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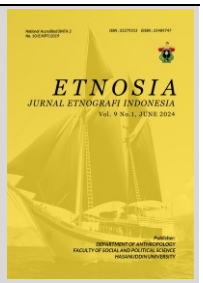

Adaptation of Farmers in Bengawan Solo Watershed in Facing Climate Change

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ABSTRACT

Currently, climate change poses a threat to agriculture, including in the Bengawan Solo watershed. This study aims to explore farmers' perceptions of climate change and understand the adaptations they undertake. The study was conducted in Mejuwet Village, Sumberrejo Subdistrict, Bojonegoro Regency, using qualitative. This study involved six informants, consisting of three farmers and three farm laborers. The selection of informants was based on the criterion of having more than ten years of experience in farming. Data was collected using in-depth interview and observation. Subsequently, the data were analyzed using an interactive model. The study indicates that farmers have knowledge of and can articulate the climate changes they have encountered, albeit with some limitations in understanding, and they actively participate in adaptation efforts. Farmer adaptation encompasses technical modifications like establishing planting schedules and methods, and choosing high-quality varieties. Cultural adaptation encompasses traditions like the wiwitan ceremony. Social adaptation involves using social connections and prioritizing investments in children's schooling. Lastly, economic adaptation involves broadening job opportunities and liquidating assets.

1. Introduction

Climate change refers to the prolonged alteration of temperature and weather patterns, a phenomenon primarily driven by changes in climate patterns attributed to the release of greenhouse gases. These gases, including carbon dioxide and methane, accumulate in the Earth's atmosphere and act as a thermal blanket, trapping heat and leading to a gradual increase in global temperatures,

a process commonly referred to as global warming. The emission of greenhouse gases stems from both natural occurrences and anthropogenic activities, with human-related factors playing a significant role in exacerbating the issue (Fawzy *et al*., 2020).

Natural systems contribute to greenhouse gas emissions through various phenomena such as forest fires, seismic activities like earthquakes, marine processes within oceans, thawing permafrost, the decomposition of organic matter in wetlands, mud volcanoes, and volcanic eruptions (Yue & Gao, 2018). These natural occurrences release substantial amounts of greenhouse gases into the atmosphere, further intensifying the effects of climate change.

Among the sectors impacted by climate change, agriculture stands out as particularly vulnerable (Abeysekara *et al*., 2023; Lail & Suryanto, 2020; Fahad & Wang, 2020; Nhemachena *et al*., 2020). The agricultural sector relies heavily on climatic conditions for successful crop growth and livestock rearing. Shifts in weather patterns, such as irregular rainfall, prolonged droughts, or unexpected extreme weather events, pose significant challenges to agricultural productivity and food security. As such, understanding the complexities of climate change and its implications for agriculture is crucial for developing effective mitigation and adaptation strategies to safeguard food systems and livelihoods.

The agricultural sector is highly dependent on seasonal conditions and rainfall levels. Climate change can result in decreased productivity due to floods, increased air temperatures, droughts, pest attacks, and diseases (Skendžić *et al*., 2021; Yadav *et al*., 2021). These conditions pose a serious threat to food security. Therefore, farmers' adaptation to climate change is a crucial step in maintaining agricultural resilience. Farmers, as key stakeholders in this sector, play a role in addressing the impacts of weather and environmental changes. By exploring adaptation strategies, farmers are not only trying to adjust physically, but also changing behaviours, technologies, and policies. These efforts are crucial in minimizing risks and increasing agricultural productivity. Climate change affects cropping patterns, planting times, production, and agricultural sector yields (Hermans & McLeman, 2021; Aryal *et al*., 2020; Shaffril *et al*., 2018).

As climate change occurs, farmers strive to sustain their farming practices by making various adjustments to farming practices according to prevailing climate conditions. Adaptation to climate change can be formulated with various community actions and can be carried out by individuals, groups, and governments. Adaptation is motivated by various factors including protection of safety and well-being. According to Epule *et al*. (2017:124), adaptation to climate change involves several adaptation categories including technical, cultural, social, and economic aspects. Key factors influencing farmers' adaptation to climate change involve education level, access to credit, experience with climate change, knowledge, beliefs, and farmers' specific needs (Khanal *et al*., 2018; Menike & Arachchi 2016). Meanwhile, the selection of farmers' adaptation methods to climate change is influenced by social, economic, environmental, institutional, and economic structure aspects. Other specific factors such as household size, income, education level, access to climate information,

membership in farmer groups, land location, crop variation, and access to loans have a significant influence on farmers' decisions in adapting. Farmer adaptation steps to climate change include crop diversification and crop varieties, changes in planting/sowing time, irrigation technical management, afforestation, soil conservation practices, and job diversification. These efforts are made to survive under conditions that are less supportive of paddy cultivation (Saputra *et al*., 2023; Tambo & Abdoulaye, 2013).

