



# Road improvement enhances smallholder productivity and reduces forest encroachment in Ghana<sup>☆</sup>



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## ABSTRACT

Agriculture employs about 70% of the active labour force, yet contributes only 30% to the Gross Domestic Product (GDP) of Sub-Saharan Africa. About 60% of African farmers cultivate mainly for household consumption on 2–2.5 ha of land and depend upon roads to access local and regional markets. Forest encroachment by smallholder farmers is a major cause of deforestation in Africa. We used regression analysis to determine the degree to which road improvement influenced farm size, forest encroachment and market participation in rural Ghana. We obtained data on household size and characteristics and farm plot size from 300 farmers in 10 communities. Farms accessible by improved roads had stable or slightly declining areas under cultivation. Improved roads led to better market integration, more use of farm inputs and higher yields. Farmers in areas with unpaved roads used fewer inputs, had less market penetration and were forced to encroach on forests for additional farmland to increase production. Our evidence suggests that linking rural people more efficiently to markets by improving roads will encourage commercial farming and reduce farm expansion into forests. Improved agriculture alone will not limit forest encroachment. Enforcement of forest protection regulations will also be needed to restrict encroachment.

## 1. Introduction

Agriculture is an important economic sector in Africa. About 70% of the active labour force in Sub-Saharan Africa (SSA) are farmers practicing subsistence farming mostly for household consumption (Food and Agriculture Organization (FAO), 2012). About 60% of farmers in SSA consume their own farm produce partially or entirely. Almost 75% of cereals and all root crops consumed in Africa are produced by both small- and large-scale farmers (Alliance for a Green Revolution in Africa (AGRA), 2013). Agriculture in Africa is constrained by poor infrastructure, especially poor quality and extent of roads, which increases the prices of inputs such as fertilizers and limits access to markets for farm produce. Poor road networks are obstacles to farmers' technology uptake, training, and education and these factors combine to limit innovation in farming (Badu et al., 2013). In Africa, roads are the main means through which farmers transport their produce to market (Angmor, 2012; Bafoil and Ruiwen, 2010). Farm size and the integration of farms into the cash economy are influenced directly by roads that connect farmers to markets (Amadi, 1988). However, the degree to which improved roads influence farm size and commercialization of agriculture varies from place to place, and few empirical studies have

been published (Amadi, 1988; Yamauchi, 2016). This research statistically tests the degree to which improved roads influence farm size, which has been identified as a proxy for deforestation (Gibbs et al., 2010; Laurance et al., 2014), and market participation in rural Ghana.

Global population is projected to exceed 9 billion by 2050 at which time Africa is expected to have 25.5% of the world's people (FAOSTAT, 2015). Some authors predict that global food demand will increase by 70–110% during this period as a result of population growth and changed diets (e.g. Laurance et al., 2014). Other authors have suggested that up to a billion hectares of land would need to be converted to agriculture by 2050 to meet this growing food demand (e.g. Edwards et al., 2014). Agricultural expansion is portrayed as a major threat to tropical forest conservation (Laurance et al., 2014). However, agricultural production could increase through the use of improved seeds and inputs, introduction of new farming techniques that are resistant to varied climatic conditions, and improved transport (Sayer and Cassman, 2013). Food needs could be met by producing more food on existing farmlands using modern agricultural techniques (Alliance for a Green Revolution in Africa (AGRA), 2013). Improved transport, especially roads, could make a major contribution to facilitating farm productivity enabling food needs to be met without increasing the need for

