

REVIEW

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# Land and heterogenous constraints nexus income diversification strategies in Ethiopia: systematic review

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## Abstract

**Background:** Agriculture is a key to Africa's future. With alarming population growth, the quest for land increases not only for farming, but also for housing, and the building of industries. Likewise, Ethiopian highlands, cultivated land-holding sizes are very small and the land-to-man ratio is declining over time. This exposes the young rural population to facing severe land constraints, poverty, and food insecurity. In addition, constraints facing rural households are inevitably varied and diverse. Hence, this paper examines an in-depth and systematic review of how the rural economy responds to the existing land constraints and what specifically drives them for income diversification outlooks; accumulative or survival strategies in the spatial and temporal dimensions.

**Method:** We have used a systematic review with concept definitions and a qualitative approach that relies on the analysis of current literature and deductive logical reasoning to generate a comprehensive scientific understanding of a topic that can capitalize information for future research and policies. Different inclusion and exclusion criteria were applied and filtered pertinent articles to this study in countrywide verdicts.

**Result:** The burgeoning literature underscores farm sizes are strongly and positively correlated with net farm income and overall livelihood options, and land constraint leads to rural poverty. One of the pressing issues in rural, as well as urban areas, is that millions of small-scale farmers are becoming landless, and forced as daily laborers for other income sources or joining the already massively overloaded urban and peri-urban low-productivity services sector. In addition, skill, capital (financial and physical), and multiple constraints coupled with the small land sizes including high unemployment, social tension, migration and *crowding out* the nearest towns. Further, findings pointed out that rural market failures—particularly in the areas of land and finance—force poorer subpopulations to choose strategies with demonstrably lower returns, while wealthier ones are engaging in higher returns with lower marginal and entry costs of participation. Hence, push-and-pull factors of off-farm and non-farm engagements are the survival strategies and persuade the social welfare of the poor.

**Conclusion:** With heterogenous constraints, diversification patterns reflect people's voluntary asset exchanges and asset allocation across diverse activities to attain the best possible balance of projected returns and risk exposure given the restrictions they confront due to missing or incomplete markets for land, credit, or labor. Particular emphasis for the vibrant income diversification strategies should be set in and policymakers must stimulate buoyant rural economies, with robust non-farm and off-farm income and innovative farming practices. Hence, the poor must gain

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access to the growing market niches and basic infrastructure development. Smooth and unconstrained labor markets provide one important bridge linking the rural poor to growing non-farm opportunities.

**Keywords:** Land constraint, Rural poverty, Food insecurity, Income diversification

## Background

Agriculture is a key to Africa's future. The continent has most of the world's arable land, and over half of the population is employed under the agricultural sector and it is the largest contributor to the total gross domestic product (GDP). Yet, still Africa is producing too little food and low value-added products, and productivity has been broadly stagnant since the 1980s [2].

In addition to that, in developing countries due to high population growth, the quest for land increasing for housing, farming, and the building of industries. However, its existence is limited. Equally, enhancing agricultural production in the face of a growing population is one of the major challenges facing the sub-Saharan Africa (SSA) region at the start of the twenty-first century including Ethiopia. The high population growth rate becomes a critical challenge and the region accounts for 900 million people and is expected to double in 2050. The rapid population growth in many developing countries threatens to undermine different investments and exacerbate the challenges of poverty existence, and job creation. It also puts pressure on agricultural land, freshwater, and natural resources [42].

Ethiopian highland is one of the most densely populated regions of Africa and has long been associated with both Malthusian disasters and Boserupian agricultural intensification. As Malthus pointed out that small and shrinking farm sizes have long been associated with agricultural crises and food insecurity.<sup>1</sup> As Headey and Jayne [50] noted that Ethiopia is among the 12 African countries in which constitute a high population density<sup>2</sup> group with rural population densities above 100 people per square kilometer (i.e., 194 people per square kilometer). FAOSTAT and census/survey data show that farm size declined sharply from the 1970s to the 2000s.

According to Headey and Jayne [50], Ethiopia has a long history of intensification of agriculture through the appropriation of advances that either conserve on labor (the ox-plow), preserve natural resources (different land structures, as an example, terracing, and also the utilization of tree harvests to protect soil integrity), or augment

value per hectare. Nonetheless, with quick population growth in a few years, endogenous technological change might be insufficient and that arrangement incited reactions to population growth needs a higher priority than ever.

Recently, Ethiopia's government gave emphasis and priority to agricultural development. Highly agrarian and nearly 80% of the population depend on small-scale agriculture. To increase smallholder productivity, Ethiopia endorsed an ambitious plan to develop and extend new seeds, chemical fertilizers, new crops, and new natural resource management practices (including irrigation and all this planning to develop small-scale agriculture against the high population pressure of Ethiopia [50]. It has likewise made a generous investment in road and agricultural extension services [15, 24, 28] and sanctioned ambitious socio-economic plans, for example, decreasing rural fertility rates [68], giving widespread essential primary schooling, and creating secondary urban communities and towns.

However, with the continual and emerging human pressure; the quest for land becomes devastating. It causes deforestation for the interest of convert forest and woodland areas to pasture and cropland, the harvesting of logs, and the gathering of fuelwood [20]. According to the CSA Medium Variant projection, the Ethiopian population will double in the next 20 years if the fertility rate continues as the years between 1994–2007, it increased by more than 25% with an annual population growth rate of 2.5%.

In this review, we emphasize on the population pressure and its projection and land, multiple constraints, and food insecurity coupled with the poor practice of agricultural activity that will become a pressing issue for many decades to come in Ethiopia despite the recent agricultural productivity growth slightly. Hence, our main concern and initiative is to deepen the concept and shed light on overall agriculture and food security discourse specific to Ethiopia where heterogenous constraints entrapped back on the move.

