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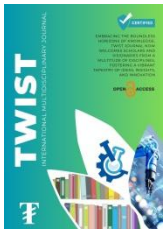

Climate Change Awareness and Farming Adaptation Practices among Rice Farmers in Surallah, Philippines

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Abstract
The increasing unpredictability of climate patterns has made rice farming more vulnerable, particularly in developing countries like the Philippines where smallholder farmers dominate the agricultural landscape. This study examined the level of climate change awareness and the extent of adaptation practices among upland and lowland rice farmers in the Municipality of Surallah, South Cotabato. A quantitative descriptive-comparative approach was employed using a total enumeration of 74 respondents—34 from upland areas and 40 from lowland zones. Data were gathered through adapted and validated survey instruments, and analyzed using descriptive statistics and independent samples t-tests. Findings revealed that upland farmers were generally less aware of climate change compared to their lowland counterparts. Likewise, adaptation practices were more frequently applied in the lowland context. Significant differences were observed in both awareness and adaptation practices between the two groups. These results suggest the need to strengthen localized information campaigns and ensure that adaptation resources reach farmers in more geographically isolated areas. This study contributes to local-level planning and reinforces the importance of differentiated support based on geographical and socioeconomic conditions.

Keywords
Climate change awareness, Adaptation practices, Upland farmers, Lowland farmers, Rice farming, Surallah, South Cotabato, Agricultural resilience, Smallholder farming, Climate variability

INTRODUCTION

Climate variability has become one of the major challenges confronting global agriculture. Its effects are most pronounced in regions where farming remains the primary source of income and food security. Unstable rainfall patterns, extended dry periods, and increasingly severe weather disturbances have disrupted planting calendars, reduced harvests, and intensified the vulnerability of farming households (Abebaw, 2025). In tropical countries where rice is the dominant crop, these environmental pressures threaten not only productivity but also the broader social and economic stability of rural communities.

In low- and middle-income countries, where the majority of smallholder farmers lack access to sophisticated farming technologies or predictive climate tools, responses to these changes are shaped largely by direct experience and local knowledge. Shifts in rainfall, unusual heat, or delayed monsoons are often recognized informally, and farmers rely heavily on these observed patterns to make decisions on planting, harvesting, and resource allocation (Rivera-Ferre et al., 2021). The recognition of such changes, however, varies significantly among farming communities and is influenced by education, access to information, and previous exposure to environmental risks.

In the Philippines, where rice production is central to both subsistence and commerce, the agricultural sector remains highly sensitive to climate fluctuations (Tandog & Condes-Tandog, 2023). Farmers in different geographical settings, such as upland and lowland areas, are exposed to varying degrees of risk depending on their location, access to water, and support infrastructure. Upland farmers often contend with steeper terrain, weaker soil conditions, and minimal irrigation, while lowland farmers typically operate on flatter land with relatively more consistent water access (Pinon,

2022). These physical and social distinctions create different vulnerabilities and, potentially, different levels of awareness and adaptive behavior.

Previous studies have highlighted the role of farmer perceptions in determining adaptive responses to environmental change. Awareness of climate change plays a key role in influencing whether and how farmers adopt new practices, alter cropping calendars, or shift to alternative inputs (Khan et al., 2022). Adaptation, meanwhile, is highly contextual. It may include simple adjustments such as early planting, or more structural strategies such as water conservation, crop diversification, or the use of stress-tolerant varieties. These responses are shaped not only by knowledge but also by available resources, institutional support, and local farming traditions.

In this context, the present study focuses on rice farmers situated in both upland and lowland areas of the municipality of Surallah in the Philippines. It seeks to understand how farmers perceive the ongoing effects of climate change and the kinds of strategies they employ to cope with its impacts. The study examines the extent of their climate change awareness, identifies the adaptation practices currently in use, and investigates whether notable differences exist between farmers in upland and lowland environments. Furthermore, it explores the relationship between climate awareness and the actual adjustments farmers implement in their fields. By doing so, the research aims to contribute to a deeper understanding of localized adaptation and offer practical evidence that can inform policies to support resilient farming communities.

RESEARCH QUESTIONS

To better understand how rice farmers in Surallah adapted to the challenges brought about by changing climatic conditions, this study examined their level of climate change awareness and the adaptation practices they employed. Specifically, it sought to answer the following questions:

1. What is the level of climate change awareness among upland and lowland rice farmers in the municipality of Surallah?
2. What adaptation practices have upland and lowland rice farmers adopted in response to climate-related challenges?
3. Is there a significant difference in the level of climate change awareness between upland and lowland rice farmers?
4. Do the adaptation practices significantly differ between upland and lowland rice farmers?

HYPOTHESES

The following null hypotheses were tested at the 0.05 level of significance:

$H0_1$: There is no significant difference in the level of climate change awareness between upland and lowland rice farmers in the municipality of Surallah.

