

The Role of the Agriculture and Forestry Sectors in Greenhouse Gas Emission: The Case of Albania

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Abstract

This research work explores the significant contribution of the agriculture and forestry sectors to greenhouse gas emissions. Focusing on the case of Albania, it investigates the extent of emissions, emphasizing the impact on the country's economy and environment. The research also addresses challenges and potential mitigation strategies, emphasizing the importance of sustainable practices in these crucial sectors.

Keywords: Greenhouse gas emission; forestry; agriculture; energy efficiency; decarbonization

1. Introduction

The primary sector contributing to atmospheric emissions of greenhouse gases is energy (44%), followed by agriculture (27.12%), and land-use change and forests (21.60%) [1-3]. In comparison to industrialized countries, these emissions are 4-5 times lower.

Agriculture stands out as one of the most crucial sectors across the Western Balkans, contributing significantly to the gross domestic product (GDP) with a share of around 10% [4-6]. In Albania, agriculture holds a pivotal role, serving as the primary sector that sustains the livelihoods of the population and acts as a buffer against unemployment. This sector plays a vital role in the Albanian economy, contributing approximately 20% to the overall value added. Despite the structural shift from agriculture to industry and services due to emigration and urbanization over the last decade, agriculture remains a substantial and essential sector in Albania. Serving as the primary source of employment and income, especially in rural areas, agriculture represented 22.6% of the total GDP in 2014, while accounting for about half of the total employment [7, 8]. However, the sector's development is hindered by various structural challenges, including outdated technology, insufficient investments, and lower overall productivity compared to EU averages. The transformation of the country's economic structure from agriculture and the primary sector towards a less energy-intensive service sector, focusing on higher value-added products, is reflected in Albania's energy intensity evolution. Although energy intensity was more than double the EU average in 2000, it has since declined. To some extent, this reduction in energy intensity can be attributed

to improvements in energy efficiency (EE) and the implementation of relevant measures such as thermal insulation of housing, efficient lighting, and other EE initiatives.

Moreover, similar to any other sector of the economy, agriculture faces unique challenges irrespective of assets, natural resources, or agri-food systems. One of the most pressing challenges confronting the sector is climate change. The projected increase in temperatures by 4°C in the coming decades poses a significant threat to agricultural production and the well-being of the population. Given that agriculture serves as the primary source of income and food for a substantial portion of the population in the region, phenomena such as uncontrolled floods and droughts resulting from climate changes present real risks to human existence. Further regional forecasts indicate that, with warming and a 4°C temperature increase, precipitation is expected to decrease by 20-30%, and the frequency of dry days will rise by 20%. Consequently, this will be accompanied by a 45% reduction in the amount of water in water sources during the summer months by 2100. Large hydropower plants may experience a 15% decrease in average annual output, while small hydropower plants could see a reduction of 20%. Meanwhile, the risk of flooding, especially along major rivers such as Drini and Vjosa, is expected to increase during the winter and spring.

This research work aims to describe the role of forestry sectors and agriculture in greenhouse gas emission (GHG) at the republic of Albania.

2. Agricultural Sector

Land use in Albania covers a total area of 28,750 km², with distribution among various categories: agricultural land (24%), forests (37%), pastures and meadows (15%), and other lands, including urban areas, approximately 135,000 hectares of lakes, and unused rocky and mountainous terrain [9]. Despite its importance in the national economy, the agricultural sector faces challenges. Although the share of agricultural land in Albania is 24% (compared to about 40% in the EU28), the small average size of agricultural farms (1.21 ha) leads to high degrees of land fragmentation [10].

The primary reason for the low percentage of agricultural land is the lack of competitiveness in Albanian agriculture compared to neighbouring countries. The limited irrigated area results from damage to irrigation infrastructures. Cultivated land constitutes 55% to 60% of the total agricultural land area, with an average use of chemical fertilizers around 87.5 kg/ha, exceeding the EU-27 average of 76 kg/ha [11, 12].

Undeveloped rural infrastructure hinders the marketing of Albanian agricultural products. This, combined with structural issues like outdated technology, low mechanization, restricted access to credit facilities, and lower productivity compared to EU averages due to inappropriate agronomic practices, discourages continued investment in the agricultural sector.

To enhance the sector's condition and promote sustainable development, future economic policies should prioritize developments and structural reforms. The goal is to improve efficiency in agricultural production, facilitate local agricultural product access

to both domestic and foreign markets, and provide financial support to businesses and farms.

3. The Forest Sector

Forests cover a significant portion of the country's total area, encompassing about 1,040,881 hectares. These forests are classified into high forests (45.7%) and low forests, including stumps and shrubs (54.3%), further categorized as simple (72.3%) and mixed (27.7%). According to the forest cadastre, approximately 96% of Albanian forests are state-owned, with the remaining 4% being private as can be seen in Figure 1.

