CLIMATE CHANGE ASSESSMENT IN AGRICULTURAL PRODUCTION IN BARANGAY DOLOGON, MARAMAG, BUKIDNON

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ABSTRACT

Climate change poses significant threats to agricultural productivity, particularly in rural communities dependent on farming. This study assesses the impacts of climate change on agricultural production in Barangay Dologon, Maramag, Bukidnon, with a focus on crop yields, soil fertility, and water availability. The respondents of the study would be the smallholder farmers in Brgy Dologon. Simple random sampling methods was used to select 50 respondents who have engaged in farming. A structured survey questionnaire was prepared and gather data on farming practices, perceived climate change, crop yields and adaptation strategies. Based on the results and discussion, drought is the most frequently reported and impactful stressor, 84% of respondents reported that drought affects their yields, making it the most widespread issue. Over-tilling and monocropping are the most widely acknowledged and significant contributors to soil degradation among the surveyed population. Financial constraints are the paramount challenge to adaptation efforts, affecting the vast majority of respondents and perceived as highly significant.

Keyword: climate change, agricultural production, soil fertility, farmer adaptation

1. INTRODUCTION

Climate change is deeply reforming agricultural production, depicting major challenges to food security and the livelihoods of farmers worldwide. Given that the global temperatures increase and the weather patterns are usually unpredictable, then the agricultural industry faces disturbance that menaces its potential to support an increasing population.

The influence of climate change on agriculture is multidimensional. Severe weather events such as drought, floods and storms are more numerous, guiding to lessen crop yields and water scarcity. According to Ahmad et. al (2022), studies forecast that main crops like rice and corn may go through a decrease of yield up to 17% and 12%. Independently, by mid - century because of increasing temperatures and unsettled rainfall patterns. Moreover, increasing temperatures worsens pest outbreak and plant diseases which leads to affecting productivity.

Climate impacts many aspects of agriculture both in direct and indirect ways (Wiréhn et al. 2015). Food production, which is the heart of agriculture, is heavily dependent on climate (Lobell and Gourdji, 2012), specifically on appropriate temperature and precipitation ranges for ideal growth of crops. Slight shifts in climate might mean heavy losses in production. Farmers are in the frontline in terms of food production. As climatic shifts continue to worsen, the livelihood of farmers is in jeopardy. Crops are both affected by extreme weather as well as the different climate hazards.

Furthermore, climate change influences purity of soil, developing seasons and irrigation accessibility. For some regions, high atmospheric CO_2 levels provide a tiny boost to crop growth through the "CO_2 fertilization effect," but this comes with the loss of poor nutritional quality in crops (Walsh et. al, 2020). In conclusion, climate change is an imposing problem to agricultural production worldwide. Discoursing its effect needs innovative solutions and global cooperation to secure sustainable food systems for future generations.

The effect of climate change on agricultural production in Barangay Dologon, Maramag, Bukidnon is noticeable through different challenges that endanger the effectiveness and

conservation of farming in the area. As an agricultural centered- community, Dologon faces high risks from unsettled weather patterns such as heavy rainfall and waterlogging which uninterrupted concussion crop yields and farmer livelihoods. Also, Maramag's agricultural sector depends on its different crop production such as sugarcane, corn and rice. But then, climate change triggers in precipitation and temperature patterns could disturb these systems. For instance, extended droughts or too much rains could influence the accessibility of irrigation and soil fertility where it decreases productivity. The community's dependency on agriculture emphasizes the importance of addressing these challenges to protect livelihoods.

1.1. Objectives of the Study

This study focuses on the impact of climate change assessment in agricultural production of Barangay Dologon, Maramag, Bukidnon. Specifically,

a) Determine the socio-demographic profile of the respondents in this study.
b) Assess the effect of climate change in terms of crop yields, soil fertility and water availability.
c) Identify the challenges and vulnerabilities of farmers due to climate change.

2. METHODOLOGY

2.1. Research Design

The study would employ a descriptive research design. This aims to document and describe the existing climate-related changes, agricultural practices and perceived changes in Brgy Dologon, Maramag, Bukidnon. It intends to assess the climate change on agricultural productivity and evaluate the effectiveness of farmers' current adaptation strategies.

