

Climate change from the traditional knowledge of indigenous communities in Paraguay

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Abstract

Climate change poses a threat to all people around the world, especially indigenous communities. This study sought to identify, from the worldview of indigenous communities, the traditional knowledge, innovations, and learning that allow them to face the problems generated by climate change. The research had an ethnographic, qualitative, and exploratory approach and was developed in the eastern region of Paraguay from 2020 to 2023. The sample was made up of five indigenous communities with a total of 306 participating individuals. Based on the results obtained in observations, interviews, and focus groups, the ancestral attitudes, skills, and knowledge that underpin their strategies for managing and reducing risks related to climate change were identified. The participating communities combine their traditional knowledge with new technologies through a learning process from three perspectives: intergenerational approach, intercultural approach, and gender approach, to face the problems generated by climate change.

Keywords:

climate change, knowledge, learning, risk.



Introduction

Climate change exacerbates the difficulties faced by indigenous communities in Latin America, most of them in situations of poverty and extreme poverty. According to the Intergovernmental Panel on Climate Change (IPCC), climate change is the global variation of the Earth's climate, which affects all climate parameters, caused by processes related to human activity (IPCC, 2014, 2018). In the face of this global threat, indigenous peoples are the ones who have contributed the least to generating climate change, and their territories are the ones that offer the most ecosystem contributions to mitigate its effects.

Indigenous peoples' own knowledge, traditional practices, and innovations have great potential to provide solutions in addressing actions to reduce the effects of climate change. The 2018 report of the Food and Agriculture Organization of the United Nations (FAO) estimates that territories belonging to indigenous peoples protect 80% of the biodiversity existing in the world (FAO, 2018).

In this global scenario, indigenous communities are the ultimate guardians of forests (Macqueen and Mayers, 2020) through the conservation of forests in their territories. For Mayo-Mendoza (2019), indigenous communities have developed knowledge that allows them to act in the face of the effects of climate change to minimize its devastating effects on their territories. Dinsmore (2021) shares this position and adds that the global community can learn a lot from indigenous peoples, their attitudes, values, and practices of respect for the environment. Blancas *et al.* (2020) states that an approach based on ancestral and traditional knowledge would allow for better management of the risk posed by the current climate crisis.

In Paraguay, the National Development Plan 2030 (PND 2030, for its initialism in Spanish), national policies, strategies, and plans for adaptation and mitigation to climate change make up the reference framework of the study. Official reports indicate that sectors related to extensive agricultural activities are responsible for 83.6% of the emissions that cause these alterations in the country (MADES, UNDP, GEF). Currently, poverty reaches 66% of indigenous people in Paraguay (DGEEC, 2018).

Various studies, including González *et al* (2018) research, describe the difficulties and adaptive capacities suffered by these communities in the face of significant changes in the climate that alter natural cycles. The book by the Jesuit missionary Sánchez Labrador describes traditional knowledge and therapeutic practices published by Deckmann-Fleck y Alliatti-Joaquim (2017). Some of this knowledge is maintained to this day despite the process of foreignization of their traditional territories. Wimer and Hellmund (2020) describe the situation of indigenous communities affected by the foreignization and concentration of land in recent history.

The general objective of this research was to identify the traditional knowledge, innovations, and learning of indigenous communities in the face of the challenges of climate change through an ethnographic study in five indigenous communities in Paraguay. This study adopts the concept of Climate Change from the United Nations Framework Convention, which defines it as the set of climate changes that affect all continents and countries as a result of human activity that produces alterations in the atmosphere (Naciones Unidas, 1992).

Conceptual, institutional, and legislative references include national and international policies and legislation, specifically the Sustainable Development Goals (SDGs), as well as the provisions of the Paris Agreement on Climate Change and the Sendai Framework for Disaster Risk Reduction 2015-2030.

Materials and methods

The research design had a qualitative ethnographic approach, also considered as flexible or emergent design (Mendizábal, 2007; Blanco, 2012). Ethnographic research is oriented towards the understanding of cultures (Lerma-Rodríguez, 2014). The unit of analysis consists of the indigenous communities of the eastern region of Paraguay. The type of sampling applied was by cluster since the population under study is very geographically dispersed.

