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REDUCING THE RISK OF LANDSLIDES BY ENHANCING LAND CONSERVATION AND FERTILITY IN BALAI GADANG SUB-DISTRICTS, KOTO TANGAH DISTRICTS, PADANG CITY

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ABSTRACT: The significant volume of erosion produced will lead to the loss of topsoil layers and the depletion of soil nutrients. Hence, conservation efforts are necessary to prevent soil dispersion, regulate the force of movement, and control surface runoff to avoid soil uplift. This study involves qualitative research, requiring fieldwork and discussions with the community to gather data. The methods proposed for problem-solving with partners include: 1) Direct discussions with the residents of Balai Gadang Sub-District, an area prone to landslides, 2) Training on utilizing fruit waste for eco-enzymes and decomposers, as well as vegetative conservation on the land. Results from the third year of service include: (1) Discussions with farmers regarding the production of decomposers and eco-enzymes, (2) Survey activities to enhance agricultural and livestock activities, (3) Training and practice in making decomposers from rice washing water, (4) Practical sessions on producing Eco-enzymes from fruit peel waste, (5) Refreshment discussions for farmer group organizations, (6) Joint practical sessions with students to assess the fertility of agricultural land, (7) Surveys at new landslide locations for vegetative conservation activities with black bamboo, bananas, sugar palms, betel nuts, vetiver grass, and others.

Keywords: Disaster Resilience, Land Conservation, Landslides

1. INTRODUCTION

The Batu Gadang area is located in the Upper ColdWater Basin, and this region is hilly, experiencing frequent landslides that bury roads and damage crops of the surrounding community. Human activities in this area, such as land clearing for plantations and settlements, reduce organic matter content and soil permeability [1]. The significant erosion volume produced will lead to the loss of topsoil layers and a decrease in soil nutrient levels [2]. This leads to soil depletion, making it difficult for plants to grow. Ultimately, groundwater quantity and quality in the catchment area will decrease. Therefore, soil conservation efforts are necessary to prevent soil dispersion, regulate the force of movement, and control surface runoff.

Land use with slopes greater than 15% is not recommended for food crop cultivation, and land processing should be based on land conservation. Many people in Batu Gadang are already farming and raising livestock in this area, some even receiving government assistance in cattle for each group. This area has about four farming groups, all under the leading farming group called Kato Sepakat. Specific issues in the Batu Gadang area, particularly in the Balai Gadang Sub-District, include the lack of cultivated conservation-based agricultural land; frequent landslides of farm regions with farmers **not resilient enough to face** them; farmers' limited knowledge in utilizing land according to its potential and limitations, especially with techno-ecological farming models; and inadequate management of farmer group organizations [4]. The government has included disaster mitigation programs, specifically Mission 6, in creating a resilient community. Therefore, engagement in the Batu Gadang area is crucial, especially in addressing landslides in the surrounding agricultural areas.

2. METHODS

This research is qualitative in nature, where data collection involves fieldwork and discussions with the community. The approach methods offered in partner issue resolution are as follows: 1) Direct discussions with the residents of Balai Gadang Sub-District, an area prone to landslides, 2) Training on utilizing fruit peel waste for eco-enzyme production, 3) Training on utilizing rice washing

water waste for decomposer production, 4) Joint practical sessions with students to assess agricultural land fertility, 5) Surveys of new landslide locations for reforestation with suitable plants to mitigate landslides.

3. RESULTS AND DISCUSSION

Balai Gadang Sub-District is one of the areas within the administrative jurisdiction of Koto Tangah District, Padang City. Astronomically, Balai Gadang Sub-District is located between 1000 20' - 1000 25' east longitude and 00 44' - 00 52' south latitude. Balai Gadang Sub-District consists of 14 neighborhoods (RW) and 55 community units (RT). It covers an area of 106.90 square kilometers, comprising 14 neighborhoods (RW) and 58 community units (RT). The population of Balai Gadang Sub-District is 17,805 people, consisting of 8,955 males and 8,850 females. Administratively, Balai Gadang Sub-District is bordered to the north by the Buluh Padang Pariaman River, to the south by Koto Panjang Sub-District, to the west by Batipuh Panjang, and to the east by Lubuk Minturun Sub-District [5]. The administrative map of the research location can be seen below:
This research is related to landslide disaster mitigation, which means that communities in this area must be prepared to face and address this disaster. The research results have been obtained from the combination of interview data with farmers, exploring how they adapt and continue their agricultural activities in this landslide-prone area.

