Making Village Disaster Resistant By Applying Techno-Ecological Agriculture Models In Balai Gadang Village, Koto Tangah District, Padang

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Abstract. Following the mission of the Padang City RPJMD 2019 – 2024, the 6th mission is to create an Aware, Caring, and Disaster Resilient Community. A disaster-resilient community is a community that is responsive, trained, resilient, and resistant to all types of potential disasters, including erosion and landslides. The Batu Gadang area is located in the Upper Air cold watershed, this area is hilly and landslides often occur which cover up roads and damage the plantations of the surrounding community. Many human activities in this area in the form of clearing land for plantations and settlements have caused the organic matter content and soil permeability to decrease. The aims of this study were (1) to increase farmers' knowledge in utilizing land according to their potential and limited land by implementing a techno-ecological farming model on their agricultural land. (2) Increasing farmers' knowledge in managing group organizations so that organizational management of farmer groups increases, the birth of active members. This study used a qualitative descriptive approach, data were taken from community information, and by conducting discussions with the relevant community, and interviews were conducted by asking questions and seeking data in the field. The stages of the research carried out were (1) Case Studies, (2) Practice/demonstration especially in making silage, (3) Brains Storming/gathering ideas from the community, (4) Questions and answers, (5) Lectures containing core material related to agricultural models techno-ecology and silage/fodder production and plans for follow-up activities which are solutions to the problems faced by housewives. The results of this study are (1) Discussions and FGDs to renovate farmer group posts and farmer group programs for 2022 which are carried out with farmer group leaders and members, (2) Survey activities to improve the application of techno-ecological farming models in farmer's land areas, (3) Conducting training and practice of making animal feed (silage) made from straw, 4) Discussion on the preparation of black bamboo seeds, (5) Refreshing the management and organizational members of farmer groups in Balai Gadang Village.

Keywords: Disaster Resilience, Land Conservation, Landslide

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1 Introduction

The Balai Gadang sub-district development plan continues. The facilities that are being built in the Balai Gadang sub-district are the construction of Campus III of the Imam Bonjol Padang State Islamic University and the Padang alternative road to Solok. Based on preliminary observations that the researchers made in the construction area of the alternative road to Solok, approximately 8 km had been completed, however, along the completed road, many landslides were found on the cliffs of the road, apart from along the Padang alternative road to Solok, similar problems were also found in the area of Campus III Development of UIN Campus III UIN Imam Bonjol on the Sungai Bangek, the topography in the area is included in a hilly area surrounded by protected forest (Putra, 2019). The land cover vegetation is in the form of shrubs and soil particles in the form of sandy loam. The condition of the area has the potential for landslides. Areas with a high level of landslide threat are those with slopes of 40-50%. The area has a high level of landslide threat because this area has high rainfall. In addition, the rock consists of volcanic deposits and sand and clay-sized sedimentary rocks which are generally less strong. Areas with a high level of landslide threat are the Anak Air area and the Batu Gadang area. The Batu Gadang area is mostly hilly and many people cultivate fields around it.

A disaster-resilient community is a community that is responsive and trained in dealing with all forms of potential disasters and is steadfast and resilient in the face of disasters that occur. Following the mission of the Padang City RPJMD 2019 – 2024, the 6th mission is to create an Aware, Caring, and Disaster Resilient Community. facing all forms of potential disasters that occur including erosion and landslides. The government has included a program for disaster management, namely the 6th mission to create a disaster-resilient community, so that community service in the Batu Gadang area is very important, especially to overcome landslides around community agricultural areas (RPJMD Padang City, 2019). Soil erosion is influenced by two factors, namely erosivity and erodibility. Erosivity is the energy produced by rainfall, while erodibility is the sensitivity of the soil to erosion. Erodibility is affected by soil texture. soil structure, organic matter content, and soil permeability (Barlian, 2012). The Batu Gadang area is located in the Upper Air cold watershed, this area is hilly and landslides often occur which cover up roads and damage the plantations of the surrounding community. Many human activities in this area in the form of clearing land for plantations and settlements have reduced the organic matter content and soil permeability (Wilis, 2020). The large volume of erosion that will result from causes the loss of the top soil layer and a decrease in soil nutrients (Ramadhani, 2017). This causes the soil to be poor in nutrients, making it difficult for plants to grow. In the end, the quantity and quality of groundwater in the catchment area will decrease. For this reason, soil conservation efforts are needed to keep the soil from being dispersed and to regulate the strength of motion and the amount of surface runoff so that soil removal does not occur (Wilis, 2017).

