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Study of Constraints in the Management of Dry and Hilly Lands in Flores Bajawa

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ABSTRACT: Dry land is a landscape where water is stagnant for a long time or all the time. The use of dry land usually occurs on land, dry land, or uncultivated land. Dry land has the potential to become agricultural land, with 45% of Indonesia's territory consisting of hills and dry land, which are ideal areas for development. However, many obstacles arise in arid, dry regions. In addition to dry land, hills, or areas above ground, they have a positive impact on the agricultural system. Bajawa is a region in the Flores plateau that has a very extensive dryland area. The purpose of writing this article is to facilitate the resolution of problems or obstacles that occur in dryland and hilly areas (upland areas) with a dry climate. The method used in this research is a literature approach. (library research). Data collection in the research was conducted by reviewing and exploring several journals, books, and documents (both printed and electronic) as well as other data sources and information deemed relevant to the research or study. To support sustainable agriculture, dryland management must be sustainable. In land management, there are several issues that often arise. This includes soil fertility decline due to erosion and leaching, very steep topography, water availability, and production issues. Able to identify obstacles and determine solutions. As an alternative, one can use vegetative or mechanical soil management methods, enhance rainwater harvesting, manage water resources comprehensively, and plant drought-resistant crops.

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INTRODUCTION

Indonesia is an agrarian country in Southeast Asia. This country with a tropical climate has a land area of more than 191.09 million hectares, encompassing all the islands of Indonesia. The biophysical and environmental characteristics of Indonesia are quite diverse, especially in the context of agriculture. The diversity of parent materials, soil types, climate, and topography are some of these characteristics. In addition to biophysical factors, land use and development are also influenced by social, economic, and local wisdom factors (Alim dkk, 2022).

Besides other earth systems, natural water, and the atmosphere, land is responsible for the functions, changes, and stability of ecosystems. In addition, land performs various important functions, such as ensuring sustainable activities, diversity, and biological productivity; regulating and distributing the flow of water and solutions; and filtering, buffering, degrading, immobilizing, and detoxifying organic and inorganic materials, including industrial and urban by-products. Preventing the degradation of various soil functions is crucial for the sustainability of peri-life and its well-being. For inhabited living environments, soil conservation is necessary because soil, wherever it is located, is a component of the living environment that must be protected or shielded from negative impacts (Noywuli, 2023).

Dry land is a type of land where water does not accumulate for more than one year. (Alim et al., 2022). Land is one of the important factors that influence the livelihood of humans. In agricultural cultivation, land serves as a medium for plant growth. Land that has the capacity to enhance plant productivity is land that provides nutrients and all the minerals necessary for plant growth.

In reality, due to rapid population growth, the area of productive agricultural land is starting to shrink. The conversion of agricultural land into industrial and other uses causes the reduction of land area. Dry land has the potential to become agricultural land. 45% of Indonesia's territory consists of hills and dry land, which are ideal areas for development. (Noywuli, 2023). However, many obstacles arise in arid, dry climate areas. In addition to dry land, hills, or elevated areas, they have a

positive impact on agricultural systems.

A hill is a natural formation with a higher land surface.Hills are a collection of hills lined up over a fairly large area. One type of land cultivated by farmers, the hilly area has an elevation between 50 and 500 meters with a slope of 7% to 20%, and the mountainous area has an elevation of more than 500 meters with a slope of more than 20%. The forms of hilly land include intrusive hills, volcanic dome hills, karst hills, elongated hills composed of sedimentary rocks, and the forms of mountainous land. Efforts to restore, maintain, and enhance land functions so that its carrying capacity, productivity, and role in supporting life-sustaining systems are preserved are known as land rehabilitation. (Noywuli, 2023).

The purpose of writing this article is to facilitate the process of resolving problems or obstacles that occur in dryland and hilly areas (upland area) with a dry climate.

METHOD

The method used in this research is the library research approach. The use of library study or literature review as an activity related to the method of library data collection, reading and note-taking, and processing research materials. Data collection in the research is conducted by reviewing and exploring several journals, books, and documents (both printed and electronic) as well as other data sources and information deemed relevant to the research or study.

RESULT AND DISCUSSION

Dry Land and Hills

In dry land conditions, evapotranspiration is greater than rainfall, yet crops are still planted periodically. In addition to being associated with land degradation, drylands are also often linked to water scarcity. Increasing population, non-conservative agricultural practices, and excessive grazing are other factors contributing to drylands. (Solowey et al., 2013; Alim, 2023).

The development of this agriculture can help national food security by increasing production. Basically, the productivity of dry land is still very low except for land used as plantations or annual crops. (Abbas et al., 2019). But some dry lands are not suitable for agriculture due to shallow soil and very steep slopes. Of the total 148 million hectares, only about 76.22 million hectares (52%) are suitable for agriculture, with 70.71 million hectares (93%) located in lowlands and the rest in highlands.

To support sustainable agriculture, dryland management must be sustainable. Sustainable agriculture in drylands aims to produce livestock feed and crops by utilizing limited water resources without employing harmful cultivation techniques or excessive grazing that endangers marginal lands. As a result, more suitable strategies for drylands must be implemented, which protect and cultivate dryland agroecosystems.

Examples include replanting useful plants from degraded areas, cultivation in water-saving soil modes, replanting drought- and salinity-tolerant or resistant plants, or managing grazing areas and water collection with consideration for conservation and future use. (Solowey et al., 2013).

Hill land has great potential for agricultural use. Farmers usually use hilly land to grow horticultural crops. Hill areas, or high regions, have significant side effects not only on the agricultural industry but also on other fields. This impact causes erosion and landslides and can affect the decision-making process regarding land and environmental management. (Juhadi, 2007).

