Development of Balai Gadang Village, Koto Tangah Subdistrict, Padang City to Become a Landslide Disaster Resilient Village

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Abstract. The objectives of this study are (1) to create a landslide-resistant community by implementing vegetative conservation on their agricultural land. (2) Increase farmers' knowledge in mitigating landslide disasters in Balai Gadang village. This study uses a qualitative descriptive approach, the data is taken from community information and by conducting discussions with the related community, interviews are carried out by asking questions and looking for data in the field. The results of this study are (1) conducting discussions with the community regarding landslide mitigation for communities around landslide-prone areas, (2) discussions, (2) mutual cooperation activities to repair bridges, (3) carrying out vegetative conservation / tree planting, (4) Landslide disaster mitigation training, (5) Providing betel nut seed assistance, (6) Establishing a post for farmer groups, (7) Increasing farmers' knowledge to mitigate landslide disasters.

Keywords: Disaster Resilient, Land Conservation, Landslide

1 Introduction

Balai Gadang Village is one of the areas under the administration of Koto Tangah District, Padang City. Astronomically, Balai Gadang village is located at 1000 20' – 1000 25' east longitude and 00 44' – 00 52' south latitude. Balai Gadang Village consists of 14 RW and 55 RT. Balai Gadang Village has a population of 16925 people (2017) consisting of 8507 men and 8418 women. Administratively, Balai Gadang Village is bordered to the north by the Buluh Padang Pariaman River, to the south by Koto Panjang Village, to the west by Batipuh Panjang and to the east by Lubuk Minturun Village.

The Balai Gadang sub-district development plan is continuing. Facilities that are being built in the Balai Gadang sub-district are the construction of campus III of the Imam Bonjol State Islamic University, Padang and the Padang alternative road to Solok (Putra, 2019). Based on the initial observations that the researchers made in the area where the alternative road to Solok has been constructed, approximately 8 km has been completed, however, along

ICGEO 2022, November 19-20, Padang, Indonesia

DOI 10.4108/eai.19-11-2022.2332162

the completed road, many landslides were found on the road cliffs, apart from along the alternative road to Padang to Solok, similar problems were also found in Construction area of Campus III UIN Campus III UIN Imam Bonjol on the Bangek River, the topography in the area is included in a hilly area surrounded by protected forests. The vegetation cover of the land in the form of shrubs and with 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 a slope of 40 – 50%. The area has a high level of landslide threat because this area has high rainfall. In addition, the rocks consist of volcanic deposits and sedimentary rocks measuring sand and clay which are generally less strong. These rocks will easily become soil when subjected to a weathering process and are generally susceptible to landslides when found on steep soil. Likewise, areas with steep slopes – very steep and the source rock as previously mentioned makes this location an even higher threat of landslides. Areas with a high level of landslide threat are found in the Anak Air area and the Batu Gadang area. The Batu Gadang area is mostly a hilly area and many people farm around it. Plants that are suitable in this area are annual plants and plantation crops such as rambutan, durian, petai, cocoa, and others. Community of this area

In particular, the problems in the Batu Gadang area, Balai Gadang Village are: The unmanaged cultivation of agricultural crops based on land conservation; Landslides are still frequent in agricultural land areas and farmers are not yet strong enough to deal with them; There is still a lack of knowledge of farmers in utilizing land according to the potential and limitations of the land; The management of farmer group organizations is still low; Have not been able to develop farming patterns to increase the entrepreneurial spirit and improve the economy of farmers. For this reason, it is necessary to create a disaster-resilient society. A disaster-resilient community is a community that is responsive, trained, steadfast and resistant to all forms of potential disasters that occur, including erosion and landslides. The government also includes the program for disaster management, namely the 6th mission of creating a disaster-resilient community, so that service in the Batu Gadang area is very important, especially to overcome landslides around community agricultural areas. 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 properly and can gradually improve the economy of the community here.