2.3. Locale of the Study

The study was conducted in Barangay Dologon, a rural farming community in Municipality of Maramag Bukidnon. The area is known for its production of corn, rice and vegetables. It is expected to continue experiencing erratic climate patterns that may significantly impact agricultural activities.
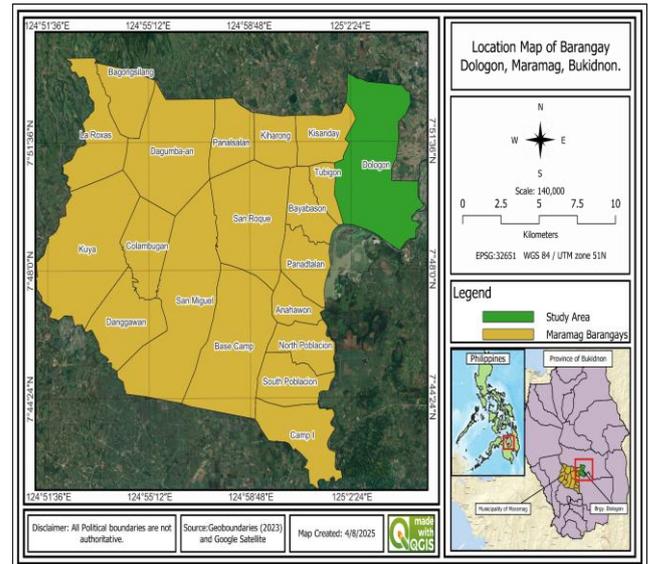

Figure 1. Map showing the Locale of the Study

2.3. Respondents and Sampling Procedure

The respondents of the study would be the smallholder farmers in Brgy Dologon. Simple random sampling methods was used to select 50 respondents who have engaged in farming. This criterion will ensure that respondents have adequate knowledge to discuss long-term climate-related changes and production patterns.

2.4. Data Gathering Techniques

A structured survey questionnaire was prepared and gather data on farming practices, perceived climate change, crop yields and adaptation strategies. Key informant interviews were conducted with local agricultural farmers to obtain qualitative insights.

2.5. Research Instrument

A researcher-made survey questionnaire served as the main instrument to be used in this study and the data collected from the answered questionnaires was consolidated, tabulated and categorized according to the parameters in objectives of the study using a Microsoft excel. Statistical tools like descriptive statistics such as frequency, mean, percentage and standard deviation.

2.6. Result and Discussion

The table 1 shows distribution of 50 farmers according to demographic profile. It includes age, gender, educational attainment, farming experience and farm size. The data reveals that the average age of the respondents was 42.5 years,

with a standard deviation of 12.2 years. This indicates that, on average, the participants were middle-aged, and the ages were moderately spread out. The age distribution shows that the largest group was between 31 and 40 years old (25%). Out of 50 farmer respondents 56% were male and only 44% female.

Table 1 also reflects that the majority (50%) of the farmer respondents are at the elementary level, 30% reached high school and only 20% went to college or vocational level. The data reveals that

little less than one third (24%) of farmer respondents have farming experience above 15 years. This is followed by farmer respondents having farming experience ranges from 1-5 years (36%), 40 percent of farmer respondents have farming experience ranges from 6-15 years. It is also revealed that almost half (46%) of the farmer respondents have land area tilled of 1 to 3 hectares, 44 percent have below 1 hectare of land 10% have land area above 3 hectares.

A. Demographic Profile

Variable	Category	Frequency	Percentage (%)
Age	31-40 years	15	30%
	41-50 years	12	24%
	Above 50 years	18	36%
Gender	Male	28	56%
	Female	22	44%
Education	Elementary	25	50%
	High School	15	30%
	College/Vocational	10	20%
Farming Experience	1-5 years	18	36%
	6-15 years	20	40%
	Above 15 years	12	24%
Farm Size	Below 1 ha	22	44%
	1-3 ha	23	46%
	Above 3 ha	5	10%

Table 2 reveals the climate stressor affecting agriculture. This data clearly highlights the most prevalent and impactful climate stressors affecting agriculture, according to the surveyed population. Drought is the most frequently reported and impactful stressor, 84% of respondents reported

that drought affects their yields, making it the most widespread issue. Its low mean (1.16) further indicates that those who experienced it perceived it as having a significant negative impact. The relatively low standard deviation (0.37) suggests a strong consensus on the severity of drought's impact.

Secondly, erratic rainfall is also a major concern. 76% of respondents experienced erratic rainfall. While slightly less impactful than drought (mean of 1.24), it still represents a significant challenge. Next is, pests/diseases are widely reported, 70% of respondents faced issues with pests/diseases.

The mean of 1.30 suggests a moderate to high perceived impact.

Lastly, floods are less frequent but still impactful for those affected, 56% reported floods affecting their yields, making it the least frequent among the listed stressors. However, its mean of 1.44, while higher than others, still indicates a notable impact for those who experience it. The higher standard deviation (0.50) suggests that there might be more varied experiences or perceptions regarding the severity of flood impacts among respondents.

