AJLP & GS
African Journal on Land Policy and Geospatial Sciences

e-ISSN : 2657-2664, Vol. 7, Issue.4, September 2024

https://revues.imist.ma/index.php/AJLP-GS/index

https://doi.org/10.48346/IMIST.PRSM/ajlp-gs.v7i4.49850 ***Category of the manuscript : Articles***

Received in: 30 June 2024 **Revised in:** 10 September 2024 ***Accepted in:*** 25 September 2024

Ethiopia's Land Certification Program: Effect on Soil Conservation Investment by Rural and Peri-urban Farmers

[1]Hailay Tesfay, [2]Charles Machethe

[1] Department of Agricultural Economics, Extension and Rural Development, University of Pretoria u16404654@tuks.co.za, Pretoria, South Africa.

[2] Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, charles.machethe@up.ac.za, Pretoria, South Africa

ABSTRACT

Context and background

In Ethiopia, farmers do not have individual property rights to the land they occupy and cultivate since the 1995 Federal Democratic Republic of Ethiopia (FDRE) constitution clearly states that land belongs to the state and the peoples of Ethiopia. To address concerns about the insecure tenure of farmers that could result from the absence of enduring private ownership of land, to eliminate land disputes, to promote sustainable use of land resources, and to support long-term land-related investments, such as soil conservation measures, the Ethiopian government introduced a land registration and certification program in 1998. In addition, cities and towns are also rapidly expanding horizontally, encroaching on fertile agricultural land, which could reverse the land tenure security expected from the land certification program.

Goal and Objectives:

This study aims to examine the effect of Ethiopia's land certification program on the soil conservation practices of rural and peri-urban farming households in the Tigray region of Ethiopia.

Methodology:

The study employs descriptive statistics and a binary logistic regression model to empirically assess the effect of the Ethiopian land certification program on investment in soil conservation practices.

Results:

The study found that 54.59%, said they conserved their plots, while the remaining 45.41% had not engaged in soil conservation practices. Conversely, 60.11% of the certified peri-urban respondents stated they did not conserve their plots. The logit model's marginal effects indicated that the influence of the Ethiopian land certification program on the probability of soil conservation depended on the geographic location of the farmers. Specifically, rural program participants were more likely to engage in soil conservation practices.

Keywords :

Land certification, soil conservation, rural farmers, peri-urban farmers, binary logistic regression

1. INTRODUCTION

Land degradation is a major challenge in Ethiopia, with serious effects on the environment and farmers' livelihoods. The country faces soil erosion, nutrient depletion, and declining soil productivity, exacerbated by factors such as population growth and poor land management practices (Belayneh et al., 2019). The problem is particularly severe in the highlands of Ethiopia, where soil erosion threatens soil quality and productivity (Amare et al., 2013). In addition, Ethiopian farmers do not have complete land ownership rights, as the 1995 Ethiopian constitution clearly states that land belongs to the government and the peoples of Ethiopia (Ambaye, 2012; Gebre et al., 2020; Tolasa et al., 2024).

To address concerns about the insecure tenure of farmers that could result from the lack of complete ownership of land, to eliminate land disputes, to promote sustainable use of land resources and to support long-term land-related investments, such as soil conservation measures, the Ethiopian government introduced a large scale land registration and certification program in 1998 (Bezu & Holden, 2014; Deininger, 2008; Gedefaw et al., 2020; Mengesha et al., 2019). The first region to introduce it was Tigray in 1998, followed by Amhara in 2003, Oromia in 2004, and SNNP in 2004. It is also one of the largest land registration projects in the world, with nearly 20 million plots and 6 million households registering their landholdings between 1998 and 2007 (Adenew & Abdi, 2005; Deininger et al., 2011; Holden et al., 2011a).

As compared to land certification systems in other African countries, the Ethiopian system is one of the least expensive to implement. For example, the programme in Madagascar costs $150, while the programme in Ethiopia costs less than $1 per farm and $3.5 per household (Deininger et al., 2011; Jacoby & Minten, 2007). However, the program is challenged by the rapid expansion of cities and towns, which poses a major threat to the security of land tenure and farmers' prospects for sustainable agriculture, as the demand for physical space is constantly increasing and is therefore likely to be met at the expense of productive agricultural land, which could reverse the land tenure security expected from the land certification program which in turn may affects the promotion of sustainable land management practices (Adam, 2014; Admasu et al., 2020; Weldearegay et al., 2021).

The Ethiopian land certification program, by legalizing land rights and providing land tenure security, has motivated farmers to engage in sustainable land management practices, such as soil conservation which ultimately enhancing agricultural production (Bezabih et al., 2021; Mohammed & Inoue, 2014). Several studies have confirmed these positive results and highlighted the impact of the program on agricultural productivity, land rentals and land-related investments (Behaylu, 2015; Di Falco et al., 2020; Holden et al., 2011a; Taye et al., 2015). Specifically, a study conducted by Holden et al., 2011a revealed that the Ethiopian land certification program has resulted in increased land related investments and improved land rental market participation. Furthermore, the program has been associated with improvements in management of land resources, sustainable land related investments, farmers confidence in land ownership rights, increase in agricultural investment and productivity (Tsegaye et al., 2012).