Despite being an interesting discourse to deal with, there is little empirical evidence on how the rural economy perceived it, especially in the highlands of Ethiopia, where land shortage and fragmentation are the most severe, its response to land, skill, and capital constraints. How do they adopt it? What kind of long-lasting policy should be devised? Furthermore, when farm households

<sup>1</sup> This food insecurity can impair health and well-being in a variety of ways, with potentially negative mental and social implications in addition to physical well-being [16].

<sup>2</sup> Population density is calculated by Midyear population divided by land area in square kilometers.

diversify their income is it an accumulative or survival motive for them taking into consideration of food security discourse?

### Objectives

The main aim of this review is to identify the response mechanism for the land constraint and multiple constraints of farm households in Ethiopia and to examine different income diversification strategies and motives.

### Review method

The comprehensive systematic literature review is carried out based on theories and empirical findings, and extracted saturated information. Both temporal and spatial dimensions able to filter information focusing on recent works that reflect countrywide verdicts were used. Following the rationalist theory, the study uses an integrative concept-centric qualitative technique that relies on the analysis of current literature and deductive logical reasoning to generate a new comprehensive scientific understanding about a topic that can be an informative input for future research and policies.

### Search engine used

Hence, the literature searches mainly emphasized land-constraint issues focused on Ethiopia. The information offered by Google Scholar; and peer-reviewed major indexers of web of science and Scopus have been used to extract useful information during this review script. Hence, journal articles, books, reports, periodicals, and proceedings were included by using the main keywords such as 'land constraints', 'food (in)security in Ethiopia', 'income diversification strategies', 'farm size and intensification in Ethiopia', 'adaptation to land constraint', 'land and population pressure', 'push and pull factors', 'non-farm income', etc.

Overall, 85 journals, books, proceedings, and thesis work, agencies reports related to the topic were browsed and around 55 materials were filtered specifically to the title by using keywords and used for this review purpose.

### Structure of the review

The next part of this script will discuss some concepts, definitions, and theoretical setups with the perspectives of population explosion and its features on land pressure and food insecurity patterns. Evidence on income diversification strategies, motives of diversification and its features, correlates of household income diversification, and its risk management strategy of farm households of Ethiopia will be discussed thoroughly.

### Population pressure agriculture nexus

In Ethiopia, growing land scarcity is a serious problem; for such the present land tenure regulations are a major contributor. Farmers are only granted user rights, not ownership rights, under the current land tenure system, hence land cannot be sold, exchanged, or mortgaged [39]. Farmers have very limited options for acquiring additional land. However, an informal land market appears to have emerged recently [7]. But both sharecropping or fixed contracts are only for a short period and resulting in insecurity for farmers.

For the equitable access to land, as well as efficient and long-term land use, it calls for African governments to pay attention to the state of land administration systems, particularly land rights delivery systems and land governance structures and institutions, and to allocate sufficient budgetary resources to land policy development and implementation [77]

*".....In many instances, unequal distribution of land has relegated a growing population of small farmers onto marginal areas leading to increasing physiological pressure and land and resource degradation including deforestation..." [77]*

In addition, in the academic arena, debates on the relationship between agriculture production and high population pressure are not a recent discourse. Its argument between population growth and resource returns to the classical theory of Malthus. In the eighteenth century, the theory of Malthus has made everybody accept the negative effect of population on development [29]. The central tenet of Malthus is "the growth of population consistently will, in general, exceed the productive capacities of land assets". He further expressed the impact of the population is inconclusively more prominent than the control of the earth to deliver means for the man [55]. As per this hypothesis, the production increment of resources could not take care of the outstanding growth of the population. This dreary speculation has reinforced the hypothesis, as the human number develops food supply would be inadequate to take care of the arising individuals so the population is pushed back underneath the carrying capacity of farming frameworks [13].

The debate on 'limits to growth' comparable to population-production nexus is a ceaseless talk. The characteristic and virtual imbalance among population and creation has multifaceted connections. Adjustment changes and adaptation towards increasing population and land shortage were at first conceivable through land extensification [74]. As open doors for land expansion vanished, farming has infringed into delicate fragile ecosystems, regularly without the fundamental asset changes, and prompted soil degradation, deforestation,

and loss of biodiversity. Subsequently, Malthus proposed positive and preventive checks to offset the rising population with the current means. The positive checks incorporate an increase in mortality because of infection, starvation, unhealthiness, and war while preventive checks are owing to decreasing fertility through postponing marriage, abstain, and others [13]. On the expression of classical economic experts, the population is a dependent variable determined by preceding changes in agricultural profitability.

The issue of land shortage for food production and cultivation purpose could potentially lead to multiple constraints including an inability to meet food security, especially for the rural farm households. Not only shortage of sufficient food production, food loss, and food wastage are huge problems in the supply chain system. Meanwhile, about one-third of the global food production is lost or wasted along the food supply chain [27, 70].

Given that Ethiopia's current status is landlocked and reliance on agricultural, agro-pastoral, and pastoral lifestyles, the country's scarce natural resources will be further strained. As Funk and Brown, [38] state that crop statistics from the United Nations' Food and Agriculture Organization show that Ethiopia's per capita cereal production is poor (150 kg/person/year). Despite improved yields, the amount of cropland per person has been dropping at twice the rate. If current trends continue, cereal production per capita could fall by 28% by 2025. With this level of food production, millions more Ethiopians could face hunger and malnutrition. Since the local agricultural output is essential for rural poor food security and economic development. The amount and quality of arable land, as well as the amount and quality of agricultural inputs (fertilizer, seeds, pesticides, etc.) and farm-related technology, practices, and legislation, will affect the degree of local agricultural production.