$H0_2$: There is no significant difference in the adaptation practices adopted by upland and lowland rice farmers in response to climate-related challenges.

METHODS

This study used a descriptive-comparative and correlational research design to examine the level of climate change awareness and the adaptation practices among rice farmers located in upland and lowland areas of the municipality of Surallah, Philippines. This design allowed for a systematic comparison of responses between the two groups while also identifying potential relationships between awareness and adaptation practices.

Research Sample

This study employed a total enumeration sampling method due to the limited number of available respondents in the selected upland and lowland areas. All identified rice farmers in these areas were invited to participate, ensuring that the entire accessible population was represented in the study. A total of 74 respondents participated, consisting of 34 upland rice farmers and 40 lowland rice farmers.

This approach allowed for complete inclusion of the target groups within the defined locale, thereby increasing the reliability of group comparisons. The inclusion criteria required that all participants be actively engaged in rice farming and have at least three years of continuous farming experience in their respective areas to ensure familiarity with local climate patterns and farming practices.

Instrument

The study employed adapted and modified instruments for data collection. To assess the level of climate change awareness, the questionnaire was based on the work of Walker and McNeal (2013), which provided validated items measuring environmental perception and understanding of climate-related concepts. For the section on adaptation strategies, the survey instrument was modified from the framework developed by Shariatzadeh and Bijani (2022), which outlined various behavioral and technical responses adopted by farmers in response to environmental stressors.

To ensure contextual relevance and clarity among respondents in the municipality of Surallah, the instruments underwent expert validation and pilot testing. The validation process involved consultations with professionals in agricultural sciences and environmental education to assess the content's appropriateness, structure, and linguistic accuracy. The refinement and localization of the tool were guided by the methodological recommendations of Baron and Robles (2023) and Baron (2024a, 2024b), who emphasized cultural alignment and cognitive accessibility in localized survey design.

Revisions were made based on the results of the pilot test, which was conducted among a small group of rice farmers outside the study area. This process allowed for final adjustments in phrasing and structure to improve respondent comprehension and instrument reliability.

Data Collection

Data were collected through face-to-face survey administration conducted in designated upland and lowland rice farming communities within the municipality of Surallah. Prior to the formal data collection, coordination was established with barangay officials and agricultural technicians to identify eligible respondents and ensure smooth access to the farming sites. Respondents were informed of the study's objectives, and verbal consent was obtained before administering the questionnaire.

To ensure consistency in the administration process, a team of trained enumerators was deployed. They were oriented on the structure, language, and ethical considerations of the instrument in accordance with the guidelines of Baron and Crus (2023). The survey was conducted over a two-week period, allowing sufficient time to reach all sampled farmers without disrupting their daily farming routines.

Given the varying literacy levels among respondents, enumerators were instructed to assist in reading and clarifying survey items when necessary, while avoiding any form of influence on the answers provided. The use of the local dialect during data collection enhanced the accuracy of responses and reduced the risk of misinterpretation, as recommended in the community-based research protocols of Baron and Robles (2023).

All responses were manually encoded and later verified for consistency and completeness. Any unclear or incomplete entries were cross-checked with the enumerators' field notes or clarified with the respondents when feasible.

Data processing and Analysis

After data collection, all completed questionnaires were reviewed, coded, and encoded into a spreadsheet for organization and accuracy checking. The data were then processed and analyzed using the Statistical Package for the Social Sciences (SPSS) software version 27. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were employed to summarize the demographic profile of respondents, as well as their levels of climate change awareness and the extent of adaptation practices.

To determine whether significant differences existed in awareness and adaptation practices between upland and lowland rice farmers, independent samples t-tests were applied. This allowed the comparison of means between the two groups on both dimensions.

All statistical tests were conducted at a 0.05 level of significance. The selection of these analytical tools followed the recommendations of Baron (2025) regarding appropriate quantitative techniques for comparative and correlational studies in agricultural and environmental research contexts.

RESULTS AND DISCUSSION

Level of Climate Change Awareness among Upland and Lowland Rice Farmers in the Municipality of Surallah

Understanding how rice farmers perceive and respond to climate change begins with gauging their level of awareness. Awareness influences how farmers recognize risks, interpret environmental changes, and make decisions regarding their farming practices. In this study, awareness was examined across two key dimensions: farmers' attitudes toward climate change risk, and their knowledge of the concept of climate change itself. These indicators provide insight into how farmers interpret their environment and the extent to which they understand the broader phenomenon of climate change.

This section first presents the responses of upland and lowland rice farmers, who often face distinct challenges due to geographic and infrastructural limitations. Their remoteness from government services, lower access to formal education, and reliance on traditional knowledge systems may influence how climate-related information is understood and acted upon. The level of awareness among upland and lowland respondents is summarized in the succeeding tables.

