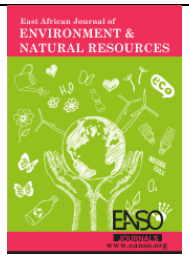


East African Journal of Environment and Natural Resources
eajenr.eanso.org
Volume 8, Issue 2, 2025
Print ISSN: 2707-4234 | Online ISSN: 2707-4242
Title DOI: https://doi.org/10.37284/2707-4242

EAST AFRICAN NATURE & SCIENCE ORGANIZATION

Original Article

Assessing Knowledge of Climate Change Management Among Smallholder Crop Farmers in a Refugee Context: Lessons from Nakivale Refugee Settlement, Uganda

Abdullahi Abdulkadir Mohamed[1*], *Doreen Atwongyeire*[1] *& Goretty Nagawa*[1]

[1] Bishop Stuart University, P. O. Box 09, Mbarara, Uganda.
[*] Correspondence ORCID ID; https://orcid.org/0009-0007-8108-8284; Email: abdalaabdikadir2020@gmail.com

Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

Date Published: *12 August 2025*

Keywords: *Climate Change, Knowledge, Adaptation, Smallholder Farmers, Nakivale.*

ABSTRACT

Climate change poses significant challenges to agricultural productivity, particularly for vulnerable populations such as smallholder farmers in refugee settlements. However, this study assessed the level of knowledge regarding climate change management among smallholder crop farmers in Nakivale Refugee Settlement, Uganda. A descriptive cross-sectional research design was employed, with a sample of 384 farmers selected through multistage and stratified sampling techniques. Data were collected via semi-structured questionnaires, key informant interviews, and field observations and were analysed using R software to produce descriptive statistics such as frequency and percentage and inferential statistics such as chi-square tests, and logistic regression, while qualitative data were analysed thematically. Results revealed high levels of climate change awareness and training exposure, with radio/TV being the most common source of information. However, critical knowledge gaps persist, particularly regarding key scientific causes such as fossil fuel emissions and industrial activities. While deforestation was identified as a major driver, none cited fossil fuels. Most respondents demonstrated only moderate knowledge. Significant predictors of higher knowledge included tertiary education, larger farm size, and household size, while construction-based occupations were negatively associated. The findings highlight the need for tailored educational interventions and strengthened institutional support to bridge scientific knowledge gaps and foster informed adaptation strategies in refugee-hosting communities.

APA CITATION

Mohamed, A. A., Atwongyeire, D. & Nagawa, G. (2025). Assessing Knowledge of Climate Change Management Among Smallholder Crop Farmers in a Refugee Context: Lessons from Nakivale Refugee Settlement, Uganda. *East African Journal of Environment and Natural Resources*, *8*(2), 381-396. https://doi.org/10.37284/eajenr.8.2.3478.

CHICAGO CITATION

Mohamed, Abdullahi Abdulkadir, Doreen Atwongyeire and Goretty Nagawa. 2025. "Assessing Knowledge of Climate Change Management Among Smallholder Crop Farmers in a Refugee Context: Lessons from Nakivale Refugee Settlement, Uganda". *East African Journal of Environment and Natural Resources* 8 (2), 381-396. https://doi.org/10.37284/eajenr.8.2.3478

HARVARD CITATION

Mohamed, A. A., Atwongyeire, D. & Nagawa, G. (2025) "Assessing Knowledge of Climate Change Management Among Smallholder Crop Farmers in a Refugee Context: Lessons from Nakivale Refugee Settlement, Uganda", *East African Journal of Environment and Natural Resources*, 8 (2), pp. 381-396. doi: 10.37284/eajenr.8.2.3478.

Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

IEEE CITATION

A. A., Mohamed, D., Atwongyeire & G., Nagawa "Assessing Knowledge of Climate Change Management Among Smallholder Crop Farmers in a Refugee Context: Lessons from Nakivale Refugee Settlement, Uganda", *EAJENR*, vol. 8, no. 2, pp. 381-396, Aug. 2025.

MLA CITATION

Mohamed, Abdullahi Abdulkadir, Doreen Atwongyeire & Goretty Nagawa. "Assessing Knowledge of Climate Change Management Among Smallholder Crop Farmers in a Refugee Context: Lessons from Nakivale Refugee Settlement, Uganda". *East African Journal of Environment and Natural Resources*, Vol. 8, no. 2, Aug 2025, pp. 381-396, doi:10.37284/eajenr.8.2.3478

INTRODUCTION

Climate change poses one of the most significant threats to global agricultural productivity, disproportionately affecting smallholder farmers in vulnerable regions such as refugee settlements (Mandel & Lipovetsky, 2021). Uganda, which hosts the largest refugee population in Africa, experiences heightened climate-related stresses due to increased demand for already limited land and natural resources (UNHCR, 2023). Among these settlements, Nakivale stands out as one of the oldest and most densely populated. Agriculture remains the primary livelihood for its residents. However, dependence on rain-fed farming and limited access to adaptive technologies render smallholder farmers in Nakivale particularly vulnerable to climate variability, including erratic rainfall patterns, prolonged droughts, and rising pest infestations (FAO, 2020).

Despite growing awareness of climate change impacts, there remains a critical gap in understanding the extent to which smallholder farmers in Nakivale possess the knowledge necessary to manage these challenges effectively. While general awareness of climate change is relatively high among rural and refugee populations, scientific literacy—particularly regarding its causes and mitigation strategies—remains limited (Belay et al., 2022). For instance, many farmers associate climate change primarily with deforestation, often overlooking the significant roles of fossil fuel emissions and industrial activities (UNDP, 2016). This knowledge gap impedes the adoption of climate-smart agriculture (CSA) practices, which are essential for enhancing resilience and ensuring long-term food security.

Understanding farmers' knowledge of climate change management is critical for designing effective, context-specific interventions that align with their lived experiences and adaptive capacities. This study aims to assess the level of knowledge among smallholder crop farmers in Nakivale Refugee Settlement, focusing on their awareness of climate change causes, impacts, and adaptation strategies. By identifying knowledge gaps and barriers, the research seeks to inform targeted policies and programs that can strengthen farmers' adaptive capacity and promote sustainable agricultural practices.

The knowledge framework has been widely applied to assess how communities perceive and respond to climate change (Nguyen et al., 2019). Knowledge—as the foundational component of adaptive behaviour—shapes farmers' ability to recognise climate risks and adopt appropriate responses (Ajzen, 1991). Research across Sub-Saharan Africa (SSA) indicates that while many farmers are aware of climate change, their understanding is often grounded in direct, observable changes—such as altered rainfall patterns—rather than in scientific explanations or systemic causes (Mutsvangwa et al., 2012). For example, in Uganda, Kaase-Bwanga (2019) reported that farmers commonly linked climate change to deforestation and unpredictable weather but lacked understanding of broader anthropogenic drivers.

