Agricultural Economics.56(3): pp 335-345.

Sharma B D (1984) Shifting cultivators and their development. Journal of Social Sciences and Humanities, North Eastern Hill University, Shillong. 2(1): pp 1 – 30.

Stephen Tyler (1974) Field are for planting, Swidden Agriculture among the Koyas of South India. Journal of the Indian Anthropological Society. 9(1): pp 17 – 38.

Tawnenga, Uma Shankar, Uma and Tripathi R S (1996) Evaluating second year cropping on jhum fallows in Mizoram, north-eastern India: Soil fertility: Journal of Biosciences 21: pp 563–575.

Thimmappa K and Mahesh K (2006) Conservation farming as an alternative to shifting cultivation in Meghalaya: An economic evaluation: Indian Journal of Agricultural Economics. 61(3): pp 297-304.

Thingbaijam Dhamen (2009) Jhum cultivation major culprit behind extreme environment changes in state.

Thomas P Tomich, Meine van Noordwijk, Stephen A Vosti and Julie Witcover (1998) Agricultural development with rainforest conservation: methods for seeking best bet alternatives to slash-and-burn, with applications to Brazil and Indonesia: Agricultural Economics 19(1-2): pp 159-174.

Toky and Ramakrishnan P S (1981). Cropping and yields in agricultural systems of the north-eastern hill region of India. Agro-Ecosystems 7: pp. 11-25 in P.S. Ramakrishnan. Shifting Cultivation and Sustainable Development. Man and the Biosphere Series, Vol. 10. 1993. Paris/New Delhi: UNESCO/Oxford University Press.

Tripathy (1974) Agricultural Problems in Tribal Areas, Perspective on Tribal Development and Administration, National Institute of Community Development, Hyderabad.

Tripura P (2000) From Jhumia to Jumma: A history of colonial transformation of Jhumia in Chittagong Hill Tracts: A Journal of Anthropology 5. pp 114-134.

Uriarte M, Schneider L and Rudel T K (2010) Untangling a decline in tropical forest resilience: constraints on the sustainability of shifting cultivation across the globe. Biotropica. 42 (1), pp – 21-30. many ref.

Ya T and Tulachan P M (2003) Managing marginalisation in shifting cultivation areas of north-east India: Community innovations and initiatives. Mountain agriculture in the Hindu Kush-Himalayan region: Proceedings of an International Symposium held in Kathmandu, Nepal on 21-24 May, 2001. pp – 207-211. International Centre for Integrated Mountain Development (ICIMOD).

Yadav R K, Yadav D S, Rai N and Sanwal S K (2006) Soil and water conservation through horticultural intervention in hilly areas. ENVIS Bulletin Vol 14(1): Himalayan Ecology: pp 1- 9.

Zbinden S and Lee D (2005) Paying for environmental services: an analysis of participation in Costa Rica's PSA Program. World Development 33(2): pp 255–272.

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Literature Cited