

Rural Communities Perception of the Environment and Climate Change: A Case Study of the Malulo Community

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Abstract: Mozambique is one of the countries in Africa whose survival base for the majority of the population is agriculture, with the majority practicing subsistence or family agriculture, which depends crucially on the weather for their income. The present work was carried out in the Malulo community, in Niassa Province, and aimed to assess the population's level of perception about the environment and climate change. To achieve the objectives outlined for this research, the following methods were used: questionnaire, interview, document analysis, and literature review. One hundred and fourteen (114) individuals from the six neighborhoods that divide the Malulo community were interviewed, the interviewees were selected based on a probabilistic sample, of the stratified and random type, where the neighborhoods were used as strata and the choice of houses was random. The responses of the members of the communities were a group in a database and, according to the similarity, percentages were obtained and these presented in graphs. In a previous analysis of the questionnaire, it was found that 55.3 percent (%) of the individuals interviewed in the community know about climate change, having pointed out some problems, such as pollution, water waste, and deforestation. Thus, it can be inferred that farmers understanding the problems that plague the community where they live.

Keywords: Desertification, Global Warming, Family Farming, Rural Extension, Community Development

1. Introduction

Climate change poses an increasingly serious threat to all forms of life, especially among the poorest populations. One of the effects of climate change is the change in temperature in the world, which has a devastating impact on crops and, consequently, food shortages [37].

Mozambique is one of the countries that suffer most from the negative impacts of climate change, as its population is mostly rural and its survival depends fundamentally on agriculture. Agricultural practice and the population's food security are affected by many problems related to climate change with repercussions arising from drought, floods, and cyclones [12].

Mozambique is historically the country most affected by

natural disasters in southern Africa, according to data from the World Disaster Report, more than eight million Mozambicans have been affected by natural disasters in the last thirty years. According to the global disaster database, Mozambique has recorded more than 53 disasters in the last 45 years – 1.17 on average per year.

During the variations in temperature and precipitation (causing floods, droughts, and even tropical cyclones), recorded in the world and in particular in the country, it is important to highlight the dependence of rural communities on meteorological conditions to obtain better productivity and availability of resources for their livelihood.

The biggest problem in rural communities and particularly in the community of Malulo is the lack of technical and scientific knowledge regarding changes in rainfall and temperature in that area, which has impacting consequences

on agricultural production and productivity and the availability of resources for subsistence.

In visits made throughout the course, the mystical and/or supernatural belief regarding changes in precipitation was notable, where some of the inhabitants claimed that the lack of ceremonies for the ancestors linked to such facts. This time, the importance of researching the field of perception of the Malulo community is highlighted to ascertain the level of technical and scientific knowledge and perception about changes in temperature and precipitation, which has a direct relationship with the climate changes that occur in the world and in particular in that community.

The lack of knowledge or even the inexistence of research in the field of the perception of rural communities regarding the environment and climate change in Mozambique is also a concern.

Perception studies on the environment and climate change, although complex, are important, as they help to understand the behavior and degree of precaution in the actions of individuals in the face of these changes.

It would be difficult or the little importance to build development programs and adaptation strategies to climate change without investigating the different perceptions of the social actors involved. Therefore, perception studies can be useful tools in rural development programs that consider the need to design climate change adaptation strategies [9].

From an educational point of view, it is essential to investigate the level of perception about the environment in the Malulo community, so that action strategies can be developed that allow for short-term changes to be made in the face of local difficulties, focusing on the real conditions of farmers, encouraging them to apply their knowledge, experiences, perceptions of life and work processes, their ways of thinking and knowing reality, daily practice and their interrelationship with climate change.

The study of the perception of the environment and climate change in the Malulo community will provide elements for the understanding of choice mechanisms and social behaviors, for the creation of adaptive measures and public policies that reflect the varied contexts of the community, identifying in them which problems they are a priority, helping to show the gravity, nature and possible negative effects of climate change felt by its inhabitants and help to identify different perceptions about climate change that enable the meeting of different perspectives and the constructive dialogue of knowledge.

2. Literature Revision

2.1. Climate Change and Perception in Mozambique

2.1.1. Climate Change in Mozambique

Climate change is a long-term alteration in the weather pattern in a specific region and for a significant period [37]. Climate change in the country is manifested through changes in the pattern of temperature and precipitation, rise in sea

level, both in frequency and intensity, of extreme weather events, such as drought, floods, and tropical cyclones, which affect different regions of the country every year, resulting in the loss of human lives, crops, domestic animals and wildlife, the destruction of social and economic infrastructure, increased dependence on international aid, increased product prices agriculture, the deterioration of human health, environmental degradation and loss of ecosystems [35]. Mozambique is especially vulnerable to climate change due to its geographical location in the intertropical convergence zone and downstream of shared river basins, its long coastline and the existence of extensive areas with an altitude below current sea level, as well as poverty, the limited investments in advanced technology and the fragility of infrastructure and social services. Climate scenarios developed for Mozambique, during the preparation of the First National Communication, indicate that by 2075 there may be an increase in the average air temperature between 1.8°C and 3.2°C, a reduction in precipitation between 2 and 9%, an increase in solar radiation between 2 and 3% and increase in evapotranspiration between 9 and 13% [43].