The level of knowledge has a direct influence on the uptake of CSA practices. Farmers with higher education levels and access to extension services are generally more likely to adopt adaptive strategies such as crop diversification, agroforestry, and water conservation (Deressa et al., 2009). However, in refugee contexts like Nakivale, multiple structural barriers—such as

Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

restricted land access, financial limitations, and weak institutional support—hinder the translation of knowledge into actionable practices (Muhangi et al., 2022).

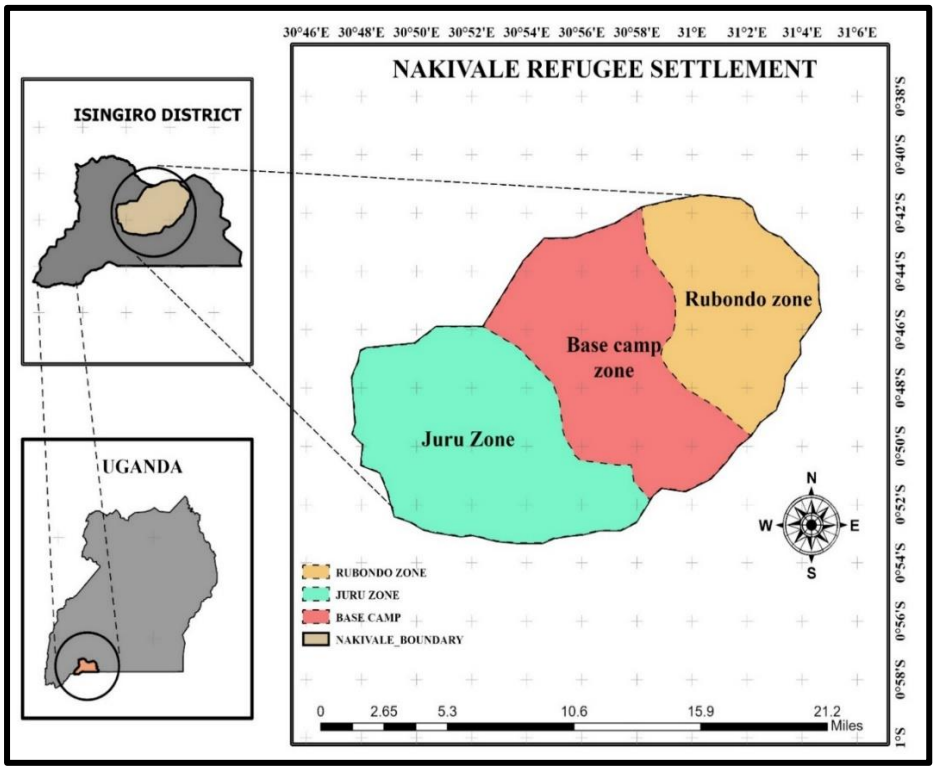
Media and agricultural extension services play a pivotal role in disseminating climate-related knowledge. Radio and television remain the most common information channels among smallholder farmers. Yet, these media outlets often fail to provide localised, participatory, and practical education tailored to the needs of refugee populations (Belay et al., 2022). Moreover, even when farmers are aware of CSA practices, technical knowledge gaps and a lack of resources frequently limit their implementation (Filho & Jacob, 2020).

This study contributes to the growing body of literature by examining the interrelationship between knowledge, socio-demographic characteristics, and institutional support in shaping farmers' climate change responses. By focusing on Nakivale Refugee Settlement, this research addresses a significant gap in studies on climate adaptation within displaced populations, offering insights to guide the design of resilience-building initiatives in similar humanitarian and development contexts.

METHODOLOGY

The study adopted a descriptive cross-sectional research design to assess knowledge related to climate change management among smallholder crop farmers. The total population was unknown, so Cochran's (1977) formula was used to estimate a sample size of 384 farmers. A multi-stage sampling technique was used, with simple random sampling within each zone. In addition, stratified sampling was followed for key informants, such as agricultural extension workers and local leaders were selected purposively. Primary data were collected using a semi-structured questionnaire, key informant interviews, and field observations. Quantitative data were coded and analysed using R software version 4.5, applying descriptive statistics, chi-square and logistic regression analysis tests to explore the factors influencing climate change management knowledge. Qualitative data from interviews were analysed thematically to complement the quantitative findings.

Figure 1: Map of the Study Area



Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

This study was conducted in Nakivale Refugee Settlement, located in Isingiro District in southwestern Uganda. The settlement is one of the oldest in Africa and hosts over 212,000 people, most of whom are smallholder crop farmers practising subsistence agriculture. The area is characterised by a tropical climate with two rainy and two dry seasons, though rainfall patterns have become increasingly unpredictable due to climate change. Agriculture is the main source of livelihood, but farmers face challenges such as land degradation, limited access to inputs, and low-income levels.

RESULTS AND DISCUSSIONS

Socio-demographic Characteristics of the Respondents

Information was gathered on key demographic characteristics of farmers: gender, educational level, farming duration, occupational status, age, household members, family income and farm size.

The table below presents the socio-demographic characteristics of the 384 smallholder crop farmers surveyed in the Nakivale refugee settlement. The distribution of participants is described across key variables including gender, educational attainment, farming experience, occupational status, age, household size, monthly family income, and family size. These demographic factors provide essential context for understanding the farmers' knowledge related to climate change management within this community.

Table 1: Socio-demographic Descriptive Characteristics of the Respondents

Variable	Group	Frequency (N= 384)	Proportion (%)
Gender			
	Female	175	45.6
	Male	209	54.4
Educational Level			
	No formal education	168	43.8
	Primary	126	32.8
	Secondary	84	21.9
	Tertiary	6	1.6
Farming duration			
	Less than 1 year	3	0.8
	1 – 5 years	65	16.9
	6 – 10 years	259	67.4
	More than 10 years	57	14.8
Occupational status			
	Agriculture	223	58.1
	Construction	34	8.9
	Trade	127	33.1
Age			
	18 – 35	84	21.9
	36 – 50	243	63.3
	Above 50	57	14.8
Household members			
	1 – 3	91	23.7
	4 – 6	184	47.9
	7 – 9	94	24.5
	More than 10	15	3.9
Family income (Monthly**)**			
	0 – 100,000	64	16.7

Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

Variable	Group	Frequency (N= 384)	Proportion (%)
	100,000 – 200,000	140	36.5
	200,000 – 300,000	89	23.2
	300,000 – 400,000	65	16.9
	400,000 – 500,000	26	6.8
Family size			
	0 – 0.5	25	6.5
	0.6 – 1	195	50.8
	Above 1	164	42.7

Of the 384 respondents, 209 individuals (54.4%) were male and 175 (45.6%) were female, reflecting a modest predominance of males within the farming population of the study area. This gender distribution indicates that while both men and women participate actively in agricultural activities, men represent the majority. Gender dynamics are critical in agricultural interventions, as they frequently affect resource accessibility, decision-making power, and the extent of engagement with extension services.