Land use should be following the ability of the land, on land with a slope of more than 15% it is not recommended for farming food crops (Wida, 2011). Many people in Batu Gadang have cultivated and raised livestock in this area and have even received assistance from the government in the form of cows to be looked after by each group. There are around 4 farmer groups here under the auspices of the core farmer group, namely Kato Sepakat. In particular, the problems in the Batu Gadang area, Balai Gadang Sub-District are: The cultivation of crops based on land

conservation has not been managed; There are still frequent landslides in agricultural land areas and farmers are not yet strong enough to deal with them; There is still a lack of farmer knowledge in utilizing land according to the potential and limitations of the land, especially with the techno-ecological farming model; Management of farmer group organizations is still low; In 2021 landslide mitigation activities have also been carried out here and bridge repairs in the farmer's land area. The government also included a program for disaster management, namely the 6th mission to create a disaster-resilient community, so that the service in the Batu Gadang area is very important to do, especially to overcome landslides around the community's agricultural area. If the community is already resilient in facing disasters, then their mentality is very good to carry out activities so that they can cultivate the land well and can gradually improve the economy of the people here.

2 Research Methods

This research is qualitative research where to get the data one has to go into the field with discussions with the community. The approach methods offered in solving partner problems are as follows: 1) Direct discussions with the people of Balai Gadang Village, especially those who live in Batu Gadang, which is an area prone to landslides, 2) Community Service in their field areas, especially on roads covered by landslides that have occurred recently, 3) Training on agricultural land management based on land conservation, the output targeted here is proper processing of agricultural land according to conservation methods, both vegetatively, mechanically and chemically, 4) Training on the use of farmer's land for animal feed in applying the techno-ecological farming model, 5) Counseling on organizational management in farmer groups.

3 Result and Discussion

3.1 The Results Achieved

Balai Gadang Village is one of the areas that are under the administration of the Koto Tangah District, Padang City. Astronomically, the Balai Gadang subdistrict is 1000 20' - 1000 25' East Longitude and 00 44' - 00 52' South Latitude. Balai Gadang Village consists of 14 RWs and 55 RTs. Balai Gadang Village has an area of 106.90 square kilometers, consisting of 14 RW and 58 RT. The population of Balai Gadang Village is 17 805 people, consisting of 8 955 males and 8 850 females. Administratively, Balai Gadang Village is bordered by the Buluh Padang Pariaman Village to the north, Koto Panjang Village to the south, Batipuh Panjang to the west, and Lubuk Minturun Village to the East. The research location can be seen in Figure 4.1 below.

