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Community Engagement in Erosion Control of Riverbank in Walanae Watershed, South Sulawesi, Indonesia

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ABSTRACT
Community involvement in environmental protection is one of the implementations of sustainable development. This study describes the effectiveness of training models to increase the knowledge and attitude of participants in controlling riverbank erosion. The study method is an experimental design with a pre-test and post-test evaluation approach that involved 60 subjects. The research subjects are people who have been cultivating on land along the river for more than five years. The results of this study describe the stages and activities of instructors and research subjects in training action. The results also indicated that there was an increasing knowledge, attitudes, and skills in controlling erosion on river banks in the community. Therefore, it can be concluded that the training model effectively involves the community in riverbank protection programs.

Keywords: *Knowledge, attitude, skill, training*

1. INTRODUCTION

Watershed is a complex and dynamic natural resource potential. Components of vegetation, soil, water, and human contribute influences on the quality of this ecosystem [1]. As a container of water drainage, a river has always been at the lowest position in the watershed ecosystem. In Indonesia, the change of land use patterns to be agricultural, residential, and industrial land has an impact on the hydrological conditions of the Watershed. Besides, various human activities also have the potential to produce waste, which contributes to the decline in river water quality.

The watershed ecosystem is inseparable from the occurrence of water runoff and land. The drainage condition causes the risk of damage to river and land quality. Riverbank erosion is one of the events that are difficult to avoid. Excessive corrosion will cause a decrease in land productivity and the risk of flooding[2].

Walanae River in Soppeng Regency is an alluvial river and high meandering. Due to the differences between upstream and downstream, this type of river allows high erosion. The geographical location of the upstream Walanae River lies in Soppeng Regency and Southern Bone Regency, while the inlet is in Lake Tempe, Wajo Regency. Flow discharge data for the past 20 years shows that the Walanae River has a high risk of flooding and erosion. Consequently, the phenomenon is caused by the decreasing capacity of the river. Based on twenty years of data in Walanae River, the average sedimentation rate is about 519 000 m3 per year and 74% comes from the Walanae river. In the past ten years, Soppeng regency has experienced flooding almost 20 times a year in each district. On the side, flooding has been causing erosion and sedimentation in most river areas. Riverbank erosion has also been eliminating several peasant land

The efforts to protect the land due to bank erosion is a form of preservation of environmental functions. Maintaining environmental sustainability and carrying capacity is not only the government's responsibility but also the responsibility of the community. The government should encourage the concept of community-based development to activate the potency of the human to be involved in riverbank protection. In the context of community development, three things need to be emphasized, namely public participation, community education, and sustainability [3], [4]. The involvement of

local communities must begin in developing awareness of their problems and circumstances. Furthermore, this awareness becomes a trigger for the birth of thought to participate in problem-solving. Further development is the awareness of utilizing personal strengths and initiatives to bring about change in their environment.

This model also refers to a training model with group methods for participatory and organizational developme nt that emphasizes how to build structures that allow people to become independent. This research develops training methods in the community intending to develop knowledge, attitudes, and skills in making simple river bank protective structures. The effectiveness of the training can be seen from four levels, namely: (a) the trainee's reaction to the contents of the training program and process; (b) Knowledge or skills of training subjects; (c) changes in the behavior of training subjects; and (d) increased productivity of individuals or organizations [5]. Practical training is not only able to develop subject knowledge but can also develop attitudes towards training targets. With the right approach, the target productivity of individuals and organizations can be achieved.

This article outlines a model of community involvement in riverbank protection. The training model aims to develop knowledge in the use of local materials with the support of practical and straightforward technology.

2. RESEARCH METHOD

The research method used in this study is a quasi-experimental method with a quantitative approach. The research design was in the form of a pretest-posttest one group design by forming one group as a representative group of 60 members. The experiment is applied by training to increase the knowledge, attitude, and skills about riverbank technique.

This study was conducted in Soppeng Regency, which is geographically and physically located in the Walanae watershed system. It was held in September 2019- January 2020 at the
Walanae watershed that administratively the study area, located in South Sulawesi Soppeng. The analysis method used descriptive statistics and inferential. Descriptive knowledge statistics refer to the distribution value at four levels (Table 1).

