

Policies for Overcoming the Impact of El Nino on the Agricultural Sector in Sinjai Regency

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Abstract. *The agricultural sector of Sinjai Regency shows significant vulnerability to climate change, especially the El Nino phenomenon. It was recorded that hundreds of hectares of agricultural land were damaged. The main objective of this research is to comprehensively identify and analyze the impact of El Niño on agricultural land damage in Sinjai Regency. In addition, this research aims to formulate policy recommendations and concrete actions that can be taken by the government and other stakeholders to reduce the negative impact of El Niño. This research uses a qualitative approach. Data was collected through interviews, documentation and field observations. The use of NVivo 12 Plus analysis tools is also maximized. These findings confirm that El Niño has caused significant damage to agricultural land in Sinjai Regency, with 13 hectares experiencing puso or total crop failure, as well as 244 hectares of light damage, 137 hectares of moderate damage, and 50 hectares of heavy damage. This damage has a direct impact on agricultural productivity and food security, threatening farmer incomes and local food supplies. To deal with this impact, the government has implemented adaptive policies such as mapping affected locations, providing clean water, distributing food aid, and supporting farmer groups. Going forward, the government needs to strengthen weather monitoring systems, develop water management infrastructure, improve training for farmers, and strengthen partnerships between various parties to reduce the impact of El Niño and repair land damage.*

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INTRODUCTION

The long dry season that is currently hitting has a serious impact on the agricultural sector in Sinjai Regency. According to data from the local Food Crops, Horticulture and Plantation Service (TPHP), damage to agricultural land reached hundreds of hectares, especially rice crops. Around 13 hectares of rice plants even experienced puso, which means they did not produce any crops at all. Meanwhile, the area of land classified as lightly damaged reached 244 hectares, followed by moderately damaged with an area of 137 hectares, and heavily damaged around 50 hectares (Sinjai Regency Government, 2023). This condition is directly influenced by the El Niño phenomenon, which has disrupted climate patterns, causing severe drought and creating unfavourable conditions for plant growth. Prevention and mitigation efforts need to be carried out immediately to overcome the negative impacts caused by this dry season.

El Niño, a natural phenomenon that occurs when sea surface temperatures in the central and eastern Pacific Ocean increase significantly, has a serious impact on agricultural land (Velivelli et al., 2024). The resulting changes in weather patterns, such as increased air temperatures and lack of rainfall, cause severe droughts (Mugiyo et al., 2023). The soil becomes

dry and infertile, resulting in plants not developing optimally or even dying (Yaling Li, Yi, Wang, & Gudaj, 2019). Apart from that, this phenomenon can also cause flooding in several areas due to extreme changes in rain patterns, which damage agricultural land and infrastructure (Amare, Geremew, Kebede, & Amera, 2024). The adverse impact of El Niño on agricultural land threatens the safety of farmers. It causes large economic losses (Y. Liu, Cai, Lin, Li, & Zhang, 2023), emphasizing the importance of effective mitigation and adaptation efforts in dealing with this natural phenomenon (Ramírez-Gil, Henao-Rojas, & Morales-Osorio, 2020).

The adverse impact of El Niño on farmers and agricultural land managers is very serious. Drought caused by this phenomenon can result in crop failure or a significant reduction in yield, threatening the main source of income for farmers (Karuniasa & Pambudi, 2022). In addition, plant death due to drought results in large financial losses and requires additional time and effort to restore land (Holmgren & Scheffer, 2001). Agricultural infrastructure, such as irrigation canals, can also be affected, limiting water access for surviving crops (Caramanica et al., 2020). These losses not only affect farmers' income directly but also negatively impact food security and the local economy (Singh, Sah, & Singh, 2023).

In dealing with the impact of El Niño on the agricultural sector, the government generally implements various policies to provide assistance and support to farmers and agricultural land managers. This includes monitoring and early warning programs for extreme weather phenomena (Ewbank, Perez, Cornish, Worku, & Woldetsadik, 2019), allocation of funds for rehabilitation of affected land (Bi et al., 2024), provision of efficient irrigation technology (Deshmukh, Kamoshita, Lopez-Galvis, & Pineda, 2021), as well as fiscal incentives and subsidies for farmers who experience losses (Alfani et al., 2021). In addition, the government can also launch price guarantees and agricultural insurance programs to protect farmers from the risk of losses caused by climate fluctuations (Ma et al., 2024). Collaborative efforts between the government, farmers and other stakeholders are key in reducing the negative impacts of El Niño and increasing food security and sustainability of the agricultural sector (Li et al., 2020).