Making Compost Starter (Decomposer) from Rice Washing Water

Rice washing water contains many nutrients needed by plants. When washing rice, the washing water is usually cloudy white (for white rice) or cloudy red (for red rice). The cloudy white/red color indicates that the outer layer of the rice has been washed away. Although many nutrients have been lost, the rice husk still contains valuable residue nutrients needed by plants, making them more fertile. In addition to nutrients, rice washing water also contains several types of beneficial bacteria for plants [6].

Fig. 1 Making decomposer from Rice Washing Water.

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Making Eco-Enzyme from Fruit Peel Waste

Eco-enzyme is a dark brown, strongly acidic, complex organic solution produced from the fermentation of vegetable and fruit scraps mixed with sugar and water. Generally, eco-enzymes can be used as multipurpose cleaning liquids for household purposes such as dishwashing, mopping, bathroom cleaning, and others because they contain acetic acid that can kill disease-causing agents, viruses, and bacteria. However, eco-enzymes can also be used as organic fertilizers and natural biopesticides [7]. The production of Eco-enzyme also has broad environmental and economic impacts. Regarding ecological benefits, O3 gas, known as ozone, is produced during the enzyme fermentation process. As is known, one of the contents of Eco-enzyme is Acetic Acid (H_3COOH), which can kill germs, viruses, and bacteria.

Meanwhile, the enzyme content consists of Lipase, Trypsin, and Amylase, which are capable of killing/preventing pathogenic bacteria. Additionally, NO_3 (Nitrate) and CO_3 (Carbon dioxide) are also produced, which the soil needs as nutrients. From an economic perspective, enzyme production can reduce the consumption of floor-cleaning liquids or insecticides.

This eco-enzyme is a liquid that can be used as an environmentally friendly antiseptic because it is made from organic waste without residues harmful to the environment. Eco-enzymes have several benefits or uses, including floor cleaner, glass cleaner, toilet cleaner, water pollution treatment, and fruit cleaner. Additionally, eco-enzymes can produce ozone into the atmosphere and act as insecticides, disinfectants, and hand cleaners. These enzymes can reduce water contamination, as indicated by the increased dissolved O2 levels contributing to ozone production in the atmosphere [8].

The uniqueness of this eco-enzyme is that it does not require ample space for the fermentation process and does not need compost containers with specific specifications. Used mineral water bottles can be reused as fermentation containers, supporting the concept of reuse to protect the environment [9]. Some functions of the fermented eco-enzyme include floor cleaner, vegetable and fruit cleaner, insect repellent, and plant fertilizer. The benefits of the fermented eco-enzyme as a disinfectant are due to its alcohol and acetic acid content. Eco-enzyme is the result of enzymatic activity contained in bacteria or fungi [10]

Fig. 2. Participants of the Eco-Enzyme service project

Fig. 3 The practice of making eco-enzyme

The benefits of Eco-Enzyme are numerous, including:

a. All All-Purpose Cleaner
   Eco-enzyme liquid can clean the entire house and clothes and even wash vegetables and fruits.
b. Plant Fertilizer
   Besides cleaning, eco-enzymes are also helpful as plant fertilizers because they can enrich the soil and plants, eliminate pests, and improve the quality and taste of fruits and vegetables.
c. Pathogen Eliminator
   The antimicrobial properties of eco-enzyme inhibit pathogens, making it suitable as a cleaning solution. As a natural enzyme, eco-enzyme is safer than commercial cleaners containing harmful chemicals. Thus, eco-enzyme is used as a detergent, pesticide, insecticide, air freshener, floor cleaner, toilet cleaner, kitchen cleaner, odor remover, dishwashing liquid, fruit and vegetable cleaner, and skincare and haircare.
d. Pest Repellent
   Eco-enzyme is effective in repelling plant pests, such as orchids and vegetables, as well as pests or animals that often disturb the house's surroundings, such as cockroaches, ants, flies, mosquitoes, and other insects.
e. Environmental Preservation
   Current commercial cleaning solutions often contain various chemical compounds, such as phosphates, nitrates, ammonia, chlorine, and others. These compounds have the potential to pollute the air, soil, groundwater, rivers, and seas. Using this organic liquid as a natural cleaning solution contributes to environmental preservation.
f. Reduction of Organic Waste
   Organic waste is one of the most produced types of waste by humans. Eco-enzyme is made by converting organic waste. Therefore, the first benefit of eco-enzymes is reducing the accumulation of organic waste and the adverse effects of its decay (such as hazardous liquids and methane gas).
g. Air Purifier
   Making eco-enzymes indirectly helps to clean the air of toxins, pollution, and odors [11].