Unfortunately, the Albanian forest sector has experienced overexploitation in recent years, leading to a substantial decrease in both surface area and volume. There has been an average annual reduction of about 540,000 m³/year, impacting both coniferous and broad-leaved forests. These valuable resources are utilized for various purposes, including timber for the construction industry, the mining industry, wood processing, and bioenergy.

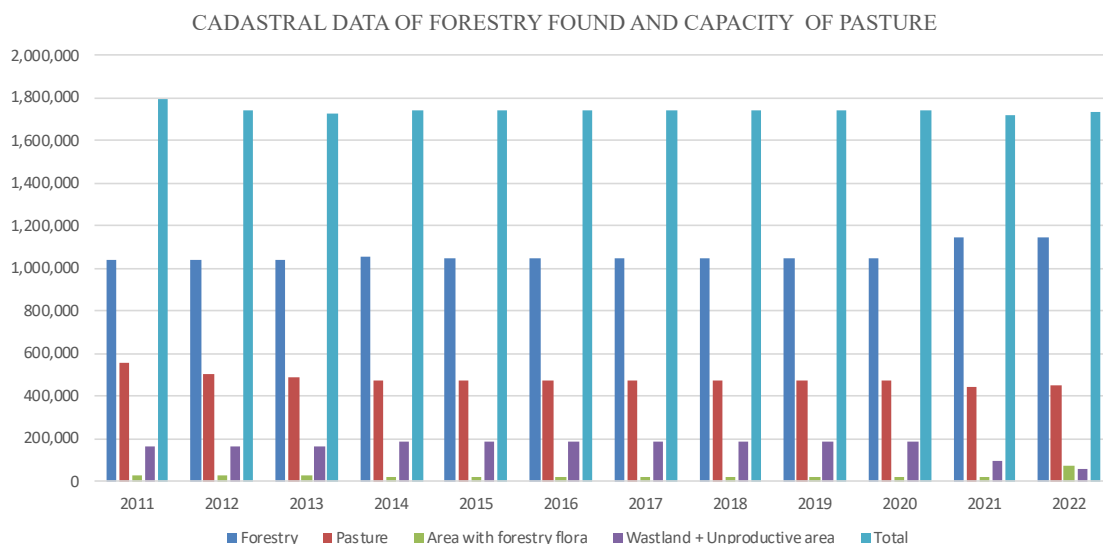


Figure 1. Stock volumes during the years 2000-2013

Albania stands out as one of the few European countries where forests have experienced a decline in recent decades, primarily due to clearing for agriculture, overgrazing, and cutting for fuel. Firewood holds particular significance in Albania, as it accounts for a substantial portion of the country's energy demand for heating (36% of households) and is also widely used for cooking in rural areas (12%). Most forests in coastal areas are situated within protected areas, comprising both natural forests and those established through plantations. Planted forests are found along the coastlines, such as Mediterranean pine forests, and other species are planted inland.

The natural growth of forests is, on average, 27% lower than the consumption of wood and timber in Albania. This indicates that the national forest stock has been and continues to be managed unsustainably. Another significant issue associated with this process is that the majority of the decline in volume is attributed to illegal logging: only

10% of the total volume of forest biomass that is cut is legal, while the remaining 90% is extracted illegally. This high percentage constitutes the primary cause of the degradation of Albanian forests. From a global perspective, the consequences of forest degradation and the loss of biodiversity in the forest cover can be substantial, especially considering that Albania is situated in the Mediterranean basin, known as a global hotspot of biodiversity with numerous endemic flora and fauna species. Additionally, the quality of existing data on land use, forest areas, and forest utilization in Albania is unclear, making any accurate assessment of the sector challenging. There is significant uncertainty even in estimates of greenhouse gas (GHG) trends. Historically, the forest sector was organized under the General Directorate of Forests and Pastures, a central institution under the Council of Ministers and the Ministry of Agriculture. Since 2005, the forestry service has been reorganized under the Ministry of Environment (MOE), with the merger of the General Directorate of Forests. Currently, the forest sector in Albania is part of the Directorate of Environmental Development Programs in the Ministry of Tourism and Environment. Furthermore, the establishment of a forestry service is anticipated by the draft law on the "Administration of the National Fund of Forests and Pastures in the Republic of Albania," which may come into force in the near future.

4. Greenhouse Gas Emission

According to the national inventory prepared within the framework of the 4th National Communication, from 2009 to 2016, the average annual level of greenhouse gas emissions (GHG) in Albania reached 10.8 Mt CO₂e/year. In comparison to the rest of Europe, this level of emissions is low. The emissions per capita in the 27 EU countries were 8.7 t CO₂e/inhabitants in 2018, whereas the emissions per capita in Albania in 2016 were 3.5 t CO₂e/inhabitants. Throughout this period, emissions increased to a limited extent, reaching 9,925 kt CO₂e in 2009 and 10,139 kt CO₂e in 2016 (+2.2%). The only significant change in emissions during this period resulted from exceptional events related to forest fires in 2011-2012. Figure 2 depict the average annual level of GHG emissions in Albania (kt CO₂e), by sector (2009-2016).