In the existing literature, however, there is a gap regarding the spatial effects of the impact of the Ethiopian land certification program. The previous studies have mainly adopted a monolithic approach to evaluating the effectiveness of the land certification program, overlooking the subtle variation that may arise based on the geographic location of farming households. Farmers' proximity to rapidly growing cities is particularly can significantly influence their choice and decision-making processes regarding soil conservation investments. Therefore, this study aims to contribute to the existing body of knowledge by examining the effects of the Ethiopian land certification program on soil conservation investment among smallholder farmers. To better understand the spatial effect of the land certification program on soil conservation practices, we disaggregated the sample households into rural farmers and peri-urban farmers. Peri-urban farmers are those farmers who lived in the study district adjacent to the capital city of the Tigray regional state, Mekelle, and within 8 km radius of the city. Rural farmers are those farmers located at a distance greater than 8 kms from the boarders of the city.

The findings of this study will contribute to the existing understanding of land certification initiatives and their impact on promoting soil conservation practices within the context of urbanization. Moreover, the insights gained from this study could assist policymakers, and interested stakeholders in formulating plans to combat land degradation and bolster farming methods not in Ethiopia but, in regions confronting comparable challenges.

2. LITERATURE REVIEW

Land certification programs have been widely implemented in developing countries to improve land tenure security, increase agricultural productivity, and reduce poverty among smallholder farmers (Adamie, 2021; Mengesha et al., 2022). Numerous scientific studies have investigated the impact of registration of land titles on tenure security, rental market participation, and on-farm investments (Deininger et al., 2011; Feder & Nishio, 1998; Holden et al., 2011b). These studies have identified various important factors determining the effectiveness of the land titling program. Moreover, previous researchers have also investigated the direct and indirect impacts of the program on land tenure security, access to credit, and agricultural productivity.

The studies that have been conducted on the relationship between land titling and land-related investment have produced inconclusive results. Some studies found a positive relationship between land titling and increased investment in land improvement, agricultural productivity and non-agricultural activities (Do & Iyer, 2008; Field, 2007; Kassa, 2014; Kehinde et al., 2021). For example, Muchomba, (2017) stated that land certification is related to the increased perception of land tenure security of households and through the provision of legal documentation of land ownership, households will feel more secure in their property rights, which, in turn, can lead to the improvement of the human capital of the households. However, other studies on the relationship between land titling and land-related investments have found no significant investment effect of land titling in rural areas (Byamugisha, 1999).

In addition, there is evidence that land titling can encourage more investment and strengthen land tenure security, but the results from Africa are less positive (Goldstein *et al*., 2018; Kubitza *et al*., 2018). For instance, Migot-Adholla *et al*. (1991) whose study mainly focused on the indigenous land tenure rights system in sub-Saharan Africa using a farm level data found that there is at best a weak

relationship between individualized land rights and greater agricultural productivity, use of credit, and land improvement. Similarly, the study conducted by Pinckney & Kimuyu (1994) also focused on comparing land use practices in Kenya and Tanzania indicated that the title has had little effect on land related investments. Another study from Kenya revealed that the impact of land registration on tenure security, credit use, and land concentration was weak, suggesting that titles are more likely obtained to improve securing rights than to boost agricultural production (Place & Migot-Adholla, 1998). In contrast, Kassa (2014) investigated the relationship between land titling and investment using instrumental variable and fixed effects models and found that the effects of titling on investment was positive and sizable.

In Ethiopia, Melesse & Bulte, (2015) investigated the productivity impacts of land registration and certification program by employing the propensity score matching method of impact evaluation technique found that households with land certificates are more likely to adopt soil-fertility management strategies on their plots than households without certificates. In addition, Deininger *et al*. (2011) assessed the impacts of the Ethiopian land certification program using the difference in different approach by utilizing a four-period panel and found that the programme increased tenure security, land-related investment, and rental market participation and yielded benefits significantly above the cost of implementation. Moreover, a study conducted by Holden et al., (2009) in the Tigray region of Ethiopia revealed the positive impacts of low-cost land certification on investment and productivity which are the soil conservation, investment in trees and land productivity. Gedefaw et al., (2020)further highlight that land certification led to improved maintenance of soil conservation structures, increased investment in trees, and enhanced land productivity, reinforcing the positive outcomes associated with secure land tenure.