The sample was made up of five Guaraní indigenous communities from the eastern region of Paraguay: Tekoa Yma Jee´a Pavé Mbya (Department of Caazapá), Cheiro Ara Poty (Department of Caaguazú), Ava Guaraní (Department of Canendiyú), Pa# Tavyterá Reko Pave (Department of Amambay), and Yvy Parana Rembe´ype (Department of Canendiyú), with 306 participating subjects: 177 men and 129 women.

The techniques used in the fieldwork were participant observation, ethnographic interview, focus group, and field diary. According to Ameigeiras (2007), the researchers' entry into each community initiated interaction with the subjects in their communities in the specific spatial-temporal dimension of the study. From that moment on, participant observation was applied, where the conditions formulated by Chavarría-Zambrano and Camacho (2020) were considered. Unstructured ethnographic interviews were conducted through spontaneous and flexible conversations. The data were recorded in field diaries, coded, and grouped by categories of analysis for interpretation (Hernández-Sampieri *et al.*, 2017).

The criteria of validity and reliability applied in this research are based on the considerations by Maxwell (1996); Hernández-Sampieri *et al.* (2017); Chavarría-Zambrano and Camacho (2020): descriptive validity, interpretive validity, theoretical validity, and evaluative validity. The interview quotes were randomly coded with a letter and a number; for example: E1, to preserve the identity of the interviewees.

The ethical care applied to the procedures carried out in this research follow the recommendations established by the Universal Declaration on Bioethics and Human Rights (UNESCO, 2005), the 2nd. World Conference on Research Integrity for Responsible Research Conduct (2010) and subsequent international declarations.

Results and discussion

The first observations and interviews made it possible to identify the problems generated by climate change. These issues were then discussed in focus group discussions in each participating community. Based on the testimonies provided, the data were grouped into four categories of analysis: livelihoods, energy, health, risks, and disasters.

Reduced livelihoods

For indigenous communities, livelihoods come from the forest. Deforestation reduces the availability of their livelihoods, mainly food and medicine, as they are gatherers and not producers. While they can produce their own food, they prefer gathering: 'we produce our own food, but in our minds, we still think like foragers' (E1). In some areas, such as honey production, they observe the impact of pollution generated by intensive agricultural production: 'soybeans are killing beekeeping' (E2).

The production of crops for self-consumption is also damaged by fumigations with agrochemicals, which also causes the loss of the production of yerba mate, complementary plants, and medicinal plants. The production of yerba mate under agroforestry is preferred by the communities. They are currently forced to buy yerba mate for their own consumption due to the low production of this wild crop. They no longer have surpluses for sale and if they do have production they cannot sell it: 'our effort and work is undervalued' (E3). In this context, indigenous people work informally to obtain money and buy food. Table 1 shows a synthesis of the emerging problems of livelihood reduction and the adaptation and mitigation strategies applied.



Table 1. Livelihood-related problems.

Subcategory	Problem identification	Adaptation-mitigation strategies and actions
Deforestation and forest degradation	Increase in deforestation. It affects the water springs, food, and medicine	They maintain forest cover on their land
Droughts	Droughts impact crop harvests and the production of different family agricultural items	Some communities have an elevated tank to store water but lack equipment to distribute in irrigation systems
Fire	Forest fires contribute to the loss of forests in the community and in the reserve areas of the residences	They have asked authorities for equipment and tools that allow them to control forest fires
Biodiversity	The availability of medicinal plants has decreased due to changes in climate	Communities are forced to request the purchase of medicines
Pollution	The streams are polluted by agrochemicals and they can no longer fish as before. It also affects honey production	Some communities have introduced livestock production to replace fishing and have requested aid to improve honey production

Energy, lighting and food preparation

Firewood is their main traditional source of energy for food preparation and for lighting houses. Open fires are perceived as the best way to cook, as they are linked to their culture: 'more wood makes more heat' (E4). Indigenous community organizations are aware of the importance of firewood and to preserve it, they promote and support reforestation initiatives with native species in their territories.