Constraints in the Processing of Dry and Hilly Lands

Problems or issues that occur during the production process are known as constraints.Mechanical manipulation of the soil is called management. (Arsyad, 2010). Problems that arise in dry and hilly lands hinder the cultivation and management processes of agriculture.In land management, there are several challenges often faced, such as the decline in soil fertility due to erosion and leaching of bases, very steep topography, and low water levels, which hinder agricultural production.

The ability of the soil to provide nutrients in sufficient and balanced amounts to ensure optimal plant growth and production is known as soil fertility. The soil's ability to supply nutrients to plants determines the amount of nutrients required for their growth and production, which is not always met. (Ceunfin et al., 2017). In addition to nitrogen (N), phosphorus, and potassium, the chemical components of soil include organic matter, nutrient range, nutrient reserves, soil reactivity (soil pH), cation exchange capacity (CEC), base saturation, and availability for plant growth. (Sitorus et al., 2018).

In dry and wet climates with high rainfall, most cations and nutrients are intensely leached. High erosion and surface runoff also reduce the physical-chemical fertility of the soil. Dry land in humid climates often faces problems due to its low productivity levels.

Based on the Indonesian Soil Resource Exploration Atlas at a scale of 1:1,000,000 (Center for Soil and Agroclimate Research and Development, 2001), plants are grouped based on soil acidity levels, resulting in the distribution and area of acid dry land covering 102.8 million hectares. This grouping is done based on annual and perennial or plantation crops suitable for wet and dry climates, as well as highland and lowland areas. Organic matter is one of the most important materials for improving soil fertility.

Organic matter can alter the physical, biological, and chemical properties of the soil. They can also increase soil porosity and cause mineralization and decomposition. The result of decomposition is organic acids (organic compounds), which can serve

as materials that aid in the formation of soil aggregates. The improvement of aggregates (structure) will be accompanied by enhancements in porosity, aeration, infiltration, water retention capacity and available water, permeability, and other physical properties. Organic matter can also improve the chemical properties of the soil. The processes of mineralization and decomposition occur on the added organic matter.Cation exchange capacity (CEC) is enhanced by the organic acids produced from decomposition. Mineralization and decomposition involve the release of nutrients, resulting in an increase in the quantity and availability of nutrients in the soil. (Wawan, 2017).

Because of its steep slopes, dry land in a wet climate has a relatively high erosion potential. It is very sensitive to erosion, especially during the heavy rainy season. Plantations are generally carried out on flat to slightly sloping land with slopes of more than 15%. However, land with such topographic conditions is more suitable for perennial crops. (Abdurachman et al., 2008).

In dry land, the climate is dry, and the annual rainfall is low, with many sloped areas. As a result, in addition to the lack of water, the potential for erosion is also high. The allowable soil loss (TSL) or erosion in East Nusa Tenggara is only between 1.12-2.24 tons/ha per year because the majority of the region is hilly and mountainous with slopes over 30%. In these shallow-soil areas, some agricultural commodities are difficult to grow and develop, so many pastures are only covered with grass suitable for livestock development. The cropping index can be improved by providing surface water resources such as ponds, pumping, and trench dams. (Las et al., 2014).

According to the International Institute of Rural Reconstruction (2002), some of the most common soil problems in dryland areas are high surface runoff caused by slopes, low infiltration, poor groundwater, soil hardening and compaction, and low soil moisture due to insufficient ground cover, low infiltration, and increased surface runoff and evaporation. Poor soil structure, caused by a lack of organic matter, surface soil erosion, and nutrient leaching; soil hardening and compaction, caused by excessive tillage, and unstable soil structure.

Hills with sloping topography can experience surface erosion of the topsoil layer. Erosion and leaching can cause a decrease in organic matter content, the number of granular structures, and soil nutrient levels. (Harahap et al., 2019). Continuous terraces and individual terraces (site, horse, or plate-shaped) are needed in areas with sloping or hilly topography. This will reduce the risk of erosion and preserve the soil so that it can retain water well.

With a planting index of <1.50, year-round farming cannot be carried out due to the lack of water in dry and hilly areas. This is due to the spatial and temporal changes in rainfall patterns and their distribution. (Abdurachman et al., 2008). Two important relationships between water and land are as follows: water hinders agricultural production systems due to its limited and uneven temporal and spatial distribution, and vice versa. Because most dry land is located in the upper watershed areas, dry land functions as a regulator and buffer of water resources. (Las et al., 2014).

One of the challenges in managing dry land for crops such as rice, secondary crops, and horticulture in Indonesia is the mismatch between the supply and demand for water in space and time. Although the high soil fertility and limited water resources in dry climates do not provide many opportunities for farmers, they often do not want to seriously develop crop cultivation and even neglect it as unproductive land. To determine strategies for developing food crops, water resource management is necessary. (Las et al., 2014).

The physical condition of the land (relatively shallow soil depth, drought, partial loss of A and B horizons due to erosion, steep slopes, weak conservation techniques, and lack of capital for the application of recommended technologies) is a production limitation on arid land. One of the consequences of these physical, technological, and socio-economic constraints is the decline in land productivity.

CONCLUTION

In dry land conditions, evapotranspiration is greater than rainfall, yet crops are still planted periodically. Water scarcity and land degradation are signs of dry land. The increase in population, non-conservation agricultural practices, and excessive grazing are additional factors causing dry land. The dry land business has great potential for development. Proper management can enhance the function of drylands and turn arid dryland soils into productive growing media for plants.

To support sustainable agriculture, dryland management must be sustainable. In land management, there are several issues that often arise. This includes the decline in soil fertility due to erosion and leaching, very steep topography, water availability, and production issues. Able to identify obstacles and determine solutions. As an alternative, one can use vegetative or mechanical land management methods, enhance rainwater harvesting, manage water resources comprehensively, and plant drought-resistant crops.

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