



Development Strategy for the Climate Village Program in Palopo City, South Sulawesi, Indonesia

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ABSTRACT

Background: The Climate Village Program (CVP) is a national program managed by the Ministry of Environment and Forestry in order to involve the community and other stakeholders in strengthening adaptation and mitigation capacity for climate change and reducing greenhouse gas (GHG) emissions. However, studies on CVP development strategies are still lacking in South Sulawesi. For this reason, this research aims to identify the programs of the climate village and formulate climate village development strategies in the Latuppa sub-district, Palopo City.

Methods: Data analysis will be performed utilizing SWOT analysis and Process Hierarchy Analysis to define strategic initiatives for developing the Latuppa climate village program.

Result: The results of this research show that the people of Latuppa subdistrict, Palopo City support the CVP through adaptation activities such as controlling drought, floods and landslides and increasing food security, controlling climate disease. Meanwhile, mitigation activities carried out by the Latuppa sub-district community, Palopo City include waste and solid waste management, use of new, renewable energy and energy conservation, agricultural cultivation, increasing vegetation cover and preventing forest and land fires. The role of various stakeholders, such as the community, traditional leaders, academics and government, is critical in the process of developing the CVP particularly in adaptation and mitigation efforts, to ensure the success of the program.

Key words: Adaptation, Climate change, Climate village, Mitigation.

INTRODUCTION

Environmental issues are a reflection of society regarding environmental damage or pollution due to development and human activities (Arifah *et al.*, 2021; Escarcha *et al.*, 2020). Environmental problems that occur as a result of human activities are driving the acceleration of the phenomenon of climate change on this earth (Ashkra *et al.*, 2023; Siddharam *et al.*, 2022). Climate change is generally defined as a condition where the climate on earth is experiencing a process of changes in air temperature which becomes hotter over time, changes in rainy periods, frequent storms (IPCC, 2021; Tran *et al.*, 2021). Indonesia is one of the countries that participates in reducing GHG emissions as agreed in the Kyoto Protocol by creating a Climate Village Program (CVP) which is abbreviated as ProKlim (GIZ and UNDP, 2019; Nurhasanah and Saeful Akbar, 2022).

ProKlim is an adaptation and mitigation effort to climate change based on community empowerment. The CVP consists of adaptation and mitigation activities carried out by the community to deal with or prevent the impacts of climate change (Rusdi *et al.*, 2022). The CVP can be developed and implemented in areas at a minimum of hamlet and a maximum of village level (Minister of the Environment Regulation No. 19 of 2012).

The CVP aims to strengthen partnerships between various stakeholders in dealing with climate change and facilitate the dissemination and exchange of information regarding best practices for climate change adaptation and mitigation (Bhargabi and Sujoy, 2017; Nurpeni *et al.*, 2022).

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Apart from that, the CVP can increase people's understanding of climate change and its impacts, resulting in changes in people's lifestyles that are resistant to the risks of climate change and have low carbon emissions that are tailored to the priorities, needs, understanding and capacity of people in the local area (Taqiyah and Fajriyanto, 2021). The various activities of communities receiving ProKlim awards show that climate change adaptation and mitigation actions are not something new and difficult to carry out. Innovations in sustainable management of natural resources and the environment can be directed at responding to society's challenges with the issue of climate change (CCAFS, 2017; Sanogo *et al.*, 2020).

The Climate Village Program is also a means of non-formal education with aim to preserve the surrounding

environment. Based on Law No. 20 Article 26 of 2003 concerning the National Education System, non-formal education is provided for community members who need educational services that function as a substitute, addition and complement to formal education in order to support lifelong education (Barooah *et al.*, 2023). Therefore, the Climate Village Program was very effectively developed considering that the entire subject of program implementation was the community (Adesipo *et al.*, 2020). There are many previous studies that analyze the implementation of ProKlim in Indonesia, including the independence of climate village communities (Hasanah and Setyowati, 2022), ProKlim activities in Gayo district (Marlina *et al.*, 2021), community empowerment in climate villages in Tangerang (Taqiyah and Fajriyanto, 2021). However, studies regarding the ProKlim development strategy are still lacking, so research is needed regarding the development strategy for implementing ProKlim in South Sulawesi. It is intended that by analyzing the climate village program development plan, the adaptation and mitigation strategies employed by ProKlim at the research site will become a pilot project that may be adopted in other locations.