Similarly, coupled with land constraints, multiple constraints have been facing farming profitability in Ethiopia. It incorporates low accessibility of improved or hybrid seed, absence of seed multiplication capacity, inappropriate and inefficient use of fertilizer application, and lack of sufficient use of irrigation practice and water limitations. Similarly, the absence of transport framework and market access diminishes productivity and receiving improved practices [52]. Its features of Ethiopia's agriculture are highly nature dependent and the common jobs of smallholder farmers and usually characterized by different problems such as poor soil fertility, erratic and volatile rainfall, crop and livestock and diseases, market and price shocks for crop and livestock products, and other related conditions ended up with low income and food insecurity and that perpetuates in the poverty vicious trap. It has been mentioned that one of the main reasons

for poverty and food insecurity in Ethiopia are the majority of smallholder farmers are extremely low agricultural productivity [17], majority of food producers use low-input, rain-fed, and low-output farming systems Ministry of Agriculture and Rural Development [62]. In addition, lack of innovation or change is frequently attributed to structural issues, such as farmers' limited access to improved technologies and credit, low financial incentives, or the problem of very small and fragmented plots, which make mechanization of agriculture unprofitable [25].

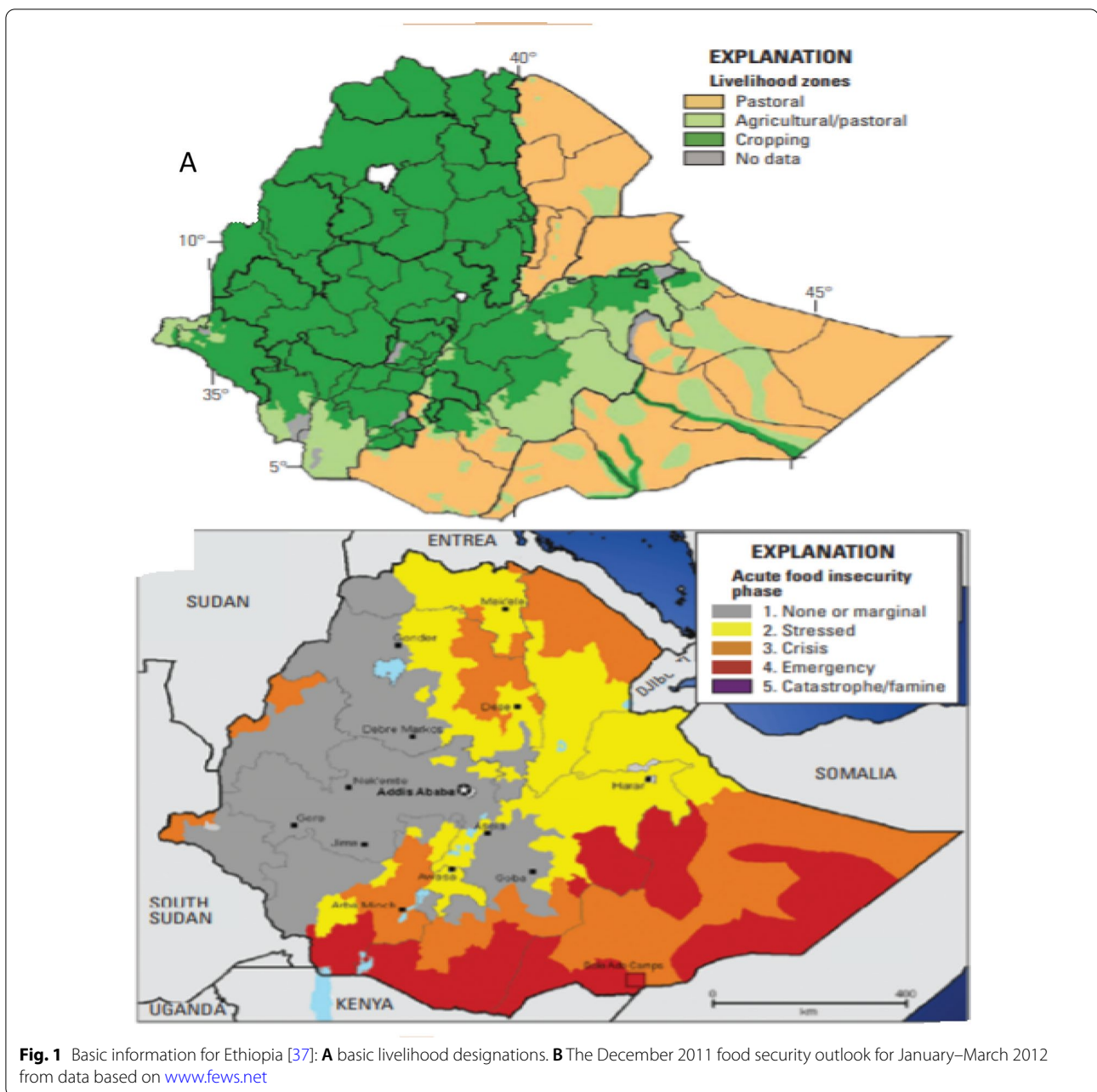
As indicated by Mulat et al. [64], the Ethiopian economy is among the most defenseless in sub-Saharan Africa. It is vigorously subject to rural area [10], which has experienced recurrent droughts and extraordinary variances of yield. The existing chances and limitations confronting the agriculture sector are unequivocally impacted by conditions that shift across topographical space. These conditions incorporate essential agricultural production possibilities, access to inputs and yield markets, and neighborhood populace densities which speak to both work accessibility and nearby interest for food.

Moreover, in the northwest highland of Ethiopia, the increasing problem of landlessness has put pressure on regional governments to redistribute land. On the contrary, land redistribution becomes a cause for social tension and unrest within the society following the redistribution. In this line, a major redistribution of land was implemented in 1997 and 1998. Following that, land redistribution in the Amhara region is linked with a positive impact on land productivity, by increasing access to the land of farmers who are more interested or able to use purchased inputs such as fertilizer and herbicides. However, Benin and Pender [8] pointed out that redistribution did not show much effect on the existing or expectations of future redistribution on land improvement and management. Thus, to the extent that investment in land improvement is necessary for conservation purposes, in the same way policy change to stop land redistributions is unlikely to have a substantial impact on reducing land degradation. However, credit and extension programs, and improving land rental markets, overall present better strategies for improving land management in the region.

