A SOCIOECONOMIC ANALYSIS OF JOINT VENTURE SMALLHOLDER PRIVATE TREEFARM – AGROFORESTRY PRACTICES BY FARMERS IN KUDAT



PERPUSTAKAAN

SCHOOL OF INTERNATIONAL TROPICAL FORESTRY UNIVERSITY MALAYSIA SABAH 2005

PUMS 99:1

UNIVERSITI MALAYSIA SABAH

BORANG PENGESAHAN TESIS		
JUDUL :		
IJAZAH :		
SAYA :	SESI PENGAJIAN :	
(HURUF BESAR)		
Mengaku membenarkan tesis *(LPSM/ Sabah dengan syarat-syarat kegunaan s	'Sarjana/Doktor Falsafah) ini disimpan di Perpustakaan Universiti Malaysia seperti berikut:-	
 Tesis adalah hak milik Universit Perpustakaan Universiti Malays Perpustakaan dibenarkan mem tinggi. Sila tandakan (/) SULIT (Menga seperti 	i Malaysia Sabah. sia Sabah dibenarkan membuat salinan untuk tujuan pengajian sahaja. nbuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian andungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia yang termaktub di AKTA RAHSIA RASMI 1972)	
IERHAD (Menga	andungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di penyelidikan dijalankan)	
TIDAK TERHAD	Disahkan oleh:	
(TANDATANGAN PENULIS) Alamat Tetap:	(TANDATANGAN PUSTAKAWAN)	
TARIKH:	(NAMA PENYELIA) TARIKH:	
Catatan: *Potong yang tidak berkenaan. *Jika tesis ini SULIT dan TERHAD, si menyatakan sekali sebab dan temp *Tesis dimaksudkan sebagai tesis b bagi pengajian secara kerja kursus	la lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan ooh tesis ini perlu dikelaskan sebagai SULIT dan TERHAD. agi Ijazah Doktor Falsafah dan Sarjana Secara Penyelidikan atau disertai dan Laporan Projek Sarjana Muda (LPSM).	

DECLARATION

The materials in this thesis are original except for quotations, excerpts, summaries and references, which have been duly acknowledged.



ROSLAN ABDILLAH PS 2002-010(K)-528

27th. JUN, 2005

ACKNOWLEDGEMENT

Alhamdulillah, praise goes to merciful and graceful Allah Almighty for I am blessed with strength and ardor to finally accomplish this project. Amen.

My utmost gratitude goes to my supervisor, Professor Dr. Aminuddin Mohamed for his supervision, guidance, and encouragement, have made the endeavor possible.

This thesis would never have been written without the help of a number of government agencies especially to SAFODA and individuals who have provided immense valuable information and cooperation. For great assistance and time spent during data gathering and not forgetting, Mr. Vun Phau Aumansai, who had done a great job in data collection.

I wish to thank first of all the 40 landholders who took the trouble to respond to my questionnaire.

I wish to convey a heartfelt thank to Forestry Department Negeri Sabah for providing the financial support and opportunity to do my study at UMS.

I also wish to express my sincere gratitude to my post graduate room-mate, and all my teachers who constantly provided moral support and guidance, and just as much as I wish to name everybody, the thoughts remain as boundless in my heart.

Last but not least, deepest indebtedness is due to my beloved family who has been very supportive and patient throughout the course of my study in UMS.

ABSTRAK

ANALISA SOSIOEKONOMI BERHUBUNG USAHASAMA DALAM PERUSAHAAN LADANG KAYU PERSENDIRIAN – AMALAN AGROPERHUTANAN OLEH PELADANG DI KUDAT