According to Besley (1995), well-defined property rights could enable investors to be more confident about their investments by reducing uncertainty and increasing expected benefits. This idea is in line with the concept of property rights, which suggests that farmers are more likely to invest in soil conservation practices if their land tenure is secure (Kousar & Abdulai, 2016)

3. DATA SOURCE AND METHODOLOGY

3.1 Description of the study area

The research was conducted in the Enderta district, located in the Tigrai regional state in the northern part of Ethiopia. Enderta is just one of the thirty-six districts in the Tigrai region, positioned at coordinates 13° 15’0” N and 39°- 30'30" E, with an elevation ranging from 1500 to 2000 meters above sea level. This district shares its boundaries with KilteAwlaelo to the north, Hintalo Wajirat to the south, the Afar Regional State to the east, and Degu'a Tembien to the west (Luchia et al., 2018). The district comprises 17 Tabiyas, which are the smallest administrative units in Ethiopia, and 60 villages. It covers an area of 89,812 square kilometers, with 30,062 hectares designated for farming. The predominant agro-climatic conditions are characterized by a warm mild climate (96%), with the remainder divided between hot lowland climate (3%) and temperate climate (1%) (Luchia et al., 2018).

The district's strategic location in comparison to other districts within the Tigray regional state presents an excellent opportunity to analyze the correlation between the Ethiopian land certification program, land tenure security, and the promotion of soil conservation efforts. This becomes

particularly significant considering the fast-paced urban growth happening in Mekelle, the capital of the Tigrai regional state in Ethiopia, a city that is encompassed by the district's borders.

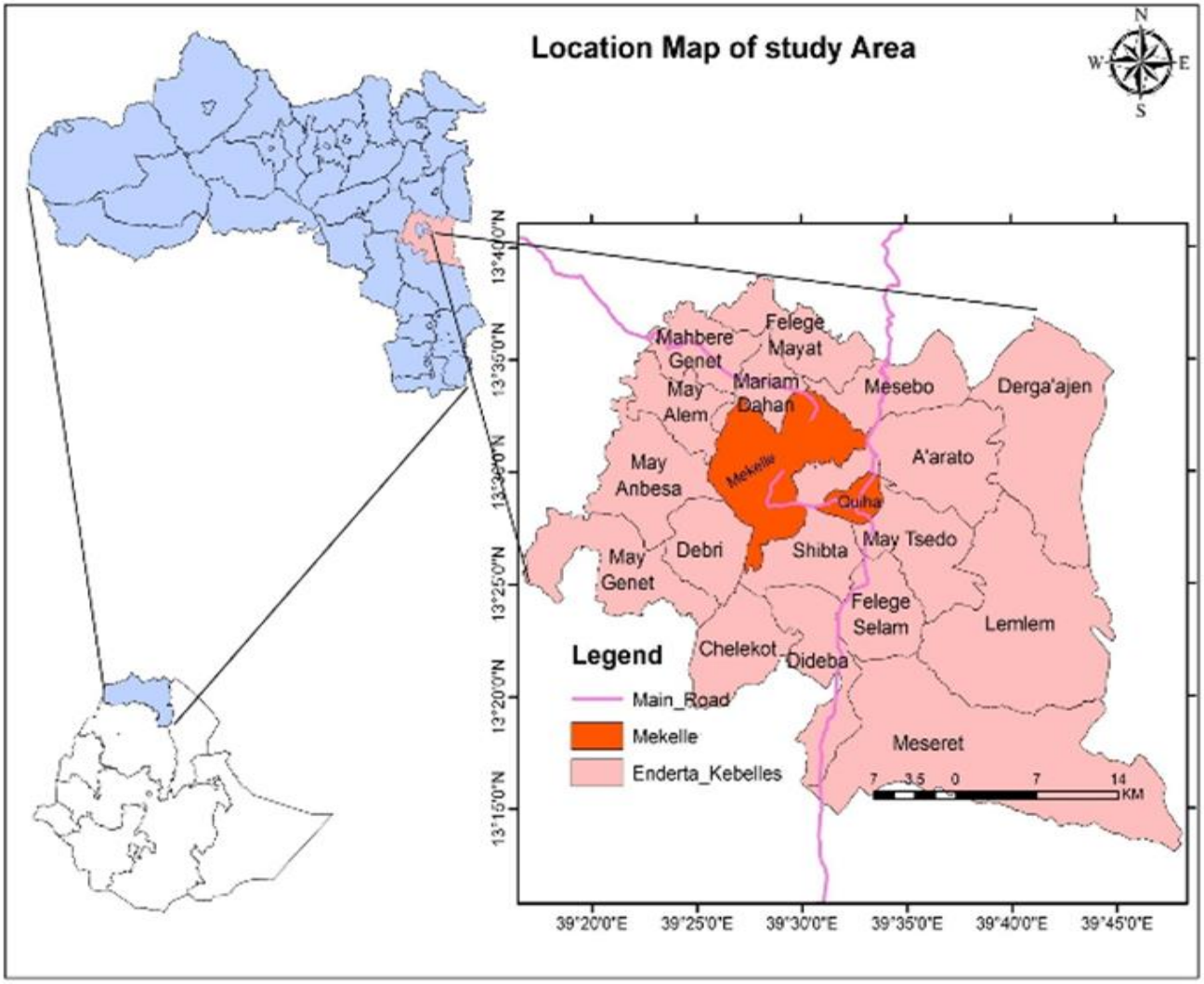

Fig. 1. Map of the study area.