2.1.2. Mozambique's Contribution to Greenhouse Gas Emissions

Greenhouse gases are those that absorb a part of the sun's rays and redistribute them as radiation in the atmosphere, heating the planet in a phenomenon called the greenhouse effect, with the main greenhouse gases being carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), ozone (O₃) halo carbides and water vapor [32]. The designation greenhouse effect is given in analogy to the heating generated by greenhouses, usually made of glass, in the cultivation of plants [34]. The greenhouse effect is a natural phenomenon that allows the existence of life on earth, as we know it since without it the heat would escape, causing a cooling that would make the planet uninhabitable for many species, and the problem lies in its intensification, due to human actions [32].

Mozambique contributes a total of direct greenhouse gases of approximately 9.3 Gigagram (Gg) of CO₂; 54.5 Gg of CH₄ and 2.3 Gg of N₂O [43]. Recent assessments by the National Institute for Disaster Management (ING) carried out in 2007 [43] indicate that there will be no significant reduction in CO₂ emissions for the next 20 years or more, meaning that the country will continue to have a contribution of around 0.025% of global emissions.

2.1.3. Environmental Perception

Perception is not just the sensation given by Organs sensory organs [13]. We see, hear, feel and touch, in short, everything that stimulates our senses. However, we perceive only what our minds assign meaning. Perception is highly selective, exploratory, and anticipatory. Hence, we consider it a perceptive activity, which explores, selects, and compares us, anticipates everything we perceive. The individual is in constant contact with the environment, even if he does not have a more elaborated perception of it, since the meaning of the environment is an attribute to the natural

environment, the physical environment, the landscape, which assumes only the role of spectator of nature. Stimulate their will to live better becomes very opportune for them to develop their perception of the environment, a fact that requires work that brings to this individual the knowledge related not only to the environment as a whole but to the social and economic context, awakening awareness of responsibility and devising strategies for survival and conservation of this set that forms the environment in which we live and work.

As described above, perception is not based only on our senses, but on what the mind gives meaning, this time it is important that organizations, whether governmental or non-governmental, together with academic institutions, can interact with the rural community, thus transmitting their experiences and knowledge.

The level of perception concerning the environment is one of the feasible methodological strategies to identify understandings on socio-environmental issues such as climate change. It also makes it possible for subjects to participate in the socio-environmental management of the context in which they are daily. Given the complexity of the harmful effects of global warming and the need for studies on adaptation, vulnerability, and resilience, humanity's accommodation and inertia are worrisome. It can be motivated either by the lack of knowledge about the subject or by the lack of interest of the entrepreneurs who caused the

problem. Thus, it is essential to identify the level of perception of the population to effectively combat the causes and consequences of global warming in the country [15].

3. Material and Methods

3.1. Description of the Study Area

3.1.1. Geographic Location

The study was conducted in Sanga district, which is located in the north of Niassa province, and covers a length of 12185 km, being one of the longest in the south-north direction (Lichinga district to the Rovuma River) and with a dense population of 4.6 inhabitants per square kilometer (inhabitant/km²) [25]. Its northern boundary is with the United Republic of Tanzania, across the Rovuma River, to the south with the district of Lichinga, to the east with the districts of Mavago and Muembe, and the west with the district of Lago [34]. Given the vastness of the district, the study was carried out at the Unango Administrative Post, in the Malulo community. With a projection of 78272 inhabitants in 2017, the district registered a population growth of 152 people in the estimated value (Census 2017), accounting for a total of 78424 against the previous 56165 inhabitants observed in the 2007 census, of which 4660 inhabitants are included in the above community cited [25].