Rice is the most important food crop in the world. This crop is a staple food for the population in Asia, especially in countries such as China, Indonesia, and Thailand, making rice a commodity with high economic value. Rice plays an important role in food security in various countries. The harvested area of rice in Indonesia in 2022 reached 10.45 million hectares with a production of 54.75 million tons (Badan Pusat Statistik, 2022a). Based on Badan Pusat Statistik (2022b), rice production in Bojonegoro Regency ranked third with a productivity of 715,198.84 tons after Lamongan Regency and Ngawi Regency with rice production of 920,935.59 tons and 785,037.99 tons respectively.

Bojonegoro Regency is a regency traversed by the Bengawan Solo River. This river is one of the largest rivers in East Java and has many tributaries. Bojonegoro Regency can be categorized as an area vulnerable to natural disasters, especially floods. This disaster occurs every year during the rainy season. This condition causes material and non-material losses that are not small in the Bengawan Solo watershed. One of them is Sumberrejo District, especially Mejuwet Village, which is located to the east of the area where the Rancang River (Pohwates River) is located, which is a tributary of the Bengawan Solo River (Badan Pusat Statistik, 2015a). The Rancang River is utilized by farmers in Mejuwet Village for irrigation. On the other hand, the Rancang River also causes vulnerability during the rainy season. The Rancang River overflows, causing floods and inundating rice fields. Flood disasters caused by climate change have led farmers in Mejuwet Village to make various adaptations. Therefore, this research aims to: (1) explore farmers' perceptions on climate change; (2) discuss about the adaptations made by farmers to climate change.

2. Method

This research was conducted in Mejuwet Village, Sumberrejo District, Bojonegoro Regency, from August 2023 to February 2024. Mejuwet Village is located in Sumberrejo District, Bojonegoro Regency, East Java Province. The population of the village reaches 2,254 inhabitants. Land use is divided for public facilities, residential areas, agricultural land, and economic activities. Mejuwet Village is a lowland area and this condition makes Mejuwet Village have high agricultural potential. The supportive natural conditions make the majority of the population, numbering 638 people, rely on agriculture for their livelihoods, both as farmers and farm laborers.

Agricultural land in Mejuwet Village covers an area of 80 hectares with rice and corn as the main crops. Farmers in this village carry out three planting seasons per year with irrigated rice fields. The common planting pattern used is rice-corn.

In addition to farming, farmers also engage in planting backyard crops and small-scale livestock farming such as poultry, goats, and cattle. Although the agricultural potential in Mejuwet Village is significant, agricultural land often faces problems due to flooding caused by the overflowing of the Rancang River. Therefore, it was purposively chosen as a research site.

This study involved six informants, consisting of three farmers and three farm laborers. The selection of informants was based on the criterion of having more than ten years of experience in farming. This criterion was intended to provide an overview of behavioural changes in the form of adaptations to climate change. The selection of these two groups of informants is expected to provide information on the differences in strategies for dealing with climate change.

The approach used in this research is a qualitative approach. The type of data used in this research is primary data obtained through in-depth interviews and observations. The in-depth interview topics included information on the climate changes perceived by the informants, the impacts of these changes, and their strategies for coping with climate change. Observations were focused on gathering information about the agricultural conditions and the activities conducted by the community at the research location.

Data analysis refers to an interactive model (Miles *et al*., 2018). This study employed descriptive coding, in vivo coding, and process coding techniques. Initially, descriptive coding was used to label basic information and opinions extracted from the data, such as identifying prevalent concerns about "water scarcity". Subsequently, in vivo coding preserved the participants' language verbatim, capturing their direct expressions and emotions, such as articulating anxieties about future uncertainties. Finally, process coding was employed to organize data units into thematic categories that reflected the sequence of events or evolving processes observed over time, exemplified by stages like awareness of climate change impacts, adaptation strategy formulation, and implementation of mitigation measures. These coding techniques facilitated a nuanced and structured analysis, enabling a comprehensive interpretation of the phenomena under investigation.

In conducting this research, all informants provided consent to participate, ensuring confidentiality and anonymity of the informants, as well as transparency regarding the research purpose and how the data would be used. While participation was voluntary, and informants could withdraw at any time without any consequences, all of them were willing to participate

3. Result and Discussion

- **Farmers' Perceptions of Climate Change**

Farmers' perceptions of climate change primarily revolve around the increasing unpredictability of weather patterns, such as extended dry seasons, higher rainfall during the rainy season, and more extreme weather conditions. They have observed longer droughts, intense rainy periods, more frequent storms, rising temperatures during the dry season, and water shortages (Below *et al*.,

2015; Turasih & Kolopaking, 2016). Farmers in Mejuwet Village are aware that there are climate changes occurring in their village, although still with limited understanding. Therefore, three indicators perceived by farmers, namely changes in wind speed, temperature changes, and changes in rainfall occurring in Mejuwet Village, as simplified in Table 1.