Table 1 The Level of Awareness Among Upland Farmers Toward Climate Change.

Awareness of Upland Rice Farmers Towards Climate Change	Mean	SD	Qualitative Description
Attitude toward climate change risk	2.57	0.91	Moderately Aware
Knowledge of the concept of climate change	2.40	0.85	Les Aware
Overall Awareness	**2.47**	**0.86**	**Les Aware**

Table 1 presents the level of awareness among upland rice farmers in Surallah, focusing on their attitude toward climate change risks and their conceptual understanding of climate change. The findings indicate that upland farmers are moderately aware of climate-related risks (M = 2.57, SD = 0.91), suggesting that they have a perceptible recognition of changing environmental patterns such as irregular rainfall, temperature extremes, and increasing frequency of dry spells. This level of awareness appears to stem from observable field-level changes, rather than from exposure to formal climate information systems or institutional advisories (Whitnall & Beatty, 2025)

However, their knowledge of the concept of climate change received a lower mean rating (M = 2.40, SD = 0.85), falling under the less aware category. This result suggests that while upland farmers may perceive unusual climatic events

as risks to their farming activities, they lack sufficient understanding of the broader causes, mechanisms, and global implications of climate change (Etumnu et al., 2023). The relatively low score in this domain may be attributed to limited access to scientific information, technical briefings, and climate education—conditions commonly experienced in upland barangays where government outreach and communication infrastructure remain minimal (Tabuga et al., 2021).

The overall awareness score of upland farmers (M = 2.47, SD = 0.86), which also falls under the less aware category, reflects a general gap in both climate literacy and risk interpretation. This has practical implications: farmers who are less informed about the drivers and projected trends of climate change may be less likely to adopt anticipatory or preventive measures (Ricart et al., 2025). Instead, their responses may remain reactive, short-term, and highly dependent on immediate experiences rather than long-term planning.

The results point to the need for more structured and localized climate education programs targeted at upland farming communities. Extension services, when designed to include climate information that is both culturally and linguistically accessible, may serve as a critical intervention (Antwi-Agyei & Stringer, 2021). Local government units and agricultural agencies may consider deploying mobile learning initiatives or barangay-based orientations to enhance understanding and build adaptive capacity in these areas.

Improving climate change awareness among upland farmers is not merely a matter of information dissemination; it is also tied to empowerment and sustainability. Farmers who understand the systemic causes and long-term consequences of climate shifts are better positioned to modify their practices, access adaptation resources, and participate in local planning processes that influence land and water use (Effiong et al., 2024). Therefore, addressing the observed gaps in awareness must be seen as foundational to strengthening climate resilience in upland agricultural zones.

Table 2 The Level of Awareness Among Lowland Farmers Toward Climate Change.

Awareness of Upland Rice Farmers Towards Climate Change	Mean	SD	Qualitative Description
Attitude toward climate change risk	3.10	0.78	Moderately Aware
Knowledge of the concept of climate change	2.93	0.80	Moderately Aware
Overall Awareness	**3.01**	**0.74**	**Moderately Aware**

Table 2 presents the level of climate change awareness among lowland rice farmers in Surallah. The findings show that, overall, lowland farmers are moderately aware of climate-related issues, with an overall mean score of 3.01 (SD = 0.74). This reflects a more established understanding of both environmental risks and the broader concept of climate change, compared to their upland counterparts.

The mean score for attitude toward climate change risk was 3.10 (SD = 0.78), suggesting that lowland farmers are generally mindful of the threats posed by changing weather conditions. These farmers likely recognize the practical consequences of climate variability, such as delayed planting seasons, increased pest outbreaks, or crop loss due to flooding or drought (Yeleliere et al., 2023). Their level of awareness in this regard may be shaped by previous exposure to weather-related crop damage, as well as more frequent interaction with government agencies and extension workers who operate more regularly in lowland zones (Zulfikri et al., 2024).

Likewise, their knowledge of the concept of climate change also falls within the moderately aware category, with a mean of 2.93 (SD = 0.80). This indicates that lowland farmers are not only experiencing environmental changes firsthand but are also more familiar with the terminology and causes associated with climate change (Troncarelli et al., 2023). This may be due to better access to climate information through farmer training programs, radio broadcasts, or school-based community awareness initiatives, which are often concentrated in more accessible lowland areas.

The combined awareness score places lowland farmers in a relatively more informed position than their upland counterparts. This difference carries significant implications for adaptation planning and policy development. Farmers who possess a clearer understanding of both the risks and the causes of climate change are generally better prepared to consider long-term adjustments to their farming systems (Wheeler & Lobley, 2021). They may be more open to trying new technologies, engaging with government initiatives, or investing in climate-resilient inputs such as drought-tolerant seeds or water-saving irrigation methods.