Pengkajian berhubung kesedaran dan penerapan inovasi agroperhutanan dikalangan para peladang kayu persendirian secara usahasama dengan kerajaan telah diusahakan di daerah Kudat, di Utara Negeri Sabah. Projek Usahasama ladang kayu persendirian telah diperkenalkan oleh SAFODA kepada para peladang di Kudat untuk mengatasi masalah ketidak suburan tanah dan kemiskinan di kawasan luar gandar. SAFODA akan memperuntukan bekalan bibit, nasihat teknikal, dan juga menjanjikan khidmat pasaran yang tetap dan harga yang berpatutan. Jenis kayu yang ditanam ialah Acacia mangium, dimana pertumbuhan (MAI) di Sabah boleh mencapai 28-44 meter padu sehektar setahun. Penglibatan peladang dalam usahasama perladangan kayu persendirian dijangka memberi banyak manafaat kepada peladang khasnya dan masyarakat amnya. Walau bagaimanpun, kejayaan projek ini memerlukan pengorbanan dan penglibatan banyak pihak khususnya para peladang dan juga komitment tinggi kerajaan. Dalam soalselidik ini seramai 40 orang responden telah ditemurama berhubung kesederan, penerapan dan penyertaan peladang dalam projek usahasama ladang kayu persendirian. Kepentingan bantuan kerajaan yang mempengaruhi penerapan dimasa hadapan juga diterokai. Sejumlah besar daripada responden sedar akan faedah inovasi agroforestry disemua tahap pendidikan yang diperolehi oleh peladang. Diuji dari sudut kewangan, biologikal, dan kesesuaian institutsi, samada peladang sepenuh masa atau separuh masa, factor utama penceburan peladang dalam projek usahasama ladang kayu persendirian, adalah untuk masa depan anak-anak dan untuk mencari keuntungan. Kajian ini juga mendapati bahawa bantuan kerajaan adalah sangat diperlukan dimana sekiraraya bantuan dihentikan maka penyertaan dan penerapan juga akan turut terhenti. Memperkukuhkan keupayaan pengembangan dalam pengetahuan perladangan kayu, bantuan teknikal, dan bantuan kewangan akan menjamin penerapan masa depan. Bagaimana pun, mengenal pasti masalah-masalah awal dan keperluan para peladang adalah diantara rekomendasi yang dicadangkan dalam kajian ini.

ABSTRACT

A SOCIOECONOMIC ANALYSIS OF JOINT VENTURE SMALLHOLDER PRIVATE TREEFARM – AGROFORESTRY PRACTICES BY FARMERS IN KUDAT

A study to assess farmer's awareness and adoption of tree farming as an agroforestry innovation in joint venture smallholder private treefarming (JV SPTF) was conducted in the district of Kudat, Sabah. The JV SPTF was introduced by SAFODA to the farmers in Kudat to help them to overcome the problems of environmental degradation and poverty in the rural area. SAFODA would provide planting stock and technical advice, and would assure a market for the output at a quaranteed agreed price. The trees planted were Acacia mangium, whereby in Sabah the MAI can reach up to 28-44 cubic meters per hectare per year. The JV SPTF project can provide many benefits to society at large, nevertheless, adoption of JV SPTF will come at a price that is, through political will and the action of many individual farmers. In a survey, a total of 40 farmers were interviewed using a structured questionnaire which focused on awareness, adoption and participation of farmers in JV SPTF project. The importance of government assistance which would limit farmer's future adoption was also explored. Majority of the respondents were found to be aware of the concept and benefits of the innovation at all level of farmer's education. The main cause driving the farmers to adopt JV SPTF is children future, and higher profit regardless of full-time or part-time farmer, as examined from the standpoints of financial, biological, and institutional viability of the project. The study also found out that expectation of government assistance is such that, without subsidies of some kind, villagers often will not participate, and when subsidies end, so does participation. Strengthening extension education on tree farming, technical assistance, and financial support can encourage future adoption of tree farming. However, these programs must clearly define the problem and address the concerns and needs of the farmers, are among the recommendations given in this study.

CONTENTS

ii
iv
v
vi
viii
ix
x

CHAPTER 1 INTRODUCTION

1.1.	Background	1
1.2	SAFODA initiatives	2
1.3	Smallholder Private Treefarm	3
1.4	Problem statement	4
1.5	Justification of Study	7
1.6	Objectives of Study	8

CHAPTER 2 LITERATURE REVIEW

2.1	Introduction	10
2.2	What is Agroforestry?	11
2.3	Tree farming: Agroforestry practice	12
2.4	Functions of tree in agroforestry	15
2.5	Adoption of agroforestry technologies	17
2.6	JV scheme potential contribution to adoption	21
2.7	Advantages	24
2.8	Potential problems	26
2.9	Precondition for successful JV	27
2.10	Government Policy	28
2.11	Conclusion	32

