

## Agroforestry Perspective in Land Use Pattern and Farmers Coping Strategy: Experience from Southwestern Ethiopia

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**Abstract:** The study aims at investigating the implication of tree based land use pattern to smallholder farmers' food insecurity coping mechanism. Information on household characteristics, purpose of land use practices, household food security situation and tree based land use has contributed to household food security were collected through household interviews. About 11% of the total households were randomly selected for the study. Data was analyzed using descriptive statistics, correlation analysis and chi square test. About 43.9 % of the respondents undertook land use pattern in a form of homegarden, coffee farm and farm. Pearson correlation results showed that there was no association between land use pattern and household land holding size ( $r(93) = -0.141, p = .177$ ). The result also showed that about 88% of the respondents were attained food security through local purchasing from local market ranging from a month to six months depending on households. Agroforestry helped the households to attain food security as source of cash for all assessed households and as a source of food for 72% of the assessed households. Pearson correlation results showed that there was positive relationship between household food security and tree based land use system ( $r(98) = .246, p = 0.016$ ). Analysis of chi square result showed households with tree based land use system were more likely to attain food security ( $\chi^2 = 4.324, df = 1, N = 98, P = .038$ ).

**Key words:** Coping mechanisms % Agroforestry % Land use % Resilience % Household % Food security

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### INTRODUCTION

Sound land use practices are the major concern in Ethiopia. This is due to the fact that land degradation resulted in low productivity [1-3] and the food security of millions of smallholder farmers is getting critical. Climate change will compound already existing food insecurity and the living condition of smallholder farmers are getting worsens in the future [4]. For example, Climate change scenarios in Sub-Saharan Africa accounts for 40-50% of global hunger by 2080 [5].

Agriculture is most vulnerable to climate change [4, 6]. Previous report [7] indicated that the largest economic impact of climate change is on agriculture particularly in developing country because of the size and sensitivity of the sector. As a result, it will be the greatest challenges for the rural people especially in Sub-Saharan Africa where the largest proportion of population depends on subsistence agriculture [8, 9]. The

climate change issue is pertinent to smallholder farmers in Ethiopia. This is due to the fact that about 80% of the Ethiopian population depends on smallholder agriculture [2].

Natural resources of the local area enable the local community to cope with the impact of any change in their livelihood [10]. Land is one of the major natural resource of a developing country [11] that smallholder farmers totally depend on it. Farming households base the land management strategies on food security objectives [12]. To this effect, the way how smallholder farmers use the land influence the coping capacity of smallholder farmers to external shocks [2]. Previous study [7] indicated that farmers make an adjustment to farming practices to best take advantage and it makes them better off to climate change. Hence, land use option that increases livelihood security and reduce vulnerability to climate and environmental changes are necessary. Traditionally, local farmers are known to have practiced the system that

encourages the development of forests through fallow system as sustainable land use [10]. With increasing population the fallow system is no longer possible. Agroforestry is emerging over period of time as the promising land use option to sustain agricultural productivity and livelihoods of farmers [13]. Hence, agroforestry plays a major role in strengthening the system's ability to cope with adverse impacts of changing climate conditions [4]. Income obtained from agroforestry also helps smallholder farmers to reduce poverty, maintain their socioeconomic needs and sustain their livelihoods [14]. Agroforestry in different parts of the world differ in nature and complexity and objective [15]. Moreover, fundamental to realization of the promise of agroforestry system is agroforestry species [16]. The objective of the study was to assess and identify potential agroforestry technology in the context of investigating the implication of tree based land use pattern to smallholder farmers' food insecurity coping mechanism.

#### MATERIALS AND METHODS

The study was conducted at Jimma, which is located at 352 km from Addis Ababa in southwest of Ethiopia. The study site is located between 36°00' and 37°00' N of latitude and 7°00' and 8°00' E of longitude. The area receives annual rainfall between 1200mm and 2800 mm. The temperature ranges between 11.8°C and 28.8°C. The altitude of the area is about 2000 m.a.s.l. Agriculture is the means of the livelihood of the people. Most agricultural producers are subsistence farmers with smallholding.