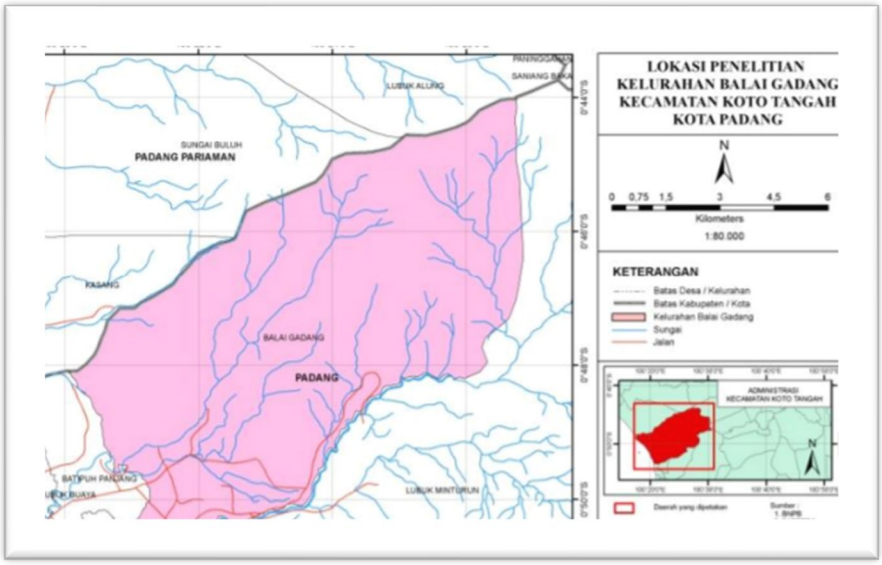

Fig. 1. Research Location Map

This research is related to landslide disaster mitigation, meaning that people in this area must be prepared to face and overcome this disaster. The research results have been obtained from the combination of data

a. Discussion on Refreshing Farmer Group Post
   In 2021 a service post has been established, all that remains is to make another nameplate. It is hoped that this post will permanently belong to the farmers and can be used for discussions and meetings. On August 10 2022 another discussion was held with the head of the farmer group to beautify this post so that they would be more enthusiastic about using it. This service post is useful for discussions or meetings for group members. A group meeting is a meeting of members of a farmer group in a certain place at a certain time, with certain rules, agreed-upon rules to discuss something, and a certain agenda. When visiting the location for a discussion with the management of the Kato Sepakat farmer group, namely Mr. Fauzil Wathan, I received an extraordinary surprise with the change from the design of the posko which was already cave-like with high artistic value.
b. Survey and Counseling related to Techno-Ecological Farming Models
   Techno-ecological agriculture is an agricultural model that is developed by combining the "ecological farming" model with advanced technological agriculture that is in harmony with natural conditions or local ecosystems. This agricultural model can satisfactorily achieve productivity targets on certain commodities, such as rice, corn, and beans. This system is more efficient and of better quality with less risk and is environmentally friendly. Several applications of the techno-ecological farming model can be applied in Indonesia, namely the techno-ecological farming model in wet dry land ecosystems, techno-ecological in dryland ecosystems, techno-ecological in paddy field ecosystems, and techno-ecological in urban area

ecosystems. , techno-ecology in coastal ecosystems. Techno-ecology in dryland ecosystems with wet climates, among others, is applied to coffee and cocoa plantations. Each method can be applied with a simple integration system or complex integration (Wilis, 2017). Techno-ecological agriculture seeks to combine the strengths of ecological agriculture with advanced technology agriculture so that a more productive, efficient, and quality agricultural model will be formed with less risk as well as being environmentally friendly. biomass in one chain) with a touch of advanced technology, will be able to lead to "zero waste" or agriculture without waste (Guntoro, 2007).

The benefits of this techno-ecological farming model are :

1. Reducing the risk of farming
   With increasingly extreme climate change, in the future agricultural businesses will be at increased risk of crop failure due to increased intensity of pest and disease attacks, floods, droughts, or strong wind attacks. By cultivating more than one commodity, business risks can be reduced, for example, a crop failure in one commodity can be covered by the yield of other commodities. If the number of chickens is reduced because of the bird flu attack, then we can still rely on rice and cattle as well as ducks. The drop in the price of one product can be helped by the price of other products. In addition, reducing dependence on external inputs will further ensure the sustainability of farming.
2. Reducing greenhouse gas emissions
   With an orientation towards the use of local resources, the dependence of farming on external inputs will be lower, the lower use of external inputs means that it will suppress transportation activities to transport various types of production facilities outside the location so that it will reduce the use of fuel as a source of carbon dioxide emissions. The integration pattern that forms a closed cycle of the utilization of food substances is a form of mitigation measure to reduce GHG emissions. The straw is no longer burned and of course, it reduces the accumulation of CO2 in the air, the straw is no longer soaked in the land so the methane levels are reduced. The use of organic fertilizers from straw compost reduces dependence on inorganic fertilizers and reduces N2O emissions.
3. Making adaptation and mitigation measures effective
   Related to efforts to anticipate the phenomenon of climate change, the techno-ecological agricultural model can apply adaptation and mitigation measures synergistically and comprehensively within one agricultural ecosystem unit. For example, in a paddy field ecosystem, methane gas emissions can be reduced by selecting low-GHG varieties. This is also followed by irrigation techniques, cultivation systems, and technology for managing crop and livestock waste that are appropriate and safe in the sense that they can effectively reduce carbon and other GHG emissions.