Page

CHAPTER 3 METHODOLOGY

3.1	Background	34
3.2	Description of Study Area	34
3.3	Selection of study site	39
3.4	Data collection	41
3.5	Data Analysis	44
CHAPTER	4 RESULTS	
4.1	Evaluation of farmer's awareness and understanding on the issue of agroforestry with respect to tree farming	45
4.2	Evaluation of the factors which influenced the farmers in Kudat to adopt tree farming, an agroforestry practices offered by SAFODA	50
4.3	Factors limiting the adoption of Smallholder Private Treefarm in Kudat	55
CHAPTER	5 DISCUSSION	
5.1	Farmer's awareness and understanding on the issue of agroforestry with respect to tree farming	65
5.2	Factors which influenced the farmers in Kudat to adopt tree farming, an agroforestry practices offered by SAFODA	70
5.3	Factors which influenced the farmers in Kudat to adopt tree farming, an agroforestry practices offered by SAFODA	75
CHAPTER	6 CONCLUSION AND RECOMMENDATIONS	
6.1	Conclusions	81
6.2	Recommendations	83
REFERENC	CES	87
APPENDIC	ES	

APPENDIX A	Questionnaire	93
APPENDIX B	Borang-Borang SAFODA	99

LIST OF TABLES

Page

Table	3.1.	Monthly mean Precipitation in millimeter for the period of five years from 1999 to 2003, recorded at M.S. Kudat Airport	35
Table	3.2.	Agricultural crops grown in the district of Kudat for 1980, 1998, and 2002	37
Table	3.3.	Hectarage of Forest Reserves and State Lands in Kudat as compared to the whole State	38
Table	3.4.	Volume of Log production from Kudat in 1996, 1998, and 2001 which shows a decreasing rate.	39
Table	4.1.	Perception of household economic benefits, by the level of household education.	48
Table	4.2.	Perception of household social benefits, by the level of household education.	48
Table	4.3.	Perception of household environmental benefits, by the level of household education.	48
Table	4.4.	Chi-Square Test	49
Table	4 5	Crosstabulation of farmer's occupation against farmer's age	51
Table	4.6.	Crosstabulation of farmer's occupation against farmer's income from Acacia harvest	52
Table	4.7.	Crosstabulation of farmer's occupation against farmer's level of education.	52
Table	4.8.	Crosstabulation of farmer's occupation against size of land the farmer had planted with Acacia.	52
Table	4.9.	Crosstabulation of farmer's occupation against slope of the land	53
Table	4.10.	Crosstabulation of farmer's occupation against the level of visit by SAFODA extension officers.	53
Table	4.11.	Crosstabulation of farmer's occupation against the quality of advice rendered.	53
Table	4.12.	Crosstabulation of farmer's occupation against level of farmer's tree farming training.	54
Table	4.13.	Chi-Square Test	54
Table	4.14.	Perception of needs of planting material by type of farmers.	56
Table	4.15	Perception of needs of technical advice by type of farmers	57
Table	4 16	Perception of needs of marketing assistance by type of farmers	57
Table	4 17	Chi-Square Test	50
Table	7.17. / 10	Chi-Square rest	50
Iable	4.10.	Farmer's decision on ruture adoption of tree farming if free	59
		seedling to be continued, by type of farmers.	
Table	4.19.	advice to be continued, by type of farmers.	59
Table	4.20.	Farmer's decision on future adoption of tree farming if market assistance to be continued, by type of farmers.	59
Table	4.21.	Farmer's decision on future adoption of tree farming if free seedling is to be terminated, by type of farmers.	60
Table	4.22.	Farmer's decision on future adoption of tree farming if technical advice is to be terminated, by type of farmers.	60
Table	4.23.	Farmer's decision on future adoption of tree farming if marketing assistance is not guarantee, by type of farmers	60
Table	4.24	Chi-Square Test	62

LIST OF FIGURES

Figure 1.1.	Joint venture framework	24
Figure 3.1.	Map of Kudat	40
Figure 4.1.	Level of education of household head	46
Figure 4.2.	Results of crosstabulation of all agroforestry awareness factors against the level of education of the household heads	47
Figure 4.3.	Type of farmers versus adoption	51
Figure 4.4.	Type of farmers versus perception of needs	56
Figure 4.5.	Results of crosstabulation of perception of needs (the three government assistance) by type of farmers in Kudat	58
Figure 4.6.	Results of crosstabulation of response of full-time and part- time farmers against the decision of continuing the government assistance	61
Figure 4.7.	Results of crosstabulation of response of full-time and part- time farmers against the decision of terminating the government assistance	62