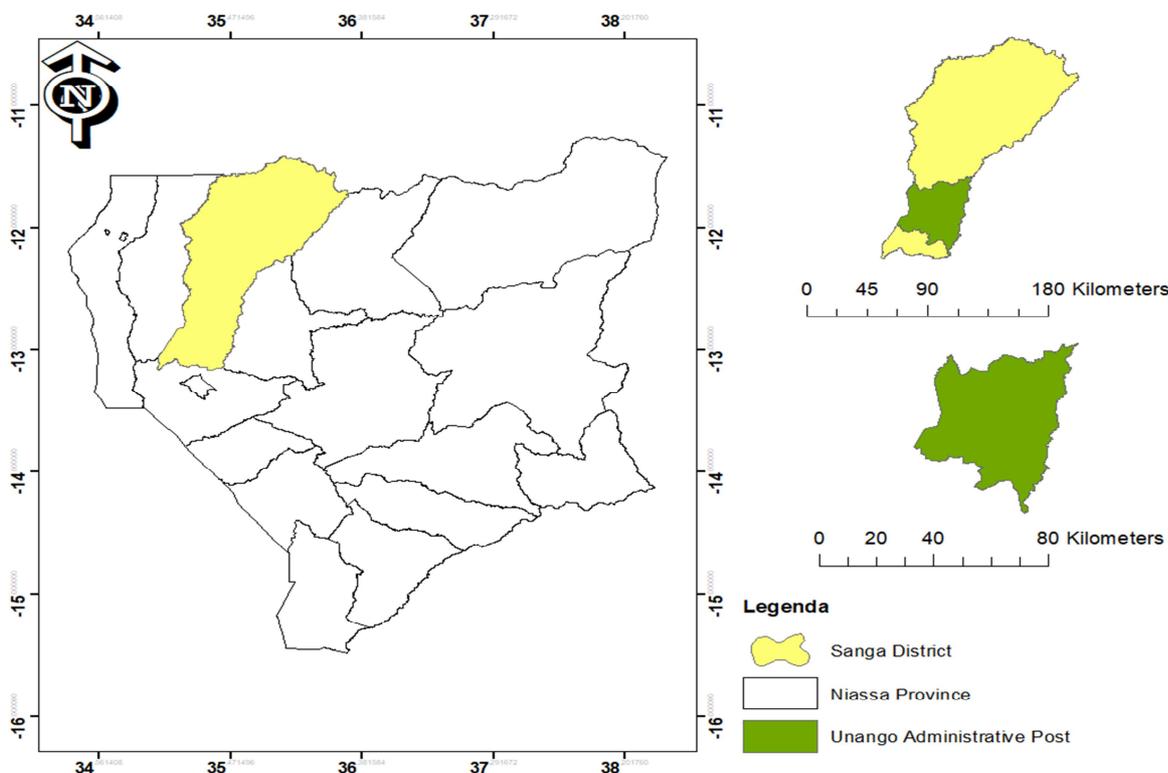


Figure 1. Location map of the study area.

3.1.2. Climate

The region is under the influence of the intertropical

convergence zone, which originates in two well-defined seasons, the hot and rainy season that runs from December to March, with April as the transition month and the dry and

cold season from May to October with November being transitional. Average annual precipitation ranges from 1000 to 1200 mm (mm) in the far north, along the Rovuma and Lucheringo rivers, reaching a maximum of 2000 mm in the highest areas of the mountain range. The average values of temperatures during the hot and humid season are 20°C and 23°C in the plateau zone and the Sanga mountain range. These values increase to 23°C to 26°C in the northern affix, in the plains zone, along the Rovuma River [33].

3.1.3. Infrastructure

External communications are limited to road transport. National road 537 that connects the districts of Unango to Lichinga is passable along its entire length of 64km. Another 51km of rural road 903 that connects the districts of Unango to Macaloge is also passable [33]. The district has 48 schools (44 of which are at level 1 primary education), 12 health units that allow the population to progressively access the services of the National Health System [25], despite these being at a very low level. Despite the efforts made, it is important to remember that the general state of conservation and maintenance of the infrastructure is not sufficient, with the water pump network in need of maintenance, as well as the network of roads and bridges, which, in the rainy season, to be a highlight. It has transit ability problems [33].

3.1.4. Economic Activities

Agriculture is the dominant activity and involves almost all households. In general, agriculture is practice manually on small family farms in a system of intercropping based on local varieties. There is a diversity of fruit trees in the district, mainly mango, orange, pear, lemon, and papaya trees, whose fruits are sold by the family sector [33]. Forest products are widely used in housing construction. Firewood and charcoal are the most used energy sources. Some communities have the closest firewood source at distances of up to 10km. Livestock promotion in the district has been weak, but given the tradition in cattle breeding and some existing infrastructure, there was some growth in the livestock population [33].

3.2. Data Collection

For the elaboration of this research, the data were collected in the months of September-November of the year 2019, in the district of Sanga, the administrative post of Unango, in the community of Malulo, specifically in the neighborhoods Cavago (CV), Eduardo Mondlane (EM), Ilinga (IL), Zimpeto (ZP), 1° de Maio (1M) and Former Combatants (AC).

3.2.1. Sampling

The study was conducted through social research [19], it can be described as the technique that allows obtaining unprecedented information in the field of social reality, using scientific methodology. In addition to quantifying opinions, the purpose of the study was to explore and understand the different points of view of the region's inhabitants on climate change. Malulo was used as a stratum and within each stratum, houses were randomly

selected for the study, thus avoiding the repetition of houses and individuals. Probabilistic sampling is one in which all individuals in the universe have an equal chance of answering the survey [15].

The choice of stratified sampling made it easier to divide the population into subgroups (strata) and that once the strata are select, random selections are performed on each of them independently, where partial samples are obtained and by aggregating them, it is obtained a complete sample [3].

3.2.2. Sample Size

For the present research, 114 individuals from 4660 inhabitants of the Malulo community were interviewed. Among the interviewees, the chief of the Malulo community stands out, the neighborhood secretaries (six individuals from the six neighborhoods of the community) who served as key people in this process, and finally the other members of the community (107 individuals), namely 30 from the Cavago neighborhood (CV), 36 from Primeiro de Maio (1M), 12 from Ilinga (IL), 12 from former fighters (AC), 18 from Eduardo Mondlane (EM) and 6 from Zimpeto (ZP).