These findings suggest that climate information is more readily reaching lowland communities and is being internalized to a moderate degree. However, while the awareness level is comparatively higher, it still does not reflect a high or comprehensive understanding of climate change. This indicates room for improvement in how technical information is translated and shared, even in areas that are geographically favored in terms of access.

To improve the adaptive capacity of rice farmers, government agencies and local stakeholders should build on the existing moderate awareness of lowland farmers by strengthening their knowledge base through continuous and updated training. Reinforcing this awareness with localized, practical examples and farmer-friendly materials could help bridge the gap between awareness and sustained behavioral change.

Adaptation Practices among Upland and Lowland Rice Farmers Adopted in Response to Climate-Related Challenges

In addition to understanding climate change, the capacity of farmers to apply concrete adaptation practices is central to their resilience in the face of environmental disturbances. Adaptation practices refer to the specific and observable

adjustments made in agricultural routines to reduce the negative effects of climate variability on crop production and livelihood security. These practices may include changes in planting schedules, the use of stress-tolerant rice varieties, soil and water conservation techniques, and other locally driven responses developed through experience or assistance from extension services.

This section presents the extent to which rice farmers in the upland and lowland areas of Surallah have adopted such practices in response to climate-related challenges. These findings provide a view into how farmers respond in practical terms to the risks they face, and whether their geographic location influences the types and extent of actions they undertake.

Table 3 summarizes the extent of adaptation practices adopted by upland rice farmers, while Table 4 presents the same for lowland rice farmers. These tables offer a comparison of how farmers in different agroecological zones engage with climate adaptation through their day-to-day farming decisions.

Table 3 Extent of Adaptation Practices among Upland Rice Farmers Adopted in Response to Climate-Related Challenges

Extent of Adaptation Practices of Upland Rice Farmers Towards Climate Change	Mean	SD	Qualitative Description
Change plant varieties	2.80	0.80	Sometimes Applied
Farming calendar adjustment	2.26	0.70	Seldom Applied
Crop diversification	2.74	0.74	Sometimes Applied
Adaptation Practices	**2.60**	**0.67**	**Sometimes Applied**

Table 3 presents the extent of adaptation practices adopted by upland rice farmers in response to climate-related challenges. The overall mean score of 2.60 (SD = 0.67) suggests that adaptation practices in upland areas are sometimes applied, indicating moderate but inconsistent efforts to adjust farming activities in light of changing environmental conditions (Schröder et al., 2024).

Among the specific practices, changing plant varieties yielded the highest mean score (M = 2.80, SD = 0.80), indicating that upland farmers occasionally shift to alternative rice varieties perceived as more tolerant to drought, heat, or variable rainfall. This behavior reflects a growing awareness of the role of varietal selection in minimizing crop loss, though it may still be constrained by access to seed supply, technical support, or cost considerations (Maity et al., 2023; Singh et al., 2020).

Crop diversification followed closely (M = 2.74, SD = 0.74), also described as sometimes applied. Diversifying crops may be a strategy to spread risk and improve household resilience, particularly in areas where monocropping increases vulnerability to climatic stress. However, the only occasional application of this practice suggests that structural or economic barriers may limit its wider adoption, especially in upland regions where access to capital, inputs, or market linkages is often limited (Lamichhane et al., 2022).

The lowest score was observed for farming calendar adjustment (M = 2.26, SD = 0.70), which falls under the seldom applied category. This suggests that many upland farmers continue to follow traditional planting and harvesting schedules despite observed changes in rainfall patterns or temperature (Schröder et al., 2024). Several factors may contribute to this behavior, including lack of localized weather forecasting, limited technical advisories, or cultural reliance on fixed seasonal cycles (Muita et al., 2021). Inflexibility in planting calendars may expose farmers to avoidable losses when seasonal expectations do not match current climate realities.

The moderate overall rating implies that while upland rice farmers are beginning to implement some forms of adaptation, these remain irregular and potentially reactive rather than systematic (Singh et al., 2021). Their actions may be shaped more by immediate need than by long-term planning or access to technical information. As such, the findings point to the necessity of more proactive agricultural extension services that offer targeted guidance, build confidence in scientific advisories, and improve access to resources tailored to the upland context.

These results emphasize the importance of scaling up interventions that promote not just awareness but actual behavioral change. Government agencies, NGOs, and academic institutions can play a significant role in helping upland farmers move from occasional to more consistent application of adaptation practices. Without sustained support, the capacity of upland farming communities to cope with increasing climate variability may remain limited.

