POLICY BRIEF

The Impact of Agricultural Productivity on Deforestation in Central Africa

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Abstract

This paper examines the effect of agricultural productivity on the environment, using deforestation as an example. We examined this relationship using a sample of nine countries in Central Africa, with data from the 1990s to 2020. The econometrics results show that an increase in agricultural productivity reduced the rate of deforestation in these countries. This suggests that policies that facilitate the adoption of modern inputs and investment in technology leading to an increase in yields from agriculture could lead to a reduction in the demand for agricultural land.

Introduction

Low levels of agricultural production constitute a major problem in developing countries (Barbier and Hochard, 2014). According to FAO (2012), lack of food security affects close to 870 million people, or close to 12% of the world population (a percentage that increases to 27% in sub-Saharan Africa). According to forecasts given by Bruinsma (2009), the global population will increase by 40% by 2050. This, coupled with an increase in the rate of food consumption, means the population growth will need an increase in agricultural production by 70% (100% in developing countries) (Bruinsma, 2009).

Improvement in agricultural production is quite often seen as a solution to problems related to both the production of a larger quantity of food and protection of forest land. Indeed, an increase in productivity per hectare meets the set production targets using less acreage, which could lead to weakening the demand for more agricultural land. (Ngoma *et al*., 2021; Lundberg and Abman, 2022). However, Lambin and Meyfroidt (2011) have demonstrated that an increase in productivity does not necessarily lead to land conservation. In certain cases, one observes increased deforestation following an increase in productivity. This could be explained mainly through "the rebound effect", whereby increased productivity would make agriculture more attractive, leading to an increase in the demand for farmland, which generally comprises "virgin lands that provide easy access" to farmers (Angelsen and Kaimowitz, 2001).

It is therefore necessary to understand the underlying relationship between an increase in agricultural productivity and deforestation in the developing world. If the increase in agricultural productivity increases the demand for farmland, development policies targeting an improvement in agricultural productivity could have negative effects on the environment. However, if an increase in productivity allows farmers to defer the need to put new land under cultivation, these development policies could have positive environmental benefits for forest conservation.

In this study, we examined the impact of agricultural productivity on deforestation in Central Africa. We defined Central Africa as all the countries belonging to the Commission for Central African Forests (COMIFAC), namely Gabon, The Republic of Congo, The Democratic Republic of Congo, Equatorial Guinea, Cameroon, Central African Republic, Burundi, Rwanda, and Chad. Sao Tomé and Principe was excluded from the analysis due to lack of data. COMIFAC is the reference subregional institution in matters related to harmonization of forest and environmental policy in Central Africa. It guides, coordinates, and makes decisions on subregional actions and initiatives in the domain of conservation and the sustainable management of forest ecosystems. Member countries of COMIFAC develop national forestry programmes

and/or environmental action plans (NFAP, etc.) within the framework of implementing COMIFAC policy. Some countries have national action plans in place and others have yet to formulate theirs.

To the best of our knowledge, this study provides the first empirical analysis of the influence of agricultural productivity on deforestation in Central African countries. The relationship between agricultural productivity and deforestation is a fundamental question. It has significant implications for development policies which support use of agricultural inputs and also encourage the adoption of technologies for improving yields in the Central African region, which is at the heart of global concerns on preservation of biodiversity. Indeed, the Congo Basin, the second largest forest ecosystem in the world after the Amazon Forest, is situated in Central Africa. The Basin plays an important role in the preservation of biodiversity.

Drivers of deforestation in the Central Africa: A multisectoral analysis

In Central Africa, expansion of agricultural land is the most commonly cited precipitating cause for deforestation. The migration of farmers and the concentration of new immigrants in certain countries of Central Africa are major reasons for the clearing of forests. Bessat (1996) demonstrated that the massive exodus of Chadian farmers towards the north of Cameroon or towards the north of the Central African Republic is a major cause of deforestation in these regions. The researcher showed how forest land was rapidly disappearing in certain regions of Central Africa (such as, the case in the Savannah region of Pool in Congo or close to Bangui) whereby farmers are settling in peri-urban zones, seeking to move closer to large urban agglomerations so as to engage in the production of food crops that would find a ready market. In the two cases, deforestation occurs not only through the clearing of land that was previously uncultivated, but also because the traditional know-how of the new arrivals does not allow for them to easily adapt to local conditions. This illustration applies, for example, to immigrants coming from Mount Mandarah in the north of Cameroon (Bessat, 1996). The speed of the degradation of the newly occupied lands quickly led to a fresh migration towards new zones. In the mid-1990s the poor soils in several zones led to an increase in cultivated land to compensate for the reduction in yield. (Bessat, 1996).