Information was collected in June 2010 regarding tree based land use pattern that enable household to attain food security. A combination of assessment and interview were used to collect data. Economically important tree species in the land use were recorded through plant inventory. Information on household characteristics, purpose of land use practices, household food security situation and tree based land use has contribute to household food security were collected through household interview. Semi structured and structured type of questionnaire was used for the interview. The total number of the households in the study area was 888 households. 11% of the total households were randomly selected for the study. Data was analyzed using descriptive statistics, correlation analysis and chi square test. SPSS version 16 was employed for data analysis.

#### RESULT AND DISCUSSION

##### Land Use Pattern and Potential Agroforestry

**Technology:** Land use pattern in the area were identified as homegarden, coffee farm, farm and woodlot. The study result showed that household basis the combination of the land uses than single land use. About 43.9 % of the respondents undertook land use pattern in a form of homegarden, coffee farm and farm. About 6.1% of the respondent practiced land use pattern in a form of homegarden and coffee farm and homegarden and farm respectively. Land use pattern in a form of homegarden, coffee farm and woodlot was not common among majority of households (Table 1). Land holding size was investigated to see whether it influences diversification of land uses. However, household with similar landholding sizes were found practicing different land use patterns indicating land holding size was not the crucial factor for household land use pattern (Table 2). For this, Pearson correlation was calculated and the result showed that there was no association between land use pattern and household land holding size ( $r(93) = -0.141, p=.177$ ). Report from Bangladesh showed weak relationship between agroforestry land use pattern and total land area [14]. The study agrees with the same finding in that relationship between land use pattern and total land area was weak.

All farmers in the study area have their own land use [14] strategy. This implicitly explains household land use pattern has a sense of assigning land for specific purpose. The study result shows land use pattern helps smallholder farmers to strengthen their resilient capacity to food insecurity and lead sustainable live. Table 3 depicts the purpose of land use at household level. The basic necessities of households are possible only under combination of the land uses, indicating the whole system influence the household living situation than single land use. This study shares the same opinion with agroforestry finding for land degradation management from Nepal. Agroforestry system is diversified and integrated; any change in any component of the whole system will have effects on the other components [11]. Homegarden, coffee farm and woodlot were identified as traditional tree based land use system among households indicating potential agroforestry intervention area in the future. All farmers are practicing coffee farm and woodlot for source of cash. However, homegarden and woodlot were the land use types that household are getting benefits directly from the tree itself. Homegardens were mainly dominated by fruit

Table 1: Household land use pattern

Land use	Respondent (N)	Percent.	Area(ha)	
			minimum	maximum
Homegarden, coffee farm and farm	43	43.9	0.32	2.65
Homegarden, coffee farm, farm and woodlot	42	42.9	0.25	2.85
Homegarden, coffee farm and woodlot	1	1.0	0.25	0.75
Homegarden and coffee farm	6	6.1	0.20	0.50
Homegarden and farm	6	6.1	0.36	0.36
Total	98	100.0		

Table 2: Landholding size vis. Identified land use Pattern

Landholding size(ha)	Recorded household Land use pattern
0.25	2,3
0.5	1,2,3
0.55	1,2
0.65	1,2
0.75	1,2,3
0.85	1,2
1.05	1,2
1.25	1,2,4
1.3	1,2
1.45	1,2
1.5	1,2

Table 3: Purpose of land use at household level

Land use	Purpose	Percent	Dominant species
Homegarden	Source of food and cash	61.2	Fruit trees
Coffee farm	Source of cash	100	Shade trees
Woodlot	Source of cash	100	Eucalyptus spp.
Farm	Source of food	100	Maize

Table 4: Production and household food security status

N	
Average family size per household	6
Household food security status (%)	100
C Secured	89
C In-secured	11
Household food security mechanisms (%)	
C Available (%)	12
C Access (%)	88
Food deficient period at household( months)	
C Minimum	1
C Maximum	8
Contribution of Agroforestry to food security (%)	
C Source of cash	100
C Source of food	72

Table 5: Household income from tree based land use

Land use	Value (Ethiopian Birr)/year		
	Minimum	Maximum	Average
Household Income	340	19000	4148
Income from Homegarden	74	14735	1683
Income from coffee farm	200	16000	2451
Income from woodlot	150	3200	989

trees, which provide subsistence and cash to household. Finding [14] showed that farmers concentrate on fruit species because of their subsistence and cash need. Previous [17] study revealed that many of traditional agroforestry practices in tropics are sustainable production systems. Finding [18] also mentioned that sustainability on marginal farms is largely guaranteed by a broad range of survival strategies closely interlinked and embedded in the household structure of typical family farms.

