CHAPTER I. INTRODUCTION

1.1 Research Background

Smallholder farmers rely extensively on forest Ecosystem Services (ES), encompassing various benefits, from regulating water and land to offering material and non-material advantages such as cultural and spiritual values (Bhatta et al., 2015; Cooper et al., 2016; Dolisca et al., 2007; FAO, 2013; Silvano et al., 2005). Despite their pivotal role in socio-economic development, Indonesia's forests face rapid decline due to deforestation, land degradation, and inadequate management (Deuteronomy et al., 2019), jeopardizing the provision of ES and rural livelihoods.

The Millennium Ecosystem Assessment highlights that human actions are diminishing Earth's natural capital and ES on a global scale and totably, 62 percent of the ES examined globally, including regulatory and cultural services, experienced degradation or unsustainable use between 1950 and 2000 (Reid, 2005). Existing literature on ES in agriculture primarily focuses on assessing managed landscapes providing services to communities. It comprises studies analyzing the impact of agricultural activities on ecosystems and assessing the ES offered by agricultural landscapes(Dale & Polasky, 2007; Nelson et al., 2009; Porter-Bolland et al., 2012). Failure to incorporate ecosystem service values into resource allocation decisions can lead to inefficiency and ecological losses (Kroeger & Casey, 2007). Ecosystem service assessments are increasingly conducted to enhance their consideration as a decision-making tool in ecosystem management(Muradian et al., 2010; Pascual et al., 2010). However, these assessments often rely on a market-based approach, limiting the quantification and monetization of ES, particularly in-kind and non-cash values, and necessitating further study of the socio-economic factors influencing their valuation.

In rural areas, agricultural and other activities heavily depend on environmental services. The economic value of natural production factors, such as land, water, and climate, remains largely unassessed, leading to undervaluation of agricultural products and suboptimal investments in rural environmental services (Tallis & Polasky, 2009). Quantifying in-kind costs, including farmers' sacrifices for unquantified production factors, is frequently overlooked. For instance, the in-kind value of animal-mediated seed dispersal in crop cultivation often goes

unappreciated. ES beneficial to agriculture, such as pollination, breeding, pest control, and flood regulation, receive limited economic research attention, despite their crucial role.

PES (PES) is considered an approach to mitigate forest degradation and enhance economic development in various countries (Pagiola et al., 2005). While research has explored compensating farmers for ES through market mechanisms(Asquith et al., 2008; Pagiola, 2008; Pascual et al., 2010; Wunder, 2005), rural communities' perspectives on environmental service compensation have been relatively understudied. Understanding these perspectives is essential, as rural communities actively access, manage, and utilize ecosystems for conservation and service provision.

The Batang Toru forest plays a pivotal role in providing essential ES that sustain the livelihoods of numerous residents. The local community, primarily reliant on agriculture and agroforestry adapted to the local conditions, heavily depends on these services. The forest's most prominent function is its vital hydrological role, serving as a critical water source, flood mitigation during the rainy season, and drought alleviation during prolonged dry periods.

Regrettably, the existence of the Batang Toru forest is presently in jeopardy. Between 2001 and 2010, nearly 3,500 hectares of forest within the Batang Toru area were logged, primarily by migrants from Nias (Yayasan Ekosistem Lestari, 2007). This corresponds to an annual deforestation rate of 0.48%. The threats to the Batang Toru forest also stem from oil palm plantations, gold mining activities, and power plants. These factors have led to forest fragmentation, with a significant increase in fragmentation observed in the lower reaches of the watershed over three decades from 1989 to 2013 (Samsuri et al., 2019). Notably, a substantial portion of the upstream Batang Toru watershed has been converted into agricultural land, serving various agricultural enterprises. The water from this watershed is instrumental in supporting extensive rice fields in the Sarulla Valley, sustaining fisheries along the Batang Toru River, and facilitating the cultivation of frankincense, rubber, salak, and oil palm plantations.