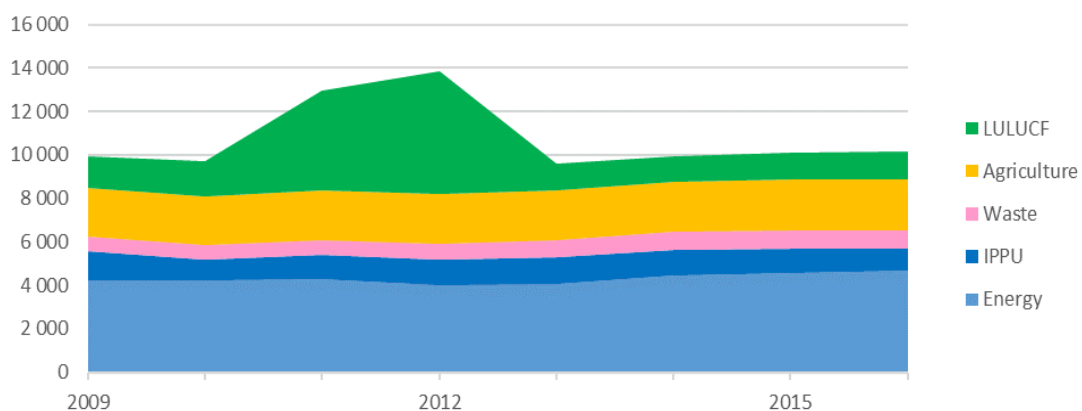


Figure 2. Average annual GHG emissions levels in Albania per sector, from 2009 to 2016, are as follows (in kt CO₂e)

It has been seen that the energy sector was the largest contributor. The emissions of the agricultural sector reached 2,239 kt CO₂e in 2009 and 2,344 kt CO₂e in 2016 (+4.7%). The emissions of the land-use change and forest sector (PTNPTP) reached 1,467 kt CO₂e in 2009 and 1,274 kt CO₂e in 2016 (-12.4%). The maximum emissions occurred due to extraordinary events related to forest fires in the years 2011-2012. However, the demand for firewood remains the most significant driver of overall trends in the PTNPTP sector. This is the main reason why PTNPTP has not been a sector that has absorbed more carbon than it has released over this period, as CO₂ emissions from wood burning.

5. Decarbonization of Economy

Decarbonizing our economy requires a substantial investment program. Over the next 30 years, a significant portion of our public and private infrastructure needs a fundamental update to become carbon neutral. This includes power grids, power plants, chemical processing plants, building stock, the transport network, waste prevention and treatment, and various other areas.

An essential sector worth mentioning is the agricultural sector, being the largest source of methane and nitrogen emissions—greenhouse gases that are more harmful to our climate than carbon dioxide. While it is often considered challenging to decarbonize the agricultural sector, it is not impossible. Decarbonization can be achieved by changing the way agricultural products are produced and traded. Climate-smart agriculture is crucial, and redirecting agricultural subsidies to ecological farming is the initial step. These subsidies, representing just under 40 percent of the EU budget, currently favor large agro-industries. Although this sector requires less intensive investment, it can become more labor-intensive, creating new jobs through innovative business models. This is particularly true when approaching the agricultural sector holistically, applying circular economy principles: bio-waste can be transformed into compost or biogas locally, without massive financial investments or specific training for local farmers.

An important contribution to making our economies more sustainable is the transition from a linear economy to a circular economy. In a linear economy, resources are extracted, processed, used, and finally discarded as waste. In contrast, in the circular economy, waste is considered a resource. Resources and materials are used for as long as possible ("cradle to cradle" approach). Beyond replacing aging infrastructure, new climate-friendly business models will emerge. Decarbonization means more than replacing greenhouse gas-emitting processes; it's an opportunity to create a new economy with better lives for all, provided we actively address social issues from the outset. Successful decarbonization depends on closing as many resource cycles as possible. This is crucial as energy transition itself is resource-intensive. While wind turbines and solar panels have a better carbon and resource footprint than fossil fuel alternatives, they require large amounts of metal for production and must be recycled. To avoid creating new environmental problems while solving others, we need to be as efficient with our resources as possible. Moreover, the exploitation of natural resources

is threatening our livelihoods, and alongside the climate crisis, it's an issue we must address.