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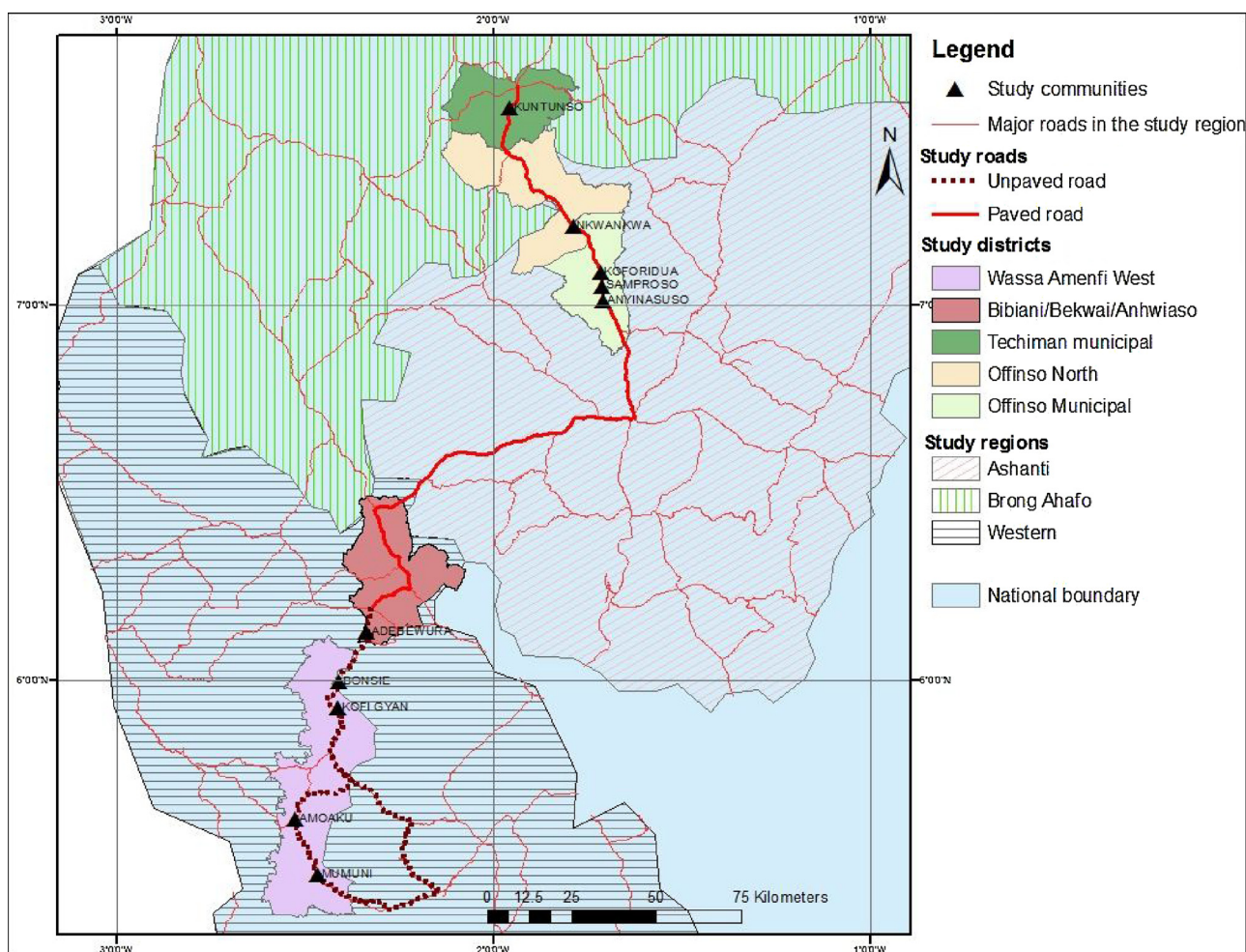


Fig. 1. Study regions, districts, and communities in Ghana.

Source: Resource Management Support Center, Forestry Commission of Ghana, 2015.

additional land (Amadi, 1988; Yamauchi, 2016). The degree to which improved roads influence farm size and market connectivity could be a major determinant of future demand for land. Farm size and productivity will determine the future of Africa's forests because most farmlands were initially forests; expanding agricultural land in forest frontiers would mean loss of the remaining forests and biodiversity (Gibbs et al., 2010).

Farm size dynamics are linked to the household life cycle (HLC); smallholder households with young age structures farm smaller plots of land (Perz et al., 2006). The HLC theory holds that farm sizes initially increase as family size increases and then decrease as land is subdivided to meet the needs of grown children (Leonard et al., 2011). Many young farmers with small household sizes and less capital migrate to new farming areas to farm on initially small land parcels. These farmers expand their farms as their household sizes expand. Farm sizes begin to decline as household members grow and leave to start their own farms and families. The presence of a successor influences the current farmer's decision to maintain, reduce, or transfer farmland to other farmers. Farmers without a successor often retire on their farm, gradually disinvesting and reducing farm size (Van Vliet et al., 2015). Migration to cities and employment in manufacturing and services reduce the trend for farm subdivision.

The HLC theory does not address the question of how other factors such as access to improved roads and farm inputs influence farm size. Neither does it address the effects of farm expansion on forests. Limited access to inputs resulting from financial constraints and lack of non-farm income could lead to the persistence of subsistence farming (Van

Vliet et al., 2015). Rural areas with high transport costs resulting from, among other factors, unimproved roads, tend to have small farms and practice subsistence farming (Gockowski et al., 2014; Hazell et al., 2010). In some SSA countries, the area under cultivation expanded by 50% between 1990 and 2011 (Alliance for a Green Revolution in Africa (AGRA), 2013) due to the growing population of farmers. However, increasing demand for land is leading to declines in farm size and farmers have little option other than continuing subsistence cultivation.

Subsistence farmers suffer financial and agricultural input constraints, which prevent them from intensifying their production. Most subsistence farmers rely on forests as land banks and achieve increased productivity due to the fertility of the soil in freshly cleared areas (Owubah et al., 2000). Large household size often exacerbates this problem (Wiggins, 2009). Evidence however shows that access to improved roads increases market integration by enabling smallholder farmers to transport a larger proportion of their produce to markets (Hazell, 2013) the income from which can be used to intensify farming. Many studies have shown that road condition, distance to market, travel time to market, household size, labour availability, and farming experience, influence the transition to commercial agriculture (Ouma et al., 2010; Sebatta et al., 2014).

Previous research has related farmers' market participation to road distance and condition by arguing that farmers in the hinterlands with poor or no roads fail to commercialize their produce due to high transport costs especially during the wet seasons (Amadi, 1988; Ouma et al., 2010; Sebatta et al., 2014). Road quality is also known to influence agricultural intensification and when combined with the

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