



Fire runners managing a controlled burn along with young family members, so they can teach them the skills. Photo: Laura Patricia Ponce-Calderón

Fire management in pyrobiocultural landscapes, Chiapas, Mexico

Laura Patricia Ponce-Calderón, Fernando Limón-Aguirre, Iokiñe Rodríguez, Dante Arturo Rodríguez-Trejo, Bibiana Alejandra Bilbao, Guadalupe del Carmen Álvarez-Gordillo, and José Villanueva-Díaz

“Only through valuing and understanding the context of cultural fire management can the socioecological benefits of fire be maximized”

Introduction

In Mexico, 71% of indigenous territories are biocultural regions. These are areas with high levels of biodiversity associated with ethnocultural diversity, where people seek a way of living that is in harmony with their values. Cultural practices are rooted in agriculture and incorporate fire, as seen throughout Mesoamerica in the *milpa* system where burning enhances soil fertility through providing ash. Fire is also used historically in medicines and ritual ceremonies and in livestock and forest management (Ponce-Calderón et al. 2020). Memory and territory underlie the patterns of life and culture (Limón-Aguirre and Pérez-Tadeo 2018).

Communities in Chiapas are pioneers in fire management (Rodríguez-Trejo 2015); for example, land users have to request burning permits from village organizations, following customary environmental management practices (Ponce-Calderón et al. 2020; Guevara-Hernández et al. 2013). This article

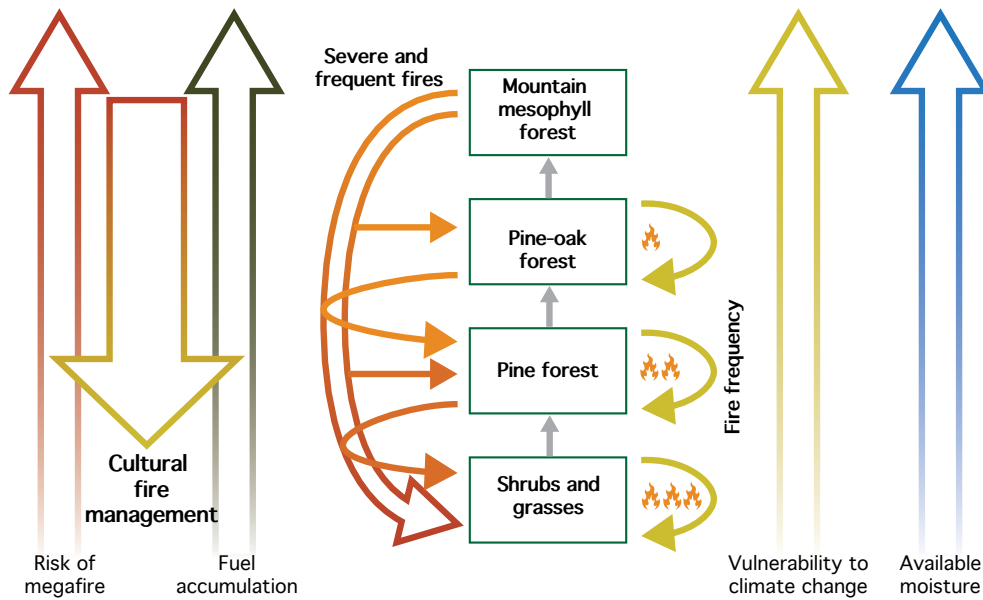


Figure 1. Model in which cultural fire management determines processes that can reduce the risk of extreme fire events. Adapted from Ponce-Calderón et al. (2021).

reports on the cultural management of fire by indigenous Antelá and Tzisco communities in and around Lagunas de Montebello National Park, Chiapas, Mexico. It addresses territoriality, memory, fire regimes and management, and the integration of cultural knowledge and perspectives, with global relevance for all Indigenous peoples.

In Antelá, the Tojol-ab'al ethnic group use fire in their farming systems, whereas fire is prohibited by the Chuj community in Tzisco, and in both, as elsewhere, public policies aim to eliminate the use of fire from farming and other activities in protected areas.