This research is very urgent because overcoming the negative impact of El Niño on the destruction of agricultural land in Sinjai Regency is an urgent need to protect farmers' livelihoods, ensure local food availability, and maintain economic and social stability in the region. By understanding the impact of El Niño and formulating effective policies, this research can become a basis for governments and other stakeholders to take strategic steps in mitigating and adapting to extreme climate change, as well as increasing food security and the sustainability of the agricultural sector in the future.

Even though there have been a number of research results that examine the government's response in overcoming the negative impact of El Niño on agricultural land damage, there are still minimal results that specifically discuss this issue by looking at cases at the local level, such as in Sinjai Regency. The advantage of the solution proposed by the proposer is its precise focus on the relevant local context, namely Sinjai Regency, which allows an in-depth analysis of the impact of El Niño on agriculture in the region. Through this approach, proposers can identify unique challenges at the local level and design mitigation and adaptation strategies that suit the specific needs and characteristics of Sinjai Regency. Thus, this research makes an important contribution to enriching the existing literature and providing new insights on how to overcome the impact of El Niño on the agricultural sector at the local level.

The formulation of this research problem includes two main questions: First, how does the impact of El Niño affect agricultural land damage in Sinjai Regency, especially related to rice crops, including the area of land affected and the level of damage? Second, what policies and actions can be taken by the government and other stakeholders to reduce the adverse impacts of El Niño and improve food security and sustainability of the agricultural sector in the region? The implications of this research provide a deep understanding of the vulnerability of the agricultural sector to extreme climate phenomena, such as El Niño, in Sinjai Regency, as well as guide

policymakers to design effective mitigation strategies to protect farmers' livelihoods and strengthen local food security.

LITERATURE REVIEW

Environmental Policy

Environmental policy is a series of regulations and actions taken by governments or organizations to protect and manage natural resources and reduce the negative impact of human activities on the environment. Theoretically, this policy is often associated with an ecocentric approach, where the main focus is maintaining ecosystem balance and biodiversity. This theory emphasizes the importance of protecting the environment as an integral part of the sustainability of human life and other creatures (Hidjaz, 2019; Nurkaidah et al., 2024). In addition, the theory of natural resources has limited capacity, and if overexploited without regulation, it will cause long-term environmental damage (Ibrahim et al., 2023; Nurkaidah et al., 2024; Wedayanti et al., 2023).

On the other hand, the theoretical approach to environmental policy can also be seen from an environmental economics perspective, which emphasizes the importance of balancing the needs of economic development with environmental sustainability. This theory introduces the concept of negative externalities, namely the negative impact of economic activity on the environment that the economic actors themselves do not bear. In response, environmental policies through regulations and incentives, such as carbon taxes or renewable energy subsidies, are designed to internalize environmental costs into economic decisions. Through this approach, environmental policy aims to achieve sustainable development, where economic, social and environmental needs are met in a balanced manner (Barbier, 2022; Lestaluhu et al., 2023; Obeng-Odoom, 2022).

Environmental policy becomes very relevant in dealing with the El Niño phenomenon, which has a significant impact on the agricultural sector. El Niño causes changes in weather patterns, including increased temperatures and decreased rainfall in many regions, resulting in severe drought. In this case, agriculture is very dependent on stable climatic conditions for sustainable food production (Alfani et al., 2021; Singh et al., 2023). When El Niño occurs, water availability decreases, the land becomes less fertile, and agricultural land productivity decreases drastically. This strengthens the urgency of policies that support sustainable water resources management and agricultural technology that is adaptive to climate change.

From an environmental economics perspective, the impact of El Niño on the agricultural sector also creates significant negative externalities, such as reduced crop yields, increased food prices, and food insecurity in communities (Amare et al., 2024; Singh et al., 2023). Environmental policies that focus on mitigating the impacts of climate change through crop diversification, developing more efficient irrigation systems, and using environmentally friendly technologies are critical to reducing economic and social losses. Incentives for farmers to switch to agricultural practices that are more resilient to climate change, as well as increasing adaptive capacity through education and training, are key to overcoming the impacts of El Niño and maintaining the sustainability of the agricultural sector.

