



Educational and Conservation Programs for Mitigating Natural Disasters

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Abstract. Sulangai Village boasts uniqueness as an ecotourism destination, offering a range of tourism potentials, including Goa Gong Waterfall, kele-lele honey cultivation, cooking classes at Puhu Camp, and agro-tourism. Sulangai Village is also designated as a Social Barn of Disaster Response Village and Environmental Service Center (PPL) with functions as an integrated agriculture, agro-tourism, and ecotourism center. This determination is both a challenge and an opportunity for Sulangai Village. Challenges include the readiness of human resources and supporting infrastructure. In addition to presenting challenges, it also offers opportunities to develop programs related to disasters and the environment, which have long been a focus of global environmentalists. The problem that Sulangai village is experiencing is that the potential for natural, agricultural, and cultural tourism is very high, but it has not been inventoried and empowered proportionally, the community has not understood the concept of conservation tourism, Sulangai Village has a high slope slope (15 to 40%), so it is prone to landslide disasters, Sulangai Village does not have human resources cadres who have knowledge, understanding and skills related to waste management management. The implementation methods employed to provide solutions include training and assistance in the fields of tourism and agriculture, constructing two rainwater harvesting wells, and creating miniature conservation tourism models.

Keywords: Conservation Tourism, Natural Disaster, Rainwater Harvesting Wells

1 Introduction

Water and climate change are very closely linked. Water is the most important source of life. Global climate change has the potential to disrupt the hydrological cycle, ultimately impacting the quality and quantity of available groundwater, as well as affecting the quality of human life. Groundwater itself is quite vulnerable to the impacts of climate change. Climate disasters characterized by global warming are expected to affect all components of the climate system, including groundwater. Based on 40 modelling studies, climate change is expected to lead to a decline in groundwater

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recharge, storage, and elevation, especially in the dry/semi-arid tropics, followed by wet tropics (Amanambu et al., 2020). Climate change can also trigger unprecedented extreme weather and climate events. The extent of the disaster that arises depends heavily on the level of vulnerability and the degree of exposure. While the risks from climate change cannot be completely eliminated, measures to reduce vulnerability and exposure, as well as increase resilience to the adverse impacts of extreme events, can still be undertaken on an ongoing basis to promote sustainability in social and economic development (Lavell et al., 2012). The groundwater crisis and climate change are global pressures felt by all countries. Various international forums are competing to develop programs that prevent and mitigate the effects of the groundwater crisis and disasters caused by climate change. At the opening of the 10th World Water Forum in Bali, Indonesia, in May 2024, the President of the World Water Council conveyed seven commitments as a form of struggle against water issues. These commitments include: 1) promoting global water security policies; 2) change behavior and habits; 3) improve the design and implementation of Nature-Based Solutions; 4) guaranteeing the right to water through the constitution, laws, and local regulations; 5) forming the “Fund for Water” Coalition; 6) ensure that most climate funds are allocated to the water sector; and 7) encourage active and decentralized governance internationally. Of the seven commitments, the two most likely to be implemented immediately are changes in community behavior and the development and implementation of Nature-Based Solutions. Facing the groundwater crisis and climate change requires collaboration from all parties, including the community. A big commitment can be the responsibility of the government and key stakeholders. However, for academics, in addition to conducting research that produces relevant technology, another important aspect is to apply the research results through community service activities, so that the benefits can be felt directly by the public. Various methods can be employed in community service, including increasing knowledge, strengthening skills, technology transfer, direct practice, and mentoring. Several studies have demonstrated that these approaches can alter behavior and enhance public awareness of environmental conservation. So far, the low public concern for the environment is often caused by a lack of understanding and awareness of the importance of protecting natural resources (Dubeuf, 2011). Of these various approaches, the most essential thing is the existence of sustainable programs. Knowledge improvement, technology transfer, practice, and mentoring activities must be carried out completely, so that after the program is completed, the community is able to continue, develop, or replicate these activities independently and sustainably. This article is compiled based on Community Service activities as an implementation of the results of previous research related to groundwater conservation in an effort to mitigate climate change and natural disasters, especially those related to environmental conservation, cultural/local values, and water resources through the development of the Conservation Edutourism.

2 Methodology

The main focus of this activity encompasses three key problem areas: tourism, agriculture, and disasters, all of which are closely related to environmental conservation efforts. Sulangai Village itself has been designated as a Disaster Resilient Village, a Social Barn, and an Environmental Service Center, playing a role as an integrated agricultural, agro-tourism, and ecotourism center. This determination presents both challenges and opportunities for the village. The challenges include the readiness of human resources and supporting infrastructure, while the opportunities lie in the potential development of environmental and disaster-based programs. The problems experienced by Sulangai Village are currently in 3 areas, namely (1) Disaster Field: the occurrence of landslides, and does not have any real products or innovations as a form of implementation in sustainable disaster management, (2) Agriculture: public awareness of the types of crops that function as disaster prevention such as floods, droughts, and landslides is still limited, and (3) Tourism Sector: the performance of the Tourism Awareness Group (*Pokdarwis*) is still not optimal. Based on these problems. The solutions are implemented through a series of activities that include conducting training, simulation, and coaching on handling flood and drought disasters by applying appropriate technology for Rainwater Harvesting Wells. Additionally, training, simulation, and coaching are implemented to promote green farming practices and sustainable agriculture. Furthermore, another important solution is conducting training, simulation, and coaching in building an Edu-Conservation Tourism Model, which serves as an integrated approach to education, conservation, and tourism development.