As can be seen in Fig. 1a livelihood options for most of the Ethiopian smallholder farmers are cropping system especially the western part; while the eastern part of the country is dominated by pastoral and exposed to frequent food insecurity, crises, and emergency sought location (see also Fig. 1b).

Along with those densely populated areas, in the Rift Valley, SNNPR and Oromia, where agriculturalists face near-chronic food insecurity, these arguments are taking into consideration the ongoing debates of food insecurity

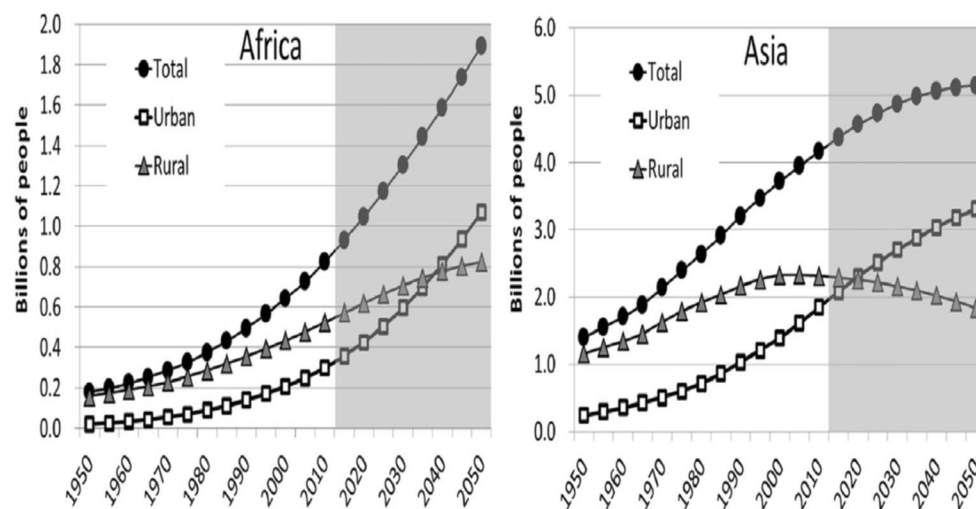




measurement discourses. For instance, following food and financial crises, food security measurement has been substantially expanded in recent decades worldwide, however, persists significant dissatisfaction with the measurement systems. In the middle of that Headey and Ecker [49] suggest four types of benchmarks for the food security indicators (in terms of calories intake, level of poverty, dietary diversity, and other subjective indicators). Preferably, dietary diversity indicators are the best performing class of indicators and are powerful

predictors of economic status and malnutrition. Similarly, the concept of food security, according to Maxwell [58], focuses on three key paradigms. The first paradigm shifts how food security is conceptualized from a global and national level to a household and individual level, the second from a food-first to a livelihood-first approach, and the third from objective indicators to subjective perception.

From time to time, the concept of food security has evolved. From the 1950s to the 1970s, the focus was on



**Fig. 2** Changes in rural, urban, and total populations, 1950–2050. Source: Adapted from Jayne, 2013 using data from United Nations (2012), World Urbanization Prospects: The 2011 Revision, online at <http://esa.un.org/unup>

the national supply-side availability of enough food to support a growing population [57]. In the early 1980s, attention shifted to the demand-side of food security, or people's ability to obtain food to feed themselves. More recently, emphasis has been placed on food consumption through adequate nutrition, preparation, and feeding methods, as well as the long-term stability of these circumstances [35]. Likewise, household food acquisition and allocation behavior are useful measures for household and individual welfare outcomes. Moreover, clean water and good sanitation should be considered where nutritional security is the goal of interest [67].

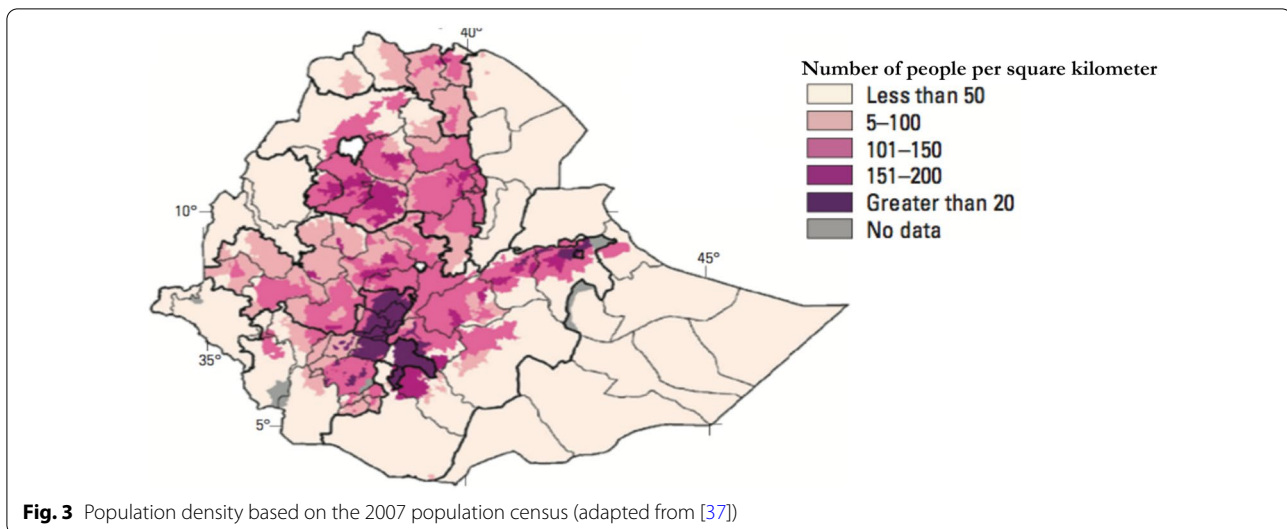
Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life [36], according to the dominant definition agreed upon at the 1996 World Food Summit. This can additionally be clarified as accomplishing food security necessitates that the total accessibility of actual supplies of food is adequate, that families have sufficient admittance to these food supplies through their production, through the market, or different sources, and that the use of these food supplies is fitting to meet the particular dietary requirements of people [60].