The Role of Government in the Agricultural Sector

The government's role in the agricultural sector is crucial in ensuring food security, improving farmers' welfare, and maintaining the sustainability of food production. The government acts as a policy maker by formulating regulations that support natural resource management, providing subsidies for agricultural inputs such as fertilizer and seeds, and building agricultural infrastructure such as irrigation and road access (Latief & Zhang, 2023; Wang et al., 2024). Apart from that, the government also plays a role in agricultural extension and providing training to farmers to adopt modern agricultural technology in order to increase productivity and efficiency (Tria et al., 2020). Through these programs, the government is trying to maintain the

stability of domestic food production, especially amidst global challenges such as climate change and commodity price fluctuations.

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The role of government is becoming increasingly important in dealing with the impact of El Niño on the agricultural sector, especially because this phenomenon often causes drought, which worsens food production conditions (Alfani et al., 2021; Singh et al., 2023). When El Niño occurs, rainfall decreases drastically, so that agricultural land becomes dry and unproductive. In this situation, the government needs to respond quickly with mitigation policies, such as providing emergency irrigation facilities, building reservoirs, and distributing water aid to affected areas. Apart from that, the government can also provide subsidies for drought-resistant seeds and encourage the implementation of agricultural technology that is more efficient in water use. These steps are important to ensure that food production is maintained, even in extreme weather conditions.

On the other hand, El Niño also causes market uncertainty due to a drastic reduction in crop yields, thus triggering an increase in food prices. In this condition, the government's role in maintaining market stability becomes crucial. The government can regulate national food reserves to cover production shortfalls, as well as intervene in the market to prevent speculation, which causes prices to rise sharply. Apart from that, the government can also provide social assistance to affected farmers, such as crop failure insurance or direct cash assistance, to ease their economic burden. Thus, the government's role in the agricultural sector during El Niño is to ensure food security, maintain economic stability, and protect farmers from the negative impacts of climate change.

METHODS

In this research, a qualitative method was chosen to gain an in-depth understanding of the negative impact of El Nino on agricultural land damage in Sinjai Regency. Data collection was carried out through interviews, documentation, and field observations. The key informants interviewed were the Sinjai Regency Food Crops, Horticulture and Plantation Service (TPHP), including farmers, who have extensive knowledge and experience related to the problem under study. Apart from that, data was also collected from official documents and direct observations in the field to gain a holistic understanding. The use of NVivo 12 Plus analysis tools facilitates comprehensive and systematic data analysis.

Using NVivo 12 Plus in data analysis is very beneficial because this tool facilitates comprehensive and systematic qualitative data analysis. In this study, maximizing the unit of analysis uses the Case Classification feature. This feature allows data to be grouped based on certain characteristics, which helps compare findings in more depth. By transcribing all data obtained, whether from interviews, documents, or observations, NVivo allows researchers to carry out a more efficient and in-depth coding process so that patterns and themes can be clearly identified. The main reason for using NVivo is its ability to manage complex qualitative data, helping researchers organize, analyze, and visualize data in a more structured and meaningful way, which supports the validity and reliability of research results (Salahudin et al., 2020).

Triangulation validation is an important step in ensuring the validity and reliability of research findings. By combining various data sources from interviews, documentation, observation, and FGD, this research ensures the consistency and accuracy of the analysis results. The triangulation validation process also involves comparing and aligning findings from multiple data sources to strengthen the reliability of the interpretation of results. Through this systematic approach, this research will provide an in-depth understanding of the impact of El Nino on the agricultural sector in Sinjai Regency and produce policy recommendations that are relevant and effective.

RESULTS AND DISCUSSION

The Impact of El Niño Affects Agricultural Land Damage in Sinjai Regency

The following is a table showing data on damage to agricultural land in Sinjai Regency due to the long dry season:

Table 1. Damage to agricultural land in Sinjai Regency 2023

Damage Level	Land Area (hectares)
Puso (Not producing)	13
Lightly damaged	244
Moderately damaged	137
Heavily damaged	50

Source: Food Crops, Horticulture and Plantation Service (TPHP), 2023

The El Niño phenomenon has had a significant impact on the agricultural sector in Sinjai Regency, especially on rice plants, which are very vulnerable to climate change. Based on data from the Sinjai Regency Food Crops, Horticulture and Plantation Service (TPHP), the damage to agricultural land recorded was very extensive, with around 13 hectares of rice plants experiencing puso, which means total crop failure with no results at all. This condition illustrates how serious the El Niño threat is to regional food security because puso eliminates land productivity, and this has a direct impact on farmer incomes and local food supplies (Sinjai Regency Government, 2023).