MATERIALS AND METHODS

This research was conducted in April 2023 - June 2023, in the Latuppa Village, Palopo City, South Sulawesi-Indonesia. This research was carried out in the form of a survey using quantitative descriptive analysis methods (Cresswell, 2014). Data and information collection is carried out by:

- a) Observation techniques include various things related to observing certain field conditions.
- b) Questionnaire/Interview technique is a form of structured questions given to respondents according to the research problem.
- c) Literature study is a data collection technique by studying and reading literature related to the research object.

The data used is primary data and secondary data. Primary data was obtained through field surveys in the research area and in-depth interviews with the community around Latuppa Village and related parties. Meanwhile, secondary data was obtained from the related institutions including the Central Statistics Agency and the Environmental Services.

Data analysis is carried out 3 stages, namely:

a) SWOT analysis

To formulate strategic steps for developing the Latuppa Village climate village program, data analysis will be carried out using SWOT analysis.

b) Focus group discussion (FGD)

This Focus Group Discussion aims to ground the strategy that has been created, re-evaluate what has been created by the researcher, equalize perceptions in formulating the

strategy and involve informants in formulating the strategy so that they feel they own the strategy.

c) Process hierarchy analysis (PHA)

Process Hierarchy Analysis (PHA) is a decision support model developed by Thomas L. Saaty. This decision support model will describe complex multi-factor or multi-criteria problems into a hierarchy, according to Saaty, (2008), hierarchy is defined as a representation of a complex problem in a multi-level structure where the first level is the goal, followed by the factor level, criteria, sub criteria and so on down to the last level of alternatives. With hierarchy, a complex problem can be broken down into groups which are then arranged into a form of hierarchy so that the problem will appear more structured and systematic.

In particular, PHA is suitable for use in decision-making processes that involve the comparison of decision elements that are difficult to assess quantitatively. This is based on the assumption that the natural human reaction when faced with complex decision making is to group the decision elements according to their general characteristics. This grouping includes a hierarchy (ranking) of decision elements and then a comparison between each pair in each group as a matrix, the standard acceptable inconsistency value in PHA is 0.25.

The results of this hierarchical process analysis are the final results of a series of research in determining ProKlim development strategies in the research location. The Development Strategy will prioritize 4 aspects, namely: 1. Socialization Aspect, 2. Mitigation Aspect, 3. Adaptation Aspect and 4. Participation Aspect.

RESULTS AND DISCUSSION

Adaptation and mitigation strategy

The community makes a variety of initiatives to address the effects of climate change, including both adaptation and mitigation efforts (Terefe, 2023). Table 1 shows the activities of residents in carrying out adaptation activities such as controlling drought, floods and landslides. Increasing food security and controlling climate disease. From the results of interviews and observations, it is known that there are several climate-related problems faced by the community, including natural disasters, crop failure and climate-related diseases. For this reason, they carry out climate change adaptation and mitigation efforts by referring to ProKlim guidelines. For adaptation efforts related to controlling drought, floods and landslides, they carry out activities including planting bamboo trees on the banks of the Latuppa River, building rain-fed wells and organic waste bins in residents' homes. In line with the Ndamani and Watanabe, (2015), the community also implemented adaptation strategies by raising building/house structures and constructing dams, flood embankments and flood control systems.

Climate change poses an increasing threat to the food system by impacting food security. One of the strategies

implemented in the climate village program is crop diversification. The same strategy has been implemented by Ethiopian society to strengthen farmers' food security against climate change through diversification of homegarden crops which has the potential to protect small

farmers from food insecurity, contribute to food diversification increase agricultural income (Teklewold *et al.*, 2019). In addition, appropriate strategies for using modern seed technology are needed to increase plant productivity (Arifah *et al.*, 2022).

Table 1: Adaptation Strategy.