Table 4 Extent of Adaptation Practices among Lowland Rice Farmers Adopted in Response to Climate-Related Challenges

The Extent of Adaptation Practices of Lowland Rice Farmers Towards Climate Change	Mean	SD	Qualitative Description
Change plant varieties	2.85	0.80	Sometimes Applied
Farming calendar adjustment	2.88	0.76	Sometimes Applied
Crop diversification	2.88	0.67	Sometimes Applied
Adaptation Practices	**2.87**	**0.67**	**Sometimes Applied**

Table 4 shows how lowland rice farmers in Surallah are responding to changes in the climate through the practices they apply in their farming routines. The results suggest that most of these farmers are making adjustments from time to time, though not yet in a consistent or widespread manner (Jamal et al., 2023). The overall average rating of 2.87 means these practices are sometimes applied, which points to a growing effort among farmers to respond to what they are observing in their fields.

Among the three practices assessed, adjusting the farming calendar and crop diversification had the same average rating of 2.88. This suggests that some farmers are no longer strictly following traditional planting schedules (Muyombano & Espling, 2020). They may be shifting their planting or harvesting dates depending on how the rains come or how the weather behaves each season. Crop diversification, on the other hand, may involve planting other crops alongside or in between rice cycles, as a way of avoiding total loss or ensuring some income even if the rice yield falls short.

Changing to other rice varieties also had a relatively close average score of 2.85. This means that while some farmers are trying out other seeds—possibly those that grow faster, need less water, or survive in harsher conditions—this is not yet a common or automatic decision (Xi et al., 2022). There may be hesitation due to cost, limited availability, or lack of information on how these new varieties will perform in their fields.

Taken together, the data suggest that while lowland farmers are taking steps to deal with the effects of climate change, these steps are still applied occasionally rather than routinely. These farmers may have more access to support services and farm inputs than those in the upland areas, but challenges still exist. Decisions to apply new practices often depend on experience, availability of resources, or advice from fellow farmers or technicians.

This situation points to the need for continued guidance at the community level. If farmers are to keep making informed decisions, support from agricultural offices should go beyond one-time training sessions. Regular follow-ups, easy-to-understand materials, and better access to needed supplies could help ensure that these practices become part of everyday farming. When farmers are able to act early and consistently, they are better prepared for whatever changes the next season might bring.

Difference in the Level of Climate Change Awareness between Upland and Lowland Rice Farmers

While both upland and lowland rice farmers in Surallah are affected by changing weather conditions, their awareness of climate change may differ depending on their environment, access to information, and farming experience. Comparing their awareness levels helps to understand whether location and conditions play a role in how farmers perceive and respond to what they observe in the climate.

This part of the study looks at whether there is a significant difference in the awareness of climate change between the two groups. It considers how each group views the risks brought about by climate change and how well they understand the ideas behind it. The results of this comparison are shown in Table 5.

Table 5 Difference in the Awareness Towards Climate Change Between Upland and Lowland Rice Farmers in Surallah, South Cotabato

Awareness	t	df	Sig. (2-tailed)	Mean Difference	Remarks
Upland	17.239	34	.000	2.4857	Significant
Lowland	25.815	39	.000	3.0125	

*Tested at the 0.05 level of significance

Table 5 shows the difference in climate change awareness between upland and lowland rice farmers in Surallah. The results reveal a clear and significant difference in how the two groups understand and perceive climate-related issues. At a significance level of 0.05, the computed p-value (.000) confirms that the gap between their awareness levels is not due to chance.

Lowland farmers had a higher mean awareness score of 3.0125, compared to 2.4857 for upland farmers. This means that, on average, lowland farmers are more aware of climate change and its possible effects on farming (Ricart et al., 2025). Several factors may help explain this result. Lowland farmers generally have easier access to agricultural technicians, learning materials, and government programs. They are also more likely to be located near centers where information is shared, such as barangay halls, cooperatives, or local offices. These conditions allow them to receive regular updates or join trainings that discuss climate-related issues.

On the other hand, upland farmers may have fewer opportunities to join such activities. Distance, limited infrastructure, and fewer scheduled outreach programs in upland areas may make it harder for them to get the same level of information or support (Tabuga et al., 2021). As a result, their understanding of climate change may remain basic, shaped more by direct observation than by technical explanation.

This gap in awareness has real implications. Farmers who are less informed may be slower to act or may rely on outdated practices that no longer fit the changing weather conditions. If awareness influences decisions in the field, then bridging this gap should be part of any effort to improve climate readiness in farming communities. Programs meant to help farmers adapt should be careful not to take a one-size-fits-all approach. More effort may be needed to reach upland areas, using language, examples, and methods that make sense in their local setting.

The difference found in this table supports the need for targeted communication and stronger local presence of agricultural support services, especially in upland communities. If both groups are to respond effectively to climate change, then both must first have a solid and equal understanding of what they are facing.