Practical Session with Students to Analyze Agricultural Land Productivity

Soil surveys are conducted not only to determine the overall capability or capacity of the land but also as a basis for soil mapping about soil classification and taxonomy. Thus, soil survey activities, mapping, classification, and taxonomy are interrelated and complement each other, providing benefits for improving land use outcomes. Based on the various needs of soil survey implementation, the objectives of soil survey can be viewed from two aspects: first, to provide information to users about the soil, landforms, and other conditions; second, to provide information that will aid decision-making regarding land use and regional development plans to be surveyed.

There are two types of soil in the service area, namely, Andosol soil covering an area of 8,650 hectares and Latosol soil covering an area of 484 hectares (Table 4). Andosol soil has the highest soil erodibility value with a K value of 0.94, classified as moderately high criteria. The erosion hazard levels in the Upper Cold Water Basin range from very slight to severe, with erosion values ranging from 1.20 to 181.64 tons/ha/year. Conservation directions are based on erosion hazard levels as follows: a) Protected forests are to be left in their natural state for forest land use with slopes ≥ 40%; b) Grasslands - grazing fields in production forests or protected forests/nature reserves with terrace bench conservation directions, manual cultivation on shrubland land use with slopes of 26-40%; and c) Limited management with crop rotation, mulching utilization, terrace width based on land use in mixed gardens and paddy fields with slopes of 14-25%. Local governments need to guide the community in land management with land conservation techniques such as bench terraces, ground cover crops, crop rotation, mulching utilization, and good crop management to minimize erosion hazards in the upstream watershed and enforce strict penalties for any actions that damage the ecosystem by irresponsible parties. Concurrently, research in the Dhamasraya area also shows land capabilities ranging from II to VI, requiring land management based on land conservation. The limiting factors here include soil texture that does not support it, and the slope of the area here almost exceeds 35%, making it vulnerable to floods and landslides [12].

Survey at New Landslide Locations for Continued Conservation Activities

Landslide disasters involve the movement of rock masses or soil on a slope due to gravitational forces. Landslides in Indonesia occur in steep topography with slope angles ranging from 15° to 45° and on weathered volcanic rocks with high rainfall. Natural factors causing landslides include surface morphology, land use, lithology, geological structure, rainfall, and seismic activity. In addition to natural factors, landslides are also caused by human activities affecting landscapes, such as

agriculture, slope loading, slope cutting, and mining. Agricultural areas in the service location, especially on hill slopes, are highly vulnerable to landslide hazards.

Several plants, including Breadfruit (jackfruit), black bamboo, coconut, palm, betel nut, banana, and vetiver, are suitable for cultivation in landslide-prone areas.

4. CONCLUSION

Based on the research titled "Reducing Landslide Hazards by Improving Land Conservation and Fertility in Balai Gadang Village, Koto Tangah District, Padang City," the following conclusions can be drawn:

1. Increased entrepreneurial spirit among farmers, aimed at creating creative members with entrepreneurial spirit to improve the economy of the farming community**.**
2. Increased farmers' knowledge and skills in making decomposers, even from rice washing water waste. In the future, they can save money by not needing to buy EM-4 anymore for making compost or other purposes.
3. Increased entrepreneurial spirit among farmers, aimed at creating creative members with entrepreneurial spirit to improve the economy of the farming community
4. Increased farmers' knowledge and skills in making decomposers, even from rice washing water waste. In the future, they can save money by not needing to buy EM-4 anymore for making compost or other purposes.

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