1.2 Research Problem

Anthropogenic activities have led to the decline of ES in Indonesia's Batang Toru forest, jeopardizing biodiversity and rural livelihoods. Despite the importance of farmers in the sustainable management of forest ES, not many studies quantify the value of ES inflows to agriculture (Aisbett & Kragt, 2010), and even fewer do so for smallholder farming in the setting of a rainforest landscape or estimating the value of inter-farm ES flows. According to a bibliometric analysis study by Firdaus et al., (2022), oil palm, deforestation, and biodiversity are all significant factors in Indonesian ES research. In Batang Toru forest, no research has been conducted on smallhold farmers and their dependence on ES. A study by Perbatakusuma et al., (2007) determined that in the Batang Toru forest timber, gold mining products, tourism and hydropower had an economic value of USD 242,152,727.07 (IDR 3,632,290,906,048) per year. Whereas another report published by UNEP found that the value of avoided CO2 emissions during the twenty-five-year transition period from primary forest to oil palm or other land use in Batang Toru ranges from 3,711-11,185 USD/ha (Wich et al., 2011).

Deforestation's adverse effects on ES lead to ecological conflicts, rooted in service scarcity and distribution of costs and benefits(Costanza et al., 2017). The Batang Toru forest has suffered degradation and conversion, disrupting the natural resources crucial for agricultural production in the area (Harahap & Yonariza, 2022). Farmers note a decline in ES supporting agriculture due to land use changes, unsustainable practices, and extractive industry development. This neglect of ecosystem values may result from insufficient knowledge and difficulties in monetary quantification. To compare the economic value of forest conservation versus human activities, understanding the full ecosystem value is crucial. This knowledge can guide decisions and resolve conflicts, aligning conservation and community welfare goals in Batang Toru forest (Lambini et al., 2018).

Despite community-based efforts to enhance environmental services, the economic value of these services and their overall benefits to agriculture remain underexplored (Harahap et al., 2022). Many ES in Batang Toru lack market trade, obscuring their real value and contributing to incomplete economic assessments. This limited valuation approach has marginalized forest ecosystems in budget

decisions and land use changes, leading to degradation and excision (Lambini et al., 2018).

The relationship between socioeconomic factors and forest resource dependence can vary by product type and location (Kalaba et al., 2013). To bridge the identified information gaps, it is imperative to undertake a comprehensive economic evaluation of forest ES within the Batang Toru forest. The assessment of Total Economic Value (TEV) in the context of the Batang Toru ecosystem in this study is based on the economic value of ES identified within a specific sample, namely provisioning and regulating services, to reflect the significant economic impact of the Batang Toru forest. However, it is important to note that this estimate does not encompass the entire economic value of the Batang Toru ecosystem. Key elements such as supporting services, cultural services, and contributions from other ecosystem areas and broader communities have not been included in the analysis. This limitation arises due to constraints in time, resources, and data availability, which restricted the scope of the study. As a result, this study provides only a partial representation, and a comprehensive valuation is needed to fully capture the total value of the Batang Toru ecosystem.

Additionally, gaining insights into community preferences regarding forest services that bolster agriculture is essential. Consequently, the research questions addressed in this study are:

1. Which ES are appreciated by smallholder farmers, and what is their level of experience with specific ES from the Batang Toru forest?
2. What is the estimated economic value of the ES provided by the Batang Toru forest at the household level for smallholder farmers?
3. What factors influence the perspective of farmers on ES, and what is their willingness to pay for certain ES provided by the Batang Toru forest?
4. What are the indigenous practices related to PES that have been undertaken by smallholder farmers?

1.3 Research Objective

1. Identify the ES utilized by Batang Toru smallholder farmers to support their livelihoods.

2. Assess the economic value of Batang Toru forest ES at the household level, highlighting their contribution to local economies.
3. Investigate the factors shaping farmers' perspectives and willingness to pay for ES, including socio-demographic and contextual influences.
4. Explore indigenous knowledge and traditional payment practices for ES and evaluate the potential for integrating these practices with mainstream PES initiatives by smallholder farmers.