Difference in the Adaptation Practices Towards Climate Change Between Upland and Lowland Rice Farmers in Surallah, South Cotabato

Farmers respond to climate-related challenges in ways that reflect not only their awareness but also their available resources, physical location, and lived experience. While both upland and lowland rice farmers in Surallah face similar

environmental pressures, their ability to apply certain adaptation practices may differ. These differences could stem from variations in access to water, soil conditions, farming tools, support services, or institutional programs.

This section examines whether there is a measurable difference in how often or how consistently upland and lowland farmers apply specific adaptation practices in response to climate change. It focuses on three key areas: adjusting the farming calendar, shifting crop varieties, and diversifying farm outputs. The results of this comparison are presented in Table 6.

Table 6 Difference in the Adaptation Practices Towards Climate Change Between Upland and Lowland Rice Farmers in Surallah, South Cotabato

Adaptation Practices	t	df	Sig. (2-tailed)	Mean Difference	Remarks
Upland	23.107	34	.000	2.6000	Significant
Lowland	26.887	39	.000	2.8666	

*Tested at the 0.05 level of significance

Table 6 presents the comparison between upland and lowland rice farmers in terms of how often they apply adaptation practices in response to climate-related changes. The results show a significant difference between the two groups, with a p-value of .000 based on the 0.05 level of significance.

Lowland rice farmers had a higher mean score of 2.8666, while upland farmers recorded a slightly lower average of 2.6000. Although both values suggest that adaptation practices are applied occasionally, the figures indicate that lowland farmers tend to apply these practices more regularly (Ballesteros & Isaza, 2021). This could be attributed to several factors, including better access to agricultural support services, more frequent extension visits, and the availability of inputs such as improved seeds or fertilizers in lowland communities.

On the other hand, farmers in upland areas may struggle to adopt certain practices due to limitations in infrastructure, distance from government programs, or fewer opportunities to attend training activities. Even when awareness is present, putting that knowledge into practice can be difficult when resources are scarce or when the physical environment presents added challenges, such as limited irrigation or steeper terrain (Muzammal et al., 2024).

The results suggest that while both groups are making efforts to adapt to climate change, those in lowland areas may be in a better position to translate awareness into concrete action. This gap calls for more focused attention on upland farming communities, particularly through locally appropriate support that goes beyond general information. Providing timely resources, sustained field guidance, and accessible adaptation technologies suited to upland conditions can help farmers in these areas strengthen their resilience.

Overall, the data reflect the need for differentiated interventions that take into account not just the type of climate risk, but also the specific conditions under which farmers are expected to respond. Equalizing support across both upland and lowland zones will contribute to a more balanced and effective approach to climate adaptation in Surallah.

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Findings

The study revealed distinct differences in climate change awareness between upland and lowland rice farmers in Surallah. Among upland farmers, the mean score for attitude toward climate change risk was 2.57 with a standard deviation of 0.91, indicating a moderate level of awareness. In terms of knowledge of the concept of climate change, the mean was 2.40 with a standard deviation of 0.85, interpreted as low awareness. The overall awareness mean for upland farmers was 2.47 with a standard deviation of 0.86, also categorized as low awareness based on the descriptive scale used.

For lowland rice farmers, the mean score for attitude toward climate change risk was 3.10 with a standard deviation of 0.78, while knowledge of the concept had a mean of 2.93 with a standard deviation of 0.80. The overall awareness mean was 3.01 with a standard deviation of 0.74, which all fall under the descriptor of moderate awareness.

Regarding adaptation practices, upland farmers scored a mean of 2.80 for changing plant varieties, 2.26 for farming calendar adjustment, and 2.74 for crop diversification. Their composite mean was 2.60 with a standard deviation of 0.67, indicating that adaptation practices were sometimes applied. In comparison, lowland farmers scored 2.85, 2.88, and 2.88 respectively on the same practices, with an overall mean of 2.87 and a standard deviation of 0.67—also interpreted as sometimes applied but at relatively higher and more consistent levels.

Statistical analysis using an independent sample t-test showed a significant difference in awareness levels, with a t-value of 17.239, degrees of freedom (df) of 34, and a p-value of 0.000. Likewise, a significant difference in adaptation practices was observed, with a t-value of 23.107, df of 34, and a p-value of 0.000. In both instances, lowland farmers demonstrated higher mean scores, confirming that the differences between the two groups were statistically meaningful based on a 0.05 significance level.

Conclusions

The study revealed that rice farmers in the municipality of Surallah have varying levels of awareness and adaptation practices in response to climate change. Lowland farmers demonstrated a stronger understanding of the causes and risks associated with changing climate conditions. They were also more consistent in applying farming adjustments, such as

altering crop varieties, modifying planting schedules, and introducing crop diversification. On the other hand, upland farmers reported a lower level of awareness and applied adaptation practices less frequently. This difference suggests a gap in access to technical support, farming inputs, and climate-related information.