Through an analysis based on a geographic information system (GIS), Zhang *et al*. (2002) highlighted how subsistence farming is the main cause of deforestation in Central Africa, particularly in places where the forests are more accessible. However, in Chad as well as in Cameroon or Central African Republic, forest–savannah transitional zones were set aside for the development of cotton farming and, to a great extent crops, amenable to mass and regular production which could then lead to a rapid decrease in forest land. For example, from the beginning of the 20th Century, forests

in the south-west of Cameroon were rapidly converted into oil palm, cocoa, and rubber plantations. These plantations, held by both small-scale farmers and large multinational firms, progressively mushroomed and now practically cover the entire region which has thus lost the quasi-totality of its forest cover (Nke Ndih, 2008). With the implementation of the structural adjustment plans imposed by the Bretton Woods institutions, agricultural enterprises which had been created by the States, were privatized and their new owners engaged in cutting down large swathes of forests in order to extend their plantations. The presence of some large commercial farms, belonging generally to multinational companies that are active in certain countries such as Gabon and Cameroon, notably in the production of palm oil and rubber (and of bananas in the case of Cameroon), could further increase deforestation in those countries (Megevand *et al.*, 2013).

More than 90% of the total volume of wood harvested from most Central African countries is used as firewood (Marien, 2009). In 2007 the total production of firewood in Central Africa was higher than 100 million cubic metres, and continues to increase (Megevand *et al*., 2013), however, the impact of energy demand on deforestation is more pronounced in certain countries. Indeed, energy profiles vary from one country to another in the region, according to the wealth of that particular country, but also according to the country's access to electricity. In the Democratic Republic of Congo, renewable fuels, and waste material (essentially firewood and charcoal) were evaluated at more than 93% of the total energy consumed in 2008, in a context whereby close to 12% of the population had access to electricity in 2009 and where fossil fuels could only cover 4% of the energy needs of the country in 2008 (World Bank, 2012). With a population of close to 10 million people, Kinshasa consumes 5 million cubic metres of firewood or the equivalent, per year. In the Democratic Republic of Congo, the human population is forecast to double by 2030. Other countries such as Cameroon and Equatorial Guinea will experience similar demographic growth that will certainly lead to a higher demand for wood-energyand therefore have a significant impact on the forest cover of these countries (Megevand *et al*., 2013). Furthermore, statistics from demographic and health surveys show that more than 80% of households use wood-energy as their primary source of energy, whether in the form of charcoal, firewood, sawdust or wood chips in Republic of Congo, Central African Republic, Burundi, Rwanda, and Chad. However, in Gabon dependence on wood-energy is considerably lower thanks to a vast electricity network and subsidized cooking gas.

The logging industry, which has a two-sided nature, is also a cause of deforestation in the Congo Basin. Indeed, there exists a formal sector that is highly visible, dominated by big Western companies and almost entirely geared towards exports. However, there exists an informal sector that can hardly be identified. Industrial forestry exports constitute the most extensive forms of land exploitation in Central Africa, with 44 million hectares in concession, or almost a quarter of the total surface of low altitude

evergreen rainforest. Production in the formal sector reaches an average of 8 million cubic metres of wood a year, with Gabon being the largest producer (Megevand *et al*., 2013). However, with the adoption of principles of sustainable forest management (SFM) as well as the increased number of species harvested, the impacts of industrial forestry are still limited. The movement towards GDF has proved to be significant. Until 2010, more than 25 million hectares had been placed under a framework of State approved plans. The rates of log harvesting are, on average, lower than 0.5 cubic metres per hectare. Compared to the two other major regions of tropical forests (Latin America and Asia), the countries of Central Africa remain relatively small players in wood production at international level, with less than 3% of global production of tropical timber (OFAC, 2011). The second type of exploitation, often called informal and which for a long time has not been studied, is that of local small-scale loggers oriented towards supplying the large urban centres in the region. This informal sector is today recognized as a major component of the timber harvesting sector. Even though the information is scanty in terms of countries such as Republic of Congo, Central African Republic, Burundi, Rwanda, and Chad, in some countries such as Cameroon and the Democratic Republic of Congo, production in the informal sector is higher than that of the formal sector (Lescuyer *et al*., 2012).