3.2.3. Data Collection Methods and Techniques

For the present study, a multi-methodological approach was used [5], this strategy is suggested for studies in the area of perception and environmental psychology, where quantitative and qualitative data were collected concomitantly and integrated into a database, transforming the themes using counts and comparing these with quantitative data. Techniques such as questionnaires, interviews, document analysis, and literature review were used.

3.3. Analysis and Interpretation of Data

The analysis aimed to organize the data so that it was possible to provide an answer to the proposed problem. For their analysis, the method of "pattern coincidence" was used, which consists of grouping similar information by patterns and is applied based on similar responses from interviews, being necessary to group the data related to the subject, joining the identical answers and explaining the different ones [31].

After obtaining the necessary data, a qualitative and quantitative analysis of the data was carried out, to build a diagnosis of the community's perception of climate change. Similar responses were transformed into quantitative data, grouped in tables and percentage graphs, which served for analysis and respective discussions following the theoretical framework, and finally, conclusions were obtained.

4. Results and Discussion

4.1. Respondents Profile

During the field research in the Malulo community, the number of respondents varied from neighborhood to neighborhood, with a total of 30, 36, 12, 12, 18, and 6 individuals belonging to the neighborhoods of CV, 1M, IL,

AC, EM, ZP, respectively constituted the sample. 114 individuals were interviewed, including the community chief, neighborhood secretaries, and state officials. Data show that, except for neighborhood 1M (41.7%), of the total number of respondents in each neighborhood, most were male individuals. Regarding the age group of the total of respondents, this ranged from 18 to 60 years of age, of which 11.4% of respondents are in the age group between 18 and 29 years, 72.8% in the range of 30 to 59 years, and 15.8% are over 60 years old.

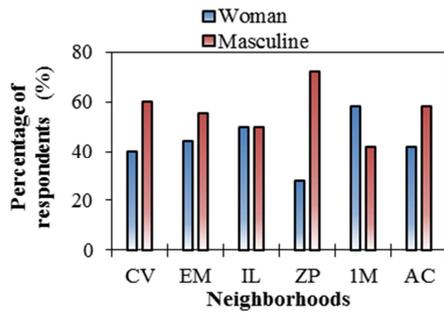


Figure 2. Distribution by gender of individuals interviewed by neighborhood in the community of Malulo, Bairro Cavago (CV), Eduardo Mondlane (EM), Ilinga (IL), Zimpeto (ZP), 1° de Maio (1M), and Antigos Combatentes (AC).

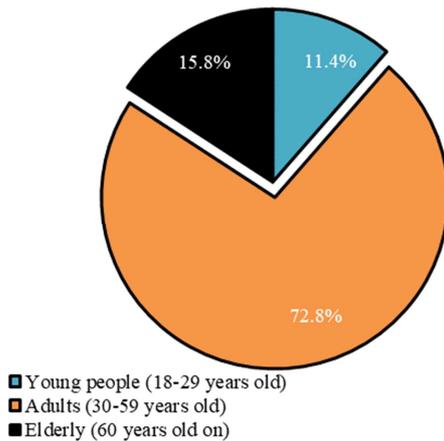


Figure 3. The age range of total respondents in the community of Malulo.

The importance of knowing the age group of the individuals interviewed in this research allows us to determine which individuals were more exposed to climate change both in the community and elsewhere, and studies of Below et al. [6] highlighted those older individuals were those who showed greater experience and knowledge regarding changes in precipitation and temperature, so for this research older individuals, even with no education, may have some knowledge regarding the subject of this study, as they already have knowledge acquired over the various years of your experience.

Data reveal that more than half of the total of respondents do not have school education (80.7%), followed by a group corresponding to 14.9% who have primary education, 0.88% with basic education, 1.75% secondary education, and technique respectively.

The importance of education lies in the fact that it makes it

possible to reduce vulnerability to extreme weather events and increase the chances of adaptation to such events [6], this is since education directly improves knowledge, increases the ability to understanding and processing the information, allows greater perception of risks and, in addition, indirectly raises the socioeconomic level [44]. The importance of knowing the level of education of the interviewees in this research helps to determine the concerns and concerns of individuals regarding changes in the climate in the area because the higher the level of education of an individual, the greater is the perception of risk about climate change.

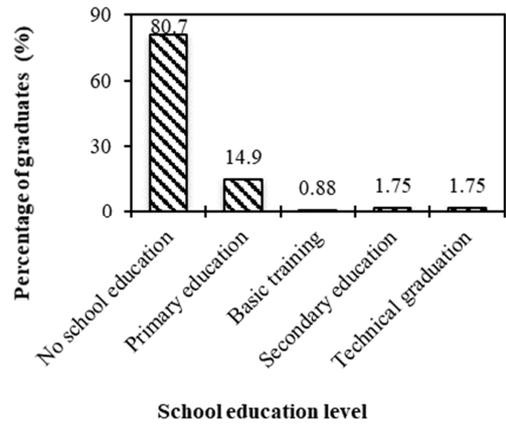


Figure 4. Distribution of the total number of individuals interviewed in the Malulo community by level of education.