Types of adaptation	Activities
A. Control of droughts, floods and landslides	
Rainwater harvesting.	Planting Bamboo Trees on the banks of the Latuppa River.
Water infiltration	Create rain-fed wells and organic waste bins in residents' homes.
Saving water use	Resaving water that has been used for certain activities.
Adaptive design	Raising the structure of the building/house.
Flood control facilities and infrastructure	Construction of check dams, flood embankments, flood control water systems.
B. Increase food security	
Implementation of planting patterns	Application of heteroculture planting patterns (intercropping) to adapt to the impacts of climate change.
Integrated farming practices	Gardening with the agroforestry concept.
Local potential management	Utilization of sago plants by making products with high economic value.
Plant breeding techniques	Perform grafting techniques on durian and rambutan plants and shoot grafting on cocoa plants.
Utilization of yard land	Utilization of the yard to grow plants needed by the family such as vegetables, chilies, tomatoes and short-term crops.
C. Control of diseases	
Vector control	Implementing a program for Draining, Containing and Closing mosquito nests.
Community-based Total Sanitation	Implementation of early awareness of diseases related to climate change (Diarrhea and Dengue Fever) carried out by sub-district health centers.
Clean and Healthy Lifestyle	Make a habit of washing your hands with soap, keep your environment clean and healthy. And have a house with good air circulation.

Table 2: Mitigation strategy.

Type of mitigation	Activities
A. waste and solid waste management	
Containerization and collection	Making proper trash cans for each house.
Waste processing agency	Encourage the community to process organic waste into fertilizer.
Utilization	Utilization of organic waste to become fertilizer.
B. Use of new, renewable energy and energy conservation	
Energy Efficiency	Use energy-saving lamps at home and use solar-powered lights on the roadside.
C. Agricultural cultivation	
Reducing chemical fertilizers and modifying water systems	reduce greenhouse gas emissions by using organic fertilizers and organic pesticides.
Post-harvest activities	Processing harvests from gardens into materials of high economic value such as sago.
D. Increased vegetation cover	
Greening program	Planting bamboo plants on riverbanks.
Agroforestry practices	Planting intercrops around perennial/annual crops such as corn, chilies and vegetables.
E. Prevention and management of forest and land fires	
Forest and land fire control and prevention system	Knowledge of local residents about early warning and early detection of forest and land fires.
Prevention of forest and land fires	Providing information about forest and land fires to people who carry out activities around the forest.

Table 2 shows the mitigation activities carried out by residents in Latuppa sub-district, such as: waste and solid waste management, use of new and renewable energy and energy conservation, agricultural cultivation, increasing vegetation cover and preventing forest and land fires. The community implements several activities as an effort to mitigate the impacts of climate change, including waste processing at the household level. This is in line with the community based waste management program in Jambi as one of the community's mitigation efforts (Herdiansyah, 2021). In agricultural cultivation, society reduce the use of chemical fertilizers and replace them with organic fertilizers and pesticides (Kome *et al.*, 2018).

Other mitigation efforts that can be carried out by the community and have been implemented by Latuppa residents are energy efficiency by using energy-saving lamps at home and using solar-powered lamps on the side of the road (Herdiansyah, 2021).

Development strategy

• SWOT Analysis

An analysis of the obstacles (internally and externally) related to the development of the Climate Village Program (Proklam) in the Latuppa sub-district was prepared based on data obtained from survey results and observations in the field, both in the form of primary data and secondary data. SWOT analysis includes strengths, opportunities, weaknesses and threats, where this method shows performance results by determining a combination of internal and external factors.

Internal factor analysis

Several internal environmental factors that influence the development of the climate village program (Proklam) in Latuppa Village are strengths and weaknesses. The strength factors (Strengths) are community participation in the climate village program (Proklam), direct sub-district government support, the strategic geographical location of Latuppa sub-district and the high awareness of the Latuppa sub-district community to protect the surrounding environment. Meanwhile, the weakness factors are the lack of socialization regarding the climate village program (Proklam), inadequate facilities and infrastructure, inadequate human resources and a minimal budget for developing the climate village program.

Analysis of external factors

There are several external factors that influence the development of climate villages (Proklam) in Latuppa sub-district, namely opportunities and weaknesses. The influential opportunity factor is the policy of the Palopo city government in developing the climate village program (Proklam), the knowledge and insight of the Latuppa subdistrict community regarding the environment will increase, as a pilot area for the climate village program in Palopo city and as an agrotourism area in Palopo city. Meanwhile, the influencing threat factors are that coordination between sectors is still weak, the pattern of the rainy and dry seasons is uncertain, as well as the use of chemical fertilizers and chemical pesticides in agricultural and plantation activities.