2 Research methods

This study uses an approach, namely a qualitative descriptive approach, the approach methods offered in partner problem solving are as follows:

a. Direct discussions with the people of Balai Gadang Village, especially those living in Batu Gadang whose area is prone to landslides, as well as with the village apparatus regarding the factors that hinder the implementation of agricultural activities based on land conservation and can prepare the mentality of every community to be ready to face any disaster. landslides on their land.
b. Community Service on the spot. Their farm area is mainly on roads that have been covered by landslides that have occurred recently.
c. Training on management of agricultural land based on land conservation, the targeted output here is proper processing of agricultural land according to conservation methods, both vegetatively, mechanically and chemically

d. Training of members of farmer groups in dealing with landslides, the targeted outcome is the birth of a community that is aware, caring and resilient to disasters, both erosion, landslides and floods.
e. Training on the use of farmers' land according to existing potentials and constraints, targeted outcomes for the creation of a techno-ecological agricultural model on their farms, which can utilize and manage every potential that exists on their land
f. Counseling on organizational management in farmer groups, the outcomes targeted here are increasing farmer group organizational management, birth of active members willing to be actively involved in their farmer group organization
g. Counseling and assistance to improve the entrepreneurial spirit of farmers, the targeted output is the creation of members who are creative, have an entrepreneurial spirit so that the economy of the farming community increases.

3 Result And Discussion

This discussion was directly with the apparatus and the people of Balai Gadang Village regarding the factors that caused frequent landslides in Balai Gadang Village, especially the community around the ABG bathing area.

The location of the service is in the area of the construction of an alternative road to Solok which has been completed for approximately 8 km, but along the completed road many landslides were found on road cliffs, apart from along the alternative road to Padang to Solok, similar problems were also found in the Campus Development area. III UIN Campus III UIN Imam Bonjol on the Bangek River, the topography of the area is included in a hilly area surrounded by protected forests. The vegetation cover of the land in the form of shrubs and with soil particles in the form of sandy loam. The condition of the area has the potential for landslides.

3.1 Mutual cooperation activities

This community service activity is to repair damaged bridges and clean up the service area. This mutual cooperation activity was carried out on Sunday, September 12, the goro activity was attended by about 60 farmers' group participants.

The mutual cooperation activity with the addition of stones and castings on the right and left of the bridge, hopes that the bridge will still be strong and can be passed by the community when visiting their farms and plantations. If this is not done, it is feared that the bridge will be damaged because it is always eroded by the river flow in the area. Mutual cooperation activities are carried out on Sundays. The chairman of the Kato Sepakat farmer group, Mr. Fauzil Wathan, succeeded in inviting the Kapolsek, the kelurahan, members of the DPRD, represented by Mr. Zal from the Gerindra party and from Golkar. The basic materials for repairing the bridge, especially stone, were taken directly from the river there, while cement and sand were bought. The members who attended were mainly members of the farmer group, totaling about 60 people.

3.2 Vegetative Conservation (Tree Planting)

The location of community service is on a steep and hilly slope so that it is prone to landslides. Landslide is the movement of slope-forming material in the form of rocks, debris, soil, or mixed materials moving down or off the slope. In principle, landslides occur when the driving force on the slope is greater than the resisting force. Retaining force is generally influenced by rock strength and soil density, while driving force is influenced by slope angle, water, load and density of rocky soil.

Vegetative soil conservation technique is any use of plants/vegetation or plant remains as a medium for protecting the soil from erosion, inhibiting surface flow, increasing soil moisture content, as well as improving soil properties, both physical, chemical and biological properties. Mechanical soil conservation techniques or also known as civil engineering are efforts to create physical land or engineering fields of agricultural land so that they are in accordance with the principles of soil conservation as well as water conservation. This technique includes: mounds, mound terraces, bench terraces, individual terraces, credit terraces, contour bunds, garden terraces, stone rows, and stone terraces. Specifically for water harvesting purposes, mechanical conservation techniques include the construction of water catchment structures, rorak, and reservoirs (Agus et al., 1999). On September 12, 2021, there will also be a symbolic planting of avocado trees on the land of farmer group members, because later in the field we will provide betel nut seeds because they have economic value and can also protect the soil from landslides