3.2 Manufacture of Animal Feed (Silage)

Straw fermentation is one of the feed choices that can be given to livestock. The feed is made from fermented rice straw using molasses or molasses which is a by-product (waste) from the sugar-making process. Molasses or commonly called molasses is the residue from the processing

of sugar factories. The origin of word molasses is from the Latin word mel which means honey. Sugarcane molasses is very useful as an ingredient for making animal feed, this has long been known and has been carried out since sugar factories were trained.

Sugarcane molasses can be used as animal feed which is given by mixing it with water, mixed with concentrate feed, or by going through a technological process of fermenting various kinds of feed sources of animal fiber, making concentrates, and making silage. Sugarcane molasses is a feed ingredient that has high carbohydrates. Besides that, it has complex B vitamins and other vitamins that dissolve easily in water. This vitamin is also very important for young cattle, goats, and sheep because young ruminants are not used to digest vitamins in their stomach or rumen. It is also important that molasses also has a variety of minerals that are important for maintaining the health condition of livestock, for example, cobalt, boron, iodine, manganese, and zinc. The main advantages of molasses as an ingredient in animal feed are its high carbohydrate content, which can reach 48-60% sugar, and mineral content.

There are several ways you can do or apply molasses to our animal feed, namely, spraying it on a source of forage fiber or dry straw, mixed with grain, or mixed with other feed ingredients. And molasses can also be one of the ingredients in the composition of complete feed. Molasses has a Crude Protein (PK) of about 3.1% and a large energy of 70.1% because the use of molasses is not used as a separate feed but mixed with other feed ingredients that contain high protein. If we give too much molasses, our livestock can experience diarrhea or diarrhea, this is because molasses contains high potassium, and for that, we should use about 15% of the concentrate mixture. Molasses is also widely applied or used in various industrial fields, such as cattle breeding, the energy industry for making ethanol, the construction industry, the composting industry, and the food fermenting industry.

The molasses contains very high carbohydrates, complex B vitamins, and several other vitamins that dissolve easily. These vitamins are needed by young cows, goats, and sheep because livestock is not yet able to digest vitamins on their own in the stomach. There are several ways to apply molasses in the process of making animal feed, namely spraying it on sources and forages or dry straw, mixed with grain, or mixed with other ingredients. The use of molasses should not be excessive because it can cause livestock to experience diarrhea or diarrhea. This is caused by high potassium substances. Therefore, you should only use about 15 percent of the concentrate mixture.

Before making straw fermentation, you need to prepare some of the materials and equipment needed, namely:

A. Materials; including rice straw, molasses, and bran
B. Tools: namely plastic drums, chopper machines/cutting machines/machetes, and 1 liter empty plastic bottles
C. Step:
    1) Prepare and wither the straw before it's fermented.
    2) Cut rice straw with a chopper machine or manually with a machete. Cutting is done to produce chopped straw measuring 2-5 cm. The small size of the straw serves to facilitate the process of packing and mixing with other materials.