Most respondents (43.8%) had no formal education. About one-third (32.8%) had attained primary education, while 21.9% had reached secondary education. Only 1.6% had attained tertiary education. These results reveal a generally low level of formal education among farmers, which may limit their ability to access and utilise information related to climate change adaptation, agricultural technologies, and market opportunities. Tailoring agricultural extension messages to match the literacy levels of the target population is therefore critical.

The data shows that 67.4% of respondents have been engaged in farming for 6 to 10 years, indicating a relatively experienced farming population. A smaller proportion (16.9%) had farmed for 1 to 5 years, while 14.8% had more than 10 years of experience. Only 0.8% had less than one year of farming experience. This suggests that most farmers have had considerable exposure to agricultural activities, which may influence their awareness and practices concerning climate change management.

Agriculture was the primary occupation for 58.1% of respondents, followed by trade (33.1%) and construction (8.9%). This highlights the significance of agriculture as a source of livelihood among refugee populations. However, the presence of non-agricultural occupations may indicate efforts by households to diversify income sources, possibly as a coping strategy in response to environmental or economic pressures.

A significant proportion of respondents (63.3%) fell within the age range of 36 to 50 years, followed by 21.9% aged between 18 and 35 years, and 14.8% aged above 50. This age distribution suggests that the majority of farmers are within their prime working years, potentially enhancing labour availability and openness to adopting improved agricultural practices. Conversely, the relatively low representation of youth may reflect a lack of interest or existing challenges that hinder their involvement in farming activities.

Nearly half of the respondents (47.9%) reported having 4 to 6 household members, followed by 24.5% with 7 to 9 members, and 23.7% with 1 to 3 members. Only 3.9% had more than 10 household members. Household size is a key determinant of labour availability and consumption needs. Larger households may face increased food security challenges but could also provide more labour for agricultural activities.

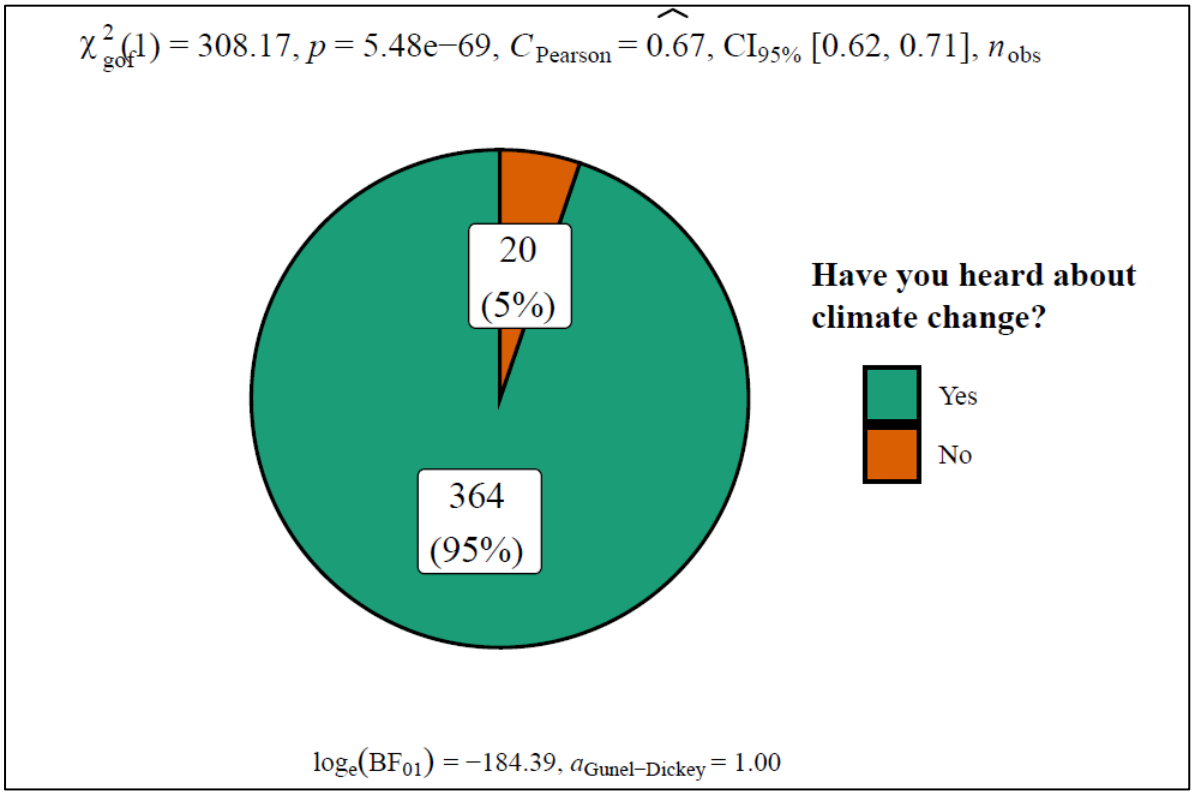
The income distribution indicates that the majority of households earn between 100,000 and 200,000 (36.5%) and between 200,000 and 300,000 (23.2%) Ugandan Shillings (UGX) per month. A notable portion (16.7%) earn less than 100,000, and only 6.8% earn between 400,000 and 500,000. These figures reflect generally low-income levels among farming households, which may limit their investment in improved

Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

agricultural technologies and practices for climate resilience.

Half of the respondents (50.8%) reported having farms between 0.6 and 1 acre. A substantial number (42.7%) have more than 1 acre, while only 6.5% operated on less than 0.5 acres. These findings suggest that while land access is limited, a significant number of farmers manage moderately sized plots. Limited farm sizes can hinder overall agricultural productivity and pose challenges to the adoption of large-scale climate-smart technologies, as such innovations often require more land, capital, and infrastructure than smallholder farmers can access.

Figure 1: Awareness of Climate Change



The Figure reveals that 95% of respondents had heard of climate change, indicating a high level of awareness among smallholder farmers. Only 5% were unaware of the issue. The statistical test (χ^2gof(1) = 308.17, p < 0.001) confirms that this distribution is highly significant, and the Pearson contingency coefficient ($C_{pearson}$ = 0.67) demonstrates a strong association. This suggests that awareness of climate change is widespread and not due to random variation. These quantitative findings are supported by qualitative insights from extension workers, many of whom emphasised that farmers are not only aware of climate change but are actively adapting to its patterns. One extension worker remarked,