Thus, accessibility, availability, utilization, and stability are presently broadly acknowledged as the four pillars of food security [78]. Indicators to measure food security have been proposed over many years: from narrow estimation on explicit factors to complex records pointed toward combining the numerous measurements that

describe food security [59, 71, 78]. Several classifications have been received to sort out the measurements. To begin with, indicators of food security may incorporate data at various levels (worldwide, national, family, and/or individual), second, indicators might be situated to at least one component of the food security (availability, accessibility, utilization, and stability); third, they can be recognized in static and dynamic indicators; fourth, they may privilege a specific sort of information [71].

Until this point, no food security measure fulfills four pillars of food security. Therefore, the global community has depended intensely on proxy estimates that take care of one, two, or maybe three of these axioms [78]. Be that as it may, a mix of measures and indicators is expected to fully mirror the complex truth of food security in any given setting [18].

Furthermore, according to Alemu et al. [4], not only land constraints, but also land fragmentation causes one of the fundamental challenges nowadays. Using cross-sectional data obtained from 240 respondents in 2016 production seasons utilizing linear and Cobb–Douglas production functions investigates the effects of land fragmentation on agriculture productivity in the highland districts of Northwestern Ethiopia, and land fragmentation account for 38% of variations in agricultural productivity in the model. The minimum size of farmland that can meet the food and cash needs of an average family of five adult equivalents was determined to be 1.25 hectares. Hence, the farmland size decrease due to subdivision has resulted in the size which does not support the average



**Fig. 3** Population density based on the 2007 population census (adapted from [37])

farm household for about 33% of the sample representatives in northwestern Ethiopia.

For instance, taking population changes and mixes of some developing countries such as Africa and Asia, as stated in Fig. 2, there is a continual high growth rate of the rural population in Africa, and there is a slight decline of the rural population of Asia. These also illustrate the year-to-year changes of rural and urban populations. This demographic transition drives rapid change in farm sizes, with less land available per family until non-farm<sup>3</sup> opportunities expand enough to absorb all new workers [56]

According to Masters et al. [56], there is great diversity within each continent, but long-term trends were driving the average farmer in both Africa and Asia to apply more labor on existing land, increasing the payoff from the development and adoption of labor-using, land-saving techniques such as new seeds and agronomic techniques. African farmers experienced much steeper declines in land per worker than Asian farmers, making year-to-year production growth per worker harder for them. Africa's distinctive demographic transition also involved a much larger increase in child dependency ratios. Gender differences in responsibilities for both food supply and child care made these trends impose a particular burden on women, worsening the cost of unequal access to resources and market opportunities.

Furthermore, like population growth and density, farm sizes in Ethiopia show big variation throughout the country. While there are large areas of mostly unpopulated

land in Ethiopia's lowland peripheries, the population-dense highlands face an extreme land shortage, and the average farm size in some areas (SNNP) has dropped to 0.49 Ha by 2012 (cf. Headey et al. [48]). The average farm size in Ethiopia was 0.96 ha in 2011–2012, with nearly 40% of the farmers relying on less than 0.5 ha (cf. Headey et al. [48]). Causes for the diminishing farm sizes can be found mainly in farm inheritance schemes and the Ethiopian land tenure system. Land in Ethiopia is owned by the state and cannot officially be sold, exchanged, or mortgaged [39]. The only way of acquiring land is through intrafamily inheritance. Due to the high rates of fertility, younger generations thus inherit much smaller farms than their parents did, even with some emigration [48]. Another consequence of these farm inheritance schemes and the land tenure system is a high fragmentation of land in Ethiopia [39].

The diminishing farm sizes and the high land fragmentation have severe impacts on food security in Ethiopia. While crop yields have been improving in the past years, farm sizes have decreased at a rate twice as fast [38]. If this trend continues, the per capita cereal production could decline by 28% until 2025 [37]. Decreasing farm sizes also influence the use of improved farming techniques such as crop rotation, intercropping, or using fallow periods and consequently, soil degradation is generally increasing with diminishing farm sizes [39]. The densest part of the country as can be seen in Fig. 3, is the central and northern part of Ethiopia, which will cause further land fragmentation and impact livelihood options.

<sup>3</sup> Non-farm activities include income sources other than crop production and animal husbandry, such as mining, manufacturing, utilities, construction, commerce, transportation, financial, and personal services (e.g. petty trading, wage laborer, handcrafting of any type, and so on) are examples of non-farm or non-agricultural activities that smallholder farmers can engage [44].

### Income diversification and its stylized facts

The burgeoning literature on *livelihood strategies* and *diversification patterns* includes many different implicit definitions for terms such as “non-farm” and “off-farm.” The farm/non-farm distinction revolves around sectoral classifications derived from standard national accounting practices while the on-farm/off-farm distinction reflects the spatial distribution of activities, with “off-farm” income generated away from one’s land [6].

