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Wildfires in the Paraná Delta, 2022. Photo: Civil Protection and Risk Management, Santa Fe Province, Argentina

Traditional knowledge of fire use by islanders in the Paraná Delta, Argentina

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"Listening, learning and encouraging community participation is a fundamental part of building a much-needed dialogue to reduce wildfire risk."

Introduction

The Paraná River Delta is the culmination of the second largest river in South America. Together with the Amazon and the Orinoco, the Paraná River provides more than 30% of the planet's renewable freshwater. This subtropical area is distinguished by its biogeographic and ecological uniqueness, with a high species diversity in its complex mosaic of wetlands. Its islands are the home of communities involved in small-scale fishing and hunting, raising cattle and other livestock for their own consumption and sale, and beekeeping (Ferrero and Arach 2020). Livestock farming has been important to the economy since colonial times and is based on grazing highly productive natural pastures (Massa 2012).

For several decades, this area has suffered from major wildfires. In 2020, coinciding with an extraordinary drought and a historic low level of the Paraná River, intense wildfires affected 487,000 ha (MAyDS 2021). The

Typical landscape and homestead in the upper delta of the Paraná River. Photos: Maiquel Torcatt

response to the crisis was considered insufficient by civil society, who through massive public demonstrations demanded that the government control the wildfires and pass laws to protect the wetlands and regulate industrial and real estate activities on the islands. The problem received extensive coverage in the national and international media, which devoted headlines to discourses that emphasized the negative aspects of fire, such as the loss of biodiversity and risks to human health.

The government responded by reinforcing fire suppression and control policies and tightening regulations that criminalized the use of fire. This negatively affected local communities and small livestock producers, who depend on the use of fire for their subsistence activities.

This article summarizes for the first time the traditional use of fire in the delta, and describes efforts to stimulate dialogue between local communities, environmental organizations and government agencies to share perspectives and come to a common agreement as to ways forward. Results of these efforts indicate the islanders' complex knowledge of the role of fire in the maintenance of the various grassland ecosystems, and show that dialogue can lead to effective and workable solutions.

Evolution in fire management

The use of controlled fires in the Paraná Delta to improve pasture for livestock was described as early as 1830, by Alcides D'Orbigny, but today, wildfire is also a recurring phenomenon. As cattle ranching developed, pasture burning began to take place towards the end of winter (late dry season), and in spring (August to October). When the river attains its lowest level, fires become more intense and extensive, because fuels and soils are drier, and watercourses and lagoons are smaller; these water bodies otherwise act as effective natural barriers to an advancing fire.

However, the availability of biomass and climatic factors are not alone sufficient to explaining the changing fire regime. Environmental organizations and government agencies consider that increased wildfire occurrence has resulted from the transformation in livestock activities on the islands, with a corresponding increase of fire use in land management. This became the dominant discourse, and the perspectives of the islands' people on the use of fire were not heard.

In response to more wildfires, institutional approaches focused on fire exclusion and on firefighting policies aimed at suppression. After the fire crises of 2020, forest fire brigades were created and others were strengthened, with the establishment of beacons (*faros de conservación*) for early detection of fires, the expansion of protected areas, and the reactivation of inter-jurisdictional territorial management agreements between the provinces of Santa Fe, Entre Ríos and Buenos Aires. The Integral Strategic Plan for Conservation and Sustainable Use in the Paraná Delta (PIECAS-DP), created in 2010, was revised and reactivated in 2020 as a result of the outbreak of

major wildfires. Despite differences between the three provinces, all provincial regulations covering the upper Paraná Delta prohibited the use of controlled fire by local communities in managing their land.

At the national level, the notion of criminalization of and penalization for the use of fire has deepened. In December 2020, Article 22 of National Law 25.815 was modified to establish a ban on changes in land use in areas affected by wildfires. However, the high cost of implementing suppression policies, and their limited effectiveness, generated social, cultural and governance conflicts, especially in conservation areas.