3) Add straw that has been cut into pieces so that you can more easily adjust the dose of straw with the amount of molasses used.
4) Pour the straw that has been weighed onto the soil surface which has been covered with plastic or tarpaulin so that the straw is not contaminated with dirt and dust.
5) Mix the bran onto the surface of the straw and stir evenly.
6) Mix molasses and water at a ratio of 1:10 in a plastic bottle or sprayer.
7) Then pour the mixture over the straw evenly so that the fermentation process runs more perfectly.
8) Put the straw that has been mixed into the drum, or thick plastic compact the straw by trampling so that there are no air cavities.
9) Once it's solid enough, cover the top with plastic so no air gets in. Secure the cover with a long black rubber.
10) Store silage for 21 days or 3 weeks. Then open the silo drum and the fermented straw is ready to be given to livestock. This animal feed can be stored for up to 6 months, as long as it does not show signs that it is unsafe for cattle consumption, for example, there is mold and mildew.

3.3 Discussion on Preparation of Black Bamboo Seeds

Bamboo plants have a fibrous root system with very strong rhizome roots. The root characteristics of bamboo allow this plant to maintain the hydrological system as a binder of soil and water so that it can be used as a conservation plant. A bamboo clump at a fairly old age can be categorized as a complete ecosystem unit. The condition of the bamboo forest allows microorganisms to develop together in a symbiotic food chain. At the location of the farmer's farm, there is a member named Pak Udin who has black bamboo seeds. The service team plans to multiply them and plant them on slopes or in locations prone to landslides. Bamboo plants have a fibrous root system with rhizome roots.

3.4 Discussion on Refreshing Farmer Group Organizations

A farmer group/POKTAN is a group of farmers/breeders formed based on common interests, similar environmental conditions (social, economic, resource), and friendship to improve and develop members' businesses. The number of farmer group members consists of 20-25 people according to the environmental conditions of the community and their farming business and is led by a chairman. The Poktan organization consists of a chairman, treasurer, secretary, farming business section, and others as needed.

The Head of the Poktan has the following duties:

a. Leading a meeting of Poktan members in the preparation of a Group Business Plan / RUK based on the Member Business Plan / RUA.
b. Conveying the results of the meeting of Gapoktan members to members of farmer groups
c. Coordinate the implementation of group business activities following the results of the Gapoktan member meeting decisions

A group meeting is a meeting of members of a farmer group in a certain place at a certain time, with certain rules, agreed upon rules to discuss something, and a certain agenda. The benefits of farmer group member meetings include:

a. Provide opportunities for group members to relate to each other on a regular basis such as exchanging information, learning from each other, helping each other, and so on.
b. Increase the discipline of the members.
c. Provide opportunities for group members to learn to communicate
d. Become a forum for compiling group plans
e. Opportunity to solve the problems encountered
f. Opportunity to unite different opinions

Several things are the key to the success of farmer groups, namely:

a. There is a meeting leader who can play a good role
b. There is a meeting agenda
c. There are rules regarding the rules of conduct of meetings that are adhered to together
d. There is an active role in all meeting participants present.
e. All group members present have the opportunity to speak, there is no dominance (talk monopoly). There are neat records of attendance, results of meetings/agreements, unresolved problems, and things that have been done by the group
f. Achieved agreements that reflect the aspirations of all members, including the management.

The main farmer group at this service location is the Kato Sepakat Farmer Group, Within the main group there are 4 farmer groups, namely:

a. Tani Bukit Kumayan Group
b. Tani Bukit Labah Group
c. Tani Mega Nanda Group
d. Tani Bukit Janang Group

4 Conclusion

Based on the results of the activities and discussion of the research entitled Development of Balai Gadang Village, Koto Tangah District, Padang City to Become a Landslide Disaster Resilient Village, it can be concluded as follows:

a. Increased knowledge and skills in applying both simple and complex techno-ecological farming models.
b. Increased knowledge and skills in processing animal feed from straw, corn stalks, and others.
c. Increased knowledge and skills of farmer groups in managing the organizational structure of the group.

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