Table 1. Farmer Knowledge of Climate Change

No.	Indicator of Knowledge	Statement	Implication
1.	Wind speed	Farmers understand changes in wind speed	Plants collapse easily
2.	Temperature changes	Increase in average temperature	Increase pests and diseases in plants
3.	Changes in rainfall	The intensity and duration of rainfall are not yet fully understood	Difficult to determine planting schedules

Source: Primary data, 2024.

Wind speed has a significant impact on rice farming, where strong winds can risk causing the plants to topple or collapse, while conversely, if the wind speed is normal, the plants can grow upright. Farmers' knowledge in Mejuwet Village is limited and uneven. Their understanding of climate change relies more on personal experiences perceived directly. Understanding related to changes in wind speed is limited to strong winds blowing. This situation is influenced by the lack of group meetings, especially on the topic of wind speed. The lack of information regarding wind speed makes farmers in Mejuwet Village seek this knowledge independently. The adaptation undertaken by farmers to cope with changes in wind speed is by planting superior varieties, namely Ciherang and Inpari 42. Inpari 42 variety has a level of resistance to lodging (Romdon, 2022). If the planted rice still collapses, the farmers will perform staking on the stems to make them sturdy again to prevent rotting.

Temperature changes perceived by farmers between the winter and dry seasons are hotter conditions during the dry season and cooler during the rainy season. In the dry season, temperatures rise to 34^{o} - 36^{o} C and even during extreme weather, temperatures can increase to 38^{o} C. Meanwhile, in the rainy season, temperatures drop to cooler temperatures of 27^{o} - 34^{o} C. Farmers explain that temperature changes have a significant impact, especially regarding the increase in plant pests and diseases, and also soil dryness. Increased temperature and air humidity can trigger plant pests (Nuraisah *et al*., 2019). The major pests that commonly affect rice production include the brown planthopper (*Nilaparvata lugens*) and rats. These pests are known to cause significant damage to rice crops, affecting both yield and quality. Farmers also use pesticides and rat hunts as preventive measures to prevent the emergence of plant pests and diseases.

Rainfall greatly affects the growth and development of plants. When rainfall increases, the water needs of the plants can be optimally met. However, excessive

rainfall can cause floods and crop failures. In Mejuwet Village, most farmers are aware of changes in rainfall but do not fully understand its intensity and duration. Farmers noted that rainfall tends to increase. This limited understanding makes it difficult for them to determine planting schedules. To cope with changes in rainfall, farmers in Mejuwet Village use planting patterns and local planting calendars to guide their planting according to prevailing climate conditions and avoid unpredictable rainfall patterns. Farmers no longer use traditional planting calendars, such as *pranoto mongso*. Interview results indicate that farmers are no longer familiar with the term *pranoto mongso* and do not know what it refers to, as stated by Dakir (57 years), as follows:

> We never clearly understood what pranoto mongso is. We occasionally hear this term, which is said to be a Javanese calendar system associated with weather conditions, serving as a guide for planting rice in the fields. However, perhaps because irrigation is now good, farmers in Java have forgotten it. Additionally, due to shifting weather patterns, the rainy season sometimes brings no rain, and vice versa.

- **Farmers' Adaptation to Climate Change**

The climate change that occurs has an impact on farming conducted by farmers. According to Epule *et al*. (2017:124), there are three forms of adaptations, namely adaptations related to cultivation techniques, cultural adaptations, and economic adaptations. This is also the case in Mejuwet Village in which three forms of adaptation occur, which will discuss in the following sub-sections.

Technical Adaptation

The planting calendar is a tool that provides guidelines for planting time, fertilizer recommendations, and optimal varieties to cultivate (Wihardjaka *et al*., 2020). This planting calendar plays a crucial role in mitigating the effects of climate change and improving agricultural adaptation strategies in Mejuwet Village. Farmers rely on a straightforward yet effective method to determine optimal planting and fertilization times. By aligning their planting schedule with seasonal cycles and the specific nutritional needs of their crops, farmers can maximize crop yield and resilience to fluctuating weather patterns. Beyond its practical application, the planting calendar also incorporates cultural beliefs and traditions that guide farmers' decisions. For instance, farmers avoid planting on days that coincide with significant events like the death anniversary (*geblak*) of their parents. This cultural practice reflects a deep-seated belief that planting on these days may lead to sub-optimal yields. Instead, they choose dates perceived as more auspicious, ensuring better outcomes for their agricultural endeavours. Moreover, the adoption of this planting calendar underscores the adaptation strategies evolving in response to changing climate conditions. By blending traditional knowledge with modern agricultural insights from extension services, farmers in Mejuwet Village are enhancing their ability to manage risks associated with extreme weather events, such as floods or droughts. This integrated approach not only supports sustainable agricultural practices, but also preserves

cultural heritage, demonstrating the resilience and ingenuity of local farming communities in adapting to environmental challenges.