In this complex context, where multiple actors, interests and perspectives collided, possible actions for and solutions to the fire problem were sought. A series of projects emerged that began to give voice to the islanders, who were otherwise underrepresented in public discourse. In mid-2021, this led to the project Strengthening the fire management of the Paraná Delta Ramsar Site (SRDP), funded by the Canada Fund for Local Initiatives. This aimed to develop climate change adaptation and mitigation strategies related to wildfires through participatory diagnosis, increased awareness of institutional actors, and integration of scientific and local knowledge about fire. The project investigated the different considerations of fire among actors in the area, to propose alternatives to the problem of wildfires under the conceptual framework of integrated fire management. At the regional level, the aim was to understand the relationship between fires, wildfires, agricultural change and public policies, and the socio-environmental conflicts that unfolded after the wildfires in the delta in 2020.

Methodological approach

The research described in this article explored the dimensions of fire use and its actors – aspects that are little studied or understood in the region — to identify opportunities to promote a paradigm shift from fire suppression to integrated fire management. The first steps assessed the practices and meanings of fire among local inhabitants, civil society organizations, governmental bodies and academic institutions. Due to antagonism among the different groups, however, each was approached in a different way in order to generate an atmosphere of trust and respect for other participants and their perspectives.

Interviews and group meetings were held with community members whose productive activities take place in islands near the towns of Puerto Gaboto, Sauce Viejo, Rosario, Monte Vera, Santa Rosa de Calchines and Las Masitas and the city of Santa Fe. See Figure 1. Ten environmental organizations from all over the region participated in a workshop in the city of Rosario to generate participatory diagnoses of the fire problem and identify possible solutions. Later, a symposium was organized with representatives from academic institutions and the governmental agencies responsible for environmental and fire management policies, who exchanged their perspectives regarding the wildfire crisis in Paraná River Delta.

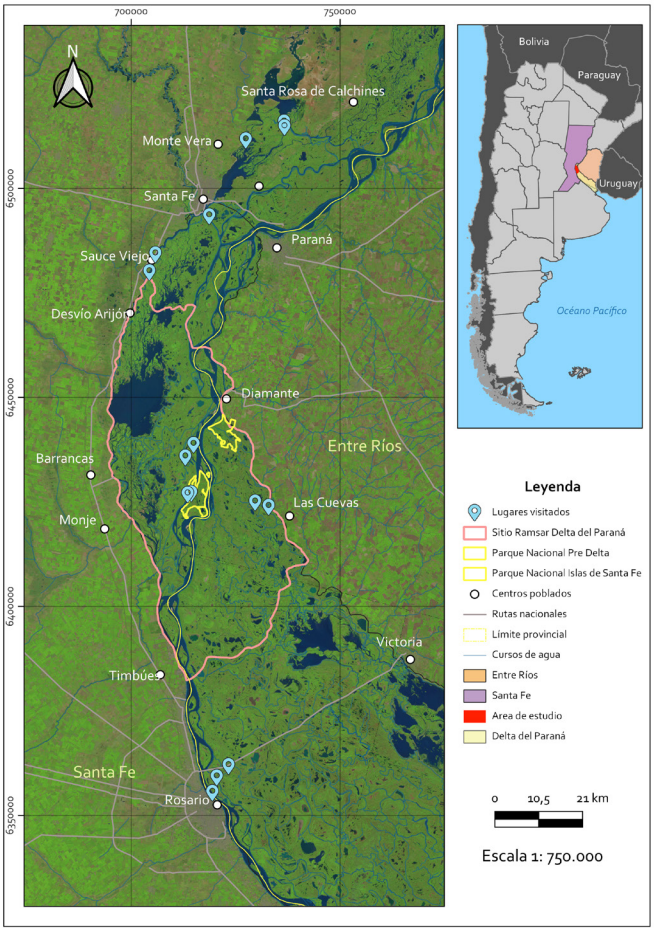

Figure 1. Location of the study area in the Paraná Delta. Source: The authors

Use of fire by local communities

Research results showed that fire has traditionally been used by the islanders, who say they cannot live without it. There is a wide diversity of fire uses, depending on the objectives, size of area to be burned, social organization and seasonality. In local terms for the uses of fire, the communities distinguish between domestic "fires" (*fuegos*) and landscape "burning" (*quema*), which are