Basically, vegetative soil conservation is all forms of utilization of plants or plant remains to reduce erosion. Plants or plant remains function as soil protectors against the impact of raindrops as well as the carrying capacity of surface runoff (runoff), as well as increasing water infiltration into the soil. The canopy functions to restrain the rate of raindrops and reduce the kinetic energy of water droplets and the release of soil particles so that the blow of water droplets can be reduced. Water that enters between the canopy (interception) will partly return to the atmosphere due to evaporation. The function of protecting the soil surface against raindrops is very important because the main cause of erosion in Indonesia is rainwater. The tighter the closure, the smaller the risk of soil aggregates being crushed by the blow of raindrops. Plant stems are also a barrier to rainwater erosion by seeping the flow of water from the canopy through the stem (stemflow) to the soil surface so that its kinetic energy is much reduced. The rods also function to break down and restrain the surface runoff. If the kinetic energy of the surface runoff decreases, the carrying capacity of the material will also be reduced and the soil has a relatively high opportunity to absorb water. Several types of plants are planted closely spaced, the stems can form a fence to break the surface runoff. Plant roots also help reduce groundwater that is saturated with rainwater, stabilize soil aggregation so that it better supports plant growth and prevents erosion, so that the soil is not easily washed away due to surface runoff, and increase infiltration, and water holding capacity. Planting at the dedication location was carried out symbolically for avocado plants, but in the future planting for betel, and Batara plants will be carried out. Seedlings were given 2 stalks for each member of the farmer group. This plant was chosen because in addition to having economic value it is also very good for maintaining soil to avoid landslides, especially around slopes or hills.

3.3 Landslide Disaster Mitigation Training

Landslides usually occur when the land on the slip plane (water-resistant layer) gets rain after a long period of drought. Dry soil then filled with rain water can increase the weight and eventually landslides occur. Therefore, at the beginning of the rainy season, the government tries to provide a warning against the danger of landslides at several points or locations. Landslides that hit residential areas can cause fatalities, although usually not as big as tsunamis and earthquakes. This disaster usually occurs in an area that is not too large and occurs in a short time.

To overcome this natural disaster, landslides require high awareness among the community members not to damage the forest by cutting trees illegally. Reduced trees in the forest will reduce water infiltration, so that water by itself without any obstacles can go straight down to lower areas, it is not uncommon for this water flow to cause landslides, causing disaster for the people in their environment. In addition, the community needs to be encouraged to participate in always maintaining the forest by planting plants in areas or forests that are deforested, to reduce or minimize the occurrence of landslides (Dwi Heru Sukoco: 2006). Several prevention strategies and several prevention strategies and efforts to deal with landslides, namely that people should avoid disaster-prone areas to build settlements and other public facilities. Local officials together with the community work together to reduce the steepness of the existing mountain slopes.

Settlements and groundwater (the function of drainage is to keep water away from the slopes, preventing water from seeping into the slopes or draining water down the slopes to the outside of the slopes. So drainage must be maintained so that it does not clog or seep water into the ground). Construction of retaining structures, anchors (anchors), and pilling. Terraces with a proper drainage system (drainage on the terraces is guarded so that it does not allow water to seep into the ground). Reforestation with plants with deep root systems and proper spacing (especially for steep slopes, with a slope of more than 40 degrees or about 80 percent) should not be too dense and interspersed with plants that are shorter and lighter, while the grass is planted at the base.). Build a building with a strong foundation, and compact the soil around the housing. Introduction of landslide-prone areas, and construction of retaining embankments for rock fall. Sealing off cracks on slopes to prevent water from rapidly entering the ground. The landslide disaster mitigation training was given by several participants, namely research team leader Ratna Wilis, S.Pd, MP, and team members namely Abel Tasman, SE, M.Sc and lecturer Bung Hatta Marjohan SE, M.Sc as a member of the visiting team from outside.