Planting patterns are efforts in agriculture to achieve optimal results by considering factors such as climate, soil conditions, and the types of crops planted (Tentua *et al*., 2022:24). The planting patterns adopted by farmers in Mejuwet Village are closely tied to rainfall patterns. Farmers schedule their planting simultaneously and uniformly to facilitate consistent monitoring of the crops throughout their growth cycle. In Mejuwet Village, the planting pattern consists of three cycles per year. The first planting season spans from October to March, while the second planting season occurs from April to June. The third planting cycle runs from July to September.

The cropping patterns practiced by farmers in Mejuwet Village have traditionally been passed down through generations. However, these practices have evolved in response to climate change, including shifts in seasons. Farmers now incorporate information from agricultural extension services to design their cropping patterns. Additionally, they rely on past experiences, particularly concerning extreme weather conditions in specific months that can lead to floods. A farmer, named Mulyo (64 years), stated that: "Farmers have always relied on experience as a guide in agricultural activities. Reflecting on past years, farmers have prepared for risks such as floods."

According to Pramono & Romdon (2022:14), the selection of superior varieties becomes an effective adaptation measure to address the impacts of climate change in the agricultural sector, which tends to be vulnerable. Farmers in Mejuwet Village take proactive steps by choosing superior plant varieties. The varieties chosen by farmers are those that have resilience to extreme conditions and specific circumstances. Additionally, consideration of disease or pest resistance is a primary factor in selecting plant varieties.

Before the onset of climate change and irrigation systems, farmers in Mejuwet Village selected upland rice varieties known for their long growing periods and drought tolerance. However, in response to climate change impacts, farmers have shifted their preference to varieties like Ciherang and Inpari 42. These varieties are planted during the first planting season, spanning from October to March. They are favoured for their tall and sturdy stems, which can withstand extreme weather conditions and ensure optimal yields even under adverse circumstances. During the second planting season, from April to June, farmers opt for Mekarsari and Inpari 32 rice varieties. These varieties have a shorter growth cycle of approximately 70 days. Choosing varieties with shorter growth periods helps farmers anticipate the impending dry season effectively. This strategy not only mitigates risks associated with climate variability, but also enhances the overall planting efficiency and productivity (Wihardjaka *et al*., 2020:27). During the third planting season from July to September, coinciding with the dry season, farmers in Mejuwet Village transition to planting pulses and horticultural crops. This strategic shift is based on the crops' lower water requirements and their perceived higher economic value.

Cultural Adaptation

The tradition of *wiwitan* is a ritual of thanksgiving and gratitude to the earth, *sedulur sikep*, and Dewi Sri (the goddess of rice) for the abundance harvest from previously planted crops (Salsabila, 2022:267). Essentially, *wiwitan* is a prayerful expression of gratitude for the bountiful harvest seen as a divine gift. This ritual encourages social interaction among farmers and symbolizes their deep connection with nature. In the Javanese cultural context, *wiwitan* is viewed as a gesture of appreciation and respect towards the earth, acknowledging the harvest as the life source for farmers.

In Mejuwet Village, *wiwitan* processions are a tradition conducted twice during each agricultural cycle. The first *wiwitan* occurs as farmers prepare to plant rice, while the second is held during the harvest of their agricultural produce. These rituals take place in the rice fields, fostering a sense of togetherness and harmony among farmers. During the *wiwitan* ceremony, a *takir*—a small container filled with food placed on a banana leaf—is central to the proceedings. The *takir* is traditionally positioned facing northeast, following ancestral teachings, and is accompanied by the burning of rice husks. Its contents include *buceng* (small cone-shaped rice), candlenuts, shallots, garlic, dried anchovies, betel leaves, small change (coins), and eggs. There is a distinction in the eggs used between the first and second *wiwitan* ceremonies. In the first *wiwitan*, raw eggs are used, while in the second *wiwitan*, boiled eggs are offered.

Currently, the tradition of *wiwitan* continues to be observed by farmers in Mejuwet Village. However, there have been changes in its practice, influenced notably by Islamic values. One adaptation is the inclusion of Islamic prayers during the *wiwitan* ceremony. According to Mulyo (64 years old),

> *Wiwitan* is not only an expression of gratitude but also a communal prayer to God. Furthermore, *wiwitan* serves as a symbol of unity, where the community comes together to eat and share in the ritual. In today's era, *wiwitan* is seen not just as an offering, but more as a communal feast.