B. Climate Stressors Affecting Agriculture

Climate Stressor	Frequency (Yes)	Percentage (%)	Mean (1-2 scale)	Std. Deviation
Drought affects yields	42	84%	1.16	0.37
Erratic rainfall	38	76%	1.24	0.43
Pests/diseases	35	70%	1.30	0.46
Floods affect yields	28	56%	1.44	0.50

Table 3 shows that this data provides insights into the primary factors contributing to soil degradation, as perceived by the surveyed population. Over-tilling is the most frequently recognized soil degradation factor. 32 respondents (64%) identified "Over-tilling degrades soil" as a problem. This makes it the most widely acknowledged factor among those listed. With a mean of 1.36, respondents generally perceive over-tilling as having a notable negative impact on soil quality. The closer to 1, the stronger the perceived negative impact. The standard deviation of 0.48 indicates a moderate level of agreement among respondents regarding the impact of over-tilling.

Monocropping is also a significant concern, 28 respondents (56%) recognized "Monocropping issues" as a problem. This is the second most reported factor. A mean of 1.44 suggests that respondents perceive monocropping as a contributing factor to soil degradation, though slightly less impactful than over-tilling on average. A standard deviation of 0.50 indicates a similar

level of variability in responses as over-tilling, meaning there's some spread in how severely respondents view its impact.

Chemical overuse is a concern for half of the respondents. 25 respondents (50%) identified "Chemical overuse" as contributing to soil degradation. The mean of 1.50 suggests a moderate perceived impact. It's exactly in the middle of the 1-2 scale, implying that while recognized, its perceived severity might be slightly less acute than over-tilling or monocropping. With a standard deviation of 0.51, there's slightly more variability in opinion compared to the top two factors, indicating some differing views on the extent of chemical overuse's impact.

Deforestation impact is the least recognized factor among those listed, only 20 respondents (40%) acknowledged "Deforestation impact" as a soil degradation factor. This is the lowest frequency and percentage among the four. The mean of 1.60, being closest to 2, suggests that while deforestation is recognized by some, its

perceived direct impact on soil degradation (relative to the other factors) is considered less severe or less immediately relevant by the surveyed group. A standard deviation of 0.49 indicates a moderate level of agreement among those who did report it, similar to the other factors.

The data suggests that over-tilling and monocropping are the most widely acknowledged and significant contributors to soil degradation among the surveyed population. Chemical overuse

is also a recognized factor for a substantial portion of respondents. While deforestation is acknowledged, it appears to be perceived as a less direct or less prevalent factor for soil degradation compared to the agricultural practices of tilling and monocropping, according to these survey results. This information is valuable for designing interventions or educational programs aimed at promoting sustainable land management practices.

C. Soil Degradation Factors

Factor	Frequency (Yes)	Percentage (%)	Mean (1-2 scale)	Std. Deviation
Over-tilling degrades soil	32	64%	1.36	0.48
Monocropping issues	28	56%	1.44	0.50
Chemical overuse	25	50%	1.50	0.51
Deforestation impact	20	40%	1.60	0.49

Table 4 reveals also that this data highlights the most significant challenges that individuals or communities face when trying to adapt to climate stressors and soil degradation issues, as perceived by the surveyed group.

Financial constraints are the most widespread and significant adaptation challenge, 38 respondents (76%) reported that "Financial constraints limit adaptation." This makes it by far the most frequently cited barrier to adaptation. With a mean of 1.24, this indicates that respondents, on average, perceive financial limitations as a highly significant obstacle to implementing adaptation measures. The closer the mean is to 1, the more critical the challenge is perceived to be. The standard deviation of 0.43 is relatively low, suggesting a strong consensus among respondents regarding the critical nature of financial limitations.

Second is lack of technical knowledge is a substantial barrier, 32 respondents (64%) identified "Lack of technical knowledge" as an adaptation challenge. This is the second most reported barrier. A mean of 1.36 suggests that respondents generally perceive a lack of technical know-how as a significant impediment to adaptation, though slightly less critical than

financial constraints. The standard deviation of 0.48 indicates a moderate level of agreement among respondents about this challenge.

Third, the farmer respondents' inadequate infrastructure poses a considerable challenge. 28 respondents (56%) reported "Inadequate infrastructure" as an issue. The mean of 1.44 indicates that respondents generally view infrastructure deficiencies as a notable barrier to adaptation, though less so than the top two challenges. A standard deviation of 0.50 suggests a similar level of variability in responses as the previous factor, indicating some spread in how severely respondents view its impact.

Lastly, limited government support is recognized by half of the respondents, 25 respondents (50%) stated that "Limited government support" is an adaptation challenge. With a mean of 1.50, this factor is perceived as a moderate challenge. It's exactly in the middle of the 1-2 scale, suggesting that while recognized, its perceived severity might be slightly less acute compared to the top challenges like financial constraints. A standard deviation of 0.51 indicates slightly more variability in opinions compared to the top two challenges, implying some differing views on the extent of government support's limiting factor.

