



EDU-CONSERVATION TOURISM MODEL FOR MITIGATING CLIMATE CHANGE AND NATURAL DISASTER

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Abstract

This Conservation Tourism was developed with a focus on groundwater conservation which is linked to climate change mitigation. Water and climate change are inextricably linked. Extreme weather events are making water more scarce, more unpredictable, more polluted or all three. These impacts throughout the water cycle threaten sustainable development, biodiversity, and people's access to water and sanitation (UN Water). The issue of water crisis is spreading globally and various industrial sectors that exploit water use are starting to receive world attention, including the tourism industry. Water is a key resource of services in tourism and most of them still rely on groundwater to meet their operational needs. To maintain the sustainability and balance of nature, it is important to create new ideas for developing tourism based on local potential without damaging the environment. Edu-Conservation Tourism Model was developed based on preserving culture and local wisdom as well as existing resources while maintaining natural balance. Tourists are directed to enjoy the beauty of various tourist destinations which are packaged in such a way that without realizing it, they gain additional knowledge, experience, and carry out cultural and environmental preservation activities. This is in line with changes in the behaviour and attention of tourists who are increasingly concerned and aware of the importance of preserving the environment and prefer to return to nature. In this way, the sustainability of natural resources is maintained and the 6th goal of the SDGs is realized and the risk of climate change can be mitigated.

Keywords: edu-conservation, mitigation, climate-change, natural-disaster.

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1. INTRODUCTION

Water and climate change are inextricably linked. Water is the vital resource of life. Changes in the Earth's climate have the potential to affect the hydrological cycle and have an impact on changes in the quality and quantity of available groundwater and ultimately have an impact on the level of human quality of life. Groundwater is vulnerable to the impacts of climate change. Climate change disasters marked by global warming are expected to affect every component of the climate system, including groundwater. From 40 modelling studies show that climate change will result in a

decrease in groundwater recharge, storage, and levels, especially in dry/semi-arid tropical areas and secondly in humid tropical areas (Amobichukwu, C, *et al.* 2020). Climate change can lead to unprecedented extreme weather and climate events. The level of disaster that occurs depends strongly on the level of vulnerability and exposure. The risks of climate change cannot be completely eliminated, but actions to reduce vulnerability and exposure, and increase resilience to the potential adverse impacts of extreme events can always be pursued. Thus promoting sustainability in social and economic development (Lavell, A., *et al.* 2012).

The issue of groundwater crisis and climate change has pressured all countries in various parts of the world. Various world forums are competing to develop programs in order to overcome and prevent the occurrence of groundwater crisis and climate change disasters. The President of the World Water Council at the opening of the 10th World Water Forum in May 2024 in Bali, Indonesia conveyed 7 commitments to be a water fighter. The seven commitments include: 1) promote water security policies worldwide; 2) modification of our behaviour and change our habits; 3) upscale the design and application of Nature-Based Solutions; 4) the right to water in their national constitutions laws and local regulations; 5) create a "Money For Water" Coalition; 6) ensure that a high proportion of the various climate funds is naturally devoted to water; and 7) international action to ensure more active, decentralized governance (World Water Council, 2024). Of the seven commitments, the ones that can be implemented immediately are the second commitment on modification of our behaviour and change our habits and the third on upscale the design and application of Nature-Based Solutions.

Overcoming the groundwater crisis and climate change requires contributions from all stakeholders comprehensively, including community members. For a big commitment, let it be the thinking of the government and other major stakeholders. For academics, in addition to conducting research related to effective efforts in designing appropriate technology, what is no less important is implementing the results of the appropriate technology design through community service activities so that the benefits of the research results can be directly felt by the community. There are many methods used in implementing community service activities, including through the increasing knowledge, skills, technology transfer, practice and mentoring. Several studies have reported that these various methods have been proven to be able to change behaviour and increase public awareness of environmental conservation efforts. So far, they have not contributed or have not been seen to have concern for the environment, this is due to their low knowledge and understanding of the importance of preserving natural resources (Agbola *et al.* 2014)

(Funda, V. U. *et al.*, 2012) (Hadian, M.S.D. *et al.* 2016). Of the various methods, the important thing is that there must be a program related to sustainability. Knowledge enhancement, technology transfer, practice and assistance must be completed so that after the program is finished, the community is able to carry out, continue or duplicate activities independently and sustainably. This article was built based on the Community Service Activities (CSA) which is as the implementation of the previous research on groundwater conservation to mitigate climate change and natural disasters, especially related to environmental conservation programs, culture/local values, and water resources through the development of the Edu-Conservation Tourism Package Model.

2. ACTIVITY METHOD

This community service activity through the knowledge enhancement, technology transfer, practice and assistance of Edu-Conservation Tourism Model was carried out in Sulangai Village, Badung Regency, Bali Province, Indonesia. There are three main problem areas, including tourism, agriculture, and disasters where the three areas refer to conservation activities. Sulangai Village is designated as a Disaster Response Village Social Barn and Environmental Service Centre with the function as an integrated agricultural centre, agritourism and ecotourism. This designation is both a challenge and an opportunity for Sulangai Village. Challenges include the readiness of human resources and supporting infrastructure. In addition to challenges, there are also opportunities to develop programs related to disasters and the environment.

a. Existing Problem

The results of the preliminary study showed the challenges and problems of Sulangai village as follows:

1. Tourism Sector

The tourism potential of the village has not yet been systematically inventoried or adequately mapped. Despite the considerable opportunities offered by natural, agricultural, and cultural tourism resources, their development remains disproportionate and insufficiently optimized. Furthermore, local communities have limited understanding of the principles of conservation-based tourism,

while the performance and effectiveness of the Tourism Awareness Group (Pokdarwis) have not yet reached their full potential in supporting sustainable tourism development.

2. Agriculture Sector

Most farmer groups continue to rely on chemical fertilizers in their agricultural practices. In addition, community understanding of plant species that can contribute to the prevention and mitigation of floods, droughts, and landslides remains limited. These conditions indicate the need for greater efforts to promote sustainable agricultural practices and enhance local knowledge regarding the ecological functions of vegetation in disaster risk reduction and environmental conservation.

3. Disaster Sector

Sulangai Village was officially designated as a Disaster Response Social Barn by the Badung Regency Social Service on October 24, 2023, and subsequently received disaster management equipment that was handed over to the village head. This disaster-resilient village initiative aims to strengthen community capacity to adapt to, respond to, and recover from disaster impacts independently. Nevertheless, several challenges persist. The village is characterized by steep slopes ranging from 15% to 40%, making it highly susceptible to landslides. Although the community possesses local cadres who understand and actively respond to flood and drought hazards, the village has yet to develop tangible community-based products or initiatives that demonstrate concrete action in disaster management. These conditions highlight the need for enhanced capacity-building and the implementation of practical disaster risk reduction programs to support long-term resilience.

b. Solutions

Based on the results of the preliminary study, this program was implemented with the following objectives: increasing the knowledge, understanding, and skills of the younger generation in the field of disaster management; enhancing the knowledge, understanding, and skills of tourism industry stakeholders regarding conservation tourism; providing new tourism products in the form of conservation tourism travel packages that attract tourists to travel while learning about conservation tourism and contributing directly to conservation activities; establishing Rainwater Harvesting Wells that can replenish water sources in Sulangai Village and other downstream villages to help prevent climate change-related and water-related disasters; and developing rainwater harvesting wells through active involvement of the local community, beginning with theoretical training, preparation, and construction activities, so that community members gain the knowledge and skills necessary to build and maintain the wells, ensuring the sustainability of the program.

3. RESULT AND DISCUSSION

3.1. Training, technology transfer, practice and direct assistance in tourism sector

The activities was conducted with 40 participants from tourism industries. The knowledge enhancement was conducted starting from providing practical theory about tourism conservation and climate change, examples of good practices in implementing conservation tourism models, discussions, practices and coaching in compiling conservation tourism packages, and presentations per group. The results of measuring the success of activities through pre-post-tests with 12 positive statement related conservation tourism and climate change. The result are presented in Table 1, Table 2, Figure. 1, and Figure. 2.

Table 1. Knowledge and competency on conservation tourism and climate change

No. of Statements	Pre-test			Post-test		
	already know (number of participants)	know a little (number of participants)	don't know (number of participants)	already know (number of participants)	know a little (number of participants)	don't know (number of participant)
1	8	26	6	27	12	1
2	9	24	7	29	10	1
3	14	20	6	28	11	1
4	7	23	10	31	9	0
5	18	21	1	32	8	0
6	10	21	9	27	12	1
7	11	23	6	26	14	0
8	21	16	3	33	7	0
9	18	20	2	28	12	0
10	14	17	9	28	10	2
11	7	16	17	25	12	3
12	17	21	2	29	10	1
Total	154	248	78	343	127	10
Average %	12,83 32,08%	20,67 51,67%	6,50 16,25%	28,58 71,46%	10,58 26,46%	0,83 2,08%

Table 2. The increasing of knowledge and competency on conservation tourism and climate change

No. of Statements	Increasing of knowledge and competency after training					
	already know		know a little		don't know	
	(number of participants)	%	(number of participants)	%	(number of participants)	%
1	19	70.37	14	53.85	5	83.33
2	20	68.97	14	58.33	6	85.71
3	14	50.00	9	45.00	5	83.33
4	24	77.42	14	60.87	10	100.00
5	14	43.75	13	61.90	1	100.00
6	17	62.96	9	42.86	8	88.89
7	15	57.69	9	39.13	6	100.00
8	12	36.36	9	56.25	3	100.00
9	10	35.71	8	40.00	2	100.00
10	14	50.00	7	41.18	7	77.78
11	18	72.00	4	25.00	14	82.35
12	12	41.38	11	52.38	1	50.00
Total % of Increasing/ knowledge and competency		666.62		576.75		1051.40
Average % of Increasing knowledge and competency		55.55		27.46		36.26

From Table 1, Figure. 1, and Figure. 2, it can be seen that the knowledge enhancement. technology transfer, practice and direct assistance in tourism sector increased the knowledge of the community. From 12 positive statements about conservation, the average of participants which already know about the conservation tourism were 12.83 (32.08 %) participants before training and 28.58 (71.46%) participants after training, it

increased about 122.76%. The average of participants which still don't know about the conservation tourism and climate change decreased from 16.25 % to 2.08 %. With the increasing knowledge about the related between conservation tourism model and the climate change through the implantation of Edu-Conservation Tourism Model, it is hope that the behaviour and the awareness of community can increase as well.

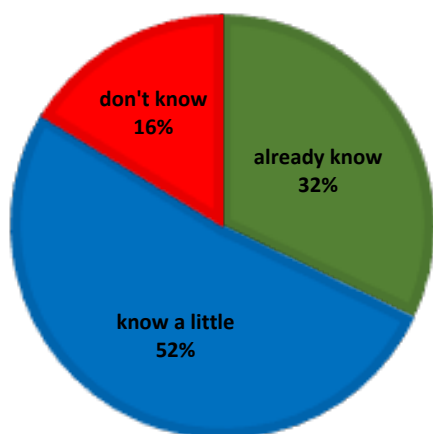


Figure. 1. Level of knowledge and competence before training

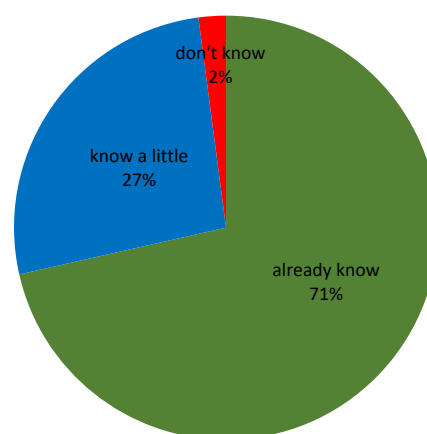


Figure. 2. Level of knowledge and competence after training

3.2. Training, technology transfer, practice and direct assistance in agriculture sector

The activities was conducted with 40 participants of farmers. Similar with tourism sector, the training was conducted starting from providing practical theory about conservation plants and organic fertilizer linked to climate change, examples of good practices in implementing of conservation plants that are

able to store rainwater and reabsorb it into the soil, discussions, practices and coaching in selecting conservation plants that are suitable for local soil conditions and characteristics, and presentations per group. The results of measuring the success of activities through pre-post-tests with 7 positive statement related conservation plants and organic fertilizer linked to climate change. The result are presented in Table 2, Table 3, Figure. 3, and Figure. 4.

Table 3. Knowledge and competency on conservation plans, organic fertilizer and climate change

No. of Statements	Pre-test			Post-test		
	already know (number of participants)	know a little (number of participants)	don't know (number of participants)	already know (number of participants)	know a little (number of participants)	don't know (number of participants)
1	10	20	10	32	8	0
2	14	16	10	32	8	0
3	8	26	6	34	6	0
4	10	20	10	32	8	0
5	6	18	16	28	12	0
6	4	10	26	24	16	0
7	10	26	4	28	12	0
Total	62	136	82	210	70	0
Average	8,86	19,43	11,71	30,00	1,75	0
%	22.14	48.57	29.29	75.00	25.00	0