But not all non-farm or off-farm activities offer equal returns. The economic theory predicts that *ceteris paribus* returns to an activity are increasing in the difficulty of entry into or exit from that market niche. Activities unfettered by entry or exit barriers, such as unskilled farm labor, offer low returns while those with significant entry barriers—e.g., the acquisition of skills or equipment—yield positive marginal economic profits in equilibrium. Previous empirical research in rural Africa has established the existence of significant entry or expansion barriers to high return niches in the non-farm economy [23]. Specifically, ‘farm’ activities are associated with those primary sector production processes that produce raw agrifood products from natural resources (land, rivers/lakes/ocean, air). The process can involve either growing (e.g., cropping, aquaculture, livestock husbandry, woodlot production) or gathering (e.g., hunting, fishing, forestry). “Non-farm” activities are associated with those secondary and tertiary sector production processes that use raw physical intermediate inputs (such as maize, milk, iron, wood) and process them into manufactured goods (such as maize flour, cheese, furniture, pails) or use financial or manufactured capital and labor to produce services (e.g., banking, commerce, transport). Notice that sectoral assignments depend only on the nature of the product and the types of factors used in the production process. Neither location (at or away from home) nor employer (self-employed or hired for a salary or wage) matter. In addition, diversification is not an end unto itself, it is vital to tie observed livelihood methods back to consequent income distributions and poverty. Especially, diversification into off-farm or non-farm income-generating activities does not always yield the same results, and not all households have equal access to the more lucrative diversification opportunities. However, there is scant information and explanation of important differences between observed diversification strategies about livelihoods in the literature.

Furthermore, diversification is can be seen as the process by which rural households construct increasingly diverse livelihood portfolios, making use of increasingly diverse combinations of resources and assets to meet their basic needs, improve their living standards or welfare, and manage risk [66]. It can be seen as the

maintenance and continuous alteration of a highly varied range of activities and occupations to minimize household income variability, reduce the adverse impacts of seasonality, and provide extra income or employment [6, 30, 45]. Diversification may occur either as a deliberate household strategy or as an involuntary response to a crisis [31]. The motivation for diversification strategies, therefore, varies in terms of household characteristics, location, assets, income level, opportunities, institutions, and social relations [30]. While some diversify because they have limited choices, better-off households need to diversify because they have a lot of choices. Similarly, while reliance on non-farm income diversification in rural areas, not all families enjoy equal access to attractive non-farm opportunities [6]. Similarly, women did not take a role to command over resources in many rural places of Ethiopia. This has been linked with imposition from the cultural, social, economic, and political settings of the country in general and policy frameworks in particular.

As Barrett et al. [6] noted that income diversification is widely understood as a form of self-insurance, and it does not seem to be a transient phenomenon or one just associated with survival. It might be associated with success in achieving livelihood security under improving economic conditions as well as with livelihood distress, such as a lack of funds to restore agricultural production in deteriorating conditions [31]. A previous study by Barrett et al., [6], suggests that income diversification is a key method of ex ante risk management or ex post coping with weather shocks, such as drought studies. Likewise, studies of Refs. [31, 43, 61, 66, 79] confirmed that rural income diversification is a key method of reducing vulnerability to unexpected disasters. Hence, either in normal or precaution purposes, using the realization of different perspectives, people collect their income from different streams. While rural poor households face multiple constraints, diversification of their income for a variety of livelihood purposes is immensely vital. Thus, we can say diversification is the norm.

Diversification is defined as the procedures that smallholder farmers or households create a different set of income-generating activities for survival and to get better living standards. Hence, income diversification is practiced by smallholder farmers in the form of increasing extra activities rather than just only farming [14].

Moreover, income diversification extends the income base by adopting new economic activities. Hence, in most cases, income diversification rises smallholder farmer’s income and they try to invest in extra non-agricultural activities. In contrast, income diversification may occur as a survival response to several negative shocks and different stresses. For instance, when members of



poor farming households are forced to migrate in search of wage labor or sell assets because their crops fail or they face a sudden need for extra income. This situation refers to push factors [72].

According to Haggblade et al. [45], outside off-farm activities like shopkeepers, handcraft, petty trading, services providing activities, food processing, preparation for sale activities, etc., business enterprise are included in the rural non-farm enterprise. Regardless of sectoral or functional classification which can be either wage employment or self-employment, all activities left from one's property include under non/off-farm activities [9]. Non-farm income includes both off-farm wage labor and non-farm self-employment [33, 69].

### Small farm size and agricultural intensification

According to Headey et al. [48] the response of small farm sizes in Ethiopia indicated that the support of the Boserupian intensification hypothesis, especially concerning very tight associations between land constraints and purchased input costs per hectare, farm labor per hectare, cereal yields, and gross farm income. At the same time, farm income per hectare net of these costs is not responsive to rising land constraints, suggesting that land constraints impose serious negative consequences for farm incomes, on an average basis. Besides, they stated that there is no evidence for land-constrained households are more likely to engage in off-farm work or more likely to send their children to school (suggesting income diversification in the future).

One of the responses for cultivating land shortage can be verified from the temporal and spatial study of empirical evidence, emphasizing the intensification of agriculture using various mechanisms. Hence, agricultural production according to Boserup, the size of the farm (at both the individual and community levels) is likely to be a key determinant of the demand for intensive technologies, such as plows, chemical fertilizers, high-yielding seeds, and improved natural resource management practices. The quick advancement of Ethiopia's road network, maybe the fastest in Africa in recent years [28], suggests that this might be a significant factor. What's more, obviously, policy-induced intensification, especially through the fast expansion of Ethiopia's farming extension services [21], is another conceivably significant driver of Agricultural intensification to increase agricultural productivity and try to seeking and feeding the huge proportion of country's population.

Increasing agricultural productivity has been considered as a response to land constraints. It is a measure of the amount of agricultural output that can be produced with a given level of inputs. It can be defined and measured in a variety of ways, including the amount of a

single output per unit of a single input (e.g., tons of wheat per acre or worker), or in terms of an index of multiple outputs relative to an index of multiple inputs (e.g., the value of all farm outputs divided by the value of all farm inputs). Land productivity helps determine total food production, incentives for land-use change, returns to landowners, and consumer food prices.