Albania, in collaboration with development partners, has initiated appropriate measures to mitigate the negative consequences of climate change. These measures encompass risk management for water resources and agriculture, as well as the utilization of impactful opportunities to enhance energy efficiency and modernize infrastructure. Specifically, for this purpose, the Climate Change Law has been approved in our country, serving as the legal basis for the adoption of the National Energy and Climate Plan (NECP) from 2021 to 2030. Key recommended measures for our country include:

- Essential afforestation and the implementation of barriers to protect arable land from erosion.
- Deployment of drip irrigation systems and the modernization of existing systems

Figure 3 depict the projections of the contribution of agriculture, land use and forests to CO₂ emissions until the year 2040.

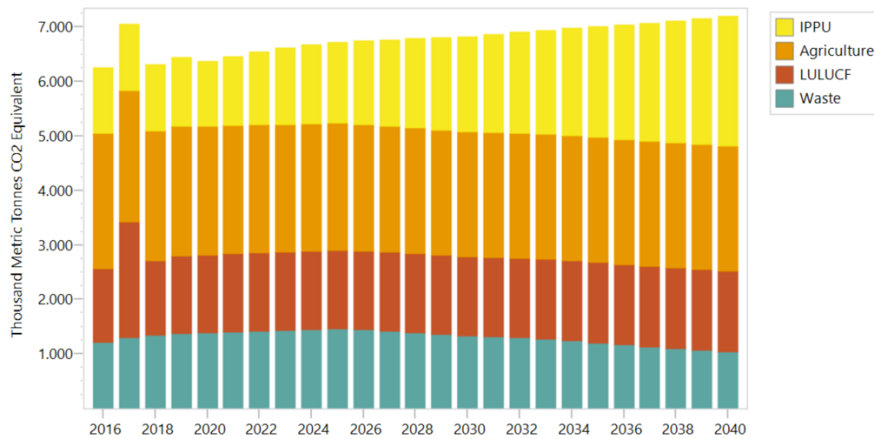


Figure 3. Projections of the contribution of agriculture, land use and forests to CO₂ emissions until the year 2040

Furthermore, Figure 4 show the projections of the detailed contribution of forests to CO₂ emissions until the year 2040.

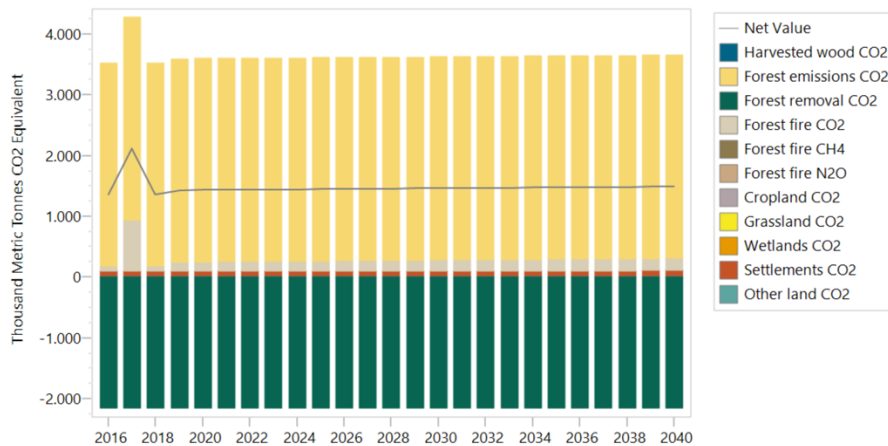


Figure 4. Projections of the detailed contribution of forests to CO₂ emissions till 2024

6. Summary and Conclusions

The role of agriculture and forestry sectors in greenhouse gas emission (GHG) at the republic of Albania has been briefly described in this paper. Based on our research work, a summary of adaptation measures and priority levels for the forest sector are as follows:

- Strengthening the Institutional Framework - Building Capacity for including forests in development plans and adapting to climate change.
- Strengthening the policy framework entails drafting a national plan for forestry, approximating and implementing EU regulations related to forestry, and implementing the national strategy and action plan on climate change.
- Improving Forest Management (Enhancing capacities for all aspects of forest management, including monitoring, insect and fire management, research and innovation, and implementation of new technologies).
- Adapting livelihoods (involves supporting forest-dependent populations, monitoring vegetation shifts, and managing species composition).
- Sustainability risk management and reduction (Early warning measures, preparedness and response).

Furthermore, mitigation opportunities for GHG contributions from agriculture and forestry are:

- Optimizing animal feed to reduce N₂O and CH₄ emissions (leads to a 10% reduction).
- A reduction in enteric CH₄ levels, achieved by the addition of fat to food, results in a 4% decrease in CH₄ emissions for every 1% of fat added.
- Reducing the use of chemical fertilizers while increasing the use of mineral fertilizers.
- Decreasing the burning of agricultural residues and pastures can have a positive impact on agriculture.
- Gradual reduction of firewood use (moratorium on firewood).
- Increase in forest areas (afforestation of abandoned lands).
- Improving management and monitoring in order to prevent fires.

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