The SWOT analysis is an initial draft that serves as a reference for the strategy for developing a CVP (Proklam) which was carried out through focus group discussions (FGD) (Table 3) with a number of stakeholders including farmer groups, RT/RW heads, community leaders, youth leaders, village heads. Latuppa, the Palopo City Environmental Service, which then obtained a number of obstacles and improvements to the development strategy for climate villages (Proklam) such as using household waste to make organic fertilizer, improving village infrastructure as well as assistance and knowledge about potential processing in Latuppa district so that it has added value.

Organizational and community development is an aspect that needs to be considered in strengthening climate program development. Village communities cannot work alone without receiving support from all parties, including the government, private sector, community and universities. Through partnerships and cooperation, it will strengthen the delivery of services in the fields of government, development and empowerment to communities at the village level (Bayala *et al.*, 2016; Nurpeni *et al.*, 2022).

• Process hierarchy analysis (PHA)

Process hierarchy analysis (AHP) was carried out to obtain problem solving using AHP software, namely Expert Choice 11, on several respondents (Fig 1), namely farmer groups, community leaders, youth leaders, Latuppa village head and the Palopo city environmental service. Based on the



Fig 1: Process Hierarchy Analysis of the CVP.

Table 3: SWOT analysis of the CVP.

	Strength (S) • Community participation for the climate village program. • Direct subdistrict government support. Strategic geographical location and circumstances. • Community tradition to carry out activities together. • High public awareness to protect the environment.	Weaknesses (W) • Socialization about the climate village program is still lacking. • Facilities and infrastructure not yet supportive. • Inadequate human resources. • The budget for developing the climate village program is still insufficient.
Opportunity (O) • Palopo city government policy in developing the climate village program. • Knowledge and insight of the latuppa village community increases. • As a pilot project for the climate village program in palopo city. • Agrotourism development area in palopo city.	S-O Strategy • Providing training to the Latuppa Village Community regarding Management of Climate Village Development. • Implementation of Activities for the Latuppa Village Community in Collaboration Activities between Residents.	W-O Strategy • Roadside Planting to Stop the Rate of Soil Erosion. • Education to the Community Regarding the Climate Village Program. • Training on the Utilization of Plantation and Agricultural Products to the Community to increase Household Income.
Threat (T) • Inter-sector coordination is still weak, uncertain rainy and dry season patterns. • Use of chemical fertilizers and chemical pesticides in agricultural and plantation activities.	S-T Strategy • Holding Regular Meetings between Stake Holders in the Climate Village Development Program. • The Need for Latuppa Community Activities in Terms of Mutual Cooperation.	W-T Strategy • Utilizing Residents' Yards for Planting Short Term Crops (Vegetables, Ginger, Turmeric) to Reduce Household Needs Costs. • Utilization of Kitchen Waste to Make Organic Fertilizer (Solid and Liquid). • Improving Facilities and Infrastructure to Support Latuppa Village as a Pilot Area for the Development of the Climate Village Program in Palopo City.

results of the PHA synthesis for the development strategy for the climate village program (Proklm), it shows that the main strategies needed by the community are training in the use of agricultural products 0.142, improving agricultural road access 0.128, creating demonstration gardens 0.126.

In the process of establishing a climate village program, several interventions and strategies are required, covering the complete range of environmental management that address specific aspects of the agricultural ecosystem, such as knowledge-smart interventions, input-smart interventions and community-smart interventions (Singh *et al.*, 2021).

CONCLUSION

The Climate Village Program creates community enthusiasm and commitment in finding solutions to the problems and obstacles faced related to the impacts of

climate change. However, the success of this program requires the involvement of various institutional and organizational elements. Failure to consider any of these factors will hinder the progress of the program.

This includes the involvement of women's organizations, youth and traditional and religious leaders as well as a lack of synergy between projects and programs. Involving local communities in problem identification, planning stages and governance of sustainable land management must be the basis of all strategic interventions for adapting and mitigating the impacts of climate change. Strengthening community capacity through farmer-to-farmer exchanges, farmer field schools and specialized training that encourages implementation of best practices on a wide scale.