In Ethiopia, the agriculture sector, which represents 80% of employment, stays a critical wellspring of development. An increase in its efficiency is predominantly answerable for expanded yields, as opposed to extensively cultivated land. This is steady with the public authority's monstrous push to advance and convey innovation bundles to smallholders [1]. Moreover, the sources of uncertainty and trait for the decline in agricultural productivity stemmed from biological and natural resource scarcity (Tilman et al. 2011) [40]. For such risk and uncertainty agricultural productivity in the evolutionary argument states that the likelihood to adopt agricultural innovations and inventions increases with time [34, 73]. Thus, it leads to agricultural technology becoming an obsolete and ineffective result of pesticides for some classes and become a cause to decline in productivity [41].

From economic theories, high population growth can influence productivity indirectly through different perspectives. According to Boserup [11], high population pressure leads to high labor-intensive inputs by causing a shift from long fallow periods to frequent and multiple cropping practices thus the population growth will change the demands of modern inputs and causing to raise productivity per unit of lands. This theory is extended by the arguments of the theory of labor, including the idea of Hayami and Ruttan [47], the idea that price will influence indirectly behavioral changes to survive and adapt under the changing condition. This is entitled "Induced innovation hypothesis" and Hayami and Ruttan's theory predicted that the positive impact of high population pressure on agricultural productivity comes to reality in the case of the price of labor input declines as compared to the price of land. This creates increasing the demand for labor input and interlinked with increasing the use of labor-intensive inputs, like inorganic fertilizer and modern varieties of seeds plants, and finally leads to boost output per unit of land.

Similarly, the high population growth is a driver of high demand for inputs and staple crop productivity. High population pressure directly affects the intensification of agriculture through facilitating the dissemination of information in the area, strengthening institutional networks, and declining transaction costs. High populated areas can distribute marketing information in high order accurately and speedily and increase the input and output

availability by lowering transaction costs, leads to boost productivity [47, 5, 19].

According to Headey and Jayne [50], in developing countries especially in Africa, there is a risk related to high and alarming population growth; continual land fragmentation and shortage of food are among the problems that will sustain in the future. Taking into account different geographical locations and agro-ecological zone, the adaptation mechanism for these falling land–labor ratios of households that faced a binding land constraint and can respond in three ways: intensifying agricultural production, engagements, and diversifying out of agriculture work practice, and reducing fertility rates.

### **Motives towards income diversification strategies**

There is a diverse motive for the households to diversify other production alternatives that induced income and support livelihoods. Many academic journals described a single reason for the nonfarm economy to diversify (most commonly, risk management) and thereby fail to consider all plausible pathways of diversification [6]. However, there are plenty of roles that non-farm income plays in rural poverty. Non-farm earnings account for 35–50% of rural household income across the developing world. Landless and near-landless households everywhere depend heavily on nonfarm income for their survival needs, while agricultural households count on non-farm earnings to diversify risk, moderate seasonal income swings, and finance agricultural input purchases. Over time, the rural non-farm economy has grown rapidly, contributing significantly to both employment and rural income growth [45].

In addition, with this the given household size, the smallholder farmers need to involve in other income-earning activities, besides attempting to improve the production and productivity of agriculture. Once Dimova and Sen [26] stated that participation and specialization of small farmers in one activity is the exception and income diversification through participating in different activities is a custom.

Accessibility of different services is among the basic factors for the diversification process. Thus, access to public assets such as roads and private assets such as education and credit facilities are crucial for diversification to other off and non-farm income activities. Increasing access to these assets will help rural communities to increase their self-employment as well as wage employment in the non-farm sector. Moreover, rural income is equated with farm income, even more with agricultural income. Thus, policymakers view state efforts to combat rural poverty as a policy to enhance farm productivity. The main thing from this discourse is most official reports of the Ethiopian government and other

multilateral institutions including the World Bank group and other policymakers in the past decades who have managed to shape the agricultural policy mainly focused exclusively on agricultural development as the way to reduce rural poverty and to achieve sustainable economic growth for rural households. This system mainly perpetuates the political system of the country and separates the agricultural policymakers from several sectoral ministers (agricultural, industry, fisheries, mining, and many others in the system).

In Ethiopia, the rural economy is usually considered as an agrarian economy in which a huge number of smallholder farmers are generally in a farming activity like crop production and animal raising with a modest number of smallholder farmers take an interest in non-farm/off-farm business practices [63]. In Ethiopia, 83% of smallholder farmers partook in cultivating activity and only 27% were occupied with non-farm/off-farm economic enterprises [65]. The larger part of the population is however subject to marginal non-farm income sources, for example, petty trade [54]. Besides small farm size and low returns from cultivating practice, the majority of families are exposed to chronic poverty. For example, International Food and Agricultural Development [51] showed that the majority of the Ethiopian rural people are poor and accessed to one or less than one hectare of land. Because of this reality that most non-industrial nations farm households are profoundly dependent on off-farm income can have great ramifications on off-farm income that they are altogether considered by farming research and extension systems of the country. As they are required to reinvest their off-farm benefit once more into their farm production would improve farm efficiency and household food security. On the other hand, if the agricultural output is low because of crop failure in bad weather shocks or market failures, farm households may use off-farm income to settle total income streams and secure food access.

Moreover, most poor families' income from the farm isn't sufficient for the entire year's consumption, and they use off-farm income in the hungry period between food stores and the next harvest [53]. Subsequently, off-farm income can be utilized as a component to balance out the household income and decreases early harvest consumption or distress selling at early harvest time. Also, under scarce land and imperfect land market, it empowers to set out more employment for some rural individuals and this contributes to the decrease of rural joblessness. For example, in southern Ethiopia rural livelihood incorporate animals keeping, crop cultivation, remittance, and handcraft [32]. Moreover, educational status, access to market for farm products, homestead attributes (farm

capital, availability of animal plows) are determinants of income diversification strategies among rural households.