1.4 Significance Of Research

Despite limited ES literacy in rural developing communities, this research aims to enhance understanding of the economic valuation of agricultural ES and shed light on independent payments for ES in low-literacy rural areas. It also seeks to provide insights into the economic values and contributions of ES payments across various stakeholders. The findings will signal policymakers and resource managers about the significance of ecosystems for household and community welfare, aiding in informed decision-making. This information is crucial for guiding government, community, and stakeholders in assessing, sustainably utilizing, and managing the Batang Toru forest.

This research contributes to the Sustainable Development Goals (SDGs), particularly SDG 13 (Climate Action), SDG 15 (Life on Land), SDG 10 (Reduced Inequalities), and SDG 2 (Zero Hunger), by enhancing understanding of the economic valuation of agricultural ES in underlooked rural areas. Despite limited awareness of ES in these communities, the study provides critical insights into independent payments for ES (PES) and their economic values across diverse stakeholders. By emphasizing sustainable agricultural practices, such as agroforestry, the findings support improved food security, enhanced livelihoods, and biodiversity conservation. These insights inform policymakers and resource managers about the essential role of ecosystems in household and community welfare, enabling more equitable and sustainable decision-making. By promoting informed strategies for assessing, utilizing, and managing the Batang Toru forest, this research supports efforts to mitigate climate change impacts, preserve biodiversity, enhance food systems, and reduce socio-economic disparities in rural contexts.

1.5 Novelty Of Research

Ecosystem service assessment is limited in lower-middle-income countries, accounting for just 14% of published research, with a mere 3% focusing on community-managed forests (Acharya et al., 2019). Research on valuing ES, particularly in biodiverse forest regions, is scarce. Existing studies often neglect to consider rural communities' views on these services, predominantly concentrating on regulatory services like carbon sequestration (Acharya et al., 2019). As a result, essential ES for rural and agricultural economies, such as pollination, pest control, and disaster mitigation, receive limited attention. Most economic assessments prioritize market values and fail to acknowledge non-market values within rural communities. This research introduces an innovative approach by economically valuing specific agricultural ES, as perceived by local farmers.

Several studies support the idea that local benefits from ES outweigh conservation costs, justifying local-level conservation efforts (Chan et al., 2011; Green et al., 2018). These conclusions rely on various valuation techniques, each tailored to assess distinct ES received by local communities. Using multiple valuation methods is crucial because forest ecosystem service valuations require diverse approaches. Contingent valuation (CV) is one such method but is often questioned due to potential biases, such as strategic, hypothetical, informational bias, and embedding (Spash, 2008). Furthermore, CV may struggle to distinguish use value from non-use value, especially in contexts where respondents interact with ES. Recognizing CV's limitations, an alternative method, Choice Modeling (CM), is essential to assess local ecosystem service benefits. CM does not ask respondents to assign direct monetary values to ecosystem changes but rather requests them to compare alternative ecosystems based on attributes and their respective levels. CM focuses on attribute relevance and assigns a monetary value to marginal attribute changes.

The novelty of this research lies in its pioneering methodological innovation through the application of diverse ecosystem service valuation methods within the Batang Toru forest context, specifically emphasizing the use of the CM. CM, employed to assess regulating services by considering individual and social values, provides a profound understanding of local community perspectives on ES conservation.

Furthermore, this study introduces the novel concept of Indigenous PES, exploring indigenous practices related to the administration and compensation of ES in agriculture derived from the Batang Toru forest. The indigenous viewpoint on payments for ES to enhance smallholder agriculture is an overlooked and unexplored aspect in the region, making it a deserving and uncharted subject for investigation. This unique combination of methodological innovation and exploration of indigenous perspectives adds a distinctive dimension to the research, contributing to the advancement of knowledge in the field of ES conservation.