The communities do not have electricity in their homes. In some cases, there is electricity in the community, but they do not have individual connections. Some homes share the energy of the school. On the other hand, some projects have wanted to install solar panels on homes. Nevertheless, communities are resistant to the idea because of the maintenance costs involved in installing panels. On this problem, a synthesis of the testimonies collected is presented in Table 2.

Table 2. Energy-related problems.

Subcategory	Problem identification	Adaptation/mitigation strategies and actions
Lighting	Lighting with electricity depends on central places, such as the school, which does not have the capacity to provide for the entire community	They use alternative forms for lighting houses. For example, an open fire pit with firewood and torches. They are taking steps to request electricity service
Fire and food preparation	In recent years, they have begun to experience a shortage of firewood, and they have to travel greater and greater distances to supply themselves	They began to regulate and prioritize the use of firewood in homes, primarily for cooking. Some communities plant trees of native species to have firewood in the future

Health-related issues

Deforestation and forest degradation have an impact on health problems due to the pollution of water sources and streams. The greatest pollution is caused by soybean production due to the indiscriminate use of agrochemicals used in plantations of this species. In addition, the lack of a waste management system also generates the pollution of their territories.

In terms of health care, the communities use traditional medicine since they have the knowledge to use plants according to the problems they face: ‘nature, God, tells us what each herb is for, it is part of our culture’ (E5). Nonetheless, they also recognize that there are diseases in which pharmacological drugs help save lives in communities.

Current problems in healthcare include the lack of medicines, the poor coverage of health centers, and the lack of care in public hospitals. They do not have ambulances or adequate transport for people who require emergency care either. A synthesis of this problem can be seen in Table 3.

Table 3. Health-related problems.

Subcategory	Problem identification	Adaptation-mitigation strategies and actions
Water, hygiene, and sanitation	Drought affects the availability of water for hygiene and basic sanitation inside homes, which negatively impacts the health of families	They protect the water sources and streams that are within their territories. Some communities have tanks for water storage, but without distribution systems
Pollution and increase in diseases	Communities perceive an increase in diseases after fumigations and rains	They request through community leaders the construction of water systems with wells to avoid the use of polluted surface water
Extreme heat	In extreme heat, they usually have sunstroke problems, which prevents them from working normally	They are forced to reduce the hours of work per day, which generates lower economic income
Diseases and epidemics	When they have diseases in the community, they do not know the care to avoid possible epidemics	The women formed an association to dignify and protect health in their community
Healthcare	They go to health posts to receive care. However, they do not always receive medication and must resort to medicinal herbs	They organize health care days in the communities to prevent the transport of the sick to hospitals. They have volunteer indigenous health promoters
Emergencies and transport of seriously ill patients	Lack of transport to transfer their patients to hospitals and health centers	There is cooperation between neighbors who have a vehicle, almost always motorcycles, but it is not the most appropriate
Nutrition	Deforestation leads to the scarce diversity of food. They depend on the aid they receive in the form of processed foods.	They request projects to improve and diversify their self-consumption gardens to have more food options
Waste disposal	There is no waste collection system. Most of the garbage is burned in the open air	In some communities, they are applying systems of separation and recycling of some materials to sell

Risks and disasters

The main risks perceived by indigenous communities are excessive rainfall, frost, fires, and droughts. They relate the increase in risks and disasters to the current changes in their territories, mainly deforestation. The roads fill with water during heavy rains and become small streams. They believe it is due to the lack of tree cover near the roads, ‘soybean plantations remove all trees’ (E7). On the other hand, drought causes crop failure: ‘the land becomes very dry and crops die’ (E8).

To reduce this risk, the communities organized training on agricultural techniques to cope with drought. They implement new crop rotation techniques to withstand droughts by integrating the communities’ own knowledge with the new technologies acquired.

They recognize that innovations in cultivation knowledge and skills help mitigate excess or lack of rainfall: ‘we are adapting, we plant only when it rains’ (E9). In other words, the cultural calendar

of sowing and harvesting is being altered. In addition, they mention the scarcity of seeds available in the communities, which is why they currently depend on the purchase of seeds for production, which are genetically modified. Table 4 presents a synthesis of the results in terms of risk and disaster identification and strategies.

