



# Adoption of sustainable agricultural practices and food security threats: Effects of land tenure in Zambia

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## ABSTRACT

Among environmental challenges, sustainable agricultural practices (SAP) are imperative to attain better agricultural productivity and food security status of smallholder farms in sub-Saharan Africa, including in Zambia. To understand the adoption behavior of SAP of Zambian farmers in more depth, the study determines factors that influence the adoption probability of SAP. In particular, we study the effect of land tenure. Furthermore, the study tests the association of SAP use and food security of smallholder households. Data collection involved a structured questionnaire survey that was conducted in southern Zambia in 2016. The sample consisted of 400 households, 200 with customary and 200 with statutory land tenure. The probit regression analysis results indicate that land ownership influences the adoption of SAP in our sample. Households with customary land tenure had a 17.4%, 17.2% and 9.1% lower probability to adopt crop diversification, agroforestry and planting basins, respectively, than households with statutory tenure. Descriptive chi-square tests revealed that the implementation of crop diversification and agroforestry is associated with the food security status of smallholder households.

## 1. Introduction

The dominate livelihood activity in Zambia is small-scale farming mainly cultivating maize. Agriculture employs 72% of the country's labor force, with more than 60% of the population residing in rural areas (FAO, 2015). The 2016 global hunger index report (GHI) ranks Zambia as the country with the third highest hunger levels after Chad and the Central African Republic, indicating alarming levels of hunger (IFPRI, 2017). In this regard, agricultural development is seen as a necessity to combat food insecurity faced by many agricultural households (Goshu et al., 2013). To increase food security, the key is to maintain soil fertility and higher food productivity with respect to environmental challenges (Wagstaff and Harty, 2010). Lovo (2016) emphasizes the critical role of adopting environmental friendly sustainable agricultural practices (SAP) to maintain soil fertility. Numerous practices such as the use of cover crops, intercropping, and agroforestry have been discussed to promote agricultural yields and soil conservation (Mensah, 2015). In this paper, we analyze the adoption and food security effects of several SAP that are relevant for the Zambian condition such as crop diversification, intercropping, agroforestry and the

use of a planting basin. SAP are promoted through the Conservation Farming Unit (CFU), a non-governmental organization in Zambia. CFU activities are conducted in collaboration with the national association called the Zambia National Farmers Union (ZNFU), which represents the farmers and the agriculture industry. The focus of both organizations is to disseminate information on the major farming practices that result in reduced soil disturbances, permanent soil cover, crop rotation, nitrogen fixation and amelioration of soil fertility to smallholder farmers (Andersson and D'Souza, 2014).

The challenges for increasing agricultural productivity are related to the decline in soil fertility due to low adoption of sustainable agricultural practices. Further, insecure property rights to agricultural land may hinder the adoption of SAP. The adoption of SAP by farmers can be motivated by the soil fertility increase and the resulting increase of crop yields, food security and household incomes. However, one of the most common obstacles in adopting SAP is land tenure insecurity (Fouladbash and Currie, 2015), as the positive effects of the SAP adoptions are often achieved after a certain period of using the SAP. Farmers whose land rights are insecure are thus not motivated to invest in future improvements they will not profit from. Furthermore, the

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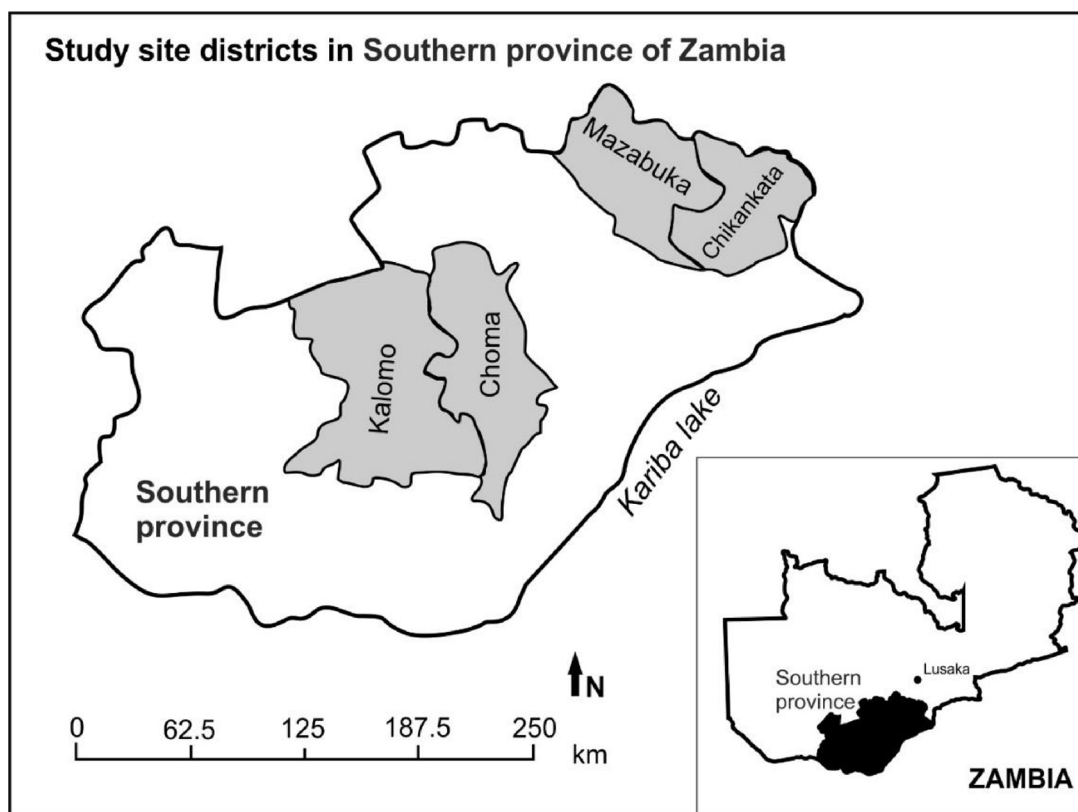


