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Agricultural Practices and Wetland Conservation in the Okavango Basin (Angola): A Community-Based Study in the Municipalities of Kuíto-Cuanavale, Cutato, and Longa

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Abstract: The wetlands of the Cubango-Okavango Basin are of high ecological, economic, and social importance to rural communities in southeastern Angola, but face pressures from agricultural expansion, fires, and intensive use of natural resources. The study aimed to analyze the knowledge, environmental perceptions and agricultural practices of the communities of Tchingango-Micango, Pedra Branca, Samassaty and Mundandamo. A mixed approach, quantitative and qualitative, was adopted, with the application of semi-structured surveys to 120 participants distributed across the four localities. The study was conducted between November 2025 to May 2026. The results revealed a strong dependence on wetlands for agriculture, fishing and water supply, with a predominance of traditional agricultural practices, especially the use of burning and reduced technical assistance. There was also a high perception of the reduction in water availability and community predisposition to adopt sustainable practices. It is concluded that the conservation of wetlands depends on the integration of local knowledge, technical assistance and participatory policies for the sustainable management of natural resources.

Keywords: *Wetlands; Conservation Agriculture; Okavango Basin; Community Participation.*

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I. INTRODUCTION

River basins are strategic territorial units for the planning, planning and sustainable management of natural resources, since they integrate, in the same functional system, the physical, biological and socio-economic components that interact dynamically in the territory. The basin-based approach allows us to understand the relationships between land use and occupation, hydrological regime, biodiversity and human activities, promoting a systemic vision that is essential for the formulation of effective public policies. In this sense, the integrated management of river basins is an essential instrument for the mitigation of environmental impacts and for the promotion of sustainable development. (Fiorense, 2021)

In the African context, Angola occupies a relevant geostrategic position as an important water reservoir in Southern and Central Africa. The national territory is drained by nine major river basins, seven of which are transboundary in nature, which reinforces the regional and international dimension of the management of its water resources. Among

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these, the endorheic basin of Cubango-Okavango stands out, whose hydrological and ecological uniqueness positions it as one of the most relevant river systems on the continent (Tundisi & Tundisi, 2011).

The Cubango-Okavango Basin extends through Angola, Namibia and Botswana, configuring a transboundary hydrographic system of high ecological, economic and social complexity. Its sources are located in the central highlands of Angola, often referred to as the "Angola Water Tower" responsible for about 95% of the flow that feeds the Okavango Delta (Ramsar Convention, 2026). This delta is one of the largest inland wetland systems in the world, internationally recognized for its biodiversity, regional hydrological regulation and its decisive role in maintaining the livelihoods of local populations (UNESCO, 2014)

The recognition of the ecological relevance of Angolan wetlands gained new momentum in 2026, with the designation of the Lisima Lya Mwono site as Angola's first wetland of international importance, under the Ramsar Convention. This act represents not only a political commitment to environmental conservation, but also the recognition of the strategic importance of the Angolan highlands in the hydrological and climatic stability of the southern region of Africa (Kissama Foundation, 2020).

Wetlands perform critical ecological functions, including regulating the hydrological cycle, retaining nutrients, recharging aquifers, sequestering carbon, and supporting high biological diversity. At the same time, they assume a central socio-economic function, serving as a basis for subsistence agriculture, artisanal fishing, water supply and the collection of non-wood forest products. This interdependence between wetlands and local communities configures a complex socio-ecological relationship, where environmental conservation and human subsistence are deeply intertwined (INRH, 2018).

However, despite their ecological and strategic importance, the wetlands of the Cubango-Okavango Basin face increasing anthropogenic pressures. Unplanned agricultural expansion, the recurrent use of fires, the intensive exploitation of natural resources and the absence of systematic conservation agriculture practices have contributed to changes in the hydrological regime, degradation of vegetation cover and progressive reduction of ecosystem services. These dynamics put at risk not only the ecological integrity of the system, but also the socio-economic resilience of dependent communities.