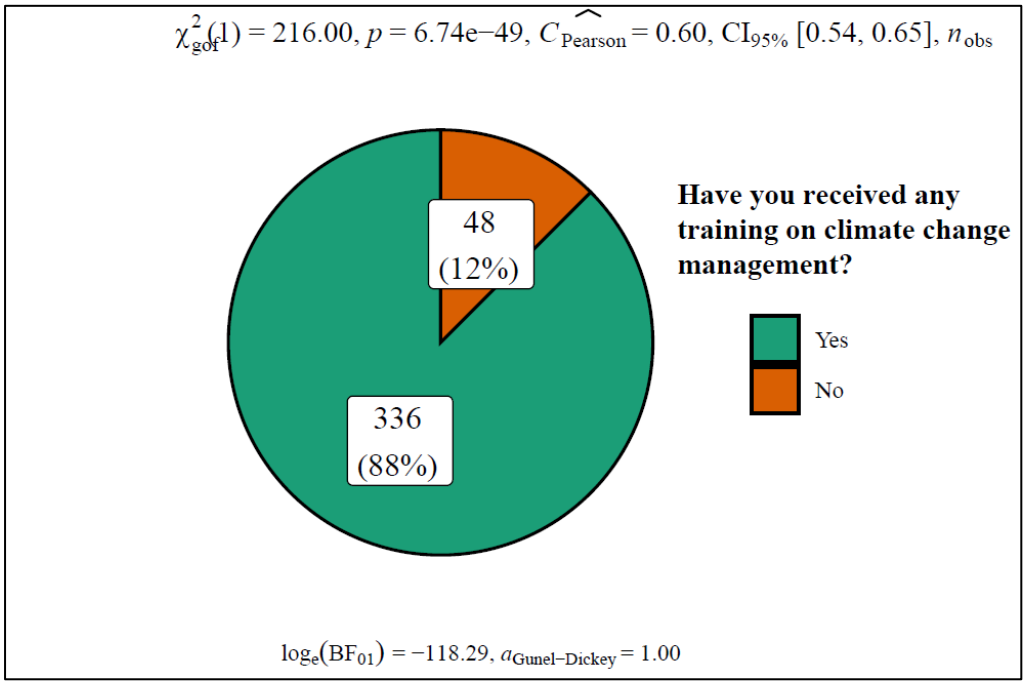
> *"Most of the farmers here are aware; they know the changes in seasons and have mastered the patterns over the years."*

This high level of awareness is likely attributed to the influence of mass media, especially radio and TV (57.3%), which were the most common sources of climate information. This aligns with previous studies, such as Mutsvangwa et al. (2012), who found that awareness of climate variability was widespread among smallholder farmers in Zimbabwe. Similarly, Bryan et al. (2009) reported that East African farmers are increasingly able to perceive climate-related changes, especially those related to rainfall and temperature. It also aligns with Belay et al. (2022) and the UNDP (2016) KAP survey, which found that while many rural populations are aware of

Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

climate change, their understanding is often superficial. Although the awareness level is encouraging, it does not necessarily reflect scientific knowledge.

Figure 2: Training on Climate Change



The Figure demonstrates that 88% of respondents reported receiving training on climate change management, while 12% had not, suggesting substantial exposure to either formal or informal training among smallholder farmers in the region. The chi-square goodness-of-fit test (χ^2(gof)(1) = 216.00, $p < 0.001$) indicates a statistically significant variation in the distribution of responses. Furthermore, the Pearson contingency coefficient ($C_{pearson}$ = 0.60) reflects a strong association between the variable and the observed frequencies. The confidence interval for the proportion of those trained, ranging from 54% to 65%, supports the reliability of these findings. The high level of training coverage in Nakivale aligns with research by Zougmoré et al. (2016), which emphasised that extension services and community-based training are among the most impactful channels for climate information dissemination in sub-Saharan Africa. Similarly, Kpadonou et al. (2017) found that access to climate-related training significantly enhances farmers' capacity to understand and adopt adaptive practices.

The table below summarises the primary sources of climate change information accessed by smallholder crop farmers (N=384) in Nakivale Refugee Settlement, Uganda. The data reveal disparities in farmers' reliance on government agencies, NGOs, community meetings, and radio/TV for climate-related knowledge. Chi-square (χ^2) tests were used to assess statistical significance, with all comparisons yielding p-values <0.001, indicating strong evidence of variation in information source preferences.

Table 2: Source of Training or Information on Climate Change

Source of Information	Yes N=384	No N=384	Overall (N=384)	χ^2	p-value
Government	135 (40.2%)	201 (59.8%)	336 (87.5%)	17.36	<0.001
NGO	101 (30.1%)	235 (69.9%)	336 (87.5%)	42.30	<0.001
Community Meetings	95 (28.3%)	241 (71.7%)	336 (87.5%)	53.38	<0.001
Radio/TV	220 (65.5%)	116 (34.5%)	336 (87.5%)	25.25	<0.001

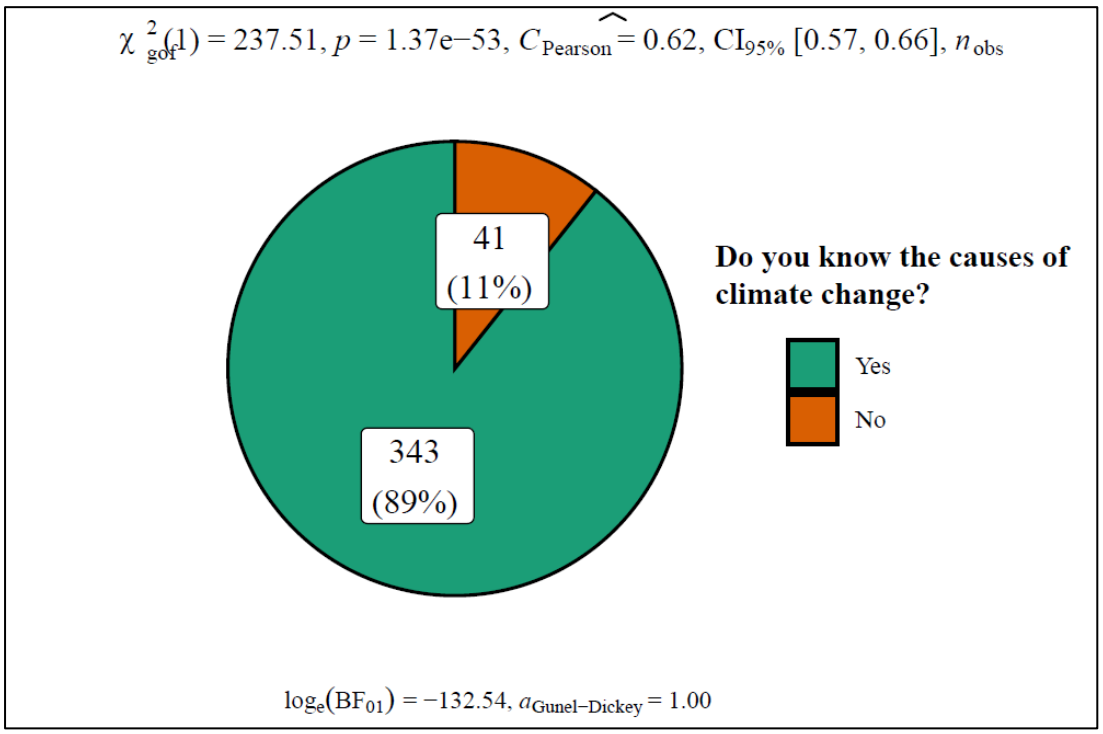
Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