Likewise, rural economies diversify their income into different off-farm and or non-farm activities into the classic category to pull and push factors. In the pull factors, where new agricultural technologies and modern farm inputs become available, they lead to agricultural surpluses in some commodities and increased opportunities for trade. Growing agriculture stimulates the growth of rural nonfarm employment. This is linked with rising labor productivity on the farm increases per capita food supplies and releases farm family workers to undertake non-farm activities [45].

There are different activates that are categorized under non-farm and off-farm activities from petty trading to processing and sales business activity. Likewise, Haggblade et al. [45] described that less income countries are often involved in outside off-farm activities like shopkeepers, handcraft, petty trading, services providing activities, food processing, preparation for sale activities, etc., business enterprises are included in the rural non-farm enterprise. In addition, [9] mentioned that regardless of sectoral or functional classification which can be either wage employment or self-employment all activities left from one's property include non/off-farm activities). Moreover, non-farm income includes both off-farm wage labor and non-farm self-employment [33, 69].

Rural households are faced with different constraints to engage in different off-farm and non-farm activities that require different types of institutions. From the “*pull side*” of diversification into off and non-farm activities there should be high productivity of labor to increase agriculture income that in turn enables them to release agriculture labor to other non-farm activities. Thus, “*pull factors*”: realization of strategic complementarities between activities, such as crop–livestock integration or milling and hog production, specialization according to comparative advantage accorded by superior technologies, skills, or endowments [6]. However, increasingly productive modern agriculture requires inputs and services such as seeds, fertilizer, credit, pumps, farm machinery, marketing, and processing of farm produce which, in turn, create a growing demand for non-farm firms that can provide these services.

In addition, what drive rural dwellers to diversify their income to support their livelihood are “*push factors*” that are linked with risk reduction, response to diminishing factor returns, it can be family labor supply in the presence of land constraints driven by population pressure and fragmented landholdings, reaction to a crisis or liquidity constraints, high transactions costs that induce households to self-provision in several goods and services [6].

A pathway out of poverty if nonfarm opportunities can be seized by the rural poor since the nonfarm activity is typically positively correlated with income and wealth [6].

As stated in Barrett et al. [6], non-farm opportunities that can support the pathway out of poverty can be considered as a double-edged sword. Meanwhile, the positive wealth–nonfarm income association can help those who begin poor in land and capital constraint to overcome entry barriers and steep investment requirements to participate in non-farm activities.

The paper done on account of smallholder farmers in Ethiopia, utilizing Tobit model for the participation in non/off-farm business employment and the level of income inferred are discovered. It is affected by human capital-related factors (sex and period of family head, number of economically active relatives, education level of household head and presence of kids going to school), livelihood assets (livestock holding, size of cultivated land), live hood diversifying strategy (crop-based diversification through many crops grown and harvested) and infrastructure-related variable (proximity to the market). The outcomes suggest that these components should be considered by policymakers in the planning of agricultural and non-agricultural activities [22].

Ahmed [3] emphasized that the elements that add to the income differential, with the proof from east Hararghe, Oromia, Ethiopia, he utilized linear regression model to recognize contributing components and the model yield showed that, irrigation use, livestock holding, education level of household head, size of cultivated area, age and amount of fertilizer used were the critical factors that add to examine income differential in the investigation region. In this manner, due consideration is given regarding speed-up of the improvement of country rural farm income households.

### Conclusions and possible suggestions

High population growth leads to the shortage of farmland and fragmentation, low agricultural output, low saving rate, low investment, low economy trap, and growth that perpetuates the vicious circle of poverty. Its alarming growth rates lead to outpacing agricultural production. Farmers producing crops by expanding farmlands to meet the short-term survival needs of increasing population and exploit the local ecosystem through slash-and-burn in vegetation. This rapid population growth causes declining per capita farm sizes. In addition, risk and uncertainty, variability, and inadequate supply of agricultural production exposing the people to food insufficiency and food insecurity. Thus, with pronounced land constraints, population

explosion and food insecurity are twin problems that perpetuate poverty in the region.

Declining cultivating land sizes and other many constraints become a critical problem for farmers to increase household income, and root for multiple problems like immigration, unemployment, social unrest, and land-related conflicts. As a result, limiting the household size and its impact on food security and income diversification is critical. The family planning program should be given more attention, and rural farmers should be made more aware of the need to lower their family size to reduce food insecurity and increase household welfare.

In addition, the government should develop a land-use policy and population growth control program that allows for identifying the minimum economic farmland size, as well as enhancing land quality, and finding ways to boost off-farm activities and livestock sector to absorb more labor and enhance means of generating more income to decrease minimum farmland size required.

As a result of time-varying or diminishing returns to labor, market failures, ex ante risk management, and ex post coping with adverse shocks, farm households diversify into non-farm industries. Moreover, farmers need to practice different income diversification strategies off-farm (livestock farming, labor market supply), and other non-farming activities of small trading, different handicrafts, and artworks to boost their income and support their family livelihoods. In addition, various forms of innovative farming including vertical agriculture for the small cultivating land can be one vibrant and potential response to the land constraints and that needs to be practiced in different levels to promote and encourage low-income groups.

In a nutshell, along with all this discourse of land shortage and diversification strategies, policymakers must stimulate buoyant rural economies, with robust non-farm/off-farm income growth and innovative farming practices. Moreover, the poor must gain access to the growing market niches and basic infrastructure development. Well performed and dynamic labor markets provide one important bridge linking the rural poor to growing non-farm opportunities. Moreover, fundamental improvements in agricultural productivity such as technological improvements, innovation, adoption of technology of agriculture, and biological improvements play an important role in the growing demand of the people. Furthermore, reforms should be implemented to ensure that women have equal access to economic resources, including land ownership and control, financial services, and inheritance. And, in accordance with national laws, natural resources [76].

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