Social Adaptation

In addressing the formidable challenges presented by climate change, social strategies are instrumental in fostering effective adaptation efforts. Among these strategies, leveraging social networks plays a crucial role. These networks serve as vital platforms for communities to share essential resources and information related to climate change impacts. One significant aspect of utilizing social networks is evident in financial resilience. Communities can pool resources through these networks, enabling them to borrow or share capital. This practice proves invaluable during times of climate-induced crises such as natural disasters or unpredictable planting seasons. By mobilizing financial resources collectively, communities enhance their capacity to withstand economic shocks and recover more swiftly from climate-related setbacks. Moreover, social networks facilitate mutual support among individuals and communities. Beyond financial assistance, they foster solidarity and cooperation, essential for navigating the complexities of climate change. Through shared experiences and

knowledge exchange, communities can adopt and implement effective adaptation practices more rapidly. This dissemination of information not only strengthens collective awareness but also promotes concerted action towards sustainable solutions. In essence, the utilization of social networks as a strategy in climate adaptation empowers communities to build resilience and adaptability. By enhancing collaboration and resource-sharing, these networks contribute significantly to mitigating the impacts of climate change and fostering sustainable development in the face of evolving environmental challenges.

In Mejuwet village, like in many rural communities, a pattern of social exchange known as reciprocity is widely practiced. This reciprocal exchange is evident in the mutual assistance provided to neighbours or relatives during significant life events ranging from births and circumcisions to marriages and deaths. Similar patterns of social reciprocity can also be observed in other rural areas (Ari *et al*., 2024; Ayuwandani & Tondok, 2024; Prasetyo *et al*., 2013). Contributions are extended to neighbours or relatives during significant life events such as birth, circumcision, marriage, and death in Mejuwet village. Upon closer scrutiny, this reciprocity not only fosters social cohesion but also ensures livelihood security, especially crucial during times of crop failures attributed to climate change. This support network enables the community to uphold customary events and rituals, even amid agricultural challenges and personal milestones like births and deaths.

Investing in children's education is a strategic step taken by farmers to improve the quality of life and create a better future for their families (Epule *et al*. 2017; Opondo, 2013). Farmers consistently save and allocate a portion of their harvest to finance their children's education, without hesitation to spend a considerable amount. Many farmers are committed to support their children's education. This effort is not only limited to primary education, but also strives to ensure that their children can complete education up to the high school level, and in some cases, they manage to fund their children's education up to college.

Children's education plays a crucial role in changing the mindset of farmers and supporting the effectiveness of agricultural extension. Children from farming families who receive good education tend to bring new knowledge about modern farming practices into the family environment. They become agents of change by being open to innovative ideas and implementing sustainable practices in agriculture. Their interest in more scientific farming encourages them to seek new information and actively participate in agricultural extension activities. Thus, it can be said that children's education directly influences the mindset of farmers and helps enhance adaptation to changes in agriculture.

Economic Adaptation

Job diversification is a strategy adopted by individuals or households to rely on more than one source of income (Widodo, 2009; 2011). The primary factor driving rice farmers in Mejuwet Village to diversify their jobs is urgent economic needs. Job diversification is seen as a response to economic challenges and as a way to utilize leisure time while waiting for the planting season. Economic factors are

the main driving force behind farmers' willingness to explore additional income and reduce financial risks during the periods between harvests.

The majority of farmers seek job diversification opportunities by managing small-scale farms. These farms include raising cattle, goats, and poultry. This action is taken as a strategy to provide backup resources to address urgent and unforeseen needs, such as healthcare and education expenses. Additionally, farmers and agricultural labourers actively utilize their alternative skills and expertise. Common side jobs for farmers include carpentry, construction work, and others, as a means to increase their income. Job diversification is an adaptive response to economic needs and creates opportunities to optimize farmers' potential in various endeavors (Asante *et al*., 2021; Funk *et al*., 2020; Mohammed *et al*., 2021).

Storage and asset sales are crucial elements in the economic activities of farmers in Mejuwet Village. These activities have a direct impact on income, business sustainability, and create sustainable economic opportunities. Farmers employ strategies involving the sale of a portion of their harvest to meet daily needs, while the remainder is preserved and stored as initial capital for the next planting season. Farmers utilize homes or storage warehouses to maintain the quality of their harvest. Stored rice is considered a form of savings for farmers, in addition to saving in the form of funds in bank accounts. Farmers in Mejuwet Village engage in rice storage as part of their storage strategy. Storage strategies are not limited to storing value in the form of money, but also involve storing rice as a precautionary measure against possible drought and crop failure (Putri & Anugrahini, 2023).

4. Conclusion

Farmers in various regions have developed an understanding of the climate changes they are experiencing. Although their knowledge is limited in some aspects, this understanding reflects a keen awareness of shifts in weather patterns, temperature fluctuations, and other climatic variables affecting their agricultural activities. Despite these limitations, farmers demonstrate a remarkable ability to articulate their observations and experiences related to climate change, indicating their active engagement in adaptation strategies.

One primary way farmers adapt to climate change is through technical adjustments in their agricultural practices, such as modifying planting calendars and patterns to align with shifting climatic conditions. In addition to technical adaptations, farmers engage in cultural practices to cope with climate change. These cultural adaptations are often deeply rooted in tradition and community rituals. For example, the *wiwitan* ceremony, a traditional Javanese ritual conducted before planting, serves as a symbolic gesture to seek blessings for a bountiful harvest and protection from environmental uncertainties. Social adaptation plays a crucial role in farmers' resilience to climate change, as they leverage social networks to share knowledge, resources, and support. Through community networks and cooperation, farmers exchange information about

climate-smart practices, access financial assistance, and provide mutual aid during times of need.