The analysis reveals stark differences in how Nakivale's smallholder farmers access climate change information. Radio/TV dominates as the primary source (65.5%), benefiting from broad accessibility and ability to bypass literacy limitations - consistent with broadcast media's established effectiveness in rural Africa. Institutional channels show limited reach, with only 40.2% using government sources and 30.1% accessing NGO information, suggesting either inadequate outreach or possible trust issues within the refugee community. Most alarmingly, community meetings - typically vital for localised knowledge exchange - were underutilised (28.3%), representing a missed opportunity for participatory climate adaptation strategies. All results were statistically significant ($p<0.001$), with community meetings showing the strongest effect size ($\chi^2=53.38$). While mass media proves effective, these findings highlight the need to bolster community-based and institutional channels to develop a comprehensive climate information network for refugee farmers. This suggests that access to information is closely linked to training in climate change management. One local leader noted,

> *"Farmers here mostly receive training and information through radio programs. It's the easiest and most accessible source for them."*

This qualitative insight aligns well with the survey findings. These results are consistent with Belay et al. (2022), who noted that access to climate information through radio is a key determinant in influencing farmers' adaptive strategies. However, the relatively low engagement with NGOs and community meetings suggests missed opportunities for more localised, participatory knowledge-sharing platforms that can provide context-specific guidance. This gap underscores the need for improved extension services and targeted educational campaigns within refugee settlements. This finding is consistent with the work of Mogues et al. (2012) and Zander et al. (2013), who emphasised the role of electronic media as a cost-effective and far-reaching tool for delivering agricultural extension services in rural areas. The high dependence on media suggests that it is both accessible and trusted among the refugee farming population.

Figure 3: Knowledge About the Causes of Climate Change



Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

The data presented in the Figure indicate that a significant majority of respondents (89%) demonstrated awareness of the causes of climate change, whereas only 11% reported a lack of such knowledge. This points to a generally high level of understanding regarding the drivers of climate change among the farmers surveyed in the study area. The accompanying statistical analysis, χ^2 goodness-of-fit ($\chi^2(1) = 237.51$, $p < 0.001$), reveals that the observed distribution significantly deviates from what would be expected under a null hypothesis of equal proportions. Additionally, the Pearson contingency coefficient ($C_{pearson} = 0.62$) indicates a strong association, suggesting a notable relationship between respondents and their level of knowledge concerning the causes of climate change.

This table presents the respondents' knowledge on various causes of climate change, showing the frequency and percentage of those who answered "Yes" or "No" to each cause. It also includes the chi-square (χ^2) values and p-values to indicate the statistical significance of the responses.

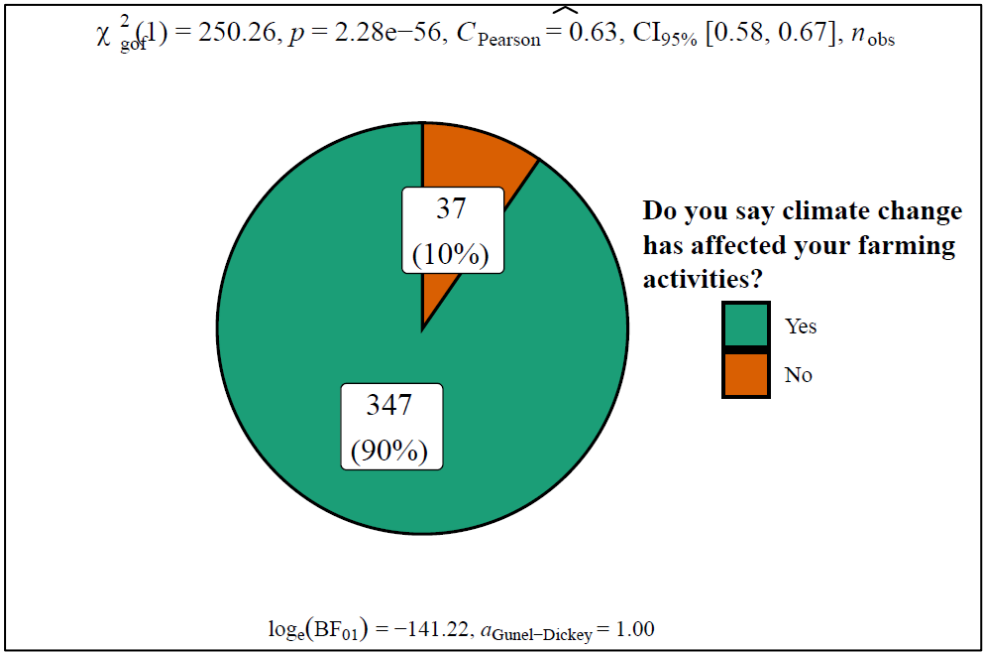
Table 3: Causes of Climate Change

Causes	Yes (N=343)	No (N=41)	Overall (N=384)	χ^2	p-value
Deforestation	274 (79.9%)	0 (0%)	274 (71.4%)	15.67	<0.001
Burning Fossil Fuels	0 (0%)	0 (0%)	0 (0%)	-	-
Industrial Activities	90 (26.2%)	0 (0%)	90 (23.4%)	8.92	0.003
Natural Processes	0 (0%)	0 (0%)	0 (0%)	-	-

The results show that a significant proportion of respondents identified deforestation (71.4%) and industrial activities (23.4%) as causes of climate change, with both showing statistically significant associations ($p < 0.05$). This indicates a relatively higher awareness of these factors among the farmers. However, none of the respondents identified burning fossil fuels or natural processes as contributors to climate change, suggesting a major gap in knowledge concerning key scientific causes. This lack of awareness may limit the community's capacity to fully understand or respond to climate change impacts, highlighting the need for targeted education and sensitisation efforts. These findings reveal that although deforestation is widely acknowledged, there is limited awareness of other scientifically established causes, such as fossil fuel use and industrial emissions. The uninformed group, as expected, failed to identify any causes, underscoring their limited understanding. Overall, the results suggest that respondents possess an incomplete grasp of the causes of climate change, with substantial gaps in knowledge concerning critical anthropogenic sources. This pattern suggests that farmers' knowledge is more rooted in observable impacts affecting their immediate farming outcomes rather than in abstract or distant scientific causes. Such awareness aligns with findings by Prajapati et al. (2024) and Minoli et al. (2022), who documented similar perceptions among smallholder farmers in climate-vulnerable regions. This limited scope of understanding reflects findings by Nzeadibe et al. (2011), who reported that farmers often hold partial or localised interpretations of climate change causes, largely shaped by environmental experiences and community discussions.

Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

Figure 4: Knowledge of Farmers About the Effects of Climate Change on Farming Activities



The Figure illustrates that a substantial majority of respondents (90%) reported experiencing the effects of climate change on their farming practices, whereas only 10% indicated no such impact. This reflects a strong perception of climate change-related disruptions among farmers within the study area. The accompanying chi-square goodness-of-fit test (χ^2 (1) = 250.26, p < 0.001) confirms that the observed distribution significantly diverges from a random or equal distribution. Additionally, the Pearson contingency coefficient ($C_{pearson}$ = 0.63) signifies a strong effect size, indicating a pronounced association between respondents and their perceived impact of climate change on agricultural activities. This high level of reported impact supports the findings of Bryan et al. (2009), who showed that farmers often recognise changes in climate through personal experience before formal climate models confirm these trends. It also corresponds with the evidence that in refugee-hosting areas like Nakivale, where resources and infrastructure are often limited, the perception of climate change is heightened due to direct exposure and lack of buffer mechanisms.

This table presents the respondents' knowledge of the effects of climate change. It shows the number and percentage of those who identified specific effects as being linked to climate change, along with the corresponding chi-square (χ^2) values and p-values to determine the statistical significance of the responses.

Table 4: Effects of Climate Change on Farming Activities

Effects	Yes (N=347)	No (N=37)	Overall (N=384)	χ^2	p-value
Reduced crop yields	296 (85.3%)	0 (0%)	296 (77.1%)	14.85	<0.001
Unpredictable rainfall patterns	253 (72.9%)	0 (0%)	253 (65.9%)	11.20	0.001
Increase in pests and diseases	206 (59.4%)	0 (0%)	206 (53.6%)	9.43	0.002
Soil degradation	120 (34.6%)	0 (0%)	120 (31.3%)	7.88	0.005

The table summarises farmers' perceptions regarding the impacts of climate change on their agricultural activities. Among respondents who acknowledged being affected by climate change (N = 347), the most frequently reported consequence was a decline in crop yields (85.3%),

Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

followed by irregular rainfall patterns (72.9%), an increase in pest and disease outbreaks (59.4%), and soil degradation (34.6%). In contrast, those who indicated that climate change had not impacted their farming (N = 37) did not identify any of the specified effects, further validating their stated perception of no influence. When considering the entire sample, reduced crop productivity was the most widely cited impact (77.1%) as Lobell et al. (2011) emphasised that climate change negatively affects crop productivity, especially in low-latitude regions, due to heat stress and water scarcity, whereas soil degradation was the least mentioned (31.3%). Unpredictable rainfall, reported by 65.9% of respondents, reflects broader climatic instability documented in East Africa, where seasonal shifts and rainfall variability disrupt planting calendars (IPCC, 2022). Thornton et al. (2014) also noted that such variability compromises food security for rain-fed agriculture systems.

The increase in pests and diseases (53.6%) corresponds with findings from Deutsch et al. (2018), who observed that rising temperatures expand the geographic range and lifecycle speed of crop pests, compounding agricultural vulnerability. Similarly, soil degradation (31.3%) is a consequence of intensified weather events and land pressure, as outlined by FAO (2018), which highlights that climate change accelerates soil nutrient depletion and erosion in sub-Saharan Africa. These results suggest that farmers tend to associate climate change predominantly with immediate, observable outcomes, particularly those affecting crop performance and weather variability, while less tangible or gradual effects, such as soil degradation, are comparatively underrecognized. A program officer from the Department of Possibility observed,

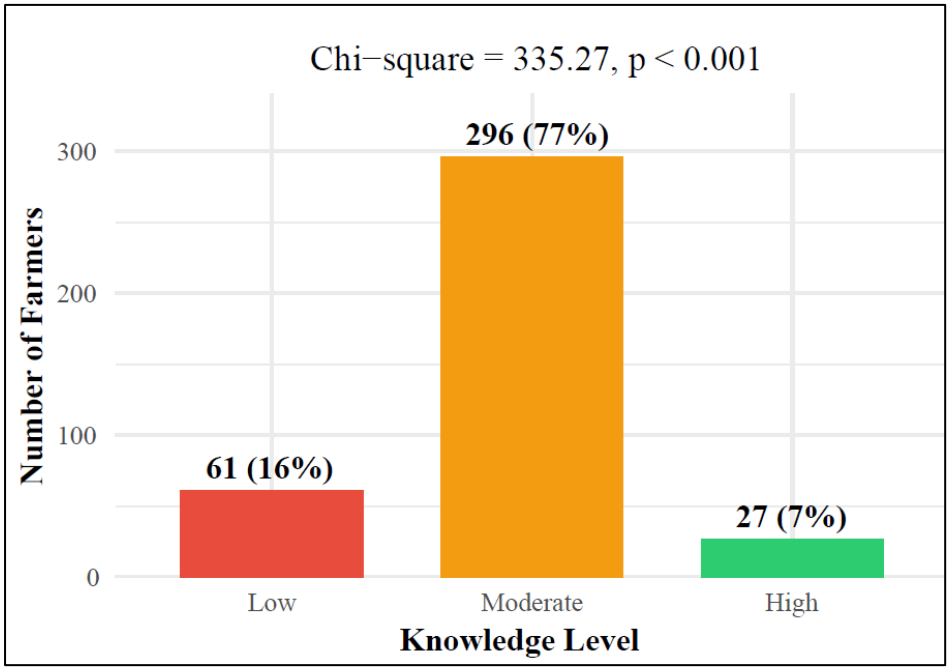
> *"The effects we're seeing here are mostly increased pests and diseases, reduced crop yields, and unpredictable rainfall patterns—it's affecting how farmers plan and manage their crops."*

This view was echoed by a representative from Action for Hunger, who confirmed that,

> *"These are the same challenges we hear from farmers regularly—yields are going down, rains are no longer reliable, and pests are becoming harder to control."*

These insights are strongly supported by the survey results above.

Figure 5: Level of Knowledge of Farmers on Climate Change



Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

The Figure depicts the categorisation of farmers according to their level of knowledge about climate change. The majority (77%) exhibited a moderate level of understanding, while 16% displayed low knowledge and only 7% demonstrated a high level of comprehension. These results suggest that although most farmers have some awareness of climate change, only a small proportion possess a thorough or advanced understanding. The chi-square test outcome ($\chi^2 = 335.27$, $p < 0.001$) confirms that the variation in knowledge levels is statistically significant and unlikely to be attributed to random chance. These findings underscore a substantial gap in in-depth knowledge, highlighting the importance of targeted educational and awareness initiatives aimed at enhancing farmers' understanding from moderate to high levels. This outcome directly contributes to addressing the first research objective by clearly illustrating the current distribution of climate change knowledge within the farming community. According to the KAP model (Nguyen et al., 2019; Vandamme, 2009), knowledge is the essential foundation for developing attitudes and practices. A moderate level of knowledge, while better than low, may not be sufficient to drive transformational behavioural changes in climate adaptation, especially in complex contexts such as refugee settlements, where vulnerabilities are heightened. The theory of planned behaviour (Ajzen, 1991) further supports this notion, suggesting that without strong and accurate knowledge, individuals are less likely to form intentions that result in proactive adaptation behaviours. The results are consistent with previous studies by UNDP (2016) and Kaase-Bwanga (2019), which similarly found that awareness exists, but comprehensive knowledge is lacking in rural and refugee communities. The results highlight a discrepancy between knowledge of climate change impacts and knowledge of its causes. While most farmers can recognise symptoms such as declining yields and erratic rainfall, their understanding of underlying drivers remains superficial or inaccurate. For example, despite the global consensus on fossil fuels as a primary climate driver, none of the respondents identified them, suggesting critical gaps in scientific climate literacy. This finding is particularly relevant considering the KAP model, which suggests that knowledge acquisition is the first step in the behaviour change process (Roger, 1995; Nguyen et al., 2019). According to Hungerford and Volk (1990), effective environmental action requires both issue-specific knowledge and action-related skills. Without an accurate understanding of causes, smallholder farmers may struggle to engage in meaningful climate change mitigation or adaptation efforts. Additionally, the Theory of Planned Behaviour (Ajzen, 1991) emphasises that behaviour is influenced by knowledge, perceived control, and attitudes. If knowledge is fragmented or incomplete, farmers' ability to form adaptive intentions and practices is diminished.