In this context, it is essential to understand local perceptions, practices and knowledge regarding wetlands, since the effectiveness of conservation strategies depends, to a large extent, on the integration of community knowledge and the active participation of populations in territorial governance. The contemporary literature on sustainable management of natural resources emphasizes that the exclusion of local communities from decision-making processes is one of the main factors in the failure of environmental policies.

Thus, the present study aims to analyze the socioeconomic profile, empirical knowledge, agricultural practices and environmental perceptions of the communities of Tchingango-Micango, Pedra Branca, Samassaty and Mundandamo, located in the Cubango-Okavango Basin. It is intended, in this way, to contribute to the formulation of participatory strategies for the conservation and promotion of sustainable agriculture in wetlands, reconciling local development and environmental protection in a context of high regional and international ecological relevance.

II. METHODOLOGY

The present research was developed based on scientific procedures that allowed the collection, organization and systematic analysis of data. The methodology adopted sought to ensure accuracy, clarity and reliability of the results, combining different approaches to better understand the socioeconomic and environmental reality of the communities studied.

Area of Study

The study was carried out in three specific localities of the Cubango-Okavango river basin district, namely Tchingango-Micango, located in the municipality of Cuíto-Cuanavale, province of Cuando (15°09′S ; 19°10′E); Pedra Branca, located in the municipality of Cutato, Cubango province (12°23′S; 16°26′E); and Samassaty, in the municipality of Longa, also in the province of Cubango (14°36′S; 18°28′E) -Map 1.

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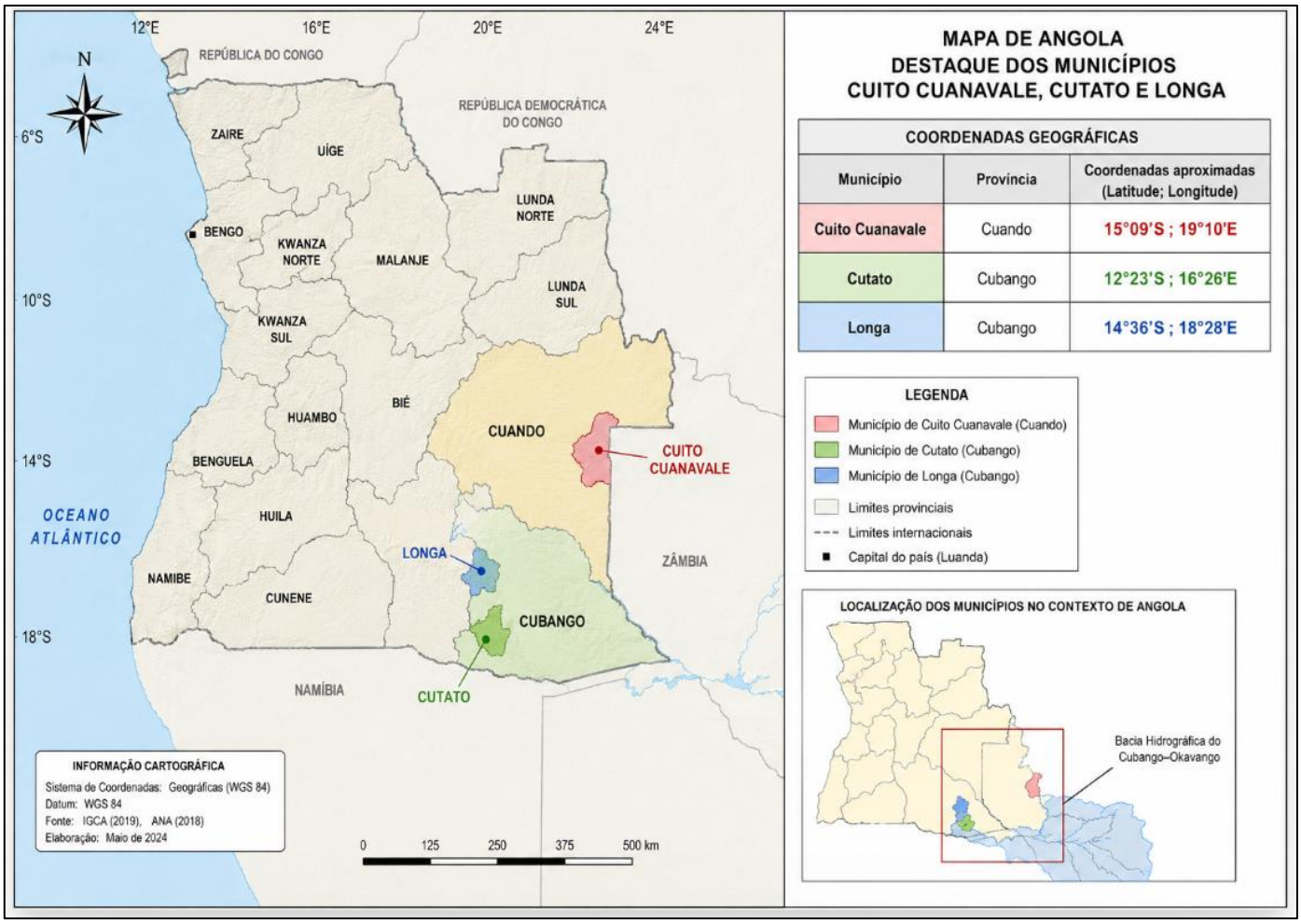