Table 1. The Class of Knowledge, attitude, and skill

Grade	Knowledge	Range	Attitude	Range	Skill	Range
I	Very low	1 - 10	Very bad	23 - 46	Very low	29 - 51
II	Low	11 - 20	Bad	47 -70	Low	52 - 73
III	High	21 - 30	Good	71-94	High	74 - 94
IV	Very high	31 - 40	Very Good	95 -118	Very high	95 - 116

3. RESULT AND DISCUSSION

3.1. Implementation of the Training Method

This study used a training instrument to measure the knowledge, attitudes, and skills of the people in the bank erosion control. The description of the experimental stages begins with the training syntax described in Table 2.

Table 2. Training syntax

Phase	Instructor activities	Participant activities
Awareness Development	Motivate participants to express the problem of river bank landslides. Convey the risk of loss due to riverbank landslides. Direct participants to comment on the risk of a riverbank landslide. Encourage apperception of participants' attitudes towards the impact of riverbank landslides.	Participants were able to reveal the problem of river bank landslides. Participants can explain the risk of loss due to riverbank landslides. Participants were able to comment on the risk of a riverbank landslide. Participants expressed their attitude towards the risk of landslides and sedimentation control
Knowledge Transformation	Provide material explanation to participants about the problem of floods, landslides, erosion, and sedimentation. Provide knowledge about types of riverbank protection.	Listen to the material about the problem of floods, landslides, erosion, and sedimentation. Participants respond about types of riverbank protection according to experience. Listen to the simple method used and comment on river bank reinforcement using local material.

Phase	Instructor activities	Participant activities
	Provide a simple river bank reinforcement method using local materials. Provide practical techniques for implementation, protection, and reinforcement of riverbank	Respond to the implementation of protection techniques and riverbank reinforcement that are practical and easy to carry out at the research location.
Formulation of Local Material	Motivate participants to reveal the material contained in the location that can be used for the protection and strengthening of river banks. Formulate local materials used for the protection and reinforcement of river banks.	Participants can reveal the materials contained in the vicinity of the study site for the protection and strengthening of river banks. Participants can formulate local materials that can be used for riverbank protection and strengthening.
Skills Development	Explain the working drawings to participants about the protection and strengthening of river banks. Explain the techniques for implementing the protection and strengthening of cliffs	Participants listened to an explanation of the moving picture of the protection and strengthening of river banks. Participants listen and respond to the explanation of the implementation of the protection and strengthening of the riverbank

The training syntax, which is an implementation guide, is based on the characteristics of the participants or the community. In this study, participants were generally farmers with a high school education background. Besides, trainees commonly reside or cultivate land along the river banks. Thus, the syntax begins with the development of its concern for flood conditions and riverbank erosion.

The results of the discussion that developed in phase one were that the community realized that erosion on riverbanks was at risk of land loss, sedimentation buildup in river bodies, and flood events. In step two, the researchers found that the public understood the various protective structures of cliffs made of river stone or concrete.

The result of syntax three is that the community can find the primary material for the construction of cliff protectors. The community submits concrete rings made from precast concrete and is easy to find at the location of the activity.

The results of phase four indicate that there is a training activity that involves the community participating in the construction of protection.

3.2. Analysis of Participant Knowledge about the Riverbank Erosion Protection

Participant knowledge is an indicator of achieving the training targets. Before the training, participants' experience was relatively low between 12-25, with a mean of 18.4. The division of knowledge categories in four groups indicates that the score of pre-test is low (11-20). Meanwhile, the highest results in the pre-test analysis showed that none of the participants knew with grade-IV. After the training, participants' knowledge increased, and achieved an average score of 32.72 or grade IV. The post-test results found none of the participants in grade I and grade II.

Table 3. Knowledge level of participant

Statistic	Pre-test	Post-test
Min	12	24
Max	25	40
Mean	18.4	32.72
Standard Deviation	4.203	4.623

Table 3 shows the values of standard deviation or diversity that are relatively the same for the attainment of knowledge among all participants. The results showed that there is an increased awareness which mean that participants have developed insight into the risk of flooding and land erosion on riverbanks.

3.3. Analysis of the Attitude of Participant about the Riverbank Erosion Protection

Training targets also lead to changes in riverbank protection attitudes. The results of the statistical values in the pre-test or before being given erosion control training can be seen in Table 4.