The data clearly indicates that financial constraints are the paramount challenge to adaptation efforts, affecting the vast majority of respondents and perceived as highly significant. This is followed by a lack of technical knowledge and inadequate infrastructure, which are also widely recognized and considerable barriers.

Challenge	Frequency (Yes)	Percentage (%)	Mean (1-2 scale)	Std. Deviation
Financial constraints limit adaptation	38	76%	1.24	0.43
Lack of technical knowledge	32	64%	1.36	0.48
Inadequate infrastructure	28	56%	1.44	0.50
Limited government support	25	50%	1.50	0.51

3. SUMMARY

The influence of climate change on agriculture is multidimensional. Severe weather events such as drought, floods and storms are more numerous, guiding to lessen crop yields and water scarcity. As an agricultural centered- community, Dologon faces high risks from unsettled weather patterns such as heavy rainfall and waterlogging which uninterrupted concussion crop yields and farmer livelihoods. Also, Maramag's agricultural sector depends on its different crop production such as sugarcane, corn and rice. But then, climate change triggers in precipitation and temperature patterns could disturb these systems. For instance, extended droughts or too much rains could influence the accessibility of irrigation and soil fertility where it decreases productivity. This study focuses on the impact of climate change assessment in agricultural production of Barangay Dologon, Maramag, Bukidnon. A researcher-made survey questionnaire will serve as the main instrument to be used in this study and the data collected from the answered questionnaires was consolidated, tabulated and categorized according to the parameters in objectives of the study using a Microsoft excel.

Based on the results and discussion, drought is the most frequently reported and impactful stressor, 84% of respondents reported that drought affects their yields, making it the most widespread issue.

Limited government support is also a concern for a significant portion of the population, although its perceived impact might be slightly less critical than the other top challenges.

D. Adaptation Challenges

Over-tilling and monocropping are the most widely acknowledged and significant contributors to soil degradation among the surveyed population. Financial constraints are the paramount challenge to adaptation efforts, affecting the vast majority of respondents and perceived as highly significant.

4. CONCLUSION AND RECOMMENDATIONS

The farming community in Brgy Dologon, Maramag, Bukidnon, Northern Mindanao, Philippines is predominantly composed of experienced, older smallholder farmers facing significant and immediate threats from climate change (especially drought and erratic rainfall) and widespread soil degradation caused by common practices like over-tilling and monocropping. Their ability to adapt and implement sustainable solutions is critically hampered by financial limitations, a lack of technical knowledge, inadequate infrastructure, and insufficient government support, highlighting urgent need for integrated and accessible interventions.

Below are the following recommendations addressing the issues about farming in Brgy Dologon, Maramag, Bukidnon, Northern Mindanao, Philippines;

Boost Financial Aid & Insurance: Implement accessible micro-finance, grants, and climate-

resilient insurance specifically for smallholder farmers.

Strengthen Practical Extension Services: Enhance agricultural extension with hands-on training, demonstrations, and simplified materials on climate-smart and sustainable farming practices (e.g., conservation tillage, crop diversification).

Invest in Rural Infrastructure: Prioritize improvements in irrigation, storage, and market access to support resilient agriculture.

Increase Government Support & Coordination: Improve the delivery and accessibility of government programs, fostering partnerships to ensure comprehensive assistance reaches farmers.

REFERENCES

[1]. Ahmed, M., Hayat, R., Ahmad, M. et al. Impact of Climate Change on Dryland Agricultural Systems: A Review of Current Status, Potentials, and Further Work Need. Int. J. Plant Prod. 16, 341–363(2022).https://doi.org/10.1007/s42106-022-00197-1

[2]. Lobell D, Gourdji S. 2012. The influence of climate change on global crop productivity. Plant Physiology 160(4), 1686–1697.

[3]. Paquit, Joseph, Climate-Risk Vulnerability Assessment of the Agriculture Sector in the Municipalities and Cities of Bukidnon, Philippines (2018). International Journal of Biosciences, Vol. 13, No. 6, p. 155-168, 2018, Available at SSRN: https://ssrn.com/abstract=3574604

[4]. Walsh, M. K., P. Backlund, L. Buja, A. DeGaetano, R. Melnick, L. Prokopy, E. Takle, D. Todey, L. Ziska. 2020. Climate Indicators for Agriculture. USDA Technical Bulletin 1953. Washington, DC. 70 pages. DOIhttps://doi.org/10.25675/10217/210930
.

[5]. Wiréhn L, Opach T, Neset T. 2017. Assessing agricultural vulnerability to climate change in the Nordic countries–an interactive geovisualization approach, Journal of Environmental Planning and Management 60, 115-134,http://dx.doi.org/10.1080/09640568.2016.1143351