3.2 Data Sources

The study used secondary source of data collected by the University of Mekelle in 2020. It focused on analyzing cross-sectional data from 500 observations, considering various factors such as household demographics, certification status of households, plot characteristics (such as size, number, slope, and soil fertility), institutional factors (like credit availability and level of education), geographic variables, and land management practices (with a specific focus on soil conservation techniques) etc.

3.3 Method of data analysis

In this study, both descriptive and econometric methods are employed, including the use of a logistic regression model. The logistic regression model is well suited for binary outcome variables and is therefore the right choice for our analysis. The sample households that made investments in soil conservation on their plots were asked about the year in which the investment was made. The soil conservation investments are made after the household heads have received their land use certificates. The process of obtaining the land use certificates starts from the Tabiya (smallest

administrative unit) and moves to the next stage after the farmers' applications for land use certificates are approved. Without the approval of the community in a particular area, the certification process cannot continue. Above all the land certification program that is being implemented in Ethiopia since 1998 is a government led initiative. In other words, the certification process is transparent as the community has the right to reject illegal applications for land certificates. Therefore, we believe, the problem of endogeneity is not relevant in our case since the soil conservation investments were made after the farmers had obtained land use certificates and since the community is involved in deciding whether the applicants for land use certificates fulfill the requirements for obtaining the certificates.

The logistic regression model is specified as follows: -

$$P(Y_i = 1) = \frac{1}{1+e^{-(\beta_0+\beta_1 X_{1i}+\beta_2 X_{2i}+\cdots\beta_k X_{ki}}}$$

Where:

Y_i is the binary dependent variable representing soil conservation investment (1 or 0).

$X_{1i}, X_{2i}, \ldots, X_{ki}$ are the independent variables, including land certification status and control variables.

$\beta_0, \beta_1, \beta_2, \ldots, \beta_k$ are parameters to be estimated.

To compare the effects of the Ethiopian land certification programme between rural and peri-urban farmers, geographic location of the sample farmers variable is interacted with the certification status of sample households and included in the soil conservation investment regression model. The explanatory variables used in the logistic regression model of investment in soil conservation practices are presented in Table 1.

Variable names	Description
HHAGE	Age of household head
HHSEX	Sex of household head; 1= Male & 0= Female
LANDUSETAX	Whether a household head pays tax; 1= Yes 0= Otherwise
DISTRANSP	Distance from household head's residence to a transportation service center in walking minutes
PLOTORIGION	Household head plot origin; 1= Government; 0= inheritance
EVICTIONEXP	Eviction experience of household head over the last five years prior to the survey year; 1= experienced 0=otherwise
SAVING	Whether the household head has saving account; 1= yes 0= otherwise
HHMARITAL	Marital status of the household head; 1= married 0=otherwise
CERLOCATION	Interaction term of the certification status of household head and household head's geographic location
SOURCEINVESTMENTFIN	Source of labour force used to conserve plots; 1 own labour 0= otherwise

Table 1: Explanatory Variables used in the logistic model

4. RESULT ANDS DISCUSSIONS

For farming communities, agricultural land management practices are central to sustainable food production and resource conservation. Adoption of soil conservation practices in agricultural households brings several benefits, among them reduction of soil erosion and increased environmental sustainability while enhancing agricultural productivity. In addition to increasing

farmer's incomes, sustainable farming practices also mitigate the effects of a changing climate on their businesses. Based on the overall descriptive findings, among the five hundred households interviewed slightly over half (52.20%) did not participate in soil conservation practices, while the remaining 47.80% conserved at least one of their plots.

The disaggregated results, disaggregation by location and certification status, are instructive. For instance, in rural areas, more than half of the sample certified households (54.59%) reported investing in soil conservation practices while 45.41% did not. Nevertheless, a chi-square test showed no significant relationship between rural household's soil conservation practices and their certification status (p-value = 0.523). In peri-urban areas, we found that the majority of certified farmers (60.11%) did not conserve their plots while this trend was almost similar among non-certified farmers (57.14%). Nonetheless, a chi-square test indicated that there was no statistically significant association between peri-urban household's conservation practices and certification status (p-value = 0.724).

When we look at the econometrics results, Table 2 shows the marginal effect of the logistic regression result. The coefficient for the variable age (HHAGE) is estimated at -0.004 and significant at the 10% level. Age is an important determinant of long-term land management practices, and its negative coefficient suggests that older household heads are less motivated to invest in conservation practices. This could be due in part to factors such as risk aversion, age-related limited physical working capacity, and unwillingness to experiment with new techniques.