Table 4. Identification and strategies for risks and disasters.

Subcategory	Problem identification	Adaptation/mitigation strategies and actions
Excess rainfall	Prolonged rains leave the road impassable, which causes community isolation and house destruction. In the season of prolonged rains, they cannot harvest their food	They request help from the authorities but the help with the repairs takes months. They protect the trees on the roads that are within the indigenous communities
Frost	In times of frost, they do not have production for self-consumption	They depend on food assistance and aid
Fire	In times of extreme heat, they have fire problems in forests, crops, and houses	In the face of large-scale fires, they ask for help directly from the government; at the local level, they do not have the capacity to deal with them
Droughts	In times of drought, the springs dry up. This causes water scarcity and a reduction in the production of crops for self-consumption. They experience declines in agricultural productivity, even total crop failure	They carry water from distant places to the community. They decrease daily food rations to one meal a day to maintain food reserves

Innovations and learnings

Communities face and seek to reduce the effects of climate change through the integration of new knowledge and strategies that complement their traditional knowledge. Although they recognize the contribution of the training they receive from various solidarity organizations, the communities claim that these projects should be based on the traditional knowledge of the communities, through prior consultation: 'the designer of the projects imposes on us the projects that they have already designed' (E10).

They are currently working under the scheme of 'response projects' (E6). Some communities have requested and developed youth training processes to have tools that allow them to innovate agricultural techniques.

To reduce the threats of deforestation and forest fires, the communities seek to develop the application of new technologies for monitoring. Regarding the impact of indigenous communities on territorial governance, they seek to identify weaknesses and build new mechanisms for reporting and monitoring with the authorities for compliance with environmental laws. These practices reaffirm the concept of shared responsibility by indigenous peoples and society for the collective care and conservation of forests mentioned by Grungberg (2003); Blancas *et al.* (2020); Dinsmore (2021).

Learning, in the view of indigenous communities, is developed in a transversal way with three forms of interaction: intergenerational, gender, and intercultural. As for the former, the exchange of knowledge and perspectives between people of different generations allows traditional knowledge to be preserved and connected with new learning in order to seek solutions.

For its part, the gender approach implies a cultural and social transformation to achieve conditions of equity so that both men and women can exercise their rights and achieve the recognition of inequalities, with inclusive behaviors, practices, and customs that respect differences (Estigarribia-Canese and Sagüi-Gómez, 2020).

The intercultural approach facilitates the interaction and equitable participation of communities with diverse cultures through dialogue and mutual respect in order to exchange traditional knowledge and build new knowledge or shared cultural products. This approach provides great strength for the construction of a common agenda among indigenous communities and organizations. It also provides communities with better possibilities for collective influence on local and national government decision-making and in international forums (Estigarribia-Canese and Sagüi-Gómez, 2020).

Conclusions

This ethnographic study was able to identify traditional knowledge, innovations, and learning implemented to face the adverse effects of climate change in five indigenous communities in Paraguay. They perceive that the availability of wild foods and the productivity of family farming has decreased due to changes in the climate: prolonged droughts, extreme heat, very intense rainfall, among others.

In addition, and as a result of the increase in these phenomena, they feel a reduction in food options from fishing, hunting, fruit gathering, and wild foods, and a reduction in medicinal herbs and raw materials for handicrafts. The traditional knowledge they apply in adaptation or mitigation actions includes the maintenance of forest cover and the protection of water sources.

The introduction of livestock production, self-consumption orchards, the implementation of waste selection and recycling systems, requests to obtain technical, service and infrastructure improvements, and the formation of associations and federations were the main innovations identified.

Innovations are introduced through the collective request for technical assistance from the authorities and the participation of young people in workshops and trainings that combine ancestral knowledge and current technologies. The intergenerational, intergender, and intercultural learning style of these communities opens up a range of new opportunities for research, innovation, and the enhancement of indigenous traditional knowledge for the management and reduction of risks related to climate change.

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