Fig 1 Map Adapted from the Geographical and Cadastral Institute of Angola (IGCA, 2019).

All localities are part of the Cubango-Okavango river basin, a region of high ecological and socio-economic relevance, recognized for its biodiversity, water resources and importance for the livelihoods of local communities. These communities are characterized by a strong dependence on natural resources, with subsistence agriculture, artisanal fishing and livestock farming as their main economic activities. The choice of these areas is due to their strategic relevance within the river basin, as well as the vulnerability of local populations to environmental variations and the socioeconomic dynamics of the region.

➢ *Type of Study*

The research adopted a mixed approach, integrating quantitative and qualitative methods. The quantitative component allowed the collection of measurable data regarding the socioeconomic conditions and productive practices of the families, while the qualitative component allowed a deeper understanding of the perceptions, experiences and challenges faced by the communities.

This is a cross-sectional study, carried out in a single time frame, with the aim of drawing a picture of the current situation of the selected localities. For data collection, a semi-structured survey was applied, consisting of closed and open questions, allowing both the systematization of the answers and the exploration of more detailed information.

The participation of the respondents was voluntary, with informed consent, ensuring respect for the ethical principles of the investigation, namely confidentiality, anonymity and freedom of withdrawal at any stage of the process.

➢ *Population and Sample*

The definition of the population and the sample was a fundamental step to ensure the representativeness and statistical robustness of the study. The target population was composed of residents of the four selected localities, whose livelihood depends, directly or indirectly, on agricultural activities and the use of natural resources in the region.

In order to ensure greater analytical consistency and balance in the comparison between the communities, a total sample of 120 participants was established. The distribution was proportional and equitable among the four locations, corresponding to 25% of the sample for each of them, i.e., 30 participants per location (Fig. 2). This distribution ensured uniformity in data collection and facilitated the comparative analysis of the results, as illustrated in the sample distribution diagram presented below.