Another form of vegetative conservation that can be done to overcome landslides at service locations is agroforestry. Agroforestry is a form of a soil conservation effort that combines tree crops or annual crops with other commodity crops that are planted together or alternately. The use of annual crops can reduce erosion better than agricultural commodity crops, especially annual crops. Perennial plants have a relatively larger leaf cover area in retaining the kinetic energy of rainwater so that water reaching the soil in the form of streamflow and throughfall does not produce such a large erosional impact. Meanwhile, annual crops can provide a good soil covering and protection effect from raindrops that have destructive energy. The combination of the two is expected to provide multiple benefits from both annual crops and annual crops. Application of agroforestry on land with steep or rather steep slopes can reduce erosion rates and improve soil quality, compared to when the land is bare or only planted with seasonal crops. In general, the proportion of annual plants increases on steeper slopes and vice versa. Annual crops require more intensive soil tillage and plant

maintenance compared to annual crops. Soil tillage for annual crops is usually done by hoeing, stirring the soil, or other methods which destroy the soil aggregates, so that the soil is easily eroded. The greater the slope of the land, the greater the risk of erosion due to tillage. The cultivation of perennial crops does not require intensive tillage. Deep roots and tight soil cover can protect the soil from erosion. The selected perennial plants should be of a type that can provide added value to farmers from their fruit and wood yields. Besides being able to generate faster and greater profits, agroforestry is also an excellent system for preventing soil erosion.

3.4 Provision of Betara Betel Seed Aid

Areca nut plants can grow in areas with altitudes ranging from 1 meter to 1,400 meters above sea level (Van Steenis, 2003). According to Purseglove (1975), the areca plant thrives in a tropical climate under the influence of sea conditions and grows up to an altitude of 900 meters above sea level. The areca plant requires sufficient soil moisture and high rainfall throughout the year in the range of 1500 to 5000 mm with rainy days ranging from 100 to 150 days. Wet months range from 3 to 6 months per year, while dry months that can be tolerated by betel nut range from 4 to 8 months per year. According to Purseglove (1975), areca nut plants are very sensitive to drought and are not suitable for development in areas with rainfall less than 1250 mm per year, so irrigation is needed. Sunlight is very influential in the growth of areca plants. The ideal sunlight requirement for the growth of areca plants is 6-8 hours/per day. Some of the effects of sunlight on the growth of areca plants, among others: 1). distance between stem segments (nodes) is shorter than protected plants; 2). plant growth is not high fast; 3). stronger plant physique; and 4). the percentage of female flowers to fruit is greater.

On Sunday, November 14, 2021, 200 areca Batara seeds were delivered to be planted on the farmers' land. This plant was chosen because in addition to having economic value it is also very good for maintaining soil to avoid landslides, especially around slopes or hills. Areca nut plants were deliberately chosen because, in addition to dealing with landslides, the fruit will also be sold by farmers thereby increasing farmers' income. The areca plant can grow in a variety of soil types, but the most suitable is clay loam. Other requirements that need to be considered are that the soil must be well aerated, the soil solum is deep and there are no layers of rock.

Empowerment of betel nut plants is carried out by covering land preparation, planting material preparation, recitation, making planting holes, and planting, maintenance, and harvesting.

3.4.1 Land Preparation

a. Persiapan Lahan
   Land preparation for areca plantations is as follows:
   1. Land survey and mapping
   2. Land clearing by felling trees
   3. Demolition of stumps and clearing the undergrowth
   4. Opening of roads and drainage.

b. Garden Design/Design
Before planting, you should first plan the ideal garden layout/design. The ideal garden layout/design is a planting distance of 2.7 m x 2.7 m, with an east-west planting direction (Figure 1.) and a barrier between the areca seed gardens and other gardens with a distance of 75 - 100 m or 30 (thirty) rows of outermost plants if around the betel seed source garden there are other varieties of areca nut plants.