The variable coefficient for the land use tax (LANDUSETAX) is estimated at 0.309, which is significant at the 1% level. The positive marginal effect coefficient implies that those household heads paying the land use tax have a probability of engaging in conservation practices that is about 30.9% higher than those who do not pay. Farmers who pay land use taxes could learn more about the value of sustainable farming practices and soil conservation. Further, taxation on agricultural lands can make people feel government presence and therefore less likely to resort to conflicts or disagreements over these lands. This could enhance security and serve as an incentive for adopting soil erosion control measures aimed at preserving soil fertility, checking erosion and conserving other natural resources.

Previous displacement experiences of households (EVICTIONEXP) are among the important factors determining the use of soil conservation practices. The marginal effect coefficient of the "evictionexp" variable is -0.135 and significant at the 1% level. Household heads who experienced displacement in the five years prior to the 2020 survey year are less likely to engage in soil conservation practices. This result suggests that past evictions may discourage households from adopting long-term land management practices due to fear of losing their remaining land holdings and limiting their resources for long-term investments, given the inadequacy of compensation payments to evicted farmers.

Household certification status is considered as the key determinant of households' decision to make long-term land-related investments in countries such as Ethiopia, where land ownership is controlled by the state and the people rather than by individual farmers. The geographic location of the farm household in the context of high urbanization is also another important factor that strongly influences the decision of farm households to engage in land-related investments. To capture the geographically disaggregated impact of the land certification programme on farm households' conservation practices, an interaction term of the household certification status and the farmer's

geographic location variables (CERLOCATION) is generated. It is one of the important variables that determine the adoption of soil conservation practices.

The marginal effect coefficient of the interaction term of certification status of household head and geographic location of household (CERLOCATION) is 0.090 and statistically significant at a 10% level, which suggests that the effect of land certification program on the probability of soil conservation depends on the geographic location of the farmers. Certified households in rural areas are more likely to engage in soil conservation practices. This finding is consistent with previous studies showing that land certification programs can lead to increased investment in land, including soil conservation efforts (Deininger et al., 2008). It also suggests that the effect of land certification on the adoption of soil conservation measures varies in different geographic location of farmers, consistent with other studies that point out the contextual nature of land certification programs (Byamugisha, 2013). This positive effect of certification on soil conservation in rural areas is supported by previous research conducted in Ethiopia, which found that land certification encouraged the adoption of soil conservation practices like terracing and tree planting (Deininger et al., 2008).

However, our finding of lower soil conservation investment in peri-urban areas contradicts prior studies suggesting that land titling positively affects land management practices, including soil conservation, in peri-urban regions (Do & Iyer, 2008). This may be because peri-urban farmers are exposed to massive expropriation of land by urban governments for public purposes such as residential expansion, the concentration of development-related projects such as wind farms and industrial parks, and the relatively strong involvement of land brokers compared to rural farmers. The positive marginal effect demonstrates the importance of considering the context of the distinction between rural and peri-urban areas when promoting conservation.

The results of this study show that key factors like age, eviction experience of farmers, and the interaction of the certification status of households and their geographic location, significantly influence the soil conservation engagement households. The certification status of household heads was found to have a positive but statistically insignificant influence.

Table 2: Logistic regression and Marginal Effects conservation investment model

Variables	(Logistic reg) HHconservation	(Marginal Effects) HHconservation
HHAGE	-0.0159*	-0.0039*
	(0.00964)	(0.0024)
HHSEX	0.203	0.0504
	(0.411)	(0.1012)
LANDUSETAX	1.241***	0.3094***
	(0.280)	(0.0695)
DISTRANSP	0.00250	0.0006
	(0.00192)	(0.0004)
PLOTORIGION	0.278	0.0692
	(0.204)	(0.0504)
EVICTIONEXP	-0.550***	-0.1357***
	(0.200)	(0.486)
SAVING	0.255	0.0634
	(0.190)	(0.0472)
HHMARITAL	0.307	0.0759
	(0.402)	(0.0982)
CERLOCATION	0.363*	0.0902*
	(0.205)	(0.0508)
SOURCEINVESTMENTFIN	0.280	0.0694
	(0.208)	(0.0512)
CONSTANT	-2.582***	
	(0.754)	
Observations	500	500

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5. CONCLUSIONS AND RECOMMENDATIONS

The major findings of this study showed important insights into how household certification status, the geographic location of households, and soil conservation practices are interconnected among the sample households. The descriptive analysis indicated that a significant portion of respondents 52.20% had not implemented conservation measures on their plots.