Corruption and the lack of good governance also affects progress towards the preservation and the sustainable management of forest resources in Central Africa. A lack of transparency and of good governance procedures in the attribution of foresting licenses in several countries leads to corruption and bad business practices. This does not stimulate long-term investments, which are indispensable in efforts to improve sustainability in the forestry sector. Bad governance also limits the aptitude to maximize the collection of benefits derived from forestry resources and to distribute them equitably among the populations of Central Africa (Megevand *et al*., 2013). Tacconi (2009), highlighted the fact that the process of corruption is a vicious cycle because the need to remunerate the agencies responsible for forest management increases logging costs, obliging logging companies to increase illegal deforestation in order to cover a part of their costs.

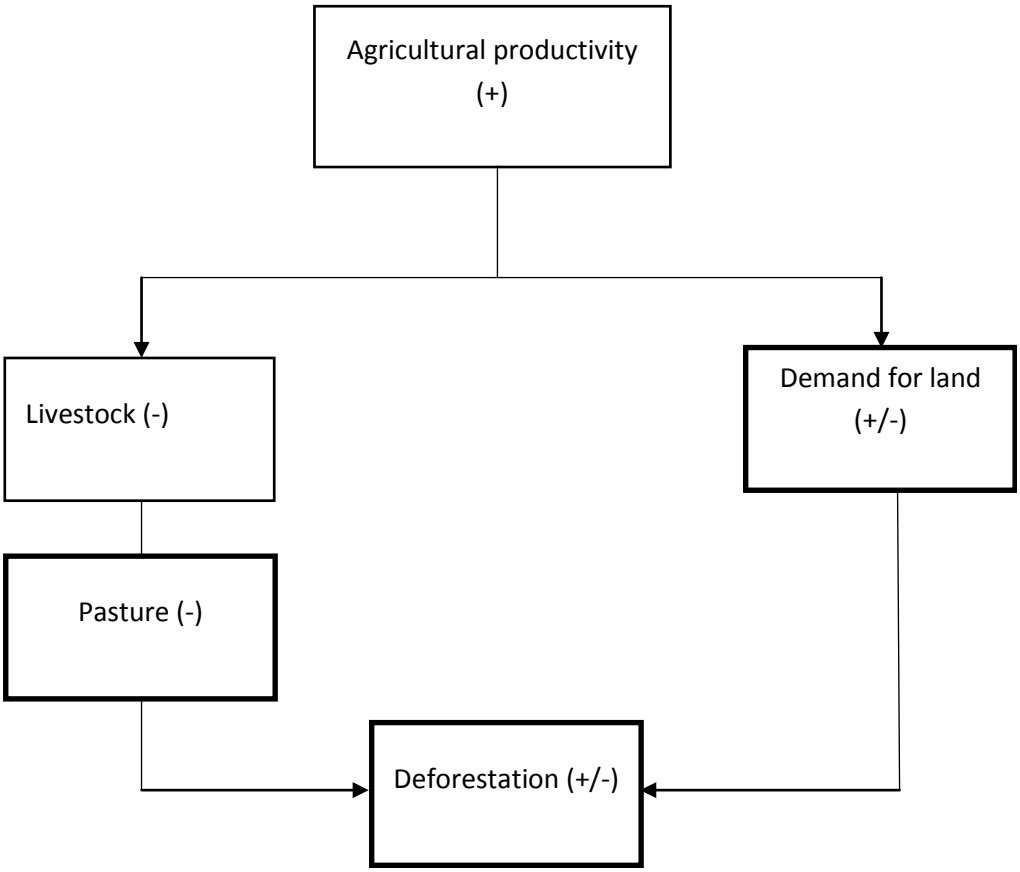
Conceptual framework

Agricultural production in Central Africa remains largely dominated by traditional systems. In the region, the agriculture sector is dominated by small-scale farmers who practice traditional farming, with a system of cultivating over two years and leaving the land to lie fallow for 7 to 10 years (Megevand *et al*., 2013), which increases demand for new land for farming.