3.4.2 Preparation of Planting Material

Preparation of planting material includes seed procurement, nursery land preparation, germination, and seed enlargement.

a. Seed Procurement
Criteria for fruit to be used as seeds
1. The fruit used should be large and uniform in size, because large fruit has the potential to produce plants with large fruit production
2. The weight of the fruit used as the seed is at least 35 (thirty-five) grams or a maximum of around 60 (sixty) fruit/kg. the less amount per kilogram, the better the seeds are used as seeds
3. Seed Needs
The number of seeds to be sown is added to 25% of the total need for seeds to be planted so that the need for seeds in 1 (one) ha with a spacing of 2.7 m x 2.7 m requires 1,700 seeds per ha.

b. Nursery Land Preparation
Before seed germination, it is necessary to prepare the seedbed first. The steps for preparing the land for the seed nursery are as follows:
1. Choose a location that is good enough or fertile and safe from disturbance of people, livestock and other distrubing organisms.
2. Clean the land from the grass first
3. Make beds with a width of 1 (one) m and length as needed (the area of the bed for 2,000 seeds is 5 m^2). This is done by digging a drainage canal and the excavated soil is piled up in the middle while leveling it.

c. Seed Development
After the land is prepared, the next step is to sow the selected seeds. The seed germination process will take about 1.5 -3 months. At that time the roots and shoots of the seeds have grown, the stages of seed germination are as follows:
1. Arrange the selected areca seeds on the beds in a horizontal position. The arrangement must be tight so that the tamping power of the beds is maximized
2. Cover the areca seed with a layer of sandy soil 0.5 cm thick
3. The beds are covered with areca nut or coconut leaves so that moisture is maintained and protected from direct sunlight;

d. Seed Enlargement
After the seeds germinate, the next step is an enlargement of the seeds which are divided into two stages as follows.

3.4.2.1 First Step

a. Before the sprouts are transferred to the polybag, first prepare a bed/land with a width of 1 (one) m and a length adjusted to field conditions. The beds are given a circumferential wall of boards as hifh as the polybags (15cm), with the aim that the polybags can be arranged upright and neatly.
b. After the seed enlargement land is ready, the next activity is to prepare polybags for seed enlargement. The polybags used are at least 25 x 25 cm in size. Polybags must have drainage holes. Then fill the polybag with soil up to ¾ of the height, then compact it; Harvesting and planting of areca sprouts planted in polybags are done carefully so that the shoots and roots are not damaged. Sprouts are immersed to a depth of 4 (four) cm or flat to the ground, each polybag contains one sprout. Polybags are placed on beds with a distance between polybags of 5 (five) cm
c. To avoid direct sunlight, the beds are given shade. The height of the shaded pole is about 1.75 (one point seven five) m. As the roof can be made of coconut leaves, nipa palm, and reeds, the shade begins to be reduced gradually after the seeds are 2 (two) months old. This reduction is carried out until the seeds will be transferred to the second stage of seed enlargement or are already 5 (five) months old.

3.4.2.2 Second Step

a. Prepare polybags with a minimum size of 40 x 50 cm;
b. Prepare the planting medium in the form of soil and compost with a ratio of 1:1, then put it in the prepared polybags. After that it is placed into the bed at a distance of 30 cm x 30 cm;
c. After the polybag containing the plant media is placed in the bed, the seeds from the first stage of seed enlargement are put into the polybag with the position of the base of the seed stalk having to be right on the surface of the polybag;
d. For the seeds to grow well, it is necessary to apply NPK fertilization at a dose of 20 (twenty) grams per polybag (fertilization is given once during the second stage of seed enlargement);
e. In the second stage of the seed enlargement area, there is no need for protection from the sun, because sunlight is very necessary for the seeds to grow;
f. The seed enlargement location should be fenced around to avoid disturbance from animals;
g. This second stage of seed enlargement is carried out for seven months or until the seeds are one-year old starting from the first stage of seed enlargement, then the seeds are ready for planting in the field.