Page

LIST OF ABBREVIATIONS

AF	Agroforestry
JV SPTF	Joint venture smallholder private tree farm
GO	Governmental Organization
MAI	Mean Annual Increment
MAS	Malaysian Airline System
NGO	Non Governmental Organization
SAFODA	Sabah Forest Development Authority



CHAPTER 1

INTRODUCTION

1.1. Background

In the northern part of Sabah in the district of Kudat (Figure 3.1), the development of Joint Venture Smallholder Private Tree Farm (JV SPTF) challenges the dominance of the Rungus agricultural systems. For centuries, the livelihoods of Rungus have been based on shifting cultivation, including upland rice production, and fallow management with tree crop gardens. This land management system was once sustainable but is now facing serious problems connected to land scarcity, which result in a shortening of fallow periods, rapid soil degradation and modification of the vegetation. Other factors accelerating these land pressures are the state economic and political development strategies that have favored large-scale forest and estate crop plantations.

Development of JV SPTF with fast-growing trees, especially on degraded lands is a method to rapidly and inexpensively diffuse agroforestry practices among rural farmers, based on the farmers' innate interests in participating and practicing new technologies that can earn more money and conserve natural resources. The aim is to encourage farmers to plant trees on portions of their land not suitable for other crops which at the end of the rotation period, the project can supply large volumes of wood of uniform quality over a short time period and decrease the pressure on remaining natural forests.

Promoting sustainable production systems for rural small-scale farmers is now a major issue. Although they may not contribute very much in terms of market value and

export earnings, small-scale farmers are a significant part of rural society, in terms of food security, environmental conservation and the solidity of rural communities. Failure to find a sustainable solution for them may damage the whole country, causing food shortages and environmental degradation, weakening the rural social structure and creating many social problems.

1.2. SAFODA initiatives

Large portion of land in the northern part of Sabah belong to the poor farmers which was mostly underutilized, unproductive, or rather idle, due to the fact that, those farmers concerned do not have the means, both financially and technically to develop their land into a sustainable enterprise. Given the prevailing structural constrains and social needs, a different approach needed to bring about economic and social changes to the rural population or at least to bring back the land into production.

To overcome the problems of environmental degradation and poverty in the rural area, the Sabah state government through it's forest agency namely Sabah Forest Development Authority (SAFODA) introduce an extension or outreach scheme to enable larger numbers of the surrounding population to benefit from its presence, and so strengthen relationships between SAFODA and adjacent communities. In late 1988, SAFODA started a JV SPTF program at the Northern region of Sabah at the District of Kudat, Kota Belud, Pitas and Kota Marudu on an experimental basis (Norbert, 1998). The Program sought to establish long-term partnership between the government (SAFODA) and the rural farmer in promoting sustainable use of degraded and idle agricultural land. Participant must be Malaysian citizens actually smallholders with title over their land.

JV SPT is a new technology that was transferred to participants as a means of improving their economic conditions while rehabilitating the degraded rural farm. It

allows farmers to plant agricultural crops (economic livelihood) in tandem with tree crops (reforestation aspect). According to Udarbe, (1982) *Acacia mangium* was selected on the basis of extensive local trials by SAFODA, as a high yielding, easily grown, coppicing tree with good pulping qualities. Based on preliminary measurements made by Sabah Softwoods Sdn Bhd in 5-6 years stands, in Sabah the Mean Annual Increment (MAI) can reach up to 28-44 cubic meters per hecter per year. A study done by Anuar, (1996) shows that the survival age at the age of 4 years was best attained by *Acacia mangium* with only 3 - 7 % mortality. SAFODA would provide planting stock and technical advice, and would assure a market for the output at a guaranteed agreed price. To this end SAFODA had created a strong extension service, and developed the necessary road infrastructure, and so strengthens relationships between SAFODA and adjacent communities. JV SPTF was expected to reduce soil erosion, improve soil quality, put vegetative cover, improve land productivity and uplift the farmers' level of living through sustained farm productivity.