While both groups have observed changes in their farming environments, the ability to act on this knowledge differs based on location and available resources. Upland farmers are more likely to face limitations in infrastructure, training opportunities, and input availability, which may hinder regular application of adaptation strategies. The findings indicate that awareness alone does not always lead to action unless supported with timely assistance and accessible tools. Addressing these limitations is essential in helping all rice farmers prepare for ongoing environmental changes and reduce potential losses in future farming cycles.

Recommendations

Based on the findings of this study, the following recommendations are offered to strengthen climate change adaptation among upland and lowland rice farmers in the municipality of Surallah:

(a) Extend climate-related agricultural programs to upland areas through regular field visits, simplified training materials, and locally organized sessions that address the actual conditions faced by farmers in remote communities.

(b) Provide timely access to climate-resilient inputs, including suitable seed varieties, flexible planting guides, and affordable soil and water technologies tailored to the needs of both upland and lowland rice-growing environments.

(c) Create participatory mechanisms that involve farmers in planning, monitoring, and assessing adaptation programs, ensuring that farmer experience helps shape relevant and effective support systems.

(d) Promote continuing research in climate adaptation at the local level. Monitoring changes in farmer behavior, resource access, and environmental conditions can help guide better decisions. Narrowing the gap between upland and lowland farmers in terms of both awareness and practical responses will contribute to a more balanced and sustainable farming system. These findings may also inform future efforts to design inclusive programs, combining technical understanding with day-to-day farming realities.

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DECLARATION OF CONFLICT

The author declares no conflict of interest related to the conduct and publication of this research.

REFERENCES

1. Abebaw, S. E. (2025). A Global Review of the Impacts of Climate Change and Variability on Agricultural Productivity and Farmers' Adaptation Strategies. *Food Science & Nutrition*, *13*(5), e70260.
2. Antwi-Agyei, P., & Stringer, L. C. (2021). Improving the effectiveness of agricultural extension services in supporting farmers to adapt to climate change: Insights from northeastern Ghana. *Climate Risk Management*, *32*, 100304.
3. Ballesteros, J., & Isaza, C. (2021). Adaptation measures to climate change as perceived by smallholder farmers in the Andes. *Journal of Ethnobiology*, *41*(3), 428-446.
4. Baron, J. V. (2024a). A double-edged sword: Examining the link between students' dependence on artificial intelligence (AI) and their psychosocial maturity. *TWIST*, *19*(3), 339-344.
5. Baron, J. V. (2024b). Predictive Role of Innovation Strategies on Organizational Performance among State Universities and Colleges in Region XII, Philippines. *TWIST*, *19*(3), 835-840.
6. Baron, J. V. (2025). The Dynamics of Vulnerability, Agency and Mental Health Challenges among Students. *Randwick International of Social Science Journal*, *6*(1), 25-38. https://doi.org/10.47175/rissj.v6i1.1098
7. Baron, J. V., & Cruz, J. A. D. (2023). The spiral progression approach in teaching science: Its Volatilities, Uncertainties, Complexities, and Ambiguities (VUCA). *Journal of Social, Humanity, and Education*, *3*(2), 89-103.
8. Baron, J. V., & Robles, A. C. M. O. (2023). Structural equation model: Organizational performance among state universities and colleges in Philippines. *Journal of Social, Humanity, and Education*, *3*(4), 307-320.
9. Effiong, C., Ngang, E., & Ekott, I. (2024). Land use planning and climate change adaptation in river-dependent communities in Nigeria. *Environmental Development*, *49*, 100970.
10. Etumnu, C., Wang, T., Jin, H., Sieverding, H. L., Ulrich-Schad, J. D., & Clay, D. (2023). Understanding farmers' perception of extreme weather events and adaptive measures. *Climate Risk Management*, *40*, 100494.