2. Result and Discussion

2.1 Result

Training, Simulation, and Practical Assistance in the Disaster Sector. This activity was attended by 40 participants, including community members and students. The resource persons for this activity came from the National Disaster Management Agency (BNPB) of Bali Province. This activity began by providing practical theories on groundwater conservation related to climate change, including examples of good practices in groundwater harvesting wells, discussions, and coaching on building rainwater harvesting wells. Followed by conducting a simulation on the landslide disaster by the National Disaster Management Agency (BNPB) of Bali Province. The result of the understanding of the Rainwater Harvesting Well through 9 statements, such as Table 1 and Figure 1 as follows:

Table 1. Result of Understanding of the Rainwater Harvesting Well

No. of Statements	Strongly agree (number of participants)	Agree (number of participants)	Neutral (number of participants)	Disagree (number of participants)
1	11	22	6	1
2	15	19	5	1
3	14	24	2	0
4	5	30	4	1
5	20	17	2	1
6	13	22	2	3
7	10	24	4	2
8	21	16	2	1
9	20	20	0	0
Total	129	194	27	10
Average	14.33	21.56	3.00	1.11
%	35.83%	53.89%	7.50%	2.78%

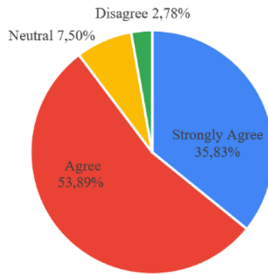


Figure 1. Level of Understanding of the Rainwater Harvesting Well

Based on Table 1 and Figure 1, of the 9 positive statements about groundwater conservation through rainwater harvesting wells are 53.89% agree, 35.83% strongly agree, 7.50% neutral, and 2.78% disagree.

Training, Simulation, and Practical Assistance in the Agriculture Sector. This activity was carried out by involving 40 participants. The training began with a presentation of practical theories on conservation crops and the use of organic fertilizers in relation to climate change. The results of the increase in participants’ knowledge after the implementation of activities such as Table 2 below.

Table 2. The Level of Understanding of the Agriculture Sector

No. of statements	Good understanding (number of participants)	Limited understanding (number of participants)	Do not know (number of participants)
1	27	12	1
2	29	10	1
3	28	11	1
4	31	9	-
5	32	8	-
6	27	12	1
7	26	14	-
8	33	7	-
9	28	12	-
10	28	10	2
Total	289	105	6
Average	28.90	10.50	0.60
%	72.25%	26.25%	1.50%

Based on Table 2, of the 10 positive statements about the Agriculture Sector, 40 respondents have a 72.50% good understanding, 26.75% limited understanding, and do not know 2.25%.

Training and Practical Assistance in the Tourism Sector. This activity involved 40 participants. The training began with a presentation of practical theories related to the tourism sector. Table 3 shows the increase in participants' knowledge after the implementation of activities such as these.

Table 3. The Level of Understanding of the Tourism Sector

No. of statements	Good understanding (number of participants)	Limited understanding (number of participants)	Do not know (number of participants)
1	32	8	-
2	32	8	-
3	34	6	-
4	32	8	-
5	28	12	-
Total	158	42	-
Average	31.60	8.40	-
%	79.00%	21.00%	0.00%

Based on Table 3, of the 10 positive statements about the Agriculture Sector, 40 respondents have a 79.00% good understanding, 21.00% limited understanding, and do not know 0.00%.

2.2 Discussion

Addressing groundwater and climate change issues demands active participation from all stakeholders, particularly local communities. Despite numerous global efforts through large-scale initiatives, many projects lack long-term sustainability due to minimal community involvement. Research highlights that successful sustainable development often involves engaging, empowering, and strengthening local communities. For instance, Khalid et al. (2019) emphasize that community participation enhances sustainable tourism, while Sutresna et al. (2019) stress the importance of integrating local aspirations in planning. Evidence from Sulangai Village reinforces these findings. Programs were tailored to local needs and challenges, involving communities in every phase from planning to execution and evaluation. Training, technology transfer, hands-on practice, and mentoring, which are aligned with real community issues, significantly improved knowledge, skills, and independence. Training in tourism, agriculture, and disaster management resulted in over 100% growth in competence, ensuring program sustainability. Sustainable development also involves fostering environmental awareness, behavioral change, and strategic action (Luppi, 2011). Ho Ngoc Son (Son et al., 2021) demonstrates that local communities can build resilience and improve livelihoods when supported. Thus, policymakers should recognize and promote traditional knowledge to shape a sustainable future. Strengthening community bonds, trust, and shared responsibility encourages program success. Furthermore, enhancing environmental knowledge is vital, as its absence hinders global and local sustainability efforts (Sola, 2014). Therefore, capacity building should be the foundation of every sustainable initiative. A lack of adequate environmental knowledge is an obstacle to achieving a sustainable future, both at the global and local levels (Sola & Michael, 2016). Social capital, beliefs, social norms, a sense of community belonging, and voluntary community involvement can act as mediators between environmental awareness, habitat quality, and pro-environmental behavior (Si et al., 2022).

3 Conclusion

Addressing the groundwater crisis and climate change requires the comprehensive engagement of all stakeholders, including local communities. Several studies demonstrate that the success of sustainable development programs can be achieved through active involvement, capacity building, and empowerment of local communities. Training, technology transfer, field practice, and mentoring, based on real-world challenges, have successfully increased citizens' knowledge, skills, and independence. The application of rainwater harvesting well technology as an effort to prevent water crises and natural disasters was welcomed by the community, as

indicated by the respondents' answers, with an agreement rate of 53.86%. Through the Training, Simulation, and Practical Assistance in the Agriculture Sector activity, the most responses received 72.50% of responses were received in the "know" category. Training and Practical Assistance in the Tourism Sector received the most responses of 79.00% in the "know" category.

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