1.3. Smallholder Private Treefarm

JV SPTF is a method to rapidly and inexpensively diffuse agroforestry practices among rural farmers, based on the farmers' innate interests in participating and practicing new technologies that can earn more money and conserve natural resources. The aim is to encourage farmers to plant trees on portions of their land not suitable for other crops. Earlier it was not possible to develop this strategy because the farmers have yet to be convinced on the viability of such project and the market of plantation logs has not been established. However, in May 1988 (Udarbe, 1989) SAFODA has successfully exported *Acacia mangium* pulpwood harvested from SAFODA plantation scattered around Ulu Kukut and Langkon to Taiwan and Japan. The success in selling them has demonstrated to the farmers in the area that fast growing trees can be successfully grown and marketed. It is also the proof needed to convince the farmers that fast growing trees can be used as an alternative crop on land where agricultural crops have failed.

According to Udarbe, (1989) the response from the rural household was then very encouraging. As of today, the project had been extended to the Western Region comprising District of Papar, Beaufort, Membakut, and Kuala Penyu, Central Region comprising District of Tuaran, Tamparuli, Ranau and Telupid, and Southern Region comprising District of Tambunan, Keningau, Nabawan and Tenom.

The incentives for both SAFODA and farmers are reasonably clearcut. These schemes inject capital into marginal areas and provide farmers with timely and appropriate inputs, professional advice, an assured market and local employment spinoffs. In return, SAFODA gain free access to land close to their plantation. Responsibility for labor management and certain production risks are delegated to the farmer, the risk of expropriation of land is reduced and the public image of SAFODA as a government agency responsible in reforestation and regreening the State is enhanced.

1.4. Problem statement

1.4.1. Infertile soil

The face of the Crocker Range and the Crocker foothills extending into Kudat Peninsular along the western seaboard and Marudu Bay is quickly changing. What was once a luxurious forest reserves are being reduced by logging, fires, and by continuous expansion of cultivated land. Shifting cultivation, which for centuries has been the welladapted farming system practiced by the Dusun/Kadazan and the Rungus communities who have been living on the hills around the Marudu Bay, had contributed significantly to the soil infertility and, increasingly become hostile to the maintenance of a balance ecosystem. The small amount of humus, which is normally present in the top few centimeters of the soil, is rapidly depleted by burning and subsequent exposure. The surface horizon tends to dry out and become compacted, and the ubiquitous lalang grass (*Imperata cylindrica*) becomes dominant.

1.4.2. Fragmented, small size, and idle farm

The farmers participated in the JV SPTF project consisted mainly of smallholders who had settled on land that had been classified as marginal land. Farmers were growing principally subsistence crops and substantial areas were devoted to low input crops, uncultivated or were idle. In Kudat, Kota Marudu, and Kota Belud areas, shifting cultivation and fire have left thousands of hectares of hills devoid of tree cover and virtually denied of further cultivation. As time goes by, populations grow and needs for food increase more and more land will then have to be opened up for more farming activities and the situation will worsen. Where these farms are dispersed, it is not possible to integrate them into bigger, more economical co-operative farms. As a result, these farmers are victims of a downward economic spiral: they are, by and large, uneconomic holdings which lack scale economies, management and agronomic skills and the capacity to commercialize, sentencing their operators to a lifelong poverty.

1.4.3. Poor farmers

Most farmers are mainly subsistence farmers with very little or no savings for investment on their farm. Whatever income they earn is just sufficient to meet their daily needs. The bumiputras especially, have no desire to improve their standard of living.

1.4.4. Low level of knowledge

Most of the farmers are ignorant of the concept of modern and sustainable agriculture, they view farming as a way of life and not as a business undertaking. Their farm management and technical know-how is very limited. Most farmers do not know which crops are suitable and profitable for a particular type of soil. They are not interested in working full-time on their farm but rather work elsewhere for paid wages.

1.4.5. Technical innovation

It is certain that there is not enough, if any, indigenous knowledge available to solve the task of establishing a sustainable farming system. New technical innovation in agricultural practice is required in the district in order to reduce deforestation, protect watershed, create sustainable land-use systems and improve farm households' living standard. Agroforestry with the intentional integration of tree growing into farming system is a potential alternative. However, the agroforestry practice must be within the context of marginal farmers adoption based on their socioeconomic environment and bio-physical environment.

Hence, a study on the socio-economic background of the participant is imperative, not simply to categorise which group they falls in, but detail probing (encompassing many multi-collinear variables) in determining the participants' well being. Socio-economic environment includes among others land, labor, and capital. This also considers farmers inability to absorb or digest complex and new information about state of-the-art conservation measures because they are generally of low literacy. The other interest is the in-depth study on the motivational factors, their opinion and level of knowledge and understanding of concepts and benefits of the innovation being introduced. Apart from that, is to look for factors that hinder the future adoption of the technology.

1.5. Justification of Study

Acacia mangium was first introduced to Sabah from Queensland, Australia, by the Forest Department in 1966. Since then it has established to be the most versatile industrial plantation species in the tropic today. Thai *et al.* (1997), stated that the species is a natural choice for tree farming because it is (1) very hardy – ability to grow at low mortality rate; (2) easy to propagate – adapted to a wide range of sites including degraded area grassland, bushes, and compacted area; (3) fast growing - 8 years for pulp and 15 years for saw logs; and (4) possesses excellent wood properties which are accepted by the pulp and paper, timber and furniture industries. According to Udarbe (2004), currently, the market price of *Acacia* saw logs ranges from RM170 to RM230 per metric tone, whilst pulp logs between RM83 to RM95 per metric tone. The price range for processed *Acacia* timber is between RM600 to RM800 per metric tone. Tree farms that were established 8 to 15 years ago are now being harvested, and obviously there is good money on these trees. The *Acacia* is a good tree species for soil erosion control, especially when planted along road embankments and newly cut or reclaimed area. It is also a good species for the rehabilitation of wastelands.

In the northern part of Sabah, especially Pitas which was the poorest region in Sabah, *Acacia* spp. was used by SAFODA as a tool for socio-economic development such as provide permanent jobs to settlers who carried out land clearing and planting work, as well as job opportunities to other people, as well as creation of public infrastructure such as road, houses, school, dispensary, community hall, etc. Now, tree harvesting and log transportation are providing employment and if the project is to continue, it would provide the next round of benefits. We therefore, should and in fact, encourage more JV SPTF project in rural area to help the poor farmers to generate sustainable income and to lessen the pressure on our natural forest.

1.6. Objectives of Study

The majority of population in the region is subsistence farmers mostly of Rungus ethnic groups. Most of the farmers with settled cultivation are still practicing subsistence farming with no fertilizer application. This poor land-use practice and environmental degradation had led to low productivity of cultivated land. Hence, the production is not even enough to serve their subsistence and causes their poverty and unsustainable life. JV SPTF scheme which was introduced by SAFODA at the Northern region of Sabah at the District of Kudat, Kota Belud, Pitas and Kota Marudu, is to attain sustainability in land use management. Therefore, the adoption of agroforestry scheme by farmers holds potential for income generation and slowing the rate of environmental decline.

The success in selling the idea of JV SPTF has demonstrated to the farmers in the area that fast growing trees can be successfully grown and marketed. It is also the proof needed to convince the farmers that fast growing trees can be used as an alternative crop on land where agricultural crops have failed.

The present study is to examine some vital aspects of agroforestry adoption by farmers in Kudat, namely socio-economic background of participants, the motivating factors, factors influencing and limiting adoption, participants' awareness and knowledge on issues related to agroforestry through JV SPTF in Kudat Sabah.

The specific objectives are:

- To evaluate farmers' responses, awareness and knowledge on the issue of agroforestry.
- To evaluate the motivational factors which influenced the farmers in Kudat to adopt tree farming.
- 3. To determine the significant of government assistance which could limit the adoption of smallholder private tree farming in the future.



CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

Generally agroforestry systems can, with their multi-species, multifunction and muftiproduct nature, provide a fairly wide range of social, economic and environmental benefits to landholders and society at large (Vergara and MacDicken, 1990). However, adoption of the new technology will come at a price and through the action of many individual landowners, extension agent, society, as well as the government. The decision to adopt is a result of each individual's unique circumstances and beliefs, their perception of the problem, and a ready, workable solution.

Farmers may be aware about the economic, social, and environmental benefits of agroforestry, but this concern does not always translate into adopting agroforestry practices. Farmers must generate personal income, meet their debt obligations, and maintain future profitability. Establishing woody vegetation on the poor farmer's land is currently providing little economic value, but at the same time, it requires time and money and reduces future options for that land, thus adoptions have been low and slow (Pannell, 1999). Many factors have been suggested as contributing to this, including: high implementation costs, lack of direct payoff from implementation, lack of physical and human capital, lack of a sufficient stewardship ethic among farmers, farming subcultures and social pressures, lack of a suitable regulatory framework, and risk and uncertainty. Therefore, it is not surprising that agroforestry establishment has met with some resistance by the agricultural community.

It is essential that farmers be motivated to use resource management if agroforestry is to be developed. The Food and Agriculture Organization (FAO, 1997) has argued that, "there is a growing belief that one of the more effective means of protecting the environment and agricultural resources is to empower local people and others directly involved in the management of natural resources to make their own analysis and decision of what should be done." Empowering the local people constitutes the main role of extension education. Therefore, it is argued that extension, as a non-formal education input, can provide an important contribution to sustainable agricultural production and rural development.

Education, awareness, technical assistance, financial support and marketing opportunity can influence the adoption of agroforestry practice. However, these programs must clearly define the problem and address the concerns and needs of the landowner.

2.2. What is Agroforestry ?

Agroforestry has been practice in Malaysia and elsewhere by farmers at subsistence level and for domestic consumption over the years, but somehow rather, the systems were rapidly displaced in favor of monocultures. According to Elevitch and Wilkinson (2000), it was thought that trees in mixed species systems interfered with production, and that outputs could be maximized by converting mixed planting into single-species cropping systems. However, many now agree that the rapid conversion to monocroping systems was shortsighted. The short-term profits gained from intensive, single-species plantings are often negated by long-term environmental degradation and high risks. Intensive cropping systems tend to be costly and environmentally damaging, requiring high inputs of fertilizers and chemicals to sustain productivity. Single-species plantings involve a high level of economic risk, because if market conditions change the single crop may not be profitable. They also involve a high level of ecological risk, because one disease or pest problems can devastate production (AIS, 1992).

There are variations of the definition of agroforestry system, but the most widely accepted definition is of the International Council for Research in Agroforestry (ICRAF), which was cited by Nair, (1990) which stated that "agroforestry is a collective name for land-use systems and technologies where woody perennials are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence". There are two main components in this definition. The first is the economical integration of trees with agricultural crops and/or animals on the same piece of land providing the farmer's requirement for food, fuel, fruit, fodder, etc., and the second is the ecological interactions between woody and non-woody components to help contribute to fertility maintenance and soil conservation. The systems that lack of one from these two components cannot be correctly termed as agroforestry (Young, 1997). Some examples of agroforestry technologies include alley cropping, contour hedgerows, riparian reserve, windbreaks, woodlots and trees planted on garden boundaries or home garden.

2.3. Tree farming: Agroforestry practice

Tree farming is the management of trees for timber yields by farmers which can take many forms. Some tree farming projects resemble small-scale forest plantations. Others are diverse agroforests, involving timber trees mixed with animals, crops, or other trees with nontimber products. Banks (1977), as cited in Evans (1982), define it "as any area of farm land with trees, the purpose of which is more than just providing shade and shelter." If given rudimentary management tree farming whether planted or natural has the potential to produce quality timber products, increase farm incomes, support community development, and provide employment and environmental benefits (Anon, 1995).

Often the term farm forestry has been associated with large-scale single-species plantations managed exclusively for commercial return of a timber product. Indeed, much of the scientific and economic study of forestry has been devoted to the needs of this industrial form of forestry. The farm forester shares the goal of commercial timber returns. However, the small-scale farm forester may have a very different set of resources, needs, and objectives compared to the industrial forest investor.

Some farm foresters may choose to devote all or part project to a solid stand of timber trees. These plantings usually consist of trees planted close together, uniformly spaced, and managed as small-scale timber plantations. In area devoid of tree cover establishment of tree farms is potentially a very effective means of raising rural living standards (Evans, 1982), and can also be a means to put idle and unproductive farmland to productive farmland, such as steep slopes, river banks, or waterlogged areas.

There are many ways to integrate timber trees with other farm practices such as with pasture, windbreaks, and crops. These may improve returns and enhance environmental benefits. Integrating trees into farm systems may also have potential drawbacks, as such that a badly managed tree stand can accelerate soil erosion (Nair, 1989). Careful planning is therefore necessary to select appropriate species, and to prevent problems from competition and shading. Good planning helps to ensure that the interactions between the trees and other farm elements are beneficial, and result in