CHAPTER I. INTRODUCTION

A. Research Background

Regardless of its utilitarian role, the ecosystem is a factor in production activity. Due to the challenges in determining property rights, the environmental and natural resources involved are classified as common pool resources (Sterner et al., 2012). A common property resource is a resource that is freely accessible to everyone and not under exclusive ownership by an individual or organization (Harris & Roach, 2015). It reflects a regular characteristic of non-excludability, in which resources are accessible to everyone and consequently impose challenges in impeding individuals or entities from consuming the same resources (Espinola-Arredondo & Muñoz-Garcia, 2021). In particular, common resources are vulnerable to be exploited. Several parties rival one another to exploit the available resources and often ignore the ecological constraints associated with such activities (Faure et al., 2017).

In parallel, the economic principle views the environment as a comprehensive resource that offers abundant services to uphold the life system for human survival (Tietenberg & Lewis, 2018). However, their resource consumption prioritizes the momentary financial benefits while overlooking the features and value provided (Ozdemiroglu & Hails, 2016). Consequently, the value of environmental attributes cannot reflect the actual services and benefits consumers receive. Responding to the issue, it can be argued that economic valuation serves the purpose of determining the monetary worth of goods and services the ecosystem provides.

Economic valuation is the process of identifying monetary worth of ecosystem goods and services for either specific individual or an organization through a quantification and assessment in financial and management frameworks (Vause et al., 2016). In addition, valuation approaches are frequently used for assessing the outcome of "dose – response function", which represents the correlation a phenomenon (dose) and the corresponding consequences (response) (Vause et al., 2016). According to Kementrian Negara Lingkungan Hidup (2007), understanding the economic value of resources is crucial for choosing a proper

resource management decision within the environmental economics framework. Hence, the economic evaluation of natural disasters is conducted to ascertain compensation mechanisms and remedial actions in the aftermath of an event, as well as to perform cost-benefit analyses before such events. Both approaches aim to identify preventive or mitigation strategies that can diminish the impact of natural hazards (Sapir & Santhos, 2013).

As noted by WHO (2024), a flood is a common natural disaster that occurs when water usually inundates dry land. Floods are often triggered by rapid snowmelt, and storm surges from tropical cyclones or tsunamis in coastal regions. A flood is characterized by the accumulation of water in a specific area due to the overflow of rivers, lakes, or seas, leading to material and non-material losses that affect humans and the environment. According to the Food and Agriculture Organization (FAO), flood disasters account for approximately 65% of crop production losses worldwide. Flooding can have both beneficial and detrimental effects on agriculture. On the positive side, it enhances soil fertility in lowland areas by depositing nutrient-rich sediments from the upland. Yet, flooding can also lead to soil erosion, damage to agricultural fields, and changes in soil (Aklan, 2024).

Furthermore, the FAO (2023) highlights that the agricultural sector is highly vulnerable to climate variability, which threatens not only agricultural productivity but also global food security and rural livelihoods. The industry increasingly faces multiple risks, including floods, droughts, water scarcity, declining yields, reduced fish stocks, loss of biodiversity, and ecosystem degradation. Given these complex challenges, studying the impact of flooding on agriculture is critically important. A comprehensive understanding of these effects is essential to assess environmental risks accurately and to develop effective adaptation and mitigation strategies.

B. Research Problem

Lake Singkarak extends across two regencies. Solok Regency encompasses the districts of X Koto Singkarak and Junjung Sirih, while Tanah Datar Regency includes the districts of X Koto and Rambatan (Idris, 2020). The lake provides numerous environmental benefits for local livelihoods, including fish resources, and water for daily activities, such as agricultural irrigation and hydroelectric power

(Ajiwibowo et al., 2019; Perret & Yuerlita, 2014). Specifically, the lake's water irrigates agricultural lands for farmers located downstream and around the lake (Permadi, 2023). Batang Paninggahan River is the sole river in Paninggahan Village that consistently flows into Lake Singkarak. It serves as the primary source of technical irrigation and traditional water supplies for rice fields, which are the locals' main agricultural activity (Yuerlita et al., 2017).

As revealed by Aqilla & Alliyu (2023), Indonesia experiences a high annual rainfall, generally ranging between 2,000 to 3,000 millimeters. This significant level of precipitation contributes to the country's vulnerability to flooding, particularly during the peak rainy season, which typically spans from October to January. During the precipitation period, Singkarak Lake water inundates and causes waterlogging on the lakeshore where the marginal rice field is located during the high-precipitation period (Appendix 1 & 2). Permadi (2023) also found that the elevation of lake water shows a positive correlation with the size of rice field land flooding, resulting in a substantial decrease in paddy production on affected land. This phenomenon also exerts a notable influence on the income levels of farmers, as flooding induces production losses that ultimately impact their financial returns (Andani et al., 2019) (Appendix 2).

The local disaster management agency (Badan Penanggulangan Bencana Daerah) also reported that annual flooding impacts nearly all regions of Solok Regency, resulting in significant damage to river flows and water infrastructure, with particularly severe effects on the housing located along the riverbanks. Additionally, abrasion in the Paninggahan River also adversely affects the agricultural land. The flood disaster in *Nagari Paninggahan* has an estimated damage value of IDR 1,320,257,400 (BPBD, 2017). This phenomenon induced disadvantages for farmers. Previously, Andani et al. (2019) revealed in their research that 160 households suffered from flooding, with 175 hectares of land inundated in 2016 at Paninggahan Village. He also discovered that the moderate rainfall and the demographic conditions of the village, located at the lakeshore, triggered the flood. Moreover, Paninggahan village is the confluence point of six rivers: Sumpur, Baing, Paninggahan, Muaro Pingai, Saningbakar, and Sumani. Additionally, the relatively flat topography of the land (<8%) significantly

contributes to the flooding. Addressing the research problem, several questions are identified below:

1. How is the flooding phenomenon in *Nagari Paninggahan*?
2. What is the relationship among land area and average monthly rainfall with paddy's production in *Nagari Paninggahan*?

C. Research Objectives

In response to the observed phenomenon, this study aims to achieve several key objectives that contribute to both a deeper understanding and practical insights regarding the issue. The specific objectives are as follows:

1. To describe the flooding phenomenon in *Nagari Paninggahan* from the perspectives of local farmers
2. To examine the relationship between land area and average monthly rainfall with paddy production in *Nagari Paninggahan*.

D. Research outcomes

The benefits of this research are twofold, encompassing both practical and theoretical contributions, as outlined below:

1. This research supplies valuable information for the development of local policies and decision-making
2. In theoretical terms, this research can be used as a valuable reference for other similar studies