11. Jamal, M. R., Kristiansen, P., Kabir, M. J., & Lobry de Bruyn, L. (2023). Challenges and adaptations for resilient rice production under changing environments in Bangladesh. *Land*, *12*(6), 1217.
12. Khan, N., Ma, J., Kassem, H. S., Kazim, R., Ray, R. L., Ihtisham, M., & Zhang, S. (2022). Rural farmers' cognition and climate change adaptation impact on cash crop productivity: evidence from a recent study. *International Journal of Environmental Research and Public Health*, *19*(19), 12556.
13. Lamichhane, P., Hadjikakou, M., Miller, K. K., & Bryan, B. A. (2022). Climate change adaptation in smallholder agriculture: adoption, barriers, determinants, and policy implications. *Mitigation and Adaptation Strategies for Global Change*, *27*(5), 32.
14. Maity, A., Paul, D., Lamichaney, A., Sarkar, A., Babbar, N., Mandal, N., ... & Chakrabarty Chakrabarty, S. K. (2023). Climate change impacts on seed production and quality: current knowledge, implications, and mitigation strategies. *Seed Science and Technology*, *51*(1), 65-96.
15. Muita, R., Dougill, A., Mutemi, J., Aura, S., Graham, R., Awolala, D., ... & Opijah, F. (2021). Understanding the role of user needs and perceptions related to sub-seasonal and seasonal forecasts on farmers' decisions in Kenya: a systematic review. *Frontiers in Climate*, *3*, 580556.
16. Muyombano, E., & Espling, M. (2020). Land use consolidation in Rwanda: The experiences of small-scale farmers in Musanze District, Northern Province. *Land Use Policy*, *99*, 105060.
17. Muzammal, H., Zaman, M., Safdar, M., Adnan Shahid, M., Sabir, M. K., Khil, A., ... & Zaib, A. (2024). Climate change impacts on water resources and implications for agricultural management. In *Transforming agricultural management for a sustainable future: Climate change and machine learning perspectives* (pp. 21-45). Cham: Springer Nature Switzerland.
18. Pinon, C. (2022). Achieving sustainable landscapes and livelihoods in the Philippine uplands: the role of farmer and stakeholder aspirations and actions.
19. Ricart, S., Gandolfi, C., & Castelletti, A. (2025). What drives farmers' behavior under climate change? Decoding risk awareness, perceived impacts, and adaptive capacity in northern Italy. *Heliyon*, *11*(1).
20. Rivera-Ferre, M. G., Di Masso, M., Vara, I., Cuellar, M., López-i-Gelats, F., Bhatta, G. D., & Gallar, D. (2021). Traditional agricultural knowledge in land management: the potential contributions of ethnographic research to climate change adaptation in India, Bangladesh, Nepal, and Pakistan. *Climate and Development*, *13*(7), 644-661.
21. Schröder, L. S., Bhalerao, A. K., Kabir, K. H., Scheffran, J., & Schneider, U. A. (2024). Managing uphill cultivation under climate change–An assessment of adaptation decisions among tribal farmers in Nagaland state of India. *Journal of Environmental Management*, *349*, 119473.
22. Shariatzadeh, M., & Bijani, M. (2022). Towards farmers' adaptation to climate change: The effect of time perspective. *Journal of Cleaner Production*, *348*, 131284.
23. Singh, R. P., Chintagunta, A. D., Agarwal, D. K., Kureel, R. S., & Kumar, S. J. (2020). Varietal replacement rate: Prospects and challenges for global food security. *Global Food Security*, *25*, 100324.
24. Singh, V. J., Vinod, K. K., Krishnan, S. G., & Singh, A. K. (2021). Rice adaptation to climate change: opportunities and priorities in molecular breeding. *Molecular breeding for rice abiotic stress tolerance and nutritional quality*, 1-25.
25. Tabuga, A. D., Umlas, A. J. L., Zuluaga, K. M. C., & Domingo, S. N. (2021). *Social networks and access and utilization of weather and climate information: The case of upland farming communities in the Philippines* (No. 2021-18). PIDS Discussion Paper Series.
26. Tandog, T. K., & Condes-Tandog, L. (2023). Farming amidst climate change: The contextual vulnerability of farmers in Cotabato, Philippines. *Journal of Agricultural Research, Development, Extension and Technology*, *5*(1), 23-46.
27. Troncarelli, L. T., de Ataide, M. T., & Morsello, C. (2023). Existing evidence of conceptual differences in research on climate change perceptions among smallholders? A systematic map. *Environmental Evidence*, *12*(1), 28.
28. Walker, S., & Mcneal, K. (2013). Development and validation of an instrument for assessing climate change knowledge and perceptions: The climate stewardship survey (CSS). *International Electronic Journal of Environmental Education*, *3*(1), 57-73.
29. Wheeler, R., & Lobley, M. (2021). Managing extreme weather and climate change in UK agriculture: Impacts, attitudes and action among farmers and stakeholders. *Climate Risk Management*, *32*, 100313.
30. Whitnall, S. C., & Beatty, T. K. (2025). Climate change and field-level crop quality, yield, and revenue.
31. Xi, L., Zhang, M., Zhang, L., Lew, T. T., & Lam, Y. M. (2022). Novel materials for urban farming. *Advanced Materials*, *34*(25), 2105009.
32. Yeleliere, E., Antwi-Agyei, P., & Guodaar, L. (2023). Farmers response to climate variability and change in rainfed farming systems: Insight from lived experiences of farmers. *Heliyon*, *9*(9).
33. Zulfikri, A., Ningsih, E. M. N., Harsono, I., & Susanto, H. (2024). Agricultural adaptation strategies to weather fluctuations for improved agribusiness sustainability in West Java. *West Science Nature and Technology*, *2*(01), 17-23.