Agroforestry potential in CDK IX's assisted areas of the Central Java Environment and Forestry Agency

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Abstract. Agroforestry is a form of sustainable farming that human needs, especially food, are met without jeopardizing future needs. Agroforestry is an urgent need, especially in highland areas in Central Java, which choose monoculture agriculture with high economic benefits but can damage the environment and endanger the ecosystem. Since 2017, the Government through the Regional Forestry Service Branch Office IX (CDK Wilayah IX), has guided farming communities in Magelang and Temanggung. However, the agroforestry output cannot be measured economically since the plant's age was only three years old. Using in-depth interviews and field observations, this study found that the CDK IX farming community has implemented agrosilvopastoral farming that there are arrangements for cropping and spacing patterns and agricultural support livestock. In addition, there is a pattern of alternate spatial rows that the planting rows were arranged. The potential for agroforestry success in this region was identified due to the support of government development through field extension workers, local leadership, and local wisdom. However, low community participation, low education and knowledge, and seeds acceptance from donors were not in the planting period.

1. Introduction
Agriculture, as the central pillar of food supply, continues to receive attention due to decreased productivity. This condition cannot be separated from many farmers, especially in Indonesia, who are entering the unproductive age. The number of millennial farmers decreased by around 415,000 from 2017 to 2018. This indicates that farmer regeneration is not optimal. Besides, many farmers practice unsustainable agriculture, for example, monoculture farming. Monoculture farming is agriculture by growing one type of crop or the same variety throughout the year [1]. Although monoculture farming tends to be easier to manage and more profitable from an economic perspective, they harm the environment through degradation that threatens the food system [1,2].

Sector tends to use land intensively, which in turn threatens food security [5]. This is due to the exploitation of natural resources, deforestation, and land [2–8]. The exploitation of forests for fuelwood in Tanzania shows that deforestation occurs due to land ownership in the community and low knowledge of environmental impacts [7].

To anticipate food security, a holistic food production system is needed to impact the economy, environment, and society. Agroforestry, as an example of the paradigmatic Climate Smart Agriculture,
is seen as being able to accommodate these sustainable development goals [9]. Agroforestry is the practice of integrating woody perennials in agricultural landscapes [10,11]. Studies in Malawi show that farmers applying agroforestry systems show increased agricultural yields in the face of climate change [9].

Agroforestry systems have the potential to restore degraded and deforested land. Agroforestry increases soil quality so that it can maintain food production [10]. Another additional benefit is the increase in ecosystems, biodiversity [9], and climate change mitigation. Agroforestry can absorb carbon, especially in tropical climates [12].

There are three classifications of agroforestry systems, they are (1) silvopastoral systems that consist of pasture or animals and trees (e.g., cattle and Calliandra Calothyrsus); (2) agrosilvopastoral systems that consist of crops, pastures, or animals, and trees; (3) agrisilviculture system which includes crops and trees [13]. A strategy is needed in adapting agriculture through agroforestry systems, a promising alternative for increasing farmer income. This model contributes to restoring and rebuilding degraded areas with diverse trees and species [3]. Agroforestry has also been widely adopted in various countries because of the positive impact it offers. The Regional Forestry Service Branch Office IX (CDK Wilayah IX), a government agency under the Indonesian Ministry of Environment and Forestry in charge of managing production forests, realizes the urgency of creating agroforestry. They have provided agroforestry guidance to forest farmer communities in their region, including Magelang and Temanggung, since 2017. The areas are plateau that prone to degradation and deforestation.

Therefore, this study was conducted to (a) characterize the existing farmland agroforestry system practiced by farmer groups; and (b) identify the factors that affect the success and failure of agroforestry. Agricultural commodities are explorative rather than transformative and innovative [4]. The agricultural

2. Methodology
To capture an overview of agroforestry practices in the Regional Forestry Service Branch Office IX (CDK Wilayah IX) under the Indonesian Ministry of Environment and Forestry, this study used a qualitative methodology in-depth interviews and field observations with farmers. Four farmer groups in Magelang & Temanggung area were selected because they were considered an active role in agroforestry practices.

3. Result and discussion
3.1. Existing agroforestry characters
In Magelang and Temanggung, the livelihood of the population was dominated by the agricultural sector. The farmers planted one species known as monoculture. Gradually this agricultural pattern turned into an agroforestry system, although it was not yet optimal. The farmers’ communities began to integrate woody perennial with crops on their land.

Previously, farmers in Magelang did not adjust their cropping patterns cause of the assumption that the more trees on the land, the more they produced. In practice, the more trees coincided with each other; the results would not be optimal. After guidance related to agroforestry, farmers started planting various types of trees such as durian, pete, jengkol, and sengon (used for shade). The tree's choice was a recommendation from the farmer because the tree species had been there for generations in the area.

The same condition also occurred in the Temanggung area, especially Tlahab and Kandangan. The main commodity of Tlahab was tobacco so that from generation to generation, the farmers here have grown tobacco. Considering that the Tlahab area was prone to landslides, especially during the rainy season, they started planting wood crops for shade, such as coffee and suren. Meanwhile, in the Kandangan area, farmers have planted robusta coffee, which was a legacy plant since the Dutch era. Now, they have started to plant sengon trees on their land.

Apart from the agricultural sector, several farmer communities also have developed livestock, although it was still relatively small. Unfortunately, livestock placement was separated from the land, which was not yet fully compatible with agroforestry designs. This was done because farmers were
worried that livestock was placed on the land; it would damage crops. However, they have used the livestock manure for fertilizer even though it was not 100%. Thus, species selection in agroforestry designs in this study tended to focus on local wisdom. Farmers considered local culture aspects in managing agroforestry while still applying traditional values, similar to those farmers in Lampung [14].

3.2. The role of stakeholders
Agroforestry system implementation could not be separated from the role of stakeholders. The stakeholders involved in this study consisted of farmers and policymakers. The Regional Forestry Service Branch Office IX (CDK Wilayah IX) was the main actor in policymaking related to agroforestry. The field assistants assisted the formation of farmer groups, identified local species, disseminated technology, and spread plant seeds. The Regional Forestry Service Branch Office IX provided agroforestry training called “Sekolah Lapang (SL)” which provided knowledge and facilitated agroforestry farmer skills.

3.3. The attitude of farmers in adopting agroforestry systems
The agroforestry system has been introduced in the Magelang and Temanggung areas since 2017. Several factors made farmers in this region adopt the agroforestry system. They were economic and environmental factors.

Agroforestry helped the farmers increase their income because monoculture farming only allowed them to harvest once a year. Meanwhile, agroforestry systems generated more income because they grew many species of plants. On the environmental aspect, agroforestry systems improved soil quality. In Temanggung, farmers who applied agroforestry felt more secure because they were not prone to landslides. This was due to the presence of woody plants that have improved soil conditions.

However, there were also some inconsistent farmers in applying agroforestry. Most farmers had low levels of education and knowledge, so they tended to ignore this system's importance. These farmers promoted a planting culture that has been passed down from generation to generation. Also, the government's role contributed to the inadequate application of the agroforestry system. In the Magelang region, the provision of plant seeds was not following the planting period. This caused farmers to fail crops.

4. Conclusion
An agroforestry system's basic concept is to integrate woody perennials with crops and livestock on the same land. This system maximizes not only productivity but also the ecosystem and socio-economy. There are several agroforestry land-use configurations, but the majority of farmers use agrosilvopastoral. The system combines crops and trees on the same land. The willingness of farmers to adopt agroforestry cannot be separated from government support in guiding farmers.

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