Conflict of interest

All authors declare that they no conflict of interest.

REFERENCES

- Adesipo, A., Fadeyi, O., Kuca, K., Krejcar, O., Maresova, P., Selamat, A. and Adenola, M. (2020). Smart and climate-smart agricultural trends as core aspects of smart village functions. *Sensors (Switzerland)*. 20(21): 1-22. <https://doi.org/10.3390/s20215977>.
- Arifah, Salman, D., Yassi, A. and Bahsar-demmellino, E. (2022). Climate change impacts and the rice farmers' responses at irrigated upstream and downstream in Indonesia. *Heliyon*. 8(12): e11923. <https://doi.org/10.1016/j.heliyon.2022.e11923>.
- Arifah, Salman, D., Yassi, A. and Demmallino, E.B. (2021). Farmer's Perception of climate change and the impacts on livelihood in South Sulawesi. *IOP Conference Series: Earth and Environmental Science*. 810(1). <https://doi.org/10.1088/1755-1315/810/1/012010>.
- Ashkra, Khan, A.A. and Jadaun, K.K. (2023). Estimating the potential effect of climate change on rice yield in India by considering the combined effects of temperature and rainfall. *Bhartiya Krishi Anusandhan Patrika*. 38(3): 284-289. <https://doi.org/10.18805/BKAP649>. doi: 10.18805/BKAP649.
- Barooah, P., Alvi, M., Ringler, C. and Pathak, V. (2023). Gender, agriculture policies and climate-smart agriculture in India. *Agricultural Systems*. 212(9): 103751. <https://doi.org/10.1016/j.agsy.2023.103751>.
- Bayala, J., Zougmore, R., Ky-dembele, C., Bationo, B.A., Buah, S., Diaminotou, S., Somda, J., Tougiani, A., Traore, K. and Kalinganire, A. (2016). Towards developing scalable climate-smart village models: Approach and lessons learnt from pilot research in West Africa. In *ICRAF Occasional*. (Issue ICRAF Occasional Paper No. 25). https://www.researchgate.net/profile/Catherine-Ky-Dembele/publication/309771750_Towards_developing_scalable_climate-smart_village_models_approach_and_lessons_learnt_from_pilot_research_in_West_Africa/links/582311e008ae61258e3c7ccd/Towards-developing-scala.
- Bhargabi, C. and Sujoy, H. (2017). Impact of climate change on yields of major agricultural crops in Tripura. *Indian Journal of Agricultural Research*. 51(4): 399-401. doi: 10.18805/ijare.v51i04.8432.
- CCAFS. (2017). Climate-Smart Villages: An AR4D Approach to Scale Up Climate-Smart Agriculture. May. 32-39. <https://ccafs.cgiar.org/publications/climate-smart-villages-ar4d~approach-scale-climate-smart-agriculture>.
- Cresswell, J.W. (2014). *Research Design/Qualitative, Quantitative and Mixed Methods Approaches*. 4th Edition (4th ed.). Sage Publications, Inc.
- Escarcha, J.F., Lassa, J.A., Palacpac, E.P. and Zander, K.K. (2020). Livelihoods transformation and climate change adaptation: The case of smallholder water buffalofarmers in the Philippines. *Environmental Development*, 33(September 2018): 100468. <https://doi.org/10.1016/j.envdev.2019.100468>
- GIZ, G. and UNDP. (2019). Strengthening community level climate change adaptation and mitigation actions: Indonesia'S Climate Village Programme (Proklam). 1-10.
- Hasanah, U. and Setyowati, R. (2022). Seminar nasional pengabdian dan CSR Ke-2 Fakultas pertanian universitas sebelas maret , surakarta kemandirian masyarakat kampung iklim pada Implementasi program kampung iklim di kelurahan ngadirejo abstrak seminar nasional pengabdian dan CSR Ke-2 Fakultas. 2017: 29-6.
- Herdiansyah, H. (2021). Climate village program for climate change adaptation and mitigation for green villages. *IOP conference series: Earth and environmental science*. 819(1). <https://doi.org/10.1088/1755-1315/819/1/012034>.
- IPCC. (2021). IPCC, 2021: Summary for policymakers. In: *Climate Change: The physical science basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. In *IPCC, Switzerl*. <https://doi.org/10.1260/095830507781076194>.
- Kome, G.K., Enang, R.K. and Yerima, B.P.K. (2018). Knowledge and management of soil fertility by farmers in western Cameroon. *Geoderma Regional*. 13: 43-51. <https://doi.org/10.1016/j.geodrs.2018.02.001>.
- Marlina, S., Lutt, B.S., Usup, A. and Sunaryati, R. (2021). Gender role in climate change adaptation on the peat swamp ecosystem in pulang pisau regency central kalimantan. *IOP Conference Series: Earth and Environmental Science*. 716(1): 0-11. <https://doi.org/10.1088/1755-1315/716/1/012090>.
- Ndamani, F. and Watanabe, T. (2015). Farmers' perceptions about adaptation practices to climate change and barriers to adaptation: A micro-level study in Ghana. *Water (Switzerland)*. 7(9): 4593-4604. <https://doi.org/10.3390/w7094593>.
- Nurhasanah, D. and Saeful Akbar, Y.G. (2022). Stakeholder mapping in the climate village program in DKI Jakarta. *JPPUMA Jurnal Ilmu Pemerintahan Dan Sosial Politik Universitas Medan Area*, 10(2): 149-158. <https://doi.org/10.31289/jppuma.v10i2.7077>.
- Nurpeni, N., Aguswan, A., Astuti, W. and Saputra, T. (2022). Development of the Climate Village Program in Tobek Godang Sub-District, Pekanbaru City At 2020-2021. *Sosiohumaniora*. 24(2): 193. <https://doi.org/10.24198/sosiohumaniora.v24i2.34403>.
- Rusdi, M., Studi, P., Psdku, K., Gayo, U.S.K., Pertanian, F. and Kuala, U.S. (2022). Kegiatan program kampung iklim (PROKLIM) (Studi Kasus Desa Tetingi Kecamatan Blangpegayon Kabupaten Gayo Lues) Activities Climate Village Program (CVP) (Case Study of Tetingi Village Blangpegayon Sub District Gayo Lues Regency) *PENDAHULUAN iklim m*. 7: 856-860.
- Saaty, T.L. (2008). Decision making with the analytic hierarchy process. *Int. J. Services Sciences*. 1(1): 83-98. <https://doi.org/10.1108/JMTM-03-2014-0020>.
- Sanogo, D., Sall, M., Camara, B.A., Diop, M., Badji, M. and Ba, H.S. (2020). The climate-smart village approach: Putting communities at the heart of restoration. *Catalogue.Unccd. Int, December*, 1-8. <https://cgspace.cgiar.org/handle/10568/111416>.
- Siddharam, K.J.B., M., N., A.T., D. and D., B. (2022). Spatio-temporal variability and climate change impact on the crop water requirement of pigeonpea (*Cajanus cajan*) - A case study, north-eastern Karnataka, India. *Legume Research*. 45(6): 780-789. doi: 10.18805/LR-4348.