The region contains mixed conifer forests dominated by pine, oak and *Liquidambar* (sweet gum) species, and humid montane vegetation. Three fire management histories are identified: (i) areas where fire is used for agricultural purposes, (ii) fire exclusion areas with no human settlements, and (iii) fire exclusion areas with human settlements (Figure 1).

The cultural context of fire management

This article defines “territory” as the space that allows and favours cultural life, and where history acquires significant dimensions (Limón-Aguirre 2012) and defines “territoriality” as the symbiotic way in which people inhabit these places. Cultural fire management is rooted in historical experiences and the territoriality of communities. This management is based on evidence, knowledge and experience with practices of sustainable

treatment of nature in diverse spheres, including religion, the home, agriculture, livestock and forest protection.

People who establish a respectful relationship with their territories do so by constantly renewing their intimacy, co-dependence and communication with the different beings and elements living there. Sources of knowledge support fire practices that are beneficial for inhabitants, ecosystems and socioenvironmental processes. When this “pyrobiocultural” use of fire has been established, prohibiting it is anathema to the ways of life of entire peoples and cultural communities.

Box 1. Introducing “pyrobiocultural”

“Pyrobiocultural” is a new term that the authors of this article (among others) have been developing over recent years, having previously appeared in unpublished reports (as “pirobiocultural” in Spanish). It builds on the concept of biocultural landscapes from the early 2010s, and of biocultural diversity, defined as “the interdependence between biological and cultural diversity, indicating how significant ensembles of biological diversity are managed, conserved and created by different cultural groups” (Merçon et al. 2019). When analyzing the important role, use, benefits and impacts of fire in a landscape or territory, it seems appropriate to have a specific term that implicitly incorporates all of the diverse social, cultural, ecological and economic components.



Indigenous customary principles shape and modulate sustainable practices by ensuring the interests of present and future inhabitants. They also guide practices, such as the use of fire, that shape territoriality and contribute to the collective identity of Indigenous peoples. For example, there is an understanding among the Chuj and the Tojol-ab'ales, respectively, that everything — including fire — has its *pixan* or *altsil*, a pseudo-soul, such as the “earth that gives life,” “blessed water,” “the hills, wind, crops” (Limón-Aguirre and Pérez-Tadeo 2018). From this perspective, fire is not only an element of nature, but also a “being” that participates in everyday life as a messenger and that is present in ceremonies and festivities (Ponce-Calderón et al. 2020), and so its cultural dimensions must be studied comprehensively.

In ancestral Maya Chuj-tojol-ab'al territory, the spiritual dimension of fire calls for dialogue and reflection; fire must be spoken to, forgiven and respected (Limón-Aguirre and Pérez-Tadeo 2018). As Ysidoro Morales of Tzisco clearly expressed: “with fire, air, water, we must understand how they function and when they should be used, so that we also know how to enjoy and take care of them, and to be careful too, because otherwise they can come against us.”

One of the most important resources of indigenous cultures and their territorialities is memory (Toledo 2005), and it influences decision-making. The loss of historical memory regarding the use of fire can be a factor that can lead to more forest fires, but in Lagunas de Montebello National Park, memory is still a valued resource for cultural knowledge and for the renewal of territoriality for future generations. For local indigenous people, fire

in general has positive connotations, which is often referred to in an affectionate way as *fueguito* (“little fire” in Spanish). Wildfire, in contrast, is considered negative because it can burn everything in its path, although it may still be a messenger.

In this region, changes and imposed fire-use restrictions have drastically modified socioecological processes and have restricted cultural practices, which has altered the cultural regime of fire (Ponce-Calderón et al. 2021). These changes occurred after a major wildfire in 1998, when the government reacted by reinforcing a strategy of fire exclusion in the area.

Cultural fire regimes and management

Two different types of fire regimes are present in the study region: ecological and cultural.