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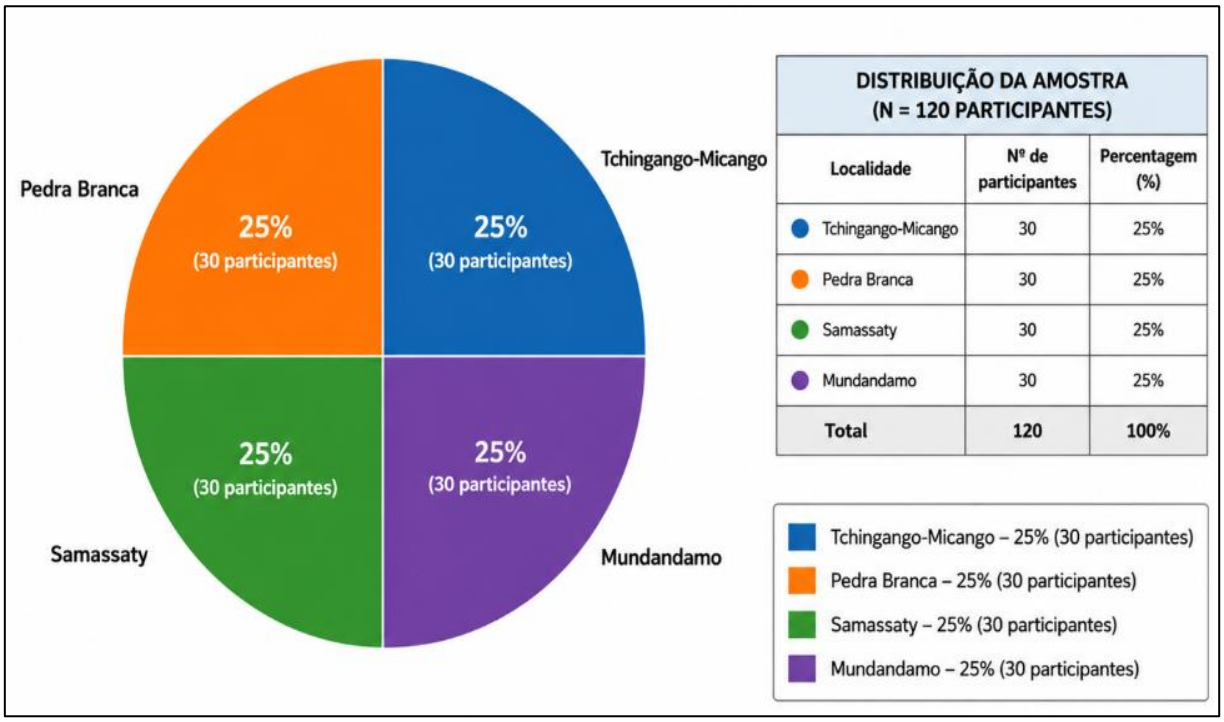

Fig 2 Proportional Distribution of the Sample by Location Considering n=120

➢ *Sample Size by Location*

The definition of the sample size and proportional distribution by locality was determined based on the statistical formula of proportion (Marconi & Lakatos, 2003).

$$n_i = \frac{N_i}{N} \times n$$

Where:

- n_i= sample size of the locality i
- N_i= population of the locality i
- N= total population of the localities;
- n= total sample size.

Considering an equitable distribution among the four localities, was applied the following formula:

$$n_i = \frac{120}{4} = 30$$

Thus, each locality contributed with 30 participants, corresponding to:

$$\% = \frac{30}{120} \times 100 = 25\%$$

III. RESULTS AND DISCUSSION

The results obtained from the application of the surveys allowed to characterize the profile of the participants, understand the land use practices, assess the level of knowledge about wetlands and analyze the environmental perceptions of the communities studied. In addition, it was possible to identify the degree of community participation and the main needs for technical support.

➢ *Sociodemographic Profile*

Most participants are in the age group between 18 and 35 years, showing a predominantly young population in the three locations. A low level of formal education was observed, which directly influences the type of economic activity carried out, with a high dependence on traditional agriculture as the main means of subsistence.

Regarding the distribution by gender, it was found that in Samassaty there was greater male participation in the study. On the other hand, in the localities of Tchingango-Micango and Pedra Branca, female participation predominated, demonstrating the active role of women in productive activities and in the management of natural resources.