Table 4. The increasing of knowledge and competency in conservation plans, organic fertilizer and climate change

Number of statements	already know		know a little		don't know	
	(number of participants)	%	(number of participants)	%	(number of participants)	%
1	22	55,00%	12	30,00%	0	0
2	18	55,00%	8	30,00%	0	0
3	26	55,00%	20	30,00%	0	0
4	22	55,00%	12	30,00%	0	0
5	22	55,00%	6	30,00%	0	0
6	20	55,00%	6	30,00%	0	0
7	18	55,00%	14	30,00%	0	0
Total % of Increasing knowledge and competency	148	385,00 %	78	210,00%	0	0
Average % of Increasing knowledge and competency	21.14	55,00%	11.14	30,00%	0	0

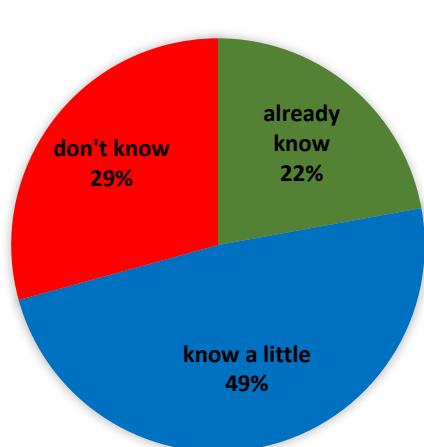


Figure. 3. Level of knowledge and competence before training

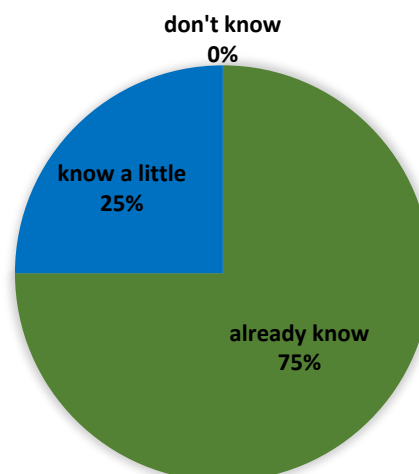


Figure. 4. Level of knowledge and competence after training

From Table 4, Figure. 3, and Figure. 4, it can be seen that the training, technology transfer, practice, and direct assistance in agriculture sector increased the knowledge and competency of community, from 7 positive statements about conservation on agriculture. The average of participants which already know about the conservation tourism were 8,86 (22.14) participants before training and 30 (75.00 %) participants after training, it increased about 238.60%. There were no participants which don't know about the

conservation in agriculture and climate change. With the increasing knowledge about the related between conservation agriculture and the climate change through the implantation of Edu-Conservation Tourism Model, it is hope that the behaviour and the awareness of community can increase as well., it is hope that the behaviour and the awareness of community can increase as well.

3.3. Training, technology transfer, practice and direct assistance in disaster sector

The activities was conducted with 40 participants of youth. Similar with tourism and agriculture sector, the training was conducted starting from providing practical theory about groundwater conservation linked to climate change, examples of good practices in groundwater harvesting wells, discussions,

practices and coaching in building rainwater harvesting wells and presentations per group. The results of measuring the success of activities through pre-post-tests with 8 positive statement related water conservation linked to climate change. The result are presented in Table 5, Table 6, Figure. 5, and Figure. 6.

Table 5. Knowledge and competency on conservation plans, organic fertilizer and climate change

No. of Statements	Pre-test			Post-test		
	already know (number of participants)	know a little (number of participants)	don't know (number of participants)	already know (number of participants)	know a little (number of participants)	don't know (number of participant)
1	1	2	3	1	2	3
2	8	16	16	20	14	6
3	9	19	12	17	17	6
4	19	15	6	26	11	3
5	6	13	21	14	19	7
6	5	22	13	17	16	7
7	3	18	19	12	22	6
8	8	25	7	19	16	5
Total	59	130	97	126	117	43
Average	7,375	16,25	12,125	15,75	14,625	5,375
%	15,63%	43,75%	29,38%	39,69%	34,06%	12,50%

Table 6. The increasing of knowledge and competency in disaster and climate change