Additionally, investing in children's education is viewed as a long-term social adaptation strategy, as educated youth are better equipped to navigate changing agricultural landscapes and contribute to sustainable farming practices in the future. Economic adaptation strategies are also prevalent among farmers facing climate change pressures. Diversifying sources of income through off-farm employment or alternative livelihoods helps farmers buffer against fluctuations in agricultural productivity and income loss due to climate-related events. Moreover, selling assets, such as land or livestock, may provide short-term financial relief during periods of economic hardship exacerbated by climate change impacts.

Farmers demonstrate a multifaceted approach to adaptation in response to climate change, encompassing technical, cultural, social, and economic dimensions. Despite challenges and limitations, their proactive engagement in adaptation activities reflects their resilience and determination to safeguard their livelihoods and agricultural practices amidst a changing climate

Conflicts of Interest:

The authors declare no conflict of interest.

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References

Abeysekara, W. C. S. M.; Siriwardana, M.; & Meng, S. (2023). Economic Consequences of Climate Change Impacts on the Agricultural Sector of South Asia: A Case Study of Sri Lanka, *Economic Analysis and Policy*, 77:435–450, https://doi.org/10.1016/j.eap.2022.12.003, accessed on 12 March 2024.

Ari, I. R. D.; Prayitno, G.; Fikriyah, F.; Dinanti, D.; Usman, F.; Prasetyo, N. E.; Nugraha, A. T.; & Onishi, M. (2024). Reciprocity and Social Capital for Sustainable Rural Development, *Societies*, 14(2):1-18, https://doi.org/10.3390/soc14020014, accessed on 12 March 2024.

Aryal, J. P.; Sapkota, T. B.; Khurana, R.; Khatri-Chhetri, A.; Rahut, D. B.; & Jat, M. L. (2020). Climate Change and Agriculture in South Asia: Adaptation Options in Smallholder Production Systems, *Environment, Development and Sustainability*, *22*(6):5045–5075, https://doi.org/10.1007/s10668-019-00414-4, accessed on 10 March 2024.

Asante, F.; Guodaar, L.; & Arimiyaw, S. (2021). Climate Change and Variability Awareness and Livelihood Adaptive Strategies among Smallholder Farmers in Semi-Arid Northern Ghana, *Environmental Development*, 39(100629):1-14, https://doi.org/10.1016/j.envdev.2021.100629 accessed on 15 March 2024

Asyrofi Haqul Lail, M. & Suryanto, S. (2020). Faktor-faktor yang Mempengaruhi

Keputusan Petani Membangun Melakukan Adaptasi Perubahan Iklim, *Jurnal Penelitian Pengelolaan Daerah Aliran Sungai*, 4(2):121–136, https://doi.org/10.20886/jppdas.2020.4.2.121-136, accessed on 2 April 2024.

Ayuwandani, Y. & Tondok, M. S. (2024). Aspek-aspek psikologis dalam tradisi "Nyumbang" Masyarakat Suku Jawa, *Santhet: Jurnal Sejarah, Pendidikan dan Humaniora*, 8(1):178–187, https://doi.org/https://doi.org/10.36526/santhet.v8i1.3326, accessed on 10 March 2024.

Badan Pusat Statistik. (2015a). *Nama dan panjang Sungai Kabupaten Bojonegoro*, https://bojonegorokab.bps.go.id/statictable/2015/03/25/108/nama-dan-panjang-sungai-kabupaten-bojonegoro.html, accessed on 12 March 2024.

Badan Pusat Statistik. (2015b). *Tinggi Dari Permukaan Laut, Hari, dan Rata-Rata Curah Hujan di Kabupaten Bojonegoro*, https://bojonegorokab.bps.go.id/statictable/2015/03/24/89/tinggi-dari-permukaan-laut-hari-dan-rata-rata-curah-hujan-di-kab-bojonegoro.html, accessed on 12 March 2024.

Badan Pusat Statistik. (2022a). *Luas Panen dan Produksi Padi di Indonesia Menurut Provinsi, Tahun 2023*, https://www.bps.go.id/pressrelease/2023/03/01/2036/pada-2022--luas-panen-padi-mencapai-sekitar-10-45-juta-hektar-dengan-produksi-sebesar-54-75-juta-ton-gkg-.html, accessed on 12 March 2024.

Badan Pusat Statistik. (2022b). *Produksi Padi dan Beras Menurut Kabupaten/Kota di Provinsi Jawa Timur, Tahun 2021 dan 2022*, https://jatim.bps.go.id/statictable/2023/03/16/2523/-produksi-padi-dan-beras-menurut-kabupaten-kota-di-provinsi-jawa-timur-2021-dan-2022-.html, accessed on 12 March 2024.