Table 4. The Attitude of Participant in Pre-Test

Statistic	Pre-test	Post-test
Min	63	73
Max	81	109
Mean	74.88	93.92
Standard Deviation	5.166	8.607

Before the training, participants generally had the right attitude, or they had less agreement about the protection of the riverbank by the community. The pre-

test means a score of 74.88 became a reference in the assessment, which was in grade III. The application of the experiment caused a slight increase in the value even though it was in the same class. The maximum score of the attitude increased from 81 to 109. Initially, all participants indicated agreement on riverbank erosion control at grade III, or none had a very high attitude towards this effort. Furthermore, after the training, some participants had a very high attitude to take part in taking action to prevent riverbank erosion.

3.4. The skills assessment of riverbank erosion protection structure building

Descriptive statistical analysis of skills assessment aims to describe the skills of trainees after receiving sediment control training with riverbank reinforcement. The results of the frequency distribution of skills assessment can be seen in Table 5.

Table 5. Frequency Distribution of Skills Assessment

Category	Range	Frequency	Percentage
Very low	29 - 51	0	0%
Low	52 - 73	3	12%
High	74 - 94	18	72%
Very high	95 - 116	4	16%

Source: Data Processing Results, 2020

Table 5 shows that the participants' skill attainment was generally at grade III, and three participants only achieved skills in grade II. This is due to the intricate level of work, especially on the ring balk concrete creation. After the training, participants got additional skills include skills in preparing the work area, installing ring concrete, making ring balk, and installing bag concrete. Construction work on river bank protection requires the participants' accuracy and care. The results of the skill achievement analysis are presented in Table 6.

Table 6 Average Skill Assessment Results

Assessment Aspect	Average Value
Preparation work	0.77
Ring Concrete work	0.76
Ringbalk Concrete work	0.55
Bag Concrete work	0.91
Average	0.75

3.5. Inferential statistical test of increasing farmers' knowledge and attitudes after training

The statistical test was done to see changes in knowledge and attitudes through T-test analysis. The results of the report on the two hypotheses are shown in Table 7.

Table 7. Statistical Analysis of Knowledge and Attitude

Hypothesis	Sig-value	Level of confidence	Conclusion
There is a difference in knowledge on the pre-test and post-test scores	0.000	0.05	The knowledge in the pre-test was different from post-test
There are differences in attitudes on the pre-test and post-test scores	0.000	0.05	The attitude in the pre-test was different from post-test

The result of the analysis means that there are differences in the knowledge and attitudes of participants before and after the training. The statements reinforce the conclusion that the training provided is effective in increasing public knowledge and attitudes. Consequently, a desire to act in the creation of cliff erosion protection structures was also formed. Achieving skills after training is evidence of the right attitude.

3.6. Discussion

The results of the analysis of participant knowledge indicated the understanding of the facts, concepts, and procedures regarding river bank erosion events through training. The fact that is introduced is a series of erosion and flood events, which are simultaneous processes that take place continuously. Therefore without the protection of river banks, the risk of damage that occurs is also higher.

Knowledge development also encourages the attitude to participate in river protection. The attitude that theoretically triggers the birth of action is shown to increase in the community. Therefore, this study has proven the series of formation of environmental responsibility. Pothitou et.al [6] describe that environmental responsibility that develops in society can encourage the birth of capacity of communities and prevent conflicts in the use of natural resources. Also, the empowerment program by increasing the capacity of the population was sufficient to increase participants' responsibility in environmental protection [7]. Ajzen and Fishbein's theories strengthen the conclusions of this study. The theory explains that ecological responsibility is a form of one's mastery of environmental problems and solutions [8].

The training syntax begins with the development of community awareness. Increasing public awareness and actions to protect the environment is part of an effort to increase their awareness of problems and dangers to their lives. Public attention is an excellent asset for

maintaining environmental quality [9]. This training contributed to the development of disaster management, namely the ability to manage disasters that emerged as knowledge of common vulnerabilities. With this awareness, the community acts for emergency response, rehabilitation, reconstruction, development, prevention, impact reduction, and preparedness. In this study, the human proved to be able to reconstruct the protection of cliffs in groups and sourced from non-governmental organizations. This research produces a basis for community involvement in preventing flood risk. For several years, the community perspective on disaster management was the responsibility of the government.

4. CONCLUSION

The results showed that community involvement in the Protection of Riverbank erosion with four stages namely the first development of awareness, the transformation of knowledge, formulation of local material, and skills development. The results of the training illustrate that there is an increase in community knowledge and attitudes towards protecting riverbank erosion. Community skills were also achieved in four aspects, namely preparatory work, ring concrete work, ring balk concrete work, and bag concrete work. Practical training methods increase community awareness to control erosion protection.

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