- Singh, R., Murai, A.S., Chahal, V.P., Singh, R. and Singh, A.K. (2021). Journey of Climate Smart Villages Pilots to Clusters.
- Taqiyah, Y.S. and Fajriyanto, F. (2021). Pemberdayaan masyarakat dalam perwujudan kampung Iklim di perumahan taman nuri tangerang. 402-417. <https://dspace.uui.ac.id/handle/123456789/43510>.
- Teklewold, H., Gebrehiwot, T. and Bezabih, M. (2019). Climate smart agricultural practices and gender differentiated nutrition outcome: An empirical evidence from Ethiopia. *World Development*. 122: 38-53. <https://doi.org/10.1016/j.worlddev.2019.05.010>.
- Terefe, M.K. (2023). Climate change adaptation measures and constraints among smallholder food crop farmers in sayo and dale Sedi District, Ethiopia. *Agricultural Science Digest*. 43(3-6): 274-281.
- Tran, D.D., Dang, M.M., Du Duong, B., Sea, W. and Vo, T.T. (2021). Livelihood vulnerability and adaptability of coastal communities to extreme drought and salinity intrusion in the Vietnamese Mekong Delta. *International Journal of Disaster Risk Reduction*. 57(3): 102183. <https://doi.org/10.1016/j.ijdr.2021.102183>.