No. of Statements	already know		know a little		don't know	
	(number of participants)	%	(number of participants)	%	(number of participants)	%
1	0	0,00%	0	30,00%	0	0,00%
2	12	30,00%	2	20,00%	10	62,50%
3	10	25,00%	0	50,00%	6	50,00%
4	15	37,50%	4	30,00%	3	50,00%
5	8	20,00%	6	15,00%	14	66,67%
6	12	30,00%	6	15,00%	6	46,15%
7	9	22,50%	4	35,00%	13	68,42%
8	11	27,50%	9	35,00%	2	28,57%
Total	148	3,700	78	195,00%	54	55,67%
Average	21,14	52,86%	11,14	27,86%	6,75	6,96%



Figure 5. Level of knowledge and competence before training

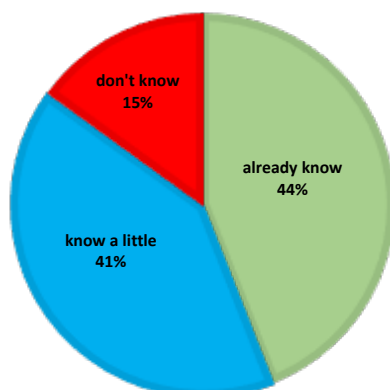


Figure 6. Level of knowledge and competence after training

From Table 5, Figure 5, and Figure 6, it can be seen that the training, technology transfer, practice and direct assistance in disaster sector increased the knowledge and competency of community. From 7 positive statements about water conservation and climate change, the average of participants which already know about the water conservation through rainwater harvesting wells were 6,25 (15.63%) participants before training and 15,88 (39.69 %) participants after training, it increased about 154.08%. There were no participants which don't know about the conservation in agriculture and climate change. With the increasing knowledge about the related between conservation tourism model and the climate change through the implantation of Edu-Conservation Tourism Model, it is hope that the behaviour and the awareness of community can increase as well.

3.4. Discussion

Overcoming the groundwater crisis and climate change requires contributions from all stakeholders comprehensively, including community members. Due to global pressure on

the water crisis and climate change, many countries are making big plans or program with various mega projects, but what often happens is that once the project is completed, its sustainability is not guaranteed. One of the main cause is less involvement of local community. There are several studies that have successfully measured the success of sustainable development programs through the involvement, strengthening and empowerment of local communities. Khalid *et al.* reported that community involvement can strengthen successful sustainable tourism development (Khalid, S. *et al.* 2019). Aspirations of local communities are important to consider in the process of sustainable tourism planning and development (Bagus, S. I *et al.* 2019).

Various findings related to the role of local communities in ensuring the sustainability of various programs are in line with research programs and community service in Sulangai Village. The program is designed based on the potential and challenges of the local community, and involves the role of the community from initial planning, program details to implementation and measuring the success of program implementation. The results show that training, technology transfer, practice, and mentoring in which designed based on potential, challenges and real problems have succeeded in increasing community knowledge, competence and independence. Of the three training areas, tourism, agriculture, and disasters, all three showed an increase in community knowledge and competence more than 100%, so that the sustainability of program implementation is guaranteed. In the perspective of sustainable development, environmental education aims to promote not only knowledge, but also behaviour, strategies, and actions to re-transform development models and lifestyles for sustainable development (Lupi, E. *et al.* 2011). The results of Ho Ngoc Son's study (Son, H. N. *et al.* 2021) illustrate unique ways that local communities can improve social, economic and environmental resilience, reduce risks and strengthen the livelihoods of marginalized communities. Therefore, policy makers should review, support and promote the values of local wisdom that already exist in these communities to advance a more sustainable future. Building

togetherness in implementing programs for the advancement of a village can foster community trust in the success of the program. Capital, trust, and social norms, sense of community belonging, and community voluntarism can role as mediation between environmental awareness, habitat quality, and pro-environmental behaviour (Si, W. *et al.* 2022). Lack of adequate environmental knowledge is an obstacle in achieving a sustainable future for humankind at both global and local levels (Sola, A. M. *et al.* 2014)). Therefore, starting the program implementation with knowledge and competency improvement activities is very important.

4. CONCLUSION

This activities designed based on the potencies, challenge, and the existing problems as the result of the preliminary study. There were three main area, included tourism, agriculture, and disaster sectors. Refers to the World Water Council's programs, the objectives of this program are to promote the water conservation program and climate change mitigation through the main activities: modification of our behaviour and change our habits and upscale the design and application of Nature-Based Solutions. By involving local community in all three sectors in the knowledge and competencies enhancement, including the tourism industry players, farmer community for the agriculture conservation, and youth generation for the water conservation and disaster, it is hope that the Edu-Conservation Program improve the behaviour of community in using the water for dally use and business operations, and increase the culture of saving water for climate change mitigation.

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