The table below presents the results of an ordinal logistic regression analysis examining the influence of selected socio-demographic factors on the level of knowledge regarding climate change management among smallholder crop farmers in Nakivale refugee settlement. The analysis includes estimates of regression coefficients (B), standard errors (SE), t-values, and associated p-values, indicating the strength and significance of each predictor.

Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

Table 5: Analysis of Ordinal Logistic Regression for Socio-demographic Factors Influencing Knowledge toward Climate Change Management among Smallholder Crop Farmers in Nakivale Refugee Settlement

Predictor	B	SE	*t*	*p*
Age (36 – 50)	0.625	0.409	1.53	0.127
Age (Above 50)	0.357	0.590	0.61	0.545
Gender (Male)	0.378	0.292	1.29	0.195
Education (Primary)	0.816	0.345	2.37	0.017
Education (Secondary)	1.010	0.457	2.21	0.027
Education (Tertiary education)	1.501***	0.451	3.33	0.001
Household members (4 – 6)	–0.032	0.378	–0.09	0.931
Household members (7 – 9)	1.107	0.291	3.81	0.017
Household members (More than 10)	–0.311	0.607	–0.51	0.718
Family income (100,000 – 200,000)	–0.010	0.424	–0.02	0.981
Family income (200,000 – 300,000)	–0.874	0.519	–1.69	0.096
Family income (300,000 – 400,000)	–0.232	0.569	–0.41	0.692
Family income (400,000 – 500,000)	1.614	1.175	1.37	0.032
Farming duration (6 – 10 years)	–0.311	0.426	–0.74	0.458
Farming duration (Less than 1 year)	1.286	0.531	2.42	0.214
Farming duration (More than 10 years)	–0.494	0.664	–0.75	0.456
Farm size (0.6 – 1)	1.301	0.225	5.84	0.010
Farm size (Above 1)	2.968	0.425	6.97	0.001
Occupation (Trade)	0.068	0.332	0.21	0.837
Occupation (Construction)	–1.302	0.512	–2.54	0.011

Significance. *codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

The results showed that participants with primary education (B = 0.816, SE = 0.345, t = 2.37, p = .017) and secondary education (B = 1.010, SE = 0.457, t = 2.21, p = .027) and Tertiary education (B = 1.501, SE = 0.451, t = 3.33, p = 0.001)were significantly more likely to report higher knowledge levels compared to those with no formal education. This finding aligns with studies by Mwalukasa (2013) and Atubukha et al. (2022), which emphasise education's role in enhancing farmers' ability to understand and apply climate information. A statistically significant association was also found for respondents from households with 7–9 members (B = 1.107, SE = 0.291, t = 3.81, p = .017), indicating a higher likelihood of increased knowledge. This may reflect greater intra-household collaboration, labour availability, and access to diverse information channels, consistent with findings by Ndamani and Watanabe (2015). Additionally, both farm size between 0.6 and 1 acre (B = 1.301, SE = 0.225, t = 5.84, p = .010) and farm size above 1 acre (B = 2.968, SE = 0.425, t = 6.97, p = .001) were significantly associated with higher knowledge levels. However, the influence of household size remains context-specific, as other studies such as Mugi-Ngenga et al. (2016) found that large families can also face resource constraints that limit information uptake. Farm size was positively associated with knowledge levels. Farmers with landholdings of 0.6 acres or more were significantly more knowledgeable, possibly due to heightened exposure to climate impacts and a stronger motivation to seek adaptive knowledge. Respondents working in construction-related occupations were significantly less likely to report higher knowledge levels (B = –1.302, SE = 0.512, t = –2.54, p = .011). Occupation also showed a significant association. Farmers engaged in construction-related work were less likely to report high climate knowledge, likely due to reduced engagement with agricultural practices and climate information channels. This aligns with Juana et al. (2013), who found that non-agricultural income sources can decrease exposure to agricultural innovation. No significant effect was observed for those in trade, suggesting that the influence of off-farm income depends on the nature of the activity. Other predictors, including age, gender, household size

Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

categories (4–6 and more than 10), family income, farming duration, and occupation in trade, were not statistically significant ($p > .05$). These results suggest that in the refugee context, access to institutional support and educational opportunities may play a more critical role in shaping climate knowledge than demographic factors or economic status. This perspective is supported by Mwalukasa (2013), who emphasises institutional outreach over income as a driver of knowledge acquisition. In conclusion, the study underscores the primacy of education, household size, farm size, and occupation in shaping farmers' climate change knowledge in refugee settings. These findings highlight the need for context-specific, inclusive, and accessible educational interventions, while also recognising that livelihood dynamics play a more decisive role than traditional demographic indicators in determining knowledge outcomes within displaced agricultural communities. This observation supports previous research by Deressa et al. (2009) and Asrat and Simane (2017), though it contrasts with Tambo and Abdoulaye (2013), who caution that land ownership does not guarantee knowledge gains in the absence of effective extension services.

CONCLUSIONS

The study concludes that while awareness of climate change is high among smallholder farmers in Nakivale Refugee Settlement, comprehensive scientific knowledge remains limited. Farmers tend to recognise the immediate and visible effects of climate change—such as reduced crop yields, irregular rainfall, and pest outbreaks—yet demonstrate a superficial understanding of its underlying causes, especially anthropogenic contributors like fossil fuels and industrial emissions. The results indicate that knowledge is shaped more by lived experiences and practical exposure than by formal scientific or institutional education. Factors significantly influencing knowledge levels include educational attainment, household size, farm size, and occupation, with farmers possessing tertiary education and larger landholdings demonstrating greater understanding. Conversely, engagement in non-agricultural livelihoods, particularly construction, was negatively associated with climate knowledge. These findings underscore the complex dynamics of knowledge formation in resource-constrained refugee environments and call for targeted strategies to enhance climate literacy and empower informed adaptation practices.