Part of the interviewees does not live exclusively from an activity. Among them, the predominant activity is agriculture followed by cattle raising and the combination of the two activities. It was observed that 80.7% of those interviewed have agricultural activity as their exclusive source of income, where they produce crops such as beans, potatoes, maize, and various vegetables. Of those who depend on cattle, raising (9.65%) have opted for the promotion of cattle, goats, and sheep and equivalent to 9.65% of those interviewed choose to use the practice of both activities.

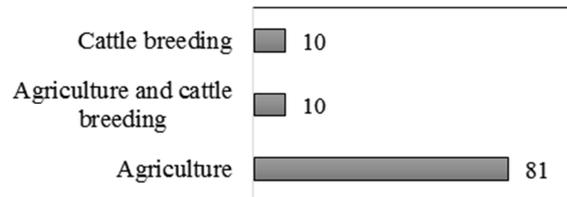


Figure 5. Activities performed by respondents in the community of Malulo.

Of the crops produced, most are intended for the subsistence of the family and a small part sold is purchased by transients and community members, making them dependent on them, as most do not have viable means to transport products from the rural area to other markets nearby, where these can be sold. Transients buy the products at low prices, which sometimes makes production unfeasible and discourages farmers. The creation of cattle, including goats, sheep, and cattle, is also used for food and the sale of meat and milk. Respondents also have chicken and poultry farms,

which are for consumption. The rearing of these animals varies from extensive, in which the animals are raised loosely on the property or in open spaces, intensive, in which they remain in corrals, and semi-intensive, in which the animals remain confined for only part of the day. For birds, the extensive form of rearing is the most common, for cattle, goats, and sheep it is opted for extensive rearing, the intensive being the less widespread.

Determining the main activities practiced by community members helps to focus on the main points for research, with climate change having impacting consequences in all areas of a human being's life, including health and education. The agricultural activity proved to be the most widespread source of income in the community, thus focusing the questions addressed to the interviewees in the area that most afflicts them. It was observed that the most common agricultural activity in its study area was the cultivation of beans and maize [11]. 72% of those interviewed carried out activities related to livestock on their properties, such as raising poultry, cattle, and swine. It can be seen that the perception of weather events and the interpretation of the possible effects of these events on their agricultural fields or even on their properties, make respondents have more adaptive responses [11].

4.2. Level of Perception of Climate Change in the Community

There are several sources for obtaining information about various content available worldwide and in particular, at the level of the community of Malulo, survey data show that 13.2% of respondents learned about climate change through television with the normal antenna on the local television station. In addition to regular antenna television, another medium is pay television with 38.6% of respondents and radio with 47.9% of respondents in the community.

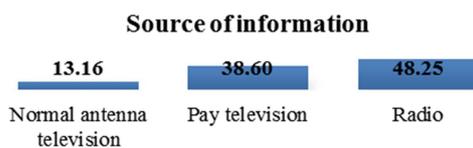


Figure 6. Sources for obtaining information at the level of interviewees in the community of Malulo.

Other means by which interviewees obtain information are indirect sources, such as circles of friends and family and farmers' associations. It is noticed that the media cannot supply the most in-depth information on this subject, as the information is transmitted superficially and not contextualized with the local, regional, or even national reality, where the lack of knowledge about the consequences of such phenomena can cause to the environment can affect agricultural production in that region. Lack of information prevents farmers from seeking and adopting adaptation strategies to the impacts that climate change on the environment and global warming can cause in the community. Thus, information is important in this research to the extent that it allows the producer to know the meaning

of climate change and the environment so that they can be aware of its effects and know what mitigation and adaptation options are. Additionally, it enables respondents to anticipate these impacts and plan or adopt, within their financial constraints, measures that can make them less vulnerable to climate change [4]. In general, the individuals interviewed have noticed climate changes in the region that include changes in the precipitation regime and an increase in temperature.

When asked about the level of understanding or perception concerning any change in the extreme climate condition, 7.89% of respondents said they did not know how to answer, 6.14% concluded that no, that perhaps they have not observed changes in that area, such This fact can be allied to the length of residence in that community, as they claimed that they do not reside in that area long enough to have observed changes in the climate, that is, they have been living for a little less than 2 years. Respondents' responses were considered about the observation of changes in temperature and precipitation patterns in summer and winter in the period 1960 – 2009, and it was observed that a group equivalent to 58.9% stated that perhaps they had observed some climate changes and 27.2% affirmed with certainty that they observed or noticed some change in the extreme climatic condition.

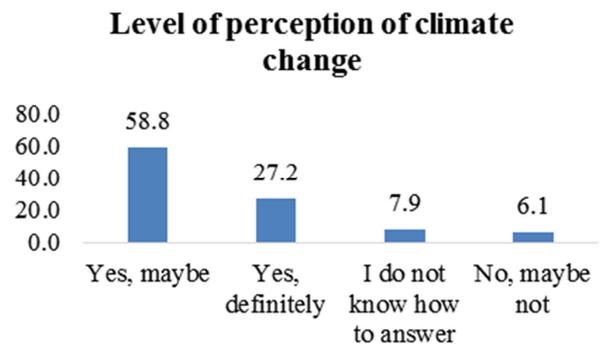


Figure 7. Level of perception of climate change in the years before 2019 at the level of respondents from the Malulo community.

People who live in areas that are more vulnerable to the impacts of climate change or who have already had some kind of experience with environmental problems, such as drought or floods, have been identified as having a high sense of risk [41]. In this way, being vulnerable or perceiving and observing events that can be attributed to climate change has an impact on the opinion and environmental behavior of the affected local community.

Of the total respondents, 83.9% of the sample responded that they noticed that the year 2019 was warmer than normal, with fewer rainfall events, with unpredictability and displacement of the rainy season, which hinders production, 7.99% did not notice changes in the temperature of the area in the year 2019 and 7.99% stated that the winter of 2019 was colder than in previous years.

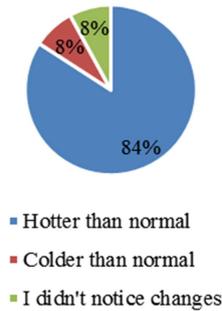


Figure 8. Level of perception of climate change in the inverse of 2019.

Although they noticed the change in the intensity and unpredictability of rainfall and temperature, farmers believe that this is due to the increase in anthropic practices in that area and the demographic increase in it, with more fields for the practice of agriculture and pasture. Open, leading to the indiscriminate felling of trees, thus causing climate change. It is common to notice changes in precipitation and temperature patterns [21]. This is since its impacts are directly felt in the productivity of the agricultural activities carried out.

Thus, respondents who believe in climate change and who are aware of the impacts that may affect their crops tend to adopt adaptation mechanisms. Results of the work of Carlos [11] with 58% of respondents who obtain their income from agriculture and from Abid et al. [1] with 60% are in line with this research where the results of both studies show that in response to the perception of respondents in general, believe that the climate is changing and realize the negative impacts that these changes will have on their properties.

4.3. Degree of Knowledge About the Changes Climate and Its Impact on Agriculture

In the analysis of the questionnaires carried out, it was found that 55.3% have little knowledge about climate change, having pointed out some problems, such as pollution, water waste, and deforestation. With this, it can be inferred that the interviewees have a minimal perception of the problems in their community. This is a fact that raises concern since it is essential to know about the environment and climate change, especially in rural areas where the basis for their survival is the practice of agriculture.

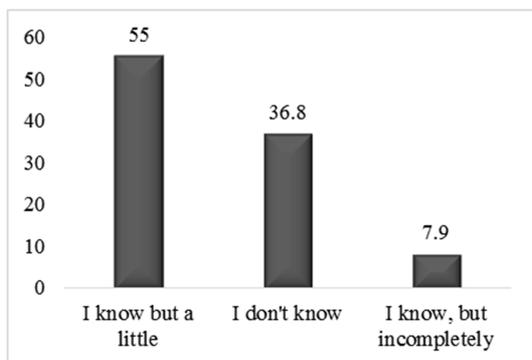


Figure 9. Degree of knowledge about climate change at the Malulo community level interviewed.

The respondents' answers were considered in terms of having heard about climate change, the degree of knowledge they believe they have about the topic and whether they believe in its occurrence and the possible negative impacts that can be felt in its production, where the climate is seen with negativity by the interviewees, who in their answers present an outburst about the difficulties that are constantly faced due to the current climate.

Studies carried out by the Food Agriculture Organization of the United Nations (FAO) in 2015, predict the intensification of the adverse effects of the climate on regions of the world and, in particular, Mozambique. Climate change will compromise global food production patterns, with negative impacts on crop productivity in low-latitude countries and tropical regions [18]. Regarding climate-related environmental perception, some studies have shown that inhabitants who have been in a certain area for a long time, as well as farmers with more experience, which is often associated with age, are more likely to observe climate change [14, 30].

For the same authors, other factors such as exposure to mass media, income, gender, education, access to technical assistance and extension services, geographic location, among others, can affect the degree of knowledge about climate change.

Works of Blennow et al. and Howe et al. [7, 23], reinforce the hypothesis that experiences arising from the perception of the local climate can influence not only the beliefs about global warming but also the responses to the attitudes of individuals towards climate change and the impacts arising from it.

For example, there are results which show that the spatial distribution of seasonal climate perceptions coincides with the spatial distribution of temperature and precipitation that varies the most during the period of analysis, that is, the individuals who most noticed climate changes were those located in regions where there have been major changes in temperature and precipitation patterns [22]. Furthermore, the belief in global warming and the ability to undertake adaptation and/or mitigation actions to these events was shown to be strongly associated with individuals' perception of changes in the local climate.

The interviewees in this research even indirectly reflect a concern with the problems arising from climate change, even though many at the time of the interview were unaware of its consequences or the real threats.

The identified understandings of the researched subjects that were revealed in the representations (attitudes and expressions) expressed demonstrate concern with the harmful effects derived from climate change. Since more than half of the interviewees have a basic level of knowledge about climate change (or have noticed some change in the climate, if different, it can be seen in other studies where a small part of the interviewees (20%) pointed to a possible benefit generated by climate change because possibly they associated the increase in temperature with the possibility of configuring new geography of agricultural production, by

allowing the cultivation of crops whose thermal requirements cannot be satisfied with the climatic conditions in Anchieta [9].

In addition to analyzing the perceptions of the inhabitants of the Malulo community about the environmental component, with a focus on climate change, the factors that influence the perception of climate and the interviewees' knowledge of climate change and global warming were, raise.

The degree of knowledge and/or the level of information about environmental issues are influenced by the sociodemographic characteristics of individuals [40]. Age,

gender, place of residence, education, and even political position can be identified as determining factors in the level of knowledge about climate change and the environmental problems that arise from it.

Due to the aforementioned indicators, mainly referring to schooling and low levels of intellectual development, what the Malulo community understands is that, at the individual level, they have low absorption of information. There is passivity and lack of a critical attitude towards reality and the weather of nature, these respect academic knowledge, however, not all of them relate to work and family farming.

Table 1. Summary of the results of the analyzes of the community's level of perception about climate change according to some criteria.

Variable	Results
Age	It was observed that older people have greater knowledge about climate change in the area
Genre	Divergent perceptions and knowledge, where men show more knowledge
Education	Different perceptions. The low level of education leads to low knowledge on this topic, as it increases with the level of education
Time experience	More experienced farmers notice more the reduction in the frequency of rainy years and the displacement and unpredictability of cold and hot months. While more recent residents believe the climate remains the same
Property size	Respondents with larger properties are more likely to know about climate change and AG.

The variable age affects the experience, the accumulated knowledge in terms of the developed activity, and the decision-making in terms of adaptation [36]. In this sense, the older producer has more knowledge about the management of their activities, as well as more experience accumulated in terms of agricultural practices and changes in the environment. In addition, past and present climatic conditions were exposed for a longer period, which can condition a greater perception of climatic events and, consequently, lead to the adoption of adaptation strategies, similar results of the analysis presented here were found in other studies [18].

The influence of schooling and technical assistance on adaptation is in two ways [11]. Both have a direct effect on reducing the risks associated with extreme weather events, as they enable greater knowledge of mechanisms and processes that reduce vulnerability to these events. In addition, it allows the farmer or agent involved to know and adopt strategies that mitigate greenhouse gases and thus reduce risks.

Certain individual conditions of farmers, such as age, income, and access to information and extension services, can influence the perception of the occurrence of climate changes [10]. Attitudes and mental representations of climate change and its risks are determined by different social, environmental, and political contexts [40]. For this author, it does not mean that the subjects do not recognize a catastrophic fact or a possibility of disaster, but rather that they relate the feeling of danger according to their personal experiences.

4.4. Level of Knowledge of Terms Related to Climate Change

Regarding knowledge about global warming, when asked 60.9% of respondents said they know how to define it, even if in a non-technical way and that they have heard or discussed it and its impact on agriculture, although 38.9% of these, did not know how to define. Those who had a positive

response to climate change, related this term to deforestation, pollution, damage to the environment, and the increase in temperature in the area, which is also related to the question raised about knowledge about global warming, although they do not know how to define it technically, they said that it is an increase in temperature, which can be caused by factors such as deforestation, for the opening of more agricultural fields, as well as fires, there is a relationship between the human activities and the gaseous composition of the Earth's atmosphere that causes several problems of accelerating global climate change [34].

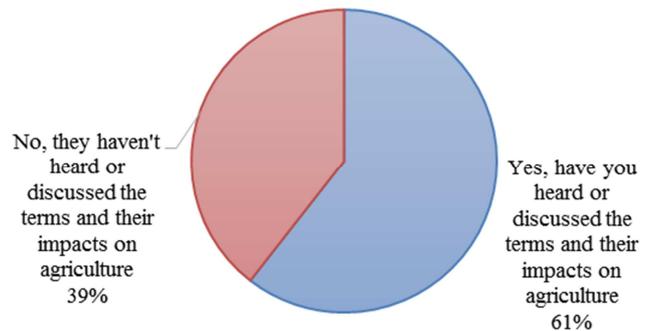


Figure 10. Level of perception on terms related to climate change and its impacts on agriculture.

Brazilian studies on the same theme show divergence in terms of conceptual knowledge about climate change and global warming (GA). Studies where the selected audience showed an adequate conceptual understanding, especially regarding climate change and GA, unlike the audience selected for this research, showed a divergence in the results [41]. This divergence may have occurred for the following reasons: different audience - were those in this work were entirely rural individuals, older people and most of the interviewees do not have a school education, while in the comparative study individuals who participated were selected. of a socio-environmental fair, also leading to the belief that

this becomes an important factor. In this research, more elaborate answers were not offered, but there were options for some of the questions asked, believing that the interviewees may have learned at the time about some of the concepts or found that the larger answers were the most convincing.

In a joint view, it can be seen that some of the concepts such as environment (AM) and environment, of the subjects studied show a perspective that translates the compatibility of the whole, including human beings [39]. This perspective was not expected for this study because the individuals as mentioned above learned some of the concepts at the time of the interview, differing from other studies where this perspective was expected, as the individuals studied were part of a socio-environmental fair, where these would have a higher understanding than the other subjects [38]. Regarding the concept of EA, the inadequate perception of its concepts does not resemble what was determined for the public in European countries [28].

4.5. Adapted Strategies in Agricultural Production

When asked about the strategies they generally adopt to define what will be produced in the following year, the interviewees who practice agriculture (80.70%) answered that the strategy is always the same, that is, they prefer to invest in species they are already used to. to plant, that is, beans, corn, cassava, sweet potatoes, potatoes, and some vegetables, also because they believe that these crops are the ones that best adapt to the region. Another common practice is to wait for the rains to feel what the year will be like and start cultivating. In general, if the winter prospects are good, the interviewees expand their planting. If the expectation of winter is not expected, respondents plant less or not at all. In the event of drought, they advise that the sale of animals in quantity to be able to pass the time of difficulty is the most adopted method.

Therefore, knowledge of the factors that guide individuals to adopt adaptation or mitigation strategies in the face of climate change events is a fundamental issue for the direction and effective formulation of public policies [8]. Furthermore, climate information must be disseminated, especially to farmers so that they know about measures and strategies that are conducive to their agricultural fields and that allow the developed public policies to be efficient in what they propose.

In general the perception of farmers in terms of changes in the local climate of the Bahia region makes them have greater knowledge about climate change and its adverse effects on their agricultural activities, making them more prone to adaptation [11].

For producers to choose to adopt adaptive measures against climate change, farmers must realize that the climate has changed, and then it is necessary to identify possible adaptive measures so that their implementation can take place [31].

Access to reliable climate information and perception of climate change are determining factors for the adoption of adaptation strategies [17]. According to the same authors,

individuals who seek ways to take precautions when they are warned of any damage caused are also important in that they allow farmers to seek greater knowledge about the adverse effects on their activities and, therefore, about new technologies and mechanisms that can reduce their vulnerability.

The perception that the impacts of climate change will bring future financial losses is also a determining factor for the adoption of strategies. However, farmers tend to see this future impact as something distant, which can compromise this decision. The perception of future impacts and the response of farmers to this perception is something that requires great cognitive skills [21].

It is noteworthy the ability to adapt to climate change and willingness to adopt mitigation techniques will also strongly depend on the availability of information related to this theme [2]. In this way, education and technical assistance are essential factors for farmers, as they allow them to understand the effects of climate change and be able to act on these events. Such variables are still important insofar as they increase the knowledge of producers about techniques and mechanisms that reduce the effects of the climate on their production and property, in addition to raising the socioeconomic level of these producers [6, 7].

5. Conclusions and Recommendations

The issue of climate change is still a novelty for most respondents to the survey. While many claim that they do not know the terms climate change and AG, others have heard of it, usually through television and radio, despite the poor perception of what it means and what consequences the occurrence of these changes can bring to production in the area. Those who have heard of these terms have some difficulties in technically explaining their meanings, pointing out financial resources and climatic adversities as the main challenges for the development of agricultural practice in that area, despite the majority having suffered damages allied to the climate, these they prefer to maintain the production of crops that they know or are used to, such as corn and beans, as well as potatoes and cassava, as they believe that these crops can adapt to the climate. In the case of drier times, their strategy is to reduce the quantity to be produced or even not to produce. For those who own cattle, the strategy to be adopted is to sell them.

Allied to the lack of knowledge and/or lack of work related to this theme in the Mozambican reality, particularly in rural communities, it is recommended that extension work in rural communities be encouraged, due to the exchange of knowledge that will support the practice of family farming, putting farmers aware of the global situation, as well as alternatives that have been discussed, especially those of prevention, adaptation and simplified technologies for small farmers. There is an intensification or deepening of issues related to the environment, which may involve environmental education, constituting a very favorable topic for reflection on the practices of resistance and expression of the demands

of the population in the areas most affected by the constant and growing environmental problems, also representing the possibility of opening spaces for the implementation of diversified alternatives of participatory democracy, notably the guarantee of access to information and the consolidation of open channels for rural participation and the need to establish programs aimed at informing, sensitizing, preparing and offer opportunities for farmers to increase their capacity to adapt to climate change, it is also necessary to know better the climate change scenarios for each area, as well as the adaptation strategies that can be adopted.

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