#### **Food Insecurity Coping Mechanisms and Agroforestry:**

Food security has different meaning to different people [19]. However, food availability and food accessibility are mentioned as the dimension of food security in many literatures [5, 20, 21]. Table 4 shows household food production and food security status in the study area. The result showed that 89% of the respondents gave their answer as food secured. However, only 12% of food secured respondents had food availability throughout the year. About 88% of the respondent attained food security through local purchasing from local market ranging from a month to six months depending on households. Agroforestry helped the households to attain food security as source of cash for all assessed households and as a source of food for 72% of the assessed households. This finding agree with [20] report from Oyo state, Nigeria indicating all households purchase one food items or another to attain food security.

Table 5 shows household income from tree based land use system. The finding showed that tree based land use system has contributed significant amount of cash with an average 4148 Ethiopian Birr per household to household income indicating high purchasing power of household due to income from agroforestry. From the assessment result it was also found that some households reported annual income of about 19000 Ethiopian Birr from tree based land use system. This helped a lot to cope with food shortage at household level. Finding [14] from Bangladesh revealed that 70% of studied farmers are the main beneficiaries and users of agroforestry due to significant amount of income from it. Correlation analysis was calculated to see the relationship between food security and tree based land use system. Pearson correlation result showed that there was positive relationship between household food security and tree based land use system ( $r(98) = .246, p=0.016$ ). Analysis of chi square result shows households with tree based land use system are more likely to attain food security ( $\chi^2=4.324, df=1, N=98, P=.038$ ).

Increasing number of studies suggests that agroforestry practices improve household food security [22]. Finding [17] reported increasing the purchasing power of the rural people are intrinsic features of traditional land use system. Report [24] showed that diversifying the production system to include a significant tree component may buffer against income risks associated with climatic variability. Finding [14] also reported that agroforestry is more profitable and less risky than other agricultural options because of the variety of produce and all farmers adopted agroforestry for its high profitability. Poor farmers practice agroforestry to mitigate their socioeconomic needs and agroforestry is their major source of cash income, which provide nearly half of their total cash income. Agroforestry land use options increases resilience and reduce vulnerability of contemporary societies and help as mitigation of the impact of climate change.

The present study showed that tree based land use system might be an effective coping strategy to household food insecurity in the future under due attention. Homegarden, woodlot and coffee farm were the potential agroforestry intervention area in the future. Despite less attention has been given to tree based land use option, agroforestry has played a major role in reducing household vulnerability to shocking. Smallholder farmers have already started mainstreaming tree based land use system as resilience to social needs because the poor are more exposed to change, agroforestry is one of best risk aversion option to make them move out of food insecurity.

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#### **REFERENCES**

1. Bishaw, B., 2009. Deforestation and land degradation in the Ethiopian highlands: A strategy for physical recovery. Ethiopian E-journal for research and innovation foresight, 1: 5-18.
2. Canali, M. and F. Slaviero, 2010. Food insecurity and risk management of smallholder farming systems in Ethiopia. In: I. Darnhofer and M. Grotzer (ed.) Building sustainable rural futures: The added value of systems approaches in times of change and uncertainty. 9<sup>th</sup> European IFSA symposium, 4-7 July 2010, Vienna, Austria. [Online] [www.ifsa-europe.org](http://www.ifsa-europe.org)