Below, T. B.; Schmid, J. C.; & Sieber, S. (2015). Farmers' Knowledge and Perception of Climatic Risks and Options for Climate Change Adaptation: A Case Study From Two Tanzanian Villages, *Regional Environmental Change*, 15(7):1169–1180, https://doi.org/10.1007/s10113-014-0620-1, accessed on 20 March 2024.

Epule, T. E.; Ford, J. D.; Lwasa, S., & Lepage, L. (2017). Climate Change Adaptation in The Sahel. *Environmental Science & Policy*, 75:121–137. https://doi.org/10.1016/j.envsci.2017.05.018, accessed on 18 March 2024.

Fahad, S. & Wang, J. (2020). Climate Change, Vulnerability, and its Impacts in Rural Pakistan: a Review, *Environmental Science and Pollution Research*, 27(2):1334–1338. https://doi.org/10.1007/s11356-019-06878-1, accesed on 18 March 2024.

Fawzy, S.; Osman, A. I.; Doran, J.; & Rooney, D. W. (2020). Strategies for Mitigation of Climate Change: a Review, *Environmental Chemistry Letters*, 18(6):2069–2094, https://doi.org/10.1007/s10311-020-01059-w, accessed on 12 March 2024.

Funk, C.; Raghavan Sathyan, A.; Winker, P.; & Breuer, L. (2020). Changing Climate - Changing Livelihood: Smallholder's Perceptions and Adaption Strategies, *Journal of Environmental Management*, 259(109702):1-16, https://doi.org/10.1016/j.jenvman.2019.109702, accessed on 20 April 2024.

Hermans, K. & McLeman, R. (2021). Climate Change, Drought, Land Degradation and Migration: Exploring the Linkages, *Current Opinion in Environmental Sustainability*, 50:236–244, https://doi.org/10.1016/j.cosust.2021.04.013, accessed on 12 March 2024.

Khanal, U.; Wilson, C.; Hoang, V.-N.; & Lee, B. (2018). Farmers' Adaptation to Climate Change, its Determinants and Impacts on Rice Yield in Nepal. *Ecological Economics*, 144:139–147, https://doi.org/10.1016/j.ecolecon.2017.08.006, accessed 30 March 2024.

Menike, L. M. C. S. & Arachchi, K. A. G. P. K. (2016). Adaptation to Climate Change by Smallholder Farmers in Rural Communities: Evidence from Sri Lanka, *Procedia Food Science*, 6:288–292, https://doi.org/10.1016/j.profoo.2016.02.057, accessed on 30 March 2024.

Miles, M.; Huberman, M.; & Saldana, J. (2018). *Qualitative Data Analysis: A Methods Sourcebook*. California: Sage Publications.

Mohammed, K.; Batung, E.; Kansanga, M.; Nyantakyi-Frimpong, H.; & Luginaah, I. (2021). Livelihood Diversification Strategies and Resilience to Climate Change in Semi-Arid Northern Ghana. *Climatic Change*, 164(53):1-23, https://doi.org/10.1007/s10584-021-03034-y, accessed on 20 March 2024.

Nhemachena, C.; Nhamo, L.; Matchaya, G.; Nhemachena, C. R.; Muchara, B.; Karuaihe, S. T.; & Mpandeli, S. (2020). Climate Change Impacts on Water and Agriculture Sectors in Southern Africa: Threats and Opportunities for Sustainable Development, *Water*, 12(10):1-17, https://doi.org/10.3390/w12102673, accessed on 22 March 2024.

Nuraisah, G.; Kusumo, B.; & Andriani, R. (2019). Dampak Perubahan Iklim Terhadap Usahatani Padi di Desa Wanguk, Kecamatan Anjatan, Kabupaten Indramayu, *Mimbar Agribisnis: Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, 5(1): 60-71, https://doi.org/10.25157/ma.v5i1.1639, accessed on 12 February 2024.

Opondo, D. O. (2013). Erosive Coping After The 2011 Floods in Kenya, *International Journal of Global Warming*, 5(4):452-466, https://doi.org/10.1504/IJGW.2013.057285, accessed on 20 April 2024.

Pramono, J. & Romdon, A. S. (2022). Peningkatan Produktivitas Melalui Perbaikan Sistem Budidaya Padi Sawah di Tengah Ancaman Perubahan Iklim, *Jurnal Prodi Agribisnis*, 3(2):9–19, https://doi.org/10.56869/kaliagri.v3i2.409, accessed on 16 March 2024.

Prasetyo, Y. E., Sumarti, T., Prasodjo, N. W., & Abbas, A. (2013). Potret Pertukaran Sosial di Pedesaan: Studi Kasus Terhadap Gantangan di Tiga Desa Miskin di Kabupaten Subang. *Seminar Nasional & Workshop : Peningkatan Inovasi Dalam Menanggulangi Kemiskinan – LIPI 2013*, 534–544.