Fig. 1. Study area.

benefits attributed to land security and land ownership include assured access to financial capital and freedom to adopt innovation (Fenske, 2011). The study published by Borrás et al. (2015) describes property rights to land as a means of providing protection to landowners to exclusively utilize and maximize returns from their land productivity. Mensah (2015) asserts that land rights on land ownership are a motivation for adopting SAP for the attainment of crop yields and food security. Research conducted on the effects of land ownership on the adoption of SAP in Africa shows that secure land tenure is one of the important factors that affect the adoption of SAP. A positive effect of secure land tenure on SAP adoption was observed by Holden et al. (2009) in his study conducted in Ethiopia. Kassie et al. (2013) focused on the adoption of innovative agricultural practices among rural smallholders in Tanzania. The results revealed that land size, land ownership and extension services use influenced the adoption of intercropping and crop rotation. Abdulai et al. (2011) conducted research on the relationship between land tenure and the use of mulching, tree planting, manure and mineral fertilizers in Ghana. Land tenure was classified as secure for the households that owned land with full property rights. Contrarily, insecure land tenure comprised owners of land with restricted property rights, fixed rent and sharecropping contracts where the tenants pay a share of their produce to the landowner. The findings indicate that secure land tenure positively influences the likelihood of adopting tree planting practices. Mbow et al. (2014) highlighted that despite the positive effects attributed to SAP, adoption of these practices is still low in Africa.

In Zambia, there are two main land tenure systems, classified as the customary and statutory systems. To our knowledge, there is no study analyzing the effect of land tenure on the adoption of SAP in Zambia. Therefore, the first aim of this study is to close this gap and improve knowledge regarding the effect of land tenure and other factors on the adoption of four selected SAP, namely, crop diversification, intercropping, agroforestry and planting basin use.

The effects of the adoption of innovative SAP on food security have

been investigated in previous studies. Quinion et al. (2010) reported the effects of adopting SAP such as agroforestry on food security among smallholder farmers in Malawi. The findings show that the adoption of sustainable practices contributes to a reduction in the number of hunger months. Kristjanson et al. (2012) considered the relationship between agricultural practices (agroforestry, cover crops and crop rotation) and their contributions to household food security in East Africa. The analysis indicated that the food-insecure households had adopted a lower number of agricultural practices. A study by Makate et al. (2016) conducted in Zimbabwe investigated the effect of adopting crop diversification on livelihoods. The findings indicated that the adoption of crop diversification enhances the food security of households. Ngoma et al. (2015) investigated the contribution of adopting planting basins for maize cultivation in Zambia. The study revealed that the adoption of planting basins increases crop yields and thus contributes to hunger reduction among smallholder households. Manda et al. (2016) determined the effect of the adoption of selected SAP (crop rotation and crop residue retention) on maize yields and household income in Zambia. The findings showed that farms that had adopted both SAP reported an increase in their maize yields and household incomes. Arslan et al. (2015) analyzed the effect of adopting intercropping and crop rotation on maize yield for smallholder farmers in Zambia. The results showed that maize yields increased in legume/maize intercropping. Surprisingly, for crop rotation, an increase in crop yields was observed in areas with a variable rainfall pattern, and a reduction in yields was observed for areas with a stable rainfall pattern.

Little attention has been given to the effect of adopting sustainable agriculture practice on food security in Zambia. Thus, to improve the understanding on this issue, the second aim of this study is to analyze the effect of the use of selected SAP (crop diversification, intercropping, agroforestry and planting basin) on food security.

The paper is organized into four sections. The next Section (2) presents the data and methodology used. The results are presented and discussed in section three. The paper closes with conclusions (Fig. 1).

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