3. Mamo, T. and G. Ayele, 2003. Poverty, land resources management and gender participation in Libokemkem district of northern Ethiopia. *Journal of Agriculture and rural development in tropics and subtropics*, 104: 51-64.
4. Verchot, L.V., M.V. Noordwijk, S. Kandji, T. Tomich, C. Ong, A. Albrecht, J. Mackensen, C. Bantilan, K.V. Anupama and C. Palm, 2007. Climate change: linking adaptation and mitigation through agroforestry. *Mitig Adapt Strat Glob change*, DOI 10.1007/s 11027-007-9105-6.
5. Schmidhuber, J. and F.N. Tubiello, 2007. Global food security under climate change. *PNAS*, 104: 19703-19708.
6. Ngaira, J.K.W., 2007. Impact of climate change on agriculture in Africa by 2030. *Scientific research and essays*, 2: 238-243.
7. Mendelsohn, R., 2009. The impact of climate change on agriculture in developing countries. *Journal of natural resources policy research*, 1: 5-19.
8. Ajayi, O., F.K. Akinnifesi, G. Silashi, S. Chakeredza and P. Matakala, 2007. Economic framework for integrating environmental stewardship into food security strategies in low income countries: case of agroforestry in southwestern African region. *African J. Environ. Sci. Technol.*, 1: 059-067.
9. Lema, M.A. and A.E. Majule, 2009. Impact of climate change, variability and adaptation strategies on agriculture in semi arid areas of Tanzania: *African J. Environ. Sci. Technol.*, 3: 206-218.
10. Nyong, A., F. Adesina and B.O. Elasha, 2007. The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel. *Mitig Adapt Glob Change*, 12: 787-797. DOI: 10.10.1007/s 11027-27-007-9099-0.
11. Acharya, A. and N. Kafle, 2009. Land degradation in Nepal and its management through agroforestry. *The J. Agric. Environ.*, 10: 115-123.
12. Chowdhury, R.R., 2010. Differentiation and concordance in smallholder land use strategies in southern Mexico's: conservation frontier. *PNAS*, 107: 5780-5785.
13. Syampunani, S., P.W. Chirwa, F.K. Akinnifesi and O.C. Ajayi, 2010. The potential of using agroforestry as a win-win solution to climate change mitigation and adaptation and meeting food security challenges in Southern Africa. *Agric. J.*, 5: 80-88.
14. Rahman, S.A., M.H. Imam, S.W. Wachira, K.M. Farhana, B. Torres and D.M.H. Kabir, 2008. Land use patterns and the scale of adoption of agroforestry in the rural landscapes of Padma floodplain in Bangladesh. *Forest, Trees and Livelihoods*, 18: 193-207.
15. Nair, P.K.R., 2007. Perspective: The coming age of agroforestry. *J. Sci. Food and Agric.*, 87: 1613-1619.
16. Nair, P.K.R., 2008. Agroecosystem management in the 21<sup>st</sup> century: It is time for a paradigm shift. *J. Trop. Agric.*, 46: 1-12.
17. Rahman M.L., M. Hasanuzzaman and M.K. Islam, 2009. Fruit distribution and diversity in the homestead of a southern Island of Bangladesh. *Advance in Biological Research*, 3:208-214
18. Kumar, B.M., 2006. Agroforestry: The new old paradigm for Asian food security, Review/synthesis. *J. Trop. Agric.*, 44: 1-14.
19. Meert, H., G.V. Huylenbroeck, T. Vernimmen, Bourgeois and E.V. Hecke, 2005. Farm household survival strategies and diversification on marginal farms. *Journal of Rural Studies*, 21: 81-97.
20. Pinstrup-Andersen, P., 2009. Food security: definition and measurement. *Food Sec.*, 1: 5-7.
21. Adekoya, A.E., 2009. Food insecurity and coping strategies among rural households in Oyo state, Nigeria. *Journal of Food, Agric. Environ.*, 7: 187-191.
22. Ndaeyo, N.U., 2007. Assessing the contribution of homestead farming to food security in a developing economy: a case study of southeastern Nigeria. *J. Agric. Social Sci.*, 3: 11-16.
23. Belsky, J.M., 1993. Household food security, farm trees and agroforestry: A comparative study in Indonesia and the Philippines. *Human Organization*, 52: 130-141.