3.5 Pengajiran, Making Planting Holes and Planting
3.5.1 Pengajiran

Setting up the stakes will make it easier to determine the location of the planting holes and the spacing will become more regular. Ajir is usually made of bamboo with a minimum diameter of 2 (two) cm. The minimum stake height is 1.5 (one point five) m. The number of

stakes prepared is following the number of plants that should be prepared for a certain area, with a spacing of 2.7 m x 2.7 m, it is necessary to prepare around 1,370 stakes for an area of 1 (one) ha. For 2014, No.1828 12 stakes are to be easily driven into the ground, the base is tapered. Other equipment needed is nylon rope and a tape measure (50 m). Prepare a nylon rope 100 m long and mark (tied with a nylon rope of a different color from the main rope) each mark is 2.7 m apart. Its function is to make it easier to determine the location of the hole to be dug according to the spacing.

3.5.2 Making Planting Holes

Making the planting hole as follows:

a. Preparation of the planting hole must be done one month before planting so that the hole is exposed to sunlight.
b. Making a planting hole with a size of 50 cm x 50 cm x 50 cm
c. Organic fertilizer is given into each planting hole. as much as 1 (one) kg.

3.5.3 Planting

Planting areca nuts to be used as a seed garden is carried out with a monoculture system in the following way:

a. Planting is done at the beginning of the rainy season
b. At the time of planting, tear the polybags carefully so as not to damage the roots of the areca seeds
c. Try not to let the soil separate from the roots
d. At the time of planting, the excavated soil is returned with the lower soil put in first, after that the topsoil which has been given 50-75 grams of NPK fertilizer per planting hole
e. Place the seed into the planting hole with the base of the seed stalk parallel to the soil surface
f. The soil around the seeds is compacted until the seeds don't shake.

3.5.4 Maintenance

To obtain optimal results it is necessary to do maintenance as follows:

a. Embroidery; Embroidery is done on dead areca plants or unhealthy plants.
b. Plant Fertilization; Plant fertilization is carried out twice in 1 (one) year, namely at the beginning of the rainy season and at the end of the rainy season. Fertilizer dosage for young plants and plants starting to flower Plants
c. Weeding; Weeding is done so that the plants are free from weed disturbances. It has endeavored that around the trunk (disc area) with a diameter of 0.5 -2.0 m there are no weeds that grow past the areca tree canopy.

3.5.5 Creation of Research Posts

The construction of the research post has been completed, but all that remains is to put up the nameplates and banners at the location. It is hoped that this post will permanently belong to the farmers and can be used for discussions and meetings. On November 14, another discussion was held with the head of the farmer group and it was deliberately used for the first time research post that had been completed.

This research post is useful for discussions or meetings for members of farmer groups, especially discussing how to cultivate land based on land conservation and following land management principles. 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 regularly 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 that 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 domination (monopoly of speech) from one person or only a few people. There are neat notes on attendance, results of meetings/agreement on unresolved problems, and things that have been done by the group
f. Achieved agreements that reflect the aspirations of all members, including the management.

4 Conclusion

One of the important things that must be considered in group meetings is the sitting position that is carried out. The best sitting position is sitting in a circle because all meeting participants can "face to face" so that the discussion can run effectively. In addition, the meeting leader also plays an important role in farmer group meetings because the leader is in control of every discussion. The leader of this meeting acts as a mediator when there are differences of opinion and other problems. The leader in the meeting must be wise and fair, able to control the meeting so that it is quickly conducive and runs smoothly. Given the importance of this farmer group meeting, it is hoped that this will continue to be carried out and reactivated. So that the function of farmer groups as a forum for accommodating the aspirations of farmers as well as a forum for exchanging experiences and knowledge can run optimally.

Acknowledgment

The researcher expresses his high appreciation and gratitude to the Padang State University Research and Community Service Institute for funding this research with research contract number: 3282/UN35.13/PG/2021

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