Apart from puso, most of the agricultural land experienced damage to varying degrees. Land with light damage reached 244 hectares, indicating that farmers are starting to feel the impact of the drought, but it can still be repaired with quick action. On the other hand, moderate damage with an area of 137 hectares and heavy damage of 50 hectares indicate land that requires more serious attention, both in terms of land rehabilitation and support for adaptive agricultural technology. Heavy damage shows that the land's ability to support plant growth has been greatly disrupted, so agricultural productivity in the area has greatly decreased (Sinjai Regency Government, 2023).

From a policy and intervention perspective, this emphasizes the importance of the government's role in addressing the impact of El Niño on the agricultural sector. Improving irrigation infrastructure, distributing seeds that are resistant to drought, and access to sustainable agricultural technology can help mitigate losses caused by extreme weather conditions (Fityah Wafa Amatulloh, 2024; Marengo et al., 2022). Support such as crop failure insurance and financial assistance is also needed to ease the economic burden faced by farmers (Eze et al., 2020). With a comprehensive approach, the impact of El Niño on agricultural land damage can be minimized, as well as maintaining the sustainability of the agricultural sector in Sinjai Regency.

To overcome the above problems, the Sinjai Regency government has made several important efforts by implementing adaptive policies, including the following:

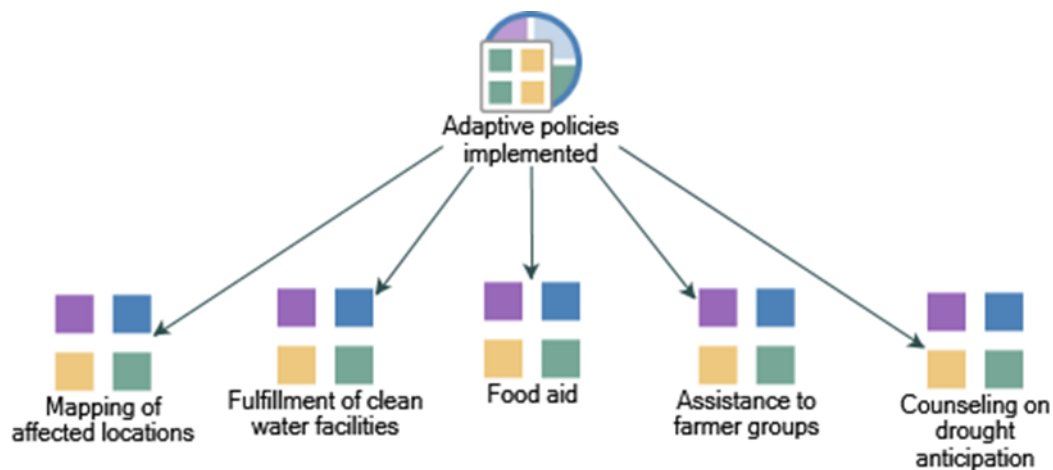


Figure 1. Adaptive policies implemented by the Sinjai Regency government

Source: Processed by researchers via Nvivo 12 Plus, 2024

Figure 1 shows the adaptive policies implemented by the government in dealing with drought conditions, especially the impact of El Niño on the agricultural sector in Sinjai Regency. Mapping affected locations is a crucial first step in dealing with drought, especially to understand the areas that are most vulnerable and require immediate treatment. By identifying the areas most affected, the government and stakeholders can set priorities in handling them, both in terms of distribution of aid, resources, and implementation of needed technology. This mapping allows for more efficient allocation of resources, such as the delivery of clean water, food aid, or distribution of irrigation equipment, so that they are right on target and provide maximum impact. In addition, mapping also helps design long-term strategies to increase the adaptive capacity of these regions against future drought threats.

Providing clean water facilities is a crucial effort in providing water access in drought-affected areas. Prolonged drought can result in water shortages that not only impact agricultural land but also threaten people's daily needs. For this reason, providing clean water facilities must be a priority to ensure the availability of sufficient water for domestic consumption and to support agricultural activities that are essential for food security and community welfare.

With crop yields decreasing due to drought, this policy includes the distribution of food aid as an important step to overcome food insecurity that arises from crop failure. The distribution of food aid aims not only to meet the basic needs of affected communities but also to provide direct support to farmers who experience losses due to extreme weather conditions. With this assistance, it is hoped that the negative impact of drought on food security and the welfare of farmers and society as a whole can be reduced.