Disaggregation of the sample respondents by geographic location as well as their land use certification status, provides additional understanding about the effects of the land certification programme on soil conservation investments. Accordingly, the study found that majority of the certified rural farmers, 54.59%, said they have invested in their plots, while the remaining 45.41%

had not made any investments. Statistical analysis using the chi-square test revealed that there was no strong evidence of a significant association between rural respondents' certification status and investment in soil conservation methods. Similarly, the majority of the certified peri-urban respondents, 60.11%, said that they did not conserve their plots. The chi-square test also indicated no statistical relationship between certification status of respondents and investment in soil conservation practices. These findings indicate that certification status alone does not appear to be a significant driver of conservation behavior among farmers in either rural or peri-urban areas.

The study also employed a binary logistic regression model to empirically assess the effect of the land certification programme on investment in soil conservation practices. The marginal effects of the model indicated that the effects of the land certification programme on the probability of soil conservation depended on the geographic location of the farmers. Specifically, programme participant sample households and located in rural areas were more likely to engage in soil conservation activities. This result suggests that the effectiveness of the land certification programme in promoting soil conservation may vary depending on the context and geographic location of farmers in reference to expanding urban centers.

This study recommends further measures to be undertaken to understand the causes of the conservation behaviour. These measures may comprise awareness campaigns, education and training programs, availability of incentives and the extension of other initiatives aimed at encouraging community-based soil conservation practices. Furthermore, it's crucial to develop targeted measures and develop location-specific strategies for addressing the needs of rural and peri-urban farmers.

6. ACKNOWLEDGMENT

The authors would like to thank Mekelle University and the Norwegian Project on Capacity Building for Climate-smart Natural Resource Management (NORHED-CLISNARP ETH-13/0015 project) for providing the data and financial support.

7. REFERENCES

Adam, A. G. (2014). Land tenure in the changing peri-urban areas of E thiopia: the case of bahir dar city. *International Journal of Urban and Regional Research*, *38*(6), 1970–1984. https://doi.org/10.1111/1468-2427.12123

Adamie, B. A. (2021). Land property rights and household take-up of development programs: Evidence from land certification program in Ethiopia. *World Development*, *147*, 105626. https://doi.org/10.1016/J.WORLDDEV.2021.105626

Adenew, B., & Abdi, F. (2005). *Research report 3 land registration in Amhara region, Ethiopia*. International Institute for Environment and Development.

Admasu, W. F., Boerema, A., Nyssen, J., Minale, A. S., Tsegaye, E. A., & Van Passel, S. (2020). Uncovering ecosystem services of expropriated land: The case of urban expansion in Bahir Dar, Northwest Ethiopia. *Land*, *9*(10), 395. DOI:10.3390/land9100395

Amare, T., Terefe, A., Selassie, Y. G., Yitaferu, B., Wolfgramm, B., & Hurni, H. (2013). Soil properties and crop yields along the terraces and toposequece of Anjeni Watershed, Central Highlands of

Ethiopia. *Journal of Agricultural Science*, *5*(2), 134. DOI:10.5539/JAS.V5N2P134

Ambaye, D. W. (2012). Land Rights in Ethiopia: Ownership, equity, and liberty in land use rights. *FIG Working Week*, 27.

Behaylu, A. (2015). Debates on Land Titling. *American Journal of Environmental Protection*, *4*(4), 182–187. doi: 10.11648/j.ajep.20150404.12

Belayneh, M., Yirgu, T., & Tsegaye, D. (2019). Effects of soil and water conservation practices on soil physicochemical properties in Gumara watershed, Upper Blue Nile Basin, Ethiopia. *Ecological Processes*, *8*(1), 1–14. https://doi.org/ 10.1186/s13717-019-0188-2

Besley, T. (1995). Property rights and investment incentives: Theory and evidence from Ghana. *Journal of Political Economy*, *103*(5), 903–937. http://www.jstor.org/stable/2138750

Bezabih, M., Di Falco, S., Mekonnen, A., & Kohlin, G. (2021). Land rights and the economic impacts of climatic anomalies on agriculture: evidence from Ethiopia. *Environment and Development Economics*, *26*(5–6), 632–656. doi:10.1017/S1355770X2100022X

Bezu, S., & Holden, S. (2014). Demand for second-stage land certification in Ethiopia: Evidence from household panel data. *Land Use Policy*, *41*, 193–205. https://doi.org/10.1016/j.landusepol.2014.05.013

Byamugisha, F. F. K. (1999). *The effects of land registration on financial development and economic growth: a theoretical and conceptual framework* (Vol. 2240). World Bank Publications.

Byamugisha, F. F. K. (2013). *Securing Africa's land for shared prosperity: A program to scale up reforms and investments*. World Bank Publications. RePEc:wbk:wbrwps:2240

Deininger, K. (2008). Implementing Low-Cost Rural Land Certification. *The Case of Ethiopia*, *34*, 141–167. https://openknowledge.worldbank.org/handle/10986/9528

Deininger, K., Ali, D. A., & Alemu, T. (2011). Impacts of land certification on tenure security, investment, and land market participation: Evidence from Ethiopia. *Land Economics*, *87*(2), 312–334. https://doi.org/10.3368/le.87.2.312

Deininger, K., Ali, D. A., Holden, S., & Zevenbergen, J. (2008). Rural Land Certification in Ethiopia: Process, Initial Impact, and Implications for Other African Countries. *World Development*, *36*(10), 1786–1812. https://doi.org/10.1016/J.WORLDDEV.2007.09.012

Di Falco, S., Laurent-Lucchetti, J., Veronesi, M., & Kohlin, G. (2020). Property rights, land disputes and water scarcity: Empirical evidence from Ethiopia. *American Journal of Agricultural Economics*, *102*(1), 54–71. https://doi.org/10.1093/ajae/aaz036

Do, Q.-T., & Iyer, L. (2008). Land titling and rural transition in Vietnam. *Economic Development and Cultural Change*, *56*(3), 531–579. doi/abs/10.1086/533549

Feder, G., & Nishio, A. (1998). The benefits of land registration and titling: Economic and social perspectives. *Land Use Policy*, *15*(1), 25–43. https://doi.org/10.1016/S0264-8377(97)00039-2

Field, E. (2007). Entitled to work: Urban property rights and labor supply in Peru. *The Quarterly Journal of Economics*, *122*(4), 1561–1602. https://doi.org/10.1162/qjec.2007.122.4.1561

Gebre, Y. R., Teno, T., Hailu, Z., Tadesse, M., & Schoenweger, O. (2020). Building Harmonized Private and State Land Holding Data and Information Systems in Ethiopia. *African Journal of Land Policy and Geospatial Sciences*, *3*(3), 123–140.

Gedefaw, A. A., Atzberger, C., Seher, W., Agegnehu, S. K., & Mansberger, R. (2020). Effects of land certification for rural farm households in Ethiopia: Evidence from Gozamin District, Ethiopia. *Land*, *9*(11), 421. https://doi.org/10.3390/land9110421

Goldstein, M., Houngbedji, K., Kondylis, F., O'Sullivan, M., & Selod, H. (2018). Formalization without certification? Experimental evidence on property rights and investment. *Journal of Development Economics*, *132*, 57–74. https://doi.org/10.1016/j.jdeveco.2017.12.008

Holden, S. T., Deininger, K., & Ghebru, H. (2009). Impacts of low-cost land certification on investment and productivity. *American Journal of Agricultural Economics*, *91*(2), 359–373. https://doi.org/10.1111/j.1467-8276.2008.01241.x

Holden, S. T., Deininger, K., & Ghebru, H. (2011a). Tenure insecurity, gender, low-cost land certification and land rental market participation in Ethiopia. *The Journal of Development Studies*, *47*(1), 31–47. https://doi.org/10.1080/00220381003706460

Holden, S. T., Deininger, K., & Ghebru, H. H. (2011b). Impact of Land Certification on Land Rental Market Participation in Tigray Region, Northern Ethiopia. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1019996

Jacoby, H. G., & Minten, B. (2007). Is Land Titling in Sub-Saharan Africa Cost-Effective? Evidence from Madagascar. *The World Bank Economic Review*, *21*(3), 461–485. https://doi.org/10.1093/WBER/LHM011

Kassa, W. (2014). Land titling and investment in Tanzania: An empirical investigation. *Available at SSRN 2480216*. http://dx.doi.org/10.2139/ssrn.2480216

Kehinde, M. O., Shittu, A. M., Adewuyi, S. A., Osunsina, I. O. O., & Adeyonu, A. G. (2021). Land tenure and property rights, and household food security among rice farmers in Northern Nigeria. *Heliyon*, *7*(2). https://doi.org/10.1016/j.heliyon.2021.e06110

Kousar, R., & Abdulai, A. (2016). Off-farm work, land tenancy contracts and investment in soil conservation measures in rural Pakistan. *Australian Journal of Agricultural and Resource Economics*, *60*(2), 307–325. https://doi.org/10.1111/1467-8489.12125

Kubitza, C., Krishna, V. V, Urban, K., Alamsyah, Z., & Qaim, M. (2018). Land property rights, agricultural intensification, and deforestation in Indonesia. *Ecological Economics*, *147*, 312–321. https://doi.org/10.1016/j.ecolecon.2018.01.021

Luchia, T., Hadush, H., & Hadas, B. (2018). Evaluation of frontline demonstration of herbicide (Pyroxsulam) for weed control in bread wheat in Tigray, Northern Ethiopia. *Journal of Agricultural Extension and Rural Development*, *10*(1), 20–27. https://doi.org/10.5897/jaerd2017.0910

Melesse, M. B., & Bulte, E. (2015). Does land registration and certification boost farm productivity? Evidence from Ethiopia. *Agricultural Economics*, *46*(6), 757–768.

https://doi.org/10.1111/agec.12191

Mengesha, A. K., Bauer, T., Damyanovic, D., Agegnehu, S. K., Mansberger, R., & Stoeglehner, G. (2022). Gender Analysis of Landholding and Situation of Female-Headed Households after Land Registration: The Case of Machakel Woreda. *Land*, *11*(7), 1029. https://doi.org/10.3390/land11071029

Mengesha, A. K., Mansberger, R., Damyanovic, D., & Stoeglehner, G. (2019). Impact of Land Certification on Sustainable Land Use Practices: Case of Gozamin District, Ethiopia. *Sustainability*, *11*(20), 5551. https://doi.org/10.3390/su11205551

Migot-Adholla, S., Hazell, P., Blarel, B., & Place, F. (1991). Indigenous land rights systems in sub-Saharan Africa: a constraint on productivity? *The World Bank Economic Review*, *5*(1), 155–175. https://doi.org/10.1093/wber/5.1.155

Mohammed, A. J., & Inoue, M. (2014). Land Tenure Reform and Its Implication for the Forest. Case Study from Oromia Regional State of Ethiopia. *Journal of Forest and Environmental Science*, *30*(4), 393–404. https://doi.org/10.7747/JFES.2014.30.4.393

Muchomba, F. M. (2017). Women's land tenure security and household human capital: Evidence from Ethiopia's land certification. *World Development*, *98*, 310–324. https://doi.org/10.1016/j.worlddev.2017.04.034

Pinckney, T. C., & Kimuyu, P. K. (1994). Land tenure reform in East Africa: Good, bad or unimportant? *Journal of African Economies*, *3*(1), 1–28. https://doi.org/10.1093/oxfordjournals.jae.a036794

Place, F., & Migot-Adholla, S. E. (1998). The economic effects of land registration on smallholder farms in Kenya: evidence from Nyeri and Kakamega districts. *Land Economics*, 360–373. https://doi.org/10.2307/3147118

Taye, G., Poesen, J., Vanmaercke, M., Van Wesemael, B., Martens, L., Teka, D., Nyssen, J., Deckers, J., Vanacker, V., & Haregeweyn, N. (2015). Evolution of the effectiveness of stone bunds and trenches in reducing runoff and soil loss in the semi-arid Ethiopian highlands. *Zeitschrift Für Geomorphologie*, *59*(4), 477–493. DOI:10.1127/ZFG/2015/0166

Tolasa, D. F., Akrofi, E. O., & Osei, E. M. J. (2024). Assessment on practice of urban land governance framework in Ethiopia. *African Journal on Land Policy and Geospatial Sciences*, *7*(3), 860–875. https://doi.org/10.48346/IMIST.PRSM/ajlp-gs.v6i2.36118

Tsegaye, A., Adgo, E., & G. Selassie, Y. (2012). Impact of Land Certification on Sustainable Land Resource Management in Dryland Areas of Eastern Amhara Region, Ethiopia. *Journal of Agricultural Science*, *4*(12). https://doi.org/10.5539/JAS.V4N12P261

Weldearegay, S. K., Tefera, M. M., & Feleke, S. T. (2021). Impact of urban expansion to peri-urban smallholder farmers' poverty in Tigray, North Ethiopia. *Heliyon*, *7*(6). https://doi.org/10.1016/j.heliyon.2021.e07303

8. KEY TERMS AND DEFINITIONS

Land certification: in the context of Ethiopia, land certification is a program that enables legalizing land rights and providing land tenure security. It has resulted in increased land related investments and improved land rental market participation. Furthermore, the program has been associated with improvements in management of land resources, sustainable land related investments, farmers confidence in land ownership rights, increase in agricultural investment and productivity

soil conservation: Soil conservation refers to the set of management strategies and practices aimed at preventing soil degradation and maintaining its health. It involves techniques that reduce erosion, prevent nutrient depletion, and enhance the soil's capacity to retain moisture and support plant growth. By protecting the soil from harmful effects of wind, water, and human activities, soil conservation ensures the long-term fertility and productivity of agricultural land, forests, and ecosystems, thus playing a crucial role in sustainable land management and environmental protection

Rural farmers: Rural farmers are individuals or communities engaged in agricultural activities in non-urban areas, typically focusing on crop cultivation, livestock rearing, or a combination of both. They rely on traditional or modern farming practices to produce food, fiber, and other agricultural products, often using the land and natural resources available in rural environments. Rural farmers are vital to local economies and food security, as they produce a significant portion of the world's food supply. Their livelihoods are closely tied to environmental conditions, and they often face challenges such as limited access to markets, infrastructure, and agricultural technology

Peri-urban farmers: Peri-urban farmers are individuals or groups engaged in agricultural activities on the outskirts of cities or urban areas, in regions where urban and rural landscapes intersect. These farmers often practice small-scale farming, growing crops or raising livestock to supply nearby urban markets with fresh produce. Peri-urban farming can include both subsistence and commercial farming, and it plays a key role in providing food to rapidly growing urban populations.