Recommendations

To address the observed gaps in climate change knowledge, especially regarding scientific causes, tailored training programs should be developed focusing on both practical impacts and scientific explanations. Mass media, particularly radio and TV, should be further utilised to deliver accessible and accurate information. Community meetings and farmer groups must be revitalised to promote participatory knowledge exchange. Integrating climate education into refugee support services can help reach vulnerable groups more effectively. Additionally, strengthening formal education, especially among youth and women, and expanding the reach of extension services will be key to improving knowledge levels. Special attention should be given to non-agricultural households, who may be less exposed to climate information, through targeted outreach and inclusion in community awareness campaigns.

REFERENCES

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211.

Asrat, P., & Simane, B. (2017). Farmers' perception of climate change and adaptation strategies in the Dabus watershed, North-West Ethiopia. *Ecological Processes, 6*(1), 1–13.

Atubukha, B., Egeru, A., & Wasonga, O. V. (2022). Climate change perception and adaptation strategies among smallholder farmers in East Africa. *Climate and Development, 14*(3), 249–261.

Belay, A., Recha, J. W., Woldeamanuel, T., & Morton, J. F. (2022). Smallholder farmers'

Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

adaptation to climate change and variability in Ethiopia. *Climate Risk Management, 36*, 100417.

Bryan, E., Deressa, T. T., Gbetibouo, G. A., & Ringler, C. (2009). Adaptation to climate change in Ethiopia and South Africa: options and constraints. *Environmental Science & Policy, 12*(4), 413–426.

Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). New York: John Wiley & Sons.

Deressa, T. T., Hassan, R. M., Ringler, C., Alemu, T., & Yesuf, M. (2009). Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. *Global Environmental Change, 19*(2), 248–255.

Deutsch, C. A., Tewksbury, J. J., Tigchelaar, M., Battisti, D. S., Merrill, S. C., Huey, R. B., & Naylor, R. L. (2018). Increase in crop losses to insect pests in a warming climate. *Science, 361*(6405), 916–919.

FAO. (2018). *The state of the world's biodiversity for food and agriculture*. Rome: Food and Agriculture Organization.

FAO. (2020). *FAO in emergencies: Uganda*. Rome: Food and Agriculture Organization. Retrieved from http://www.fao.org/emergencies

Filho, W. L., & Jacob, D. (2020). *Handbook of climate change resilience*. Springer Nature.

Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *The Journal of Environmental Education, 21*(3), 8–21.

IPCC. (2022). *Climate Change 2022: Impacts, Adaptation, and Vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

Juana, J. S., Kahaka, Z., & Okurut, F. N. (2013). Farmers' perceptions and adaptations to climate change in sub-Saharan Africa: A synthesis of empirical studies and implications for public policy in African agriculture. *Journal of Agricultural Science, 5*(4), 121–135.

Kaase-Bwanga, E. (2019). Understanding climate change perceptions and adaptation among rural farmers in Uganda. *African Journal of Environmental Science and Technology, 13*(3), 90–100.

Kpadonou, R. A. B., Nonvide, G. M. A., & Yabi, J. A. (2017). Determinants of farmers' adaptation strategies to climate change in West Africa: Evidence from Benin. *Climatic Change, 144*(2), 139–155.

Lobell, D. B., Schlenker, W., & Costa-Roberts, J. (2011). Climate trends and global crop production since 1980. *Science, 333*(6042), 616–620.

Mandel, D., & Lipovetsky, M. (2021). Risk perceptions of climate change among rural populations. *International Journal of Climate Change Strategies and Management, 13*(1), 1–15.

Minoli, S., Meza, F. J., Rojas, M., & Letta, M. (2022). Farmers' perceptions and responses to climate variability in South America. *Agricultural Systems, 198*, 103388.

Mogues, T., Benin, S., & Cudjoe, G. (2012). Do external grants to rural governments crowd out public spending on rural development? *World Development, 40*(10), 2153–2163.

Mugi-Ngenga, E., Mucheru-Muna, M., Mugwe, J., Mairura, F., & Zingore, S. (2016). Household typologies and influence of livelihood strategies on conservation agriculture adoption in eastern Kenya. *International Journal of Agricultural Sustainability, 14*(3), 249–267.

Muhangi, J., Okiror, J. J., & Kansiime, M. K. (2022). Barriers to climate change adaptation among smallholder farmers in refugee

Article DOI: https://doi.org/10.37284/eajenr.8.2.3478

settlements. *Climate and Development, 14*(5), 417–428.

Mutsvangwa, E. P., Masamvu, K., & Manyeruke, C. (2012). Climate change awareness and adaptation among farmers in Zimbabwe. *International Journal of Humanities and Social Science, 2*(8), 16–24.

Mwalukasa, T. (2013). Agricultural information sources used for climate change adaptation in Tanzania. *Library Review, 62*(4/5), 266–292.

Ndamani, F., & Watanabe, T. (2015). Farmers' perceptions about climate change and responsive strategies in Ghana. *Agriculture & Food Security, 4*(1), 1–12.

Nguyen, T. P. L., Seddaiu, G., Virdis, S. G. P., Tidore, C., Pasqui, M., Re, M., & Roggero, P. P. (2019). Perceiving to learn or learning to perceive? Understanding farmers' perceptions and adaptation to climate uncertainties. *Agricultural Systems, 176*, 102660.

Nzeadibe, T. C., Egbule, C. L., Chukwuone, N. A., & Agu, V. C. (2011). Climate change awareness and adaptation in the Niger Delta region of Nigeria. *African Technology Policy Studies Network, 57*, 1–35.

Prajapati, A., Thapa, G., & Sthapit, S. (2024). Climate change perception and adaptation strategies of smallholder farmers in Nepal. *Climate and Development*. https://doi.org/10.1080/17565529.2024.XXXXX

Roger, E. M. (1995). *Diffusion of innovations* (4th ed.). New York: Free Press.

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.

Thornton, P. K., Ericksen, P. J., Herrero, M., & Challinor, A. J. (2014). Climate variability and vulnerability to climate change: a review. *Global Change Biology, 20*(11), 3313–3328.

UNDP. (2016). *Uganda: Knowledge, attitudes and practices (KAP) survey on climate change*. Kampala: United Nations Development Programme.

UNHCR. (2023). *Uganda refugee response: Population dashboard*. United Nations High Commissioner for Refugees. Retrieved from https://data.unhcr.org

Vandamme, L. (2009). Knowledge, attitude and practices model: An overview. *International Journal of Health Promotion and Education, 47*(2), 62–64.

Zander, K. K., Parkes, R., & Garnett, S. T. (2013). A framework for understanding the role of local ecological knowledge in climate change adaptation. *Ecology and Society, 18*(3), 37.

Zougmoré, R. B., Partey, S., Ouédraogo, M., Thornton, P., & Herrero, M. (2016). West African agriculture and climate change: A comprehensive analysis. *IFPRI Research Report 175*.