Generally, in countries or regions where laws on deforestation do not exist or are difficult to implement, increasing agricultural productivity and intensification of agriculture could be used as an indirect policy instrument to reduce forest pressure.

Such a strategy is known as the Borlaug hypothesis. According to the hypothesis, "increasing crop yields can prevent cropland expansion and deforestation, thus alleviating hunger and poverty without dramatically increasing environmental impact." However, increasing agricultural productivity could have ambiguous effects on the protection of forests. Conversely, it could extend the land surface covered by agriculture, in other words, the quantity of forest land cleared for agriculture, which could effectively increase deforestation, or it could encourage or incite farmers faced with constraints related to market conditions to abandon their grazing land — which requires large tracts of land — for less harmful forms of agriculture (see Figure 1).

Figure 1. Transmission channel for increased agricultural productivity over deforestation



Assunção *et al*. (2017) demonstrated how electrification in Brazil increased crop productivity with the result that farmers: (i) enhanced their farming by converting their unused land into agricultural land; but also (ii) abandoned livestock breeding for crop farming. Given that farming had enabled farmers to preserve more of their indigenous vegetation in their rural farms, the researchers concluded that electrification increased agricultural productivity, leading to a net decrease in deforestation.

Data sources

The sampled data is from nine of the 10 countries of the Central Africa Forests Commission (COMIFAC) and covers the period between 1990 and 2020. The choice of country was determined by the availability of data. The literature review on the determinants of deforestation indicates that there is no consensus that would allow us to know which variables to include in the empirical model. The identified factors that could have an impact on the rate of deforestation could be regrouped around three major elements of a demographic, economic and political nature (Duval and Wolff, 2009).

Conclusion and suggestions for economic policy

In this article, we have discussed the role of improvement in agricultural productivity on the process of deforestation in Central Africa. Although it is now evident that the improvement of agricultural productivity has major consequences in terms of food security and human well-being, the possible consequences of deforestation still remain a subject of debate. Using data from nine COMIFAC countries over the period 1990–2020, we highlighted a few major results.

First, our results show that there was no evidence of the appearance of an environmental Kuznet's curve for deforestation. Second, we demonstrated that population growth has a negative influence on the conservation of forests in Central Africa. Furthermore, the rate of deforestation decreases with an increase in agricultural productivity. These results indicate that the increase in agricultural productivity is imperative in Central Africa because it not only satisfies the increase in demand for wood products due to an increase in population, but it also has a positive effect on the conservation of forests. However, with the exception of Cameroon, research, and development (R&D) capacity in Central Africa has been destroyed over the past few decades (Megevand *et al*., 2013). Our results call for a stimulation of research based notably on subsistence crops that are most common to the region, such as cassava, banana plantain and yams.

Beyond our overall recommendations, to be more specific, governments in Central Africa should invest in the improvement of the productivity of the main cash crops. Thus, the governments of Chad and Central African Republic must improve the production of cotton. The Government of Cameroon must place more emphasis on the production of bananas, cocoa, coffee, cotton, and rubber. The Government of Burundi should focus more keenly on coffee; Congo and Equatorial Guinea should focus on yams; the Democratic Republic of Congo on maize; Rwanda on potatoes; and Gabon on bananas and yams.

Finally, the poor quality of institutions tends to increase the rate of deforestation. Given that financial governance remains mediocre in all the Central African countries, some investors buy land at low prices and could expand their activities to large areas while neglecting their social responsibilities towards forest conservation. Governments must put in place firm policies related to matters of future large-scale investments, insisting especially that the supply of land for agriculture be oriented towards non-forested areas and abandoned plantations.

In conclusion, this study had few limitations. First, although it focused on countries with similar economic structures, the number of sampled countries was relatively low (nine countries), which could cast doubt on our results. Also, our study focused on the period from 1990 to 2020, which does not allow us to consider in our analysis long-term elements. Lastly, the aggregated approach used in this study could not allow us to further explore the underlying mechanisms of the relationship. It is therefore very difficult to provide recommendations for countries based on macroeconomic data.

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