➢ *Land Use*

Between 66% and 70% of respondents stated that they cultivate in areas close to rivers or wetlands, evidencing the strong dependence on these ecosystems for agricultural production (fig. 3). The main crops identified were corn, beans, rice, vegetables, potatoes and soybeans.

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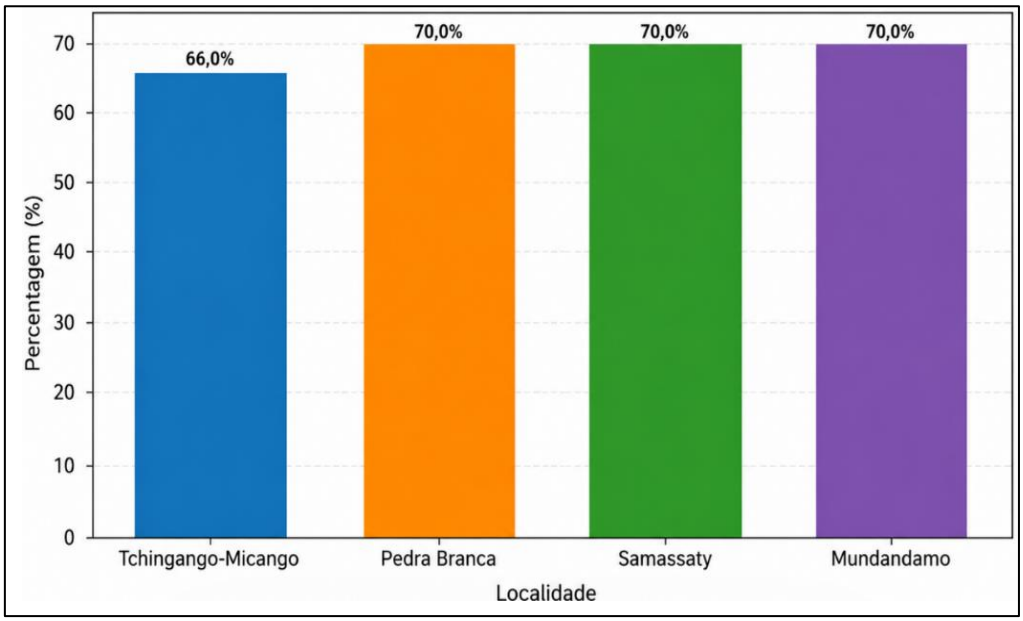

Fig 3 Land Use and Occupation

In the locality of Samassaty there was a particular incidence of sugarcane cultivation, partially distinguishing itself from the other communities analyzed. This result is associated with the local soil and climatic conditions, especially the greater availability of water and the high levels of humidity characteristic of the wetlands of the region.

The introduction of this crop also suggests the existence of a gradual process of agricultural diversification, through which communities seek to adapt their production systems to the available environmental conditions and local economic needs. In this context, Dixon (2002) states that populations established in wetlands tend to diversify agricultural activities according to hydrological seasonality and the availability of water resources, favoring crops that are more tolerant to humidity and capable of ensuring greater productive stability throughout the year.

The agricultural practices observed in the communities studied are predominantly traditional, based on the use of rudimentary techniques and on the almost exclusive dependence on locally available natural resources. The frequent use of fires to prepare agricultural land was verified, as well as the reduced use of chemical fertilizers and other modern inputs.

These results are in line with the dominant pattern of subsistence agriculture in several rural African regions, which according to Nehemias, Abbas & Jorge (2025) is characterized by low levels of mechanization, limited technical assistance, and reduced investment capacity on the part of family producers. However, although these practices reduce the immediate costs of production and facilitate the opening of new cultivation areas, several authors warn of their potential negative environmental impacts.

According to Nehemias, Abbas and Jorge (2025), the recurrent use of fire in soil preparation contributes to the gradual loss of organic matter, reduction of biodiversity and progressive degradation of humid ecosystems. Similarly, Phillipe (2025) highlights that continued agricultural pressure on wetlands can compromise the ecological regeneration capacity of these environments, affecting not only ecosystem services, but also the long-term sustainability of agricultural production.

In addition, Claudia (2020) underlines that the low adoption of modern agricultural technologies in many African regions contributes significantly to the persistence of traditional land use practices, including the use of burning. Although these techniques represent affordable solutions for smallholder farmers, the author emphasizes that their continued use can accelerate processes of environmental degradation, soil erosion and decrease in natural fertility, progressively compromising agricultural productivity and the ecological resilience of wetlands.

Against this backdrop, it is essential to strengthen technical assistance to farmers, encourage the adoption of sustainable agricultural practices, such as crop rotation, the use of organic fertilisers and soil conservation techniques, as well as progressively reduce the indiscriminate use of burning.

- *Knowledge About Wetlands (CZH)*

Most participants demonstrated basic knowledge about the concept of wetlands, defining them as seasonally flooded or permanently flooded areas. This knowledge is predominantly empirical, acquired through practical experience and community experience.

Respondents widely recognise the importance of wetlands for agriculture, with this being mentioned by approximately 75% to 80% of respondents. In addition, they highlighted the relevance of these areas for water supply and fishing, reinforcing their essential role in food security and the livelihood of communities.

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➢ *Environmental Perceptions (PA)*

The graph "*Perception of Water Reduction in Wetlands*" shows significant differences between the localities analyzed regarding the community perception of the decrease in water availability in wetlands. It can be seen in figure 4 that the localities of Samassaty and Mundandamo have the highest values, reaching 100% of the respondents, which demonstrates a unanimous perception of the reduction of water. In Tchingango-Micango, about 77.6% of the participants also recognize the decrease in water availability, while Pedra Branca has a residual or non-existent value, suggesting less perception of the phenomenon or different environmental conditions.

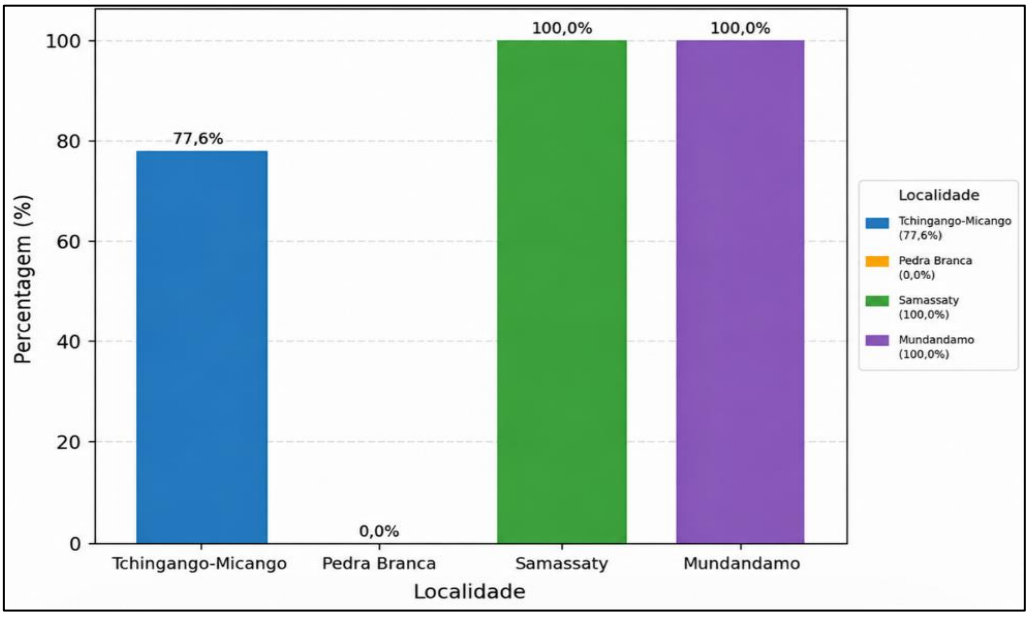

Fig 4 Environmental Perceptions of Communities

The results suggest that the communities of Samassaty and Mundandamo are more exposed to the effects of climate change and changes in the local hydrological regime. The high perception of water reduction may be associated with decreased precipitation, increased evapotranspiration, vegetation degradation and intensification of agricultural and anthropogenic activities in wetlands. Studies indicate that climate change directly affects the hydrological cycle, causing a reduction in water recharge and a greater frequency of prolonged droughts.

The results obtained corroborate the studies by Pires, (2014) who showed that rural farmers identify changes in the rainfall regime and reduction in water availability as some of the main impacts of climate change on agricultural communities. Similarly, Rozendo (2014) found that family farmers in the Brazilian semi-arid region perceive changes in the rainy and dry periods, associating these changes with decreased agricultural productivity and greater socioeconomic vulnerability.

The situation observed in the analyzed localities is also close to the conclusions presented by Sykes (2012), according to which, wetlands in Angola play a fundamental role in the storage and regulation of water, being particularly sensitive to climate change and human pressure. Thus, the high perception of communities can be an important local indicator of environmental degradation and water scarcity.

The difference observed in Pedra Branca may indicate greater local water availability, less direct dependence on wetlands or even differences in the environmental perception of the population. According to Coelho (2004), cultural, social and economic factors significantly influence the way communities perceive climate change and environmental impacts.

In general, the graph shows that most communities recognize a significant reduction in water in wetlands, reinforcing the need to implement strategies for sustainable management of water resources, conservation of riparian vegetation, recovery of degraded areas and community awareness for adaptation to climate change.

➢ *Willingness to Adopt Sustainable Practices*

It was observed that all the localities Tchingango-Micango, Pedra Branca, Samassaty and Mundandamo, presented 100% favorable responses, indicating unanimity among the respondents regarding the acceptance of practices aimed at environmental conservation and sustainable use of natural resources (Fig. 5).

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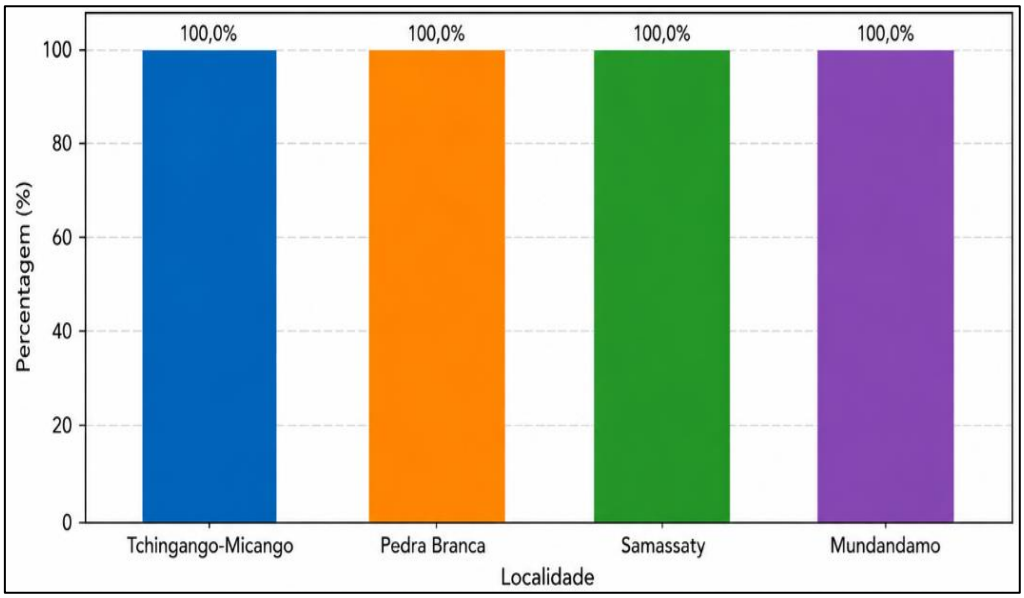

Fig 5 Willingness of Communities to Adopt Sustainable Practices

Among the main demands identified are practical training, the provision of appropriate agricultural tools, continuous technical assistance and institutional incentives that promote more sustainable production practices.