Ecological fire regimes address the characteristics of fire (frequency, severity, intensity, seasonality, duration, among other factors) composition, structure and dynamics of ecosystems. However, cultural fire regimes — in other words, the use of fire when carrying out productive and cultural practices, based on collective interests — must also be understood. This includes the experiential wisdom that provides an orientation and framework for the cultural management of fire, as well as criteria and resources for its controlled use. The parameters of a cultural fire regime include cultural knowledge of the use and management of fire, technology (techniques and methods to facilitate the work), community organization, community norms or agreements, respect (values), territory, identity (lifestyle),



Firewood collected from the forest and, like fire, integral to community life. Photo: Laura Patricia Ponce-Calderón

vitality, transmission of knowledge and permanence. A cultural fire regime corresponds to a pyrobiocultural territory, where there is a strong relationship between the use of fire and local understanding that relates to social needs within the territory and the presence of fire-dependent, fire-sensitive and fire-influenced ecosystems.

Cultural fire regimes use fire in a respectful manner, prioritizing and maintaining a historical way of life that is in harmony with nature. A cultural fire regime is based on traditional wisdom about the cultural management of fire. Fire does not represent a negative impact on the ecosystem or the community. However, this regime can be altered in three ways: (i) by prohibiting the use of fire in a territory; (ii) using fire excessively due to negligence, disagreement or failure to consider all circumstances; or (iii) through the loss of knowledge about its use. These affect the socioenvironmental system in the medium or long term, and can consequently lead to more forest fires.

Practices persist when they are rooted in collective memory and meet the needs of communities. The cultural management of fire, born within villages, involves the integration of fire use and management practices that increase the production and reproduction of cultural life and sustain the management of the cultural territory. This is reflected in cultural knowledge that results from cognitive inheritance, context analysis, territorialized experiences, and the realization of a desire for a full and rewarding community life. To provide the essentials of life, such as food, fire has to be used in an effective manner. Ponce-Calderón et al. (2021) demonstrated the

comprehensive effectiveness of practices associated with fire in forest ecosystems, such as opening clearings that allow for the regeneration and increased growth of trees, while also reducing the frequency and impact of forest wildfires by removing fuel loads.

In the national park, there is cultural knowledge, along with circumstances and conditions, that is conducive to the implementation of this type of fire management. An example is the presence of people culturally identified among the Chuj as *corredores de fuego* (“fire runners”), who are experienced in the use of fire, and knowledgeable about the variables that determine a good burn and about the techniques for fire control. People respect their knowledge of how to carry out cultural fire management, as this knowledge is needed to coexist with fire and with nature as a whole, and community life depends on it. Fire management actions are based on ecological principles, but they also incorporate economic and political factors, and even aesthetic considerations, constituting guidelines for conscious, humane, supportive and fair management for all people (Limón-Aguirre 2012).

Cultural fire management

Cultural fire management represents a promising approach for the region by reducing the risks of and impacts from wildfire (Ponce-Calderón et al. 2021). The following practices are common in the study region, and could be complemented and cross-culturally enriched into an integrated regional strategy.

1. Collecting firewood. Fire behaviour is influenced by fuel load, weather and topography, with fuel the only factor that can be manipulated. Collecting firewood can reduce fuel loads, which can in turn prevent catastrophic wildfires, such as those that occurred in 1998 (Ponce-Calderón et al. 2021).
2. Creating and maintaining firebreaks. This should be a priority in areas with higher wildfire risk to provide anchor points for fighting fires or for stopping their advance. They should be used by inhabitants and administrators of the park.
3. Observation from wildfire detection towers. When observers see smoke, they immediately alert the authorities, which allows the source to be promptly detected and controlled. The towers are operated by forest health brigades, community surveillance teams and staff from the National Commission of Natural Protected Areas (CONANP).
4. Removing combustible material. It is important to remove fallen trees, such as those that have blown over or been killed by pests or disease. Within the national park, people in neighbouring communities can take such woody material away at no cost following a written request.
5. Organizing local people for agricultural burning. This is an important three-phase process with various activities and considerations for a successful burn (Figure 2).
6. Cultural burning. These burns are carried out on forest land, in conjunction with the authorities, with the strict purpose of reducing fuel loads. These burns can have a range of local and institutional objectives.
7. Integrating cultural skills and knowledge. In the region, “fire runners” are culturally significant and can be practical teachers to youth and people from other regions in agricultural, cultural or controlled burns. They are also crucial in defining policies and strategies, maintaining the cultural value of fire, and in renewing memory as an ecosystem resource.
8. Integrating community fire-management committees. Many committees already exist and in some cases are supported with equipment and training by government agencies. It would be a step forward if these committees and people with cultural skills were integrated into broader regional fire-management committees that also include authorities that define fire-related policies, strategies, needs and priorities. In addition, an evaluation meeting should be held after a fire. This will help committee members better understand how to reduce the risk of wildfires (Bilbao et al. 2019).
9. Selecting priority wildfire risks and danger areas according to biocultural values. These values should be selected by the communities themselves. To determine those areas with a greater risk of wildfire, it is important to involve community members who know their territory, and who value certain historical or cultural elements.