Another policy involves providing support to farmer groups to strengthen their resilience in the face of ongoing drought. The support aims to increase the capacity of farmer groups to manage resources more efficiently, modernize agricultural equipment, and increase access to capital needed for adaptation and recovery from the impacts of drought. With this assistance, farmer groups will be better prepared and resilient in facing challenges caused by climate change and extreme weather conditions.

Apart from that, drought anticipation counselling is also designed to provide education to farmers about farming techniques that are more adaptive to dry conditions. This includes more efficient water management, such as using water-saving irrigation systems, as well as selecting plant varieties that are resistant to drought. With the knowledge and skills gained through this extension, farmers are expected to be able to increase their agricultural productivity, reduce losses due to drought, and ensure the sustainability of future harvests.

Policies and Actions that Can Be Carried Out By the Government in the Future

To optimize adaptive policies in dealing with drought, the Sinjai Regency government can consider the following recommendations. First, improving data monitoring and analysis is an important step. The government must strengthen the system for monitoring weather and soil moisture periodically to obtain accurate data on drought conditions (Flores & Salvador, 2024; Liu et al., 2024). This data can be used to plan and implement policies more precisely and responsively. The use of information technology and early warning systems based on weather data will also help in predicting drought events and mitigating their impact before a crisis occurs (Ruiz et al., 2023).

Second, the development of water management infrastructure needs to be prioritized. Although providing clean water facilities has become a priority, the government must consider investing in infrastructure that can store and distribute water more efficiently. This includes the construction of reservoirs, water-saving irrigation systems, and stormwater treatment technologies (Caramanica et al., 2020; Ng et al., 2017). Increasing water storage capacity can help ensure sufficient water availability during prolonged periods of drought.

Third, increased training and counseling for farmers must be expanded and improved. Training programs should include adaptive farming techniques, including the use of drought-resistant crop varieties and better soil management practices (De Silva & Hornberger, 2019; Hairani et al., 2024). Extension must also include agricultural business diversification strategies and education on ways to increase water use efficiency (Gao et al., 2024; Prianto et al., 2024). The involvement of research institutions and academics in this training program can also provide the latest knowledge and techniques that are relevant to local conditions.

Fourth, partnership building and collaboration between government, the private sector and society must be strengthened. This collaboration could include providing resources, technical support, and financing for drought adaptation projects. The government can initiate dialogue and cooperation forums between various parties to formulate more effective and sustainable solutions. Community participation in policy planning and implementation will ensure that the solutions implemented are appropriate to local needs and conditions and increase policy accountability and effectiveness (Guo et al., 2021; Matunhu et al., 2022).

In the context of El Niño, the implications of these adaptive policies for the agricultural sector are very significant. Droughts caused by the El Niño phenomenon can exacerbate water shortages and drastically affect crop yields, causing food insecurity and economic impacts for farmers. By implementing policies such as improving weather monitoring, developing water management infrastructure, and agricultural adaptation education, the government can proactively reduce the negative impact of El Niño. Support to farmer groups and distribution of food aid also plays an important role in mitigating losses. This policy helps farmers adapt to extreme drought conditions, ensures food security, and reduces economic losses that may arise due to extreme weather fluctuations.

CONCLUSION

The impact of El Niño has caused significant damage to agricultural land in Sinjai Regency, with the area of land experiencing various levels of damage reaching worrying figures. Data shows that around 13 hectares of land experienced puso, resulting in total crop failure, while 244 hectares suffered light damage, and 137 hectares and 50 hectares suffered moderate and heavy damage, respectively. This damage directly affects agricultural productivity and food security, threatening farmers' incomes as well as local food supplies. The decline in crop yields due to drought has a negative impact on the agricultural sector, which is very vulnerable to climate change, such as El Niño. To overcome this impact, the Sinjai Regency government has implemented various adaptive policies such as mapping affected locations, providing clean water facilities, distributing food aid, and supporting farmer groups. This policy aims to reduce losses due to drought, increase farmers' adaptive capacity, and ensure food security. However, to

optimize this policy in the future, the government needs to strengthen the weather monitoring system, develop water management infrastructure, improve training and counselling for farmers, and build stronger partnerships between the government, the private sector and the community. These steps will help reduce the impact of El Niño, repair land damage and increase the future resilience of the agricultural sector.

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