The results suggest a high level of environmental awareness in the communities studied, possibly associated with the direct dependence on natural resources for subsistence, especially agriculture, water and local vegetation. This predisposition represents a strategic opportunity for the implementation of participatory natural resource management, wetland conservation and climate change adaptation programs.

The data obtained corroborate the studies of Pretty (2008), according to which, the adoption of sustainable practices strongly depends on community involvement, social trust and the perception of the environmental and economic benefits associated with sustainable interventions. The author also points out that rural communities tend to adhere more easily to sustainable practices when they contribute directly to improving quality of life and food security.

Similarly, Nhemachena & Hassan (2007), when analysing African farming communities, found that farmers with greater awareness of environmental impacts and access to information are more predisposed to adopt climate adaptation measures and sustainable practices. The authors argue that factors such as environmental education, technical assistance and community participation positively influence the adoption of these practices.

The unanimity observed in the four localities also confirms the arguments of Chhatre & Agrawal (2009), who state that environmental conservation initiatives achieve better results when there is collective motivation and strong participation of local communities. According to the authors, community involvement strengthens the sustainable management of natural resources and increases the efficiency of conservation strategies.

On the other hand, Barbier (2010); Finlayson (2018), highlight that communities vulnerable to the effects of climate change, tend to value more sustainable practices when they perceive direct benefits in the protection of water resources, soil fertility and reduction of food insecurity. Thus, the observed high predisposition may also reflect growing concerns about environmental degradation and scarcity of natural resources in wetlands.

In general, the results demonstrate a favourable social context for the implementation of environmental conservation policies, wetland recovery, community environmental education and promotion of sustainable agriculture in the communities studied.

IV. CONCLUSIONS

The present study allowed us to understand the agricultural practices, local knowledge and environmental perceptions of the communities of Tchingango-Micango, Pedra Branca, Samassaty and Mundandamo, located in the Cubango-Okavango Basin, evidencing the strong relationship of dependence between populations and wetlands for their subsistence.

The results showed that traditional agriculture is the main economic activity of the communities studied, being practiced predominantly in areas close to rivers and wetlands. The predominance of rudimentary production techniques was observed, with emphasis on the recurrent use of burning and reduced technical assistance, factors that can contribute to the progressive degradation of wetland ecosystems and compromise the environmental sustainability of the region.

It was also found that the communities have relevant empirical knowledge about wetlands, recognizing their importance for agriculture, water supply, fishing and environmental balance. This traditional knowledge represents an important resource for the formulation of participatory

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strategies for the conservation and sustainable management of natural resources.

Environmental perceptions revealed high community concern regarding the reduction of water availability in wetlands, especially in the localities of Samassaty, Mundandamo and Tchingango-Micango. Such a perception suggests that communities already observe impacts associated with climate change and anthropogenic pressure on natural resources, reinforcing the urgent need for climate adaptation and environmental conservation measures.

On the other hand, it was found that communities were highly predisposed to adopt sustainable agricultural practices and participate in environmental conservation initiatives. The unanimity observed in the answers demonstrates the existence of a favorable social context for the implementation of environmental education programs, conservation agriculture, recovery of degraded areas and participatory management of wetlands.

It is thus concluded that the sustainable conservation of the wetlands of the Cubango-Okavango Basin depends on the effective integration of the traditional knowledge of the communities, the strengthening of agricultural technical assistance, the implementation of inclusive public policies and the active involvement of local populations in environmental management processes. It is also essential to promote investments in community training, sustainable agricultural technologies and strategies for adapting to climate change, while ensuring the protection of wetlands and the improvement of the living conditions of rural communities.

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