Putri, K. S., & Anugrahini, T. (2023). Strategi Bertahan Hidup Petani Padi Sawah Tadah Hujan Pada Musim Kemarau di Desa Cilebak, *Pekerjaan Sosial*, 22(1):69–83. https://doi.org/10.31595/peksos.v22i1.305, accessed on 15 March 2024.

Romdon, A. (2022). Preferensi dan Adopsi Petani Terhadap Varietas Unggul Baru Padi di Provinsi Jawa Tengah, *Jurnal Pangan*, 31(1):13–32,

https://doi.org/10.33964/jp.v31i1.569, accessed on 25 April 2024.

Salsabila, H. (2022). Perubahan Tradisi Wiwitan di Desa Turipinggir, Kecamatan Megaluh, Kabupaten Jombang (1980-2021), *Historiography*, 2(2):265-276, https://doi.org/10.17977/um081v2i22022p265-276, accessed on 20 March 2024.

Saputra, I.; Prasmatiwi, F. E.; Abidin, Z.; & Setiawan, A. (2023). Persepsi Petani Padi Sawah Irigasi dan Tadah Hujan Terhadap Perubahan Iklim di Kabupaten Lampung Selatan, *Jurnal Ekonomi Pertanian dan Agribisnis*, 7(1):166-175, https://doi.org/10.21776/ub.jepa.2023.007.01.15, accessed on 25 April 2024.

Shaffril, H. A. M.; Krauss, S. E., & Samsuddin, S. F. (2018). A Systematic Review on Asian's Farmers' Adaptation Practices Towards Climate Change, *Science of The Total Environment*, 644:683–695, https://doi.org/10.1016/j.scitotenv.2018.06.349, accessed on 20 March 2024.

Skendžić, S.; Zovko, M.; Živković, I. P.; Lešić, V.; & Lemić, D. (2021). The Impact of Climate Change on Agricultural Insect Pests, *Insects*, 12(5):440-458, https://doi.org/10.3390/insects12050440, accessed on 25 April 2024.

Tambo, J. A. & Abdoulaye, T. (2013). Smallholder Farmers' Perceptions of and Adaptations to Climate Change in the Nigerian Savanna, *Regional Environmental Change*, 13(2):375–388, https://doi.org/10.1007/s10113-012-0351-0, accessed on 18 March 2024.

Tentua, E.; Laimeheriwa, S.; & Patty, J. R. (2022). Analisis Musim Tanam dan Pengaturan Pola Tanam Tanaman Pangan pada Berbagai Kondisi Curah Hujan di Daerah Amahai Kabupaten Maluku Tengah, *Jurnal Pertanian Kepulauan*, 6(1):23–37, https://doi.org/10.30598/jpk.2022.6.1.23, accessed on 18 March 2024.

Turasih, M. & Kolopaking, L. (2016). Strategi Adaptasi Perubahan Iklim Pada Petani Dataran Tinggi: Studi Petani di Dataran Tinggi Dieng, Kabupaten Banjarnegara, *Sodality: Jurnal Sosiologi Pedesaan*, 4(1):70-82, https://doi.org/10.22500/sodality.v4i1.14408, accessed on 1 March 2024.

Widodo, S. (2009). Strategi Nafkah Rumah Tangga Nelayan dalam Menghadapi Kemiskinan. *Jurnal Kelautan*, 2(2):150–157, https://doi.org/10.21107/jk.v2i2.856, accesed on 12 December 2009.

Widodo, S. (2011). Strategi Nafkah Berkelanjutan Bagi Rumah Tangga Miskin di Daerah Pesisir, *Makara Human Behavior Studies in Asia*, 15(1):10-20, https://doi.org/10.7454/mssh.v15i1.890, accessed on 18 July 2011.

Wihardjaka, A.; Pramono, A.; & Sutriadi, M. T. (2020). Peningkatan Produktivitas Padi Sawah Tadah Hujan Melalui Penerapan Teknologi Adaptif Dampak Perubahan Iklim, *Jurnal Sumberdaya Lahan*, 14(1):25–36, https://epublikasi.pertanian.go.id/berkala/jsl/article/view/3338, accessed on 18 March 2024.

Yadav, P.; Jaiswal, D. K.; & Sinha, R. K. (2021). Climate Change: Impact on Agricultural Production and Sustainable Mitigation. In *Global Climate Change*, 151–174, https://doi.org/10.1016/B978-0-12-22928-6.00010-1, accessed on 19 March 2024.

Yue, X.-L. & Gao, Q.-X. (2018). Contributions of Natural Systems and Human

Activity to Greenhouse Gas Emissions, *Advances in Climate Change Research*, 9(4):243–252, https://doi.org/10.1016/j.accre.2018.12.003, accessed on 19 March 2024.