Working groups in the workshop, "Burning and Fires in the Paraná Delta", Rosario, November, 2021. Photo: Maiquel Torcatt

both controlled, and "wildfires" (*incendios*), which are uncontrolled.

Domestic uses: Fire is used inside the house for cooking and heating, and outside for barbecues and burning green leaves to repel mosquitoes. Fires are controlled, protected and delimited — "socialized fire" — and integrated into daily domestic life.

Maintenance and renewal of pastures: This is widespread, burning dry pastures with no food value for cattle, which allows new, green, tender pastures to regrow. It is carried out in late winter and early spring (mid-August to mid-October), by one person alone or sometimes with a small group of neighbours. People who start these fires take into account the strength and direction of winds, the presence of watercourses and ponds that can act as barriers to fire spread, and whether rain is forecast for the following days.

Land clearing: This is a central use in the delta throughout the year. These fires are set following the same criteria as for burning for pasture regrowth. Fire is also used for "cleansing" around homes to eliminate plants where snakes, weasels or caimans can hide. People also create artificial firebreaks to be used for protecting homes and barns, and for backfiring.

Hunting: This fire use is generally considered problematic, as hunters are often outsiders and do not take the necessary precautions, so control of fires is lost.

Land management and control: Fire is also a tool for territorial affirmation, to show that land is being used, and is not left to nature. Fire was also historically used to decrease the silting of lagoons when the Paraná River flooded, by burning dry vegetation in these basins.

Different perceptions of wildfires

Although wildfires in the upper Paraná delta were perceived negatively by all the actors consulted, stakeholder groups had quite different perceptions of their causes and impacts.

Small and medium-sized livestock producers stated that wildfires arise from fires started by "others," to intimidate them by affecting their livelihoods, and so people on public lands are forced by the government to leave the islands. The increased occurrence of wildfires was seen a serious threat by local communities, creating mistrust and establishing the concept of "enemies" and confrontation.

Representatives of environmental organizations considered that the increase in wildfires resulted from the spread of industrial production. In particular, they felt that agricultural intensification on good land had displaced livestock production to marginal areas such as the islands of the Paraná Delta. This led to productive activities being perceived as poorly adapted to the area's social and environmental context. The climate crisis was also considered, highlighting the role of production models in the modification of regional climate patterns and phenomena such as drought and extreme low water

levels of the Paraná River, which favour the development of large wildfires.

Environmental organizations also thought that wildfires were inadequately managed by the governmental bodies responsible for the protection and conservation of the delta's wetlands. They felt in particular that the institutions in charge of fire suppression were ineffective, in spite of all the equipment and people available, and were unable to prevent the advance of wildfires and the damage caused, with wildfires being extinguished only following rains. Some civil society organizations expressed the belief that wildfires are used for political means, diverting public attention from the adverse economic problems the country is experiencing, and that wildfires may be linked to criminal activities in the area, such as drug trafficking, and even to outside pressure on local people in order to take their land.

The Ministry of Environment and Climate Change in the Province of Santa Fe considered all fire as alien to wetlands. As a governmental body that focuses on strengthening fire suppression policies, its representatives stated that its actions are related to regulations and that any use of fire is illegal and should be penalized. One reason given was the high cost of fire control. However, the government's civil protection agency, which is responsible for coordinating and executing fire management actions, stressed the importance of learning about local practices in the use of fire, and of creating alliances with different sectors of society, especially academic institutions with expertise in natural and social sciences, in order to design strategies to improve fire management.

Researchers involved in other disciplines were made aware of the impacts caused by wildfires, both ecological (negative effects on vegetation and soil) and social. They were especially interested in the social mobilization caused by wildfires, productive activities linked to fire, and the development of a combined socio-environmental approach that addresses the roles of fire in island life. Natural science researchers explained assessments of changes after a wildfire event in floristic composition, biomass and structure of plant communities, and soil nutrients. Techniques used included satellite images and high-resolution photographs from drones, coupled with field sampling and validation.

Opportunities and challenges

Integrated fire management considers sociocultural needs and the use of fire by local communities, alongside the ecological characteristics of a region. As such, it is important to consider the distinction between controlled burning and uncontrolled wildfires. Burning by communities for land management is undertaken under specific environmental conditions, which allows control over the extent of burning, fire intensity and rate of spread in order to achieve established objectives. Burning is carried out at specific times of the year; for example, when fuel, moisture and weather conditions are favourable for fire control (Bilbao et al. 2020). Burns turn into wildfires only when they get out of control, or if the necessary fire management considerations are not followed.

Fire is traditionally used in indigenous territories (*quilombolas*) and by peasant communities for cooking, heating, lighting, communication, pasture management, land clearing, soil fertilization, hunting, road clearing, security (keeping dangerous animals away), religious purposes, honey collection, brick making, and fuel reduction to avoid large wildfires, among many other uses (Bilbao et al. 2019). In the Paraná Delta, a study showed that the use of fire in grassland management improves forage quality for cattle (Zamboni et al. 2013). However, studies do not describe fire-use practices, or differentiate between different actors and their perspectives. This knowledge gap also contributes to perpetuating the concept that fire suppression is the only strategy for dealing with the wildfire problem.

The social dimensions of fire are now becoming more apparent to academic and government institutions. Studies have revealed that the use of landscape burning by local communities creates a mosaic of patches with diverse fire histories and differentiated fuel accumulation, which prevents the advance of fires in deliberately protected spaces (Bilbao et al. 2020). Burning also reduces the amount of combustible material, which reduces the risk of large wildfires. This in turn reduces greenhouse gas emissions (Russell-Smith et al. 2017) and supports the equilibrium of fire-dependent ecosystems, where the diversity of fire regimes (pyrodiversity) fosters biodiversity.

Conclusions

Fire is part of daily and productive life in the Paraná Delta region. The islands are a territory built on land and water, including the river's ebbs and flows and its sedimentation processes. It is a space constructed through livestock practices, hunting, and looking for wood and plants, with domestic fires and controlled landscape burns playing fundamental roles. However, communities' sustainable

practices have been forced to change since colonial times. This has affected landscape maintenance and promoted more frequent and intense wildfires, due in part to the accumulation of combustible material from unmanaged grazing land.

Following major wildfires in the delta over the past 20 years, civil society has mobilized to defend wetlands; government legislation on fire prohibition has been enacted, with resources mobilized for wildfire suppression; and there is growing academic interest from a range of sciences. However, local communities, in particular small livestock producers, have not participated in these discussions. Islanders' interests, knowledge and practices regarding fire, and their territory and way of life, were not included in these debates. Only now are their voices being heard.

This article investigates the actions carried out to address the problem of fires from an alternative perspective. Integrated fire management is proposed, based on an inclusive, participatory and intercultural vision that has proved successful elsewhere in South America (Bilbao et al. 2019). This approach builds on an understanding of the ecological and human dimensions of fire, and on the need to integrate diverse viewpoints on the uses of fire by local communities.

There is a clear need to establish platforms for continuous dialogue between local and national actors, and to acknowledge the positive aspects of traditional fire knowledge, which are fundamental to the conservation of cultural and fire-resilient landscapes in the Paraná wetlands. The goal now is to develop, refine and implement participatory tools for improved intercultural governance that will lead to a reduction in high-intensity wildfires.

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