Workshop on social mapping, where community members identify priority wildfire-risk areas.
Photo: Lilibiana del Carmen Maldonado Pérez

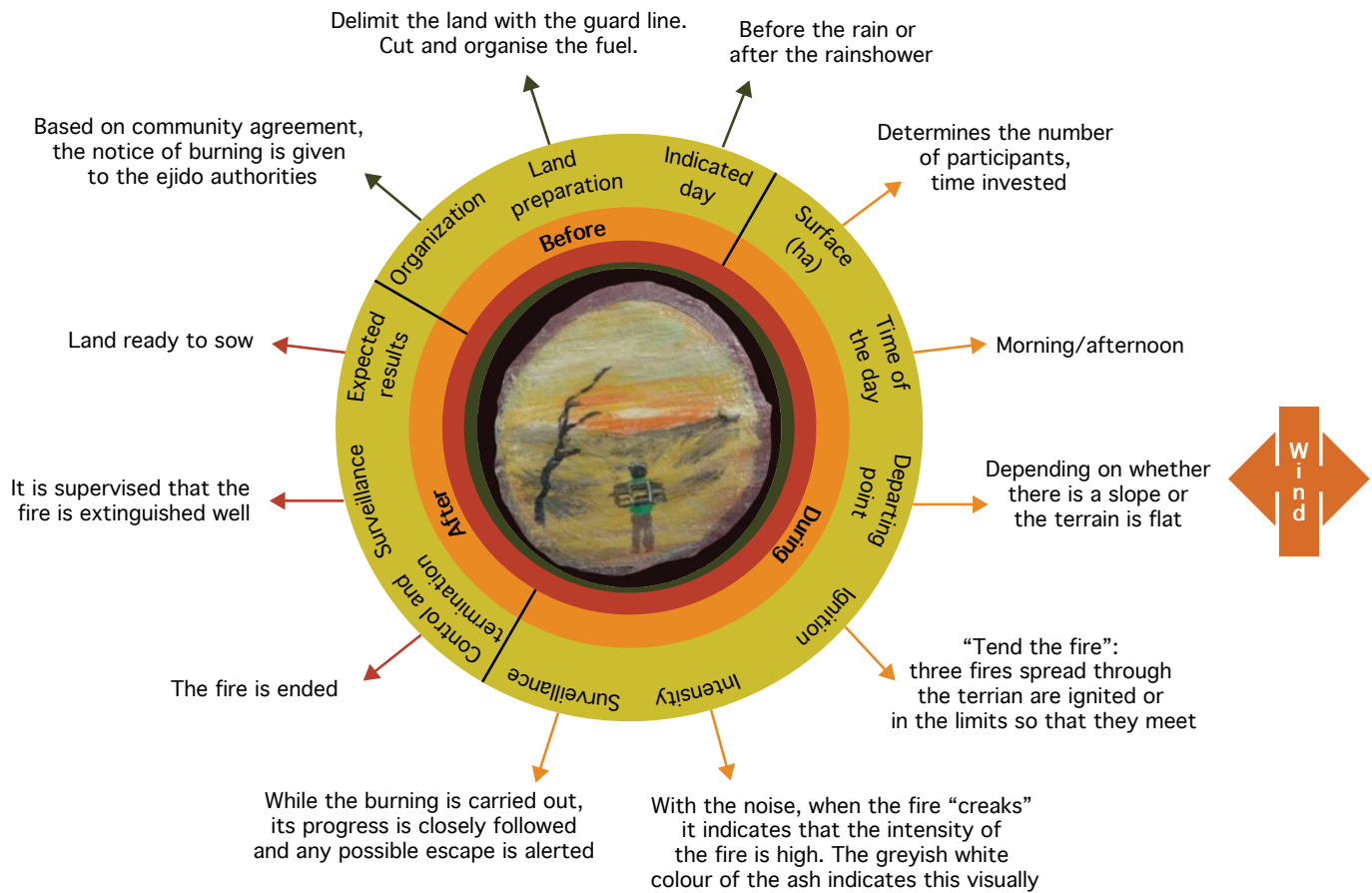


Figure 2. Cycle of application of agricultural burns. Source: Chuj artist from El Quetzal, Nentón, Huehuetenango, Guatemala.

These practices integrate social, ecological, cultural and political aspects into the ways in which people territorialize the space in which they live. In doing so, people adapt new technologies, technical knowledge and theoretical assumptions from a range of knowledge systems. This approach includes cultural fire-management practices as a core element of community life. As expressed by one of the world's leading fire scholars, "The most productive future for fire research is to create fire cultures and reconcile traditional practices with modern society" (Stephen Pyne, pers. comm., 2019). Traditional practices must be taken into account when developing strategies for integrated fire management that take a participatory and intercultural approach (Bilbao et al. 2020).

Interculturality

Cultural fire management is subsidiary to the integrated and intercultural management of fire. The concept of "interculturality" is used here is opposed to the term "monoculturalism," which increasingly governs legal and knowledge frameworks. Traditional knowledge and ways of life must be recognized and endorsed by external

agents in practical and everyday terms in order to arrive at an intercultural approach that can effectively guide the development of policies and programmes of public interest.

Dialogue, sharing knowledge, and a determination to incorporate cultural knowledge frameworks are key factors that can lead to a more sustainable, equitable, democratic and just world (Rodríguez et al. 2018). Interculturality is crucial to achieving respect for and appreciation of traditional fire-use practices that are otherwise being increasingly prohibited. It is also necessary so that communities are no longer seen as fire starters but as fire managers (Sletto and Rodríguez 2013; Rodríguez et al. 2018). An excellent example of this intercultural approach is that of indigenous peoples in the northern Amazon region (Bilbao et al. 2019).

Conclusions

The world is witness to the impacts of external social actors imposing their technical and political visions on cultural knowledge, and therefore, on pyrobiocultural territories and the people and ecosystems they contain.

However, indigenous peoples have moral and ethical rights and obligations to strengthen their relationship with the land they live on, and to keep their knowledge alive. This includes cultural fire management that is based on a diversity of knowledge from ancestral cultures and that prevents and controls fires while considering socioeconomic, cultural and ecological needs.

It is only through valuing and understanding the context of cultural fire management that the socioecological benefits of fire can be maximized. Moreover, to address the problems of extreme climate events that can lead to megafires, a truly open intercultural dialogue is required that considers local experience and knowledge to be valuable. The resulting cultural fire-management schemes should be incorporated as part of participatory community strategies, to be respected by the institutions in charge of fire prevention and firefighting. Such alliances must be encouraged and enhanced to ensure the maintenance and enhance the potential of pyrobiocultural regions as part of Mexico's national fire-management strategy.

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References

Bilbao BA, Mistry J, Millán A and Berardi A. 2019. Sharing multiple perspectives on burning: Towards a participatory and intercultural fire management policy in Venezuela, Brazil, and Guyana. *Fire* 2(3):39. <https://doi.org/10.3390/fire2030039>.

Bilbao BA, Steil L, Urbietta IR, Anderson L, Pinto C, González MC, Millán A, Falleiro RM, Morici E, Ibarregaray V, et al. 2020. Wildfires. In Moreno JM, Laguna-Defior C, Barros V, Calvo Buendía E, Marengo JA and Oswald Spring U (eds.). *Adaptation to Climate Change Risks in Ibero-American Countries*. RIOCCADAPT Report. Madrid, Spain: McGraw Hill, 435–496. https://www.researchgate.net/publication/346487629_Wildfires_Adaptation_to_Climate_Change_Risks_in_Ibero-American_Countries-RIOCCADAPT.

[publication/346487629_Wildfires_Adaptation_to_Climate_Change_Risks_in_Ibero-American_Countries-RIOCCADAPT](https://www.researchgate.net/publication/346487629_Wildfires_Adaptation_to_Climate_Change_Risks_in_Ibero-American_Countries-RIOCCADAPT).

Guevara-Hernández F, Gómez Castro H, Medina Sansón L, Rodríguez Larramendi LA, Mendoza-Nazar P, McCune NM and Tejeda-Cruz C with Pinto-Ruiz R (corresponding author). 2013. Traditional fire use, governance and social dynamics in a Biosphere Reserve of Chiapas, Mexico. *Pensee Journal* 75(11):110–125.

Limón-Aguirre F. 2012. Agua y subjetividad entre los Chuj. El respeto al corazón del agua. In Murillo Licea D. (ed.). *Culturas del agua y cosmovisión india en un contexto de diversidad cultural*. Instituto Mexicano de Tecnología del Agua, Mexico, 59–81.

Limón-Aguirre F and Pérez TC. 2018. Ko Lum k'in'al. *Aproximación a la relación del pueblo chuj en México con la naturaleza. Etnobiología y Patrimonio Biocultural de Chiapas*. Vol 1. El Colegio de la Frontera Sur. San Cristóbal de Las Casas, Chiapas, Mexico.

Merçon J, Vetter S, Tengö M, Cocks M, Balvanera P, Rosell JA and Ayala-Orozco B. 2019. From local landscapes to international policy: Contributions of the biocultural paradigm to global sustainability. *Global Sustainability* 2(e7):1–11. <https://doi.org/10.1017/sus.2019.4>.

Ponce-Calderón LP, Álvarez-Gordillo G, Vera-Cortés G, Rodríguez I, Rodríguez-Trejo DA and Villanueva-Díaz J. 2020. The birth of the “Sin fuego” people: A case study in Lagunas de Montebello National Park, Chiapas, Mexico. *Nova Scientia* 12(2):1–47. <https://doi.org/10.21640/ns.v12i25.2414>.

Ponce-Calderón LP, Rodríguez-Trejo DA, Villanueva-Díaz J, Bilbao BA, Álvarez-Gordillo GDC and Vera-Cortés G. 2021. Historical fire ecology and its effect on vegetation dynamics of the Lagunas de Montebello National Park, Chiapas, Mexico. *iForest – Biogeosciences and Forestry* 14:548–559. <https://doi.org/10.3832/ifer3682-014>.

Rodríguez I, Sletto B, Bilbao B, Sánchez-Rose I and Leal A. 2018. Speaking of fire: reflexive governance in landscapes of social change and shifting local identities. *Journal of Environmental Policy and Planning* 20(6):689–703. <https://doi.org/10.1080/1523908X.2013.766579>

Rodríguez-Trejo DA. 2015. *Incendios de Vegetación: Su Ecología, Manejo e Historia*. Vol. 2. Biblioteca Básica de Agricultura, Mexico.

Sletto B and Rodríguez I. 2013. Burning, fire prevention and meanings of landscape among the Pemón, Gran Sabana, Venezuela: Toward an inter-cultural approach to wildland fire management in neotropical savannas. *Journal of Environmental Management* 115:155–166. <https://doi.org/10.1016/j.jenvman.2012.10.041>.

Toledo VM. 2005. La memoria tradicional: la importancia agroecológica de los saberes locales. *LEISA Revista de Agroecología* 20(4):16–19. <https://www.scienceopen.com/document?vid=f76d4bac-2f51-47a7-a6ed-2481d82614c0>.

Author affiliations

Laura Patricia Ponce-Calderón, Researcher, El Colegio de la Frontera Sur, Chiapas, Mexico (laponce@ecosur.edu.mx)

Fernando Limón-Aguirre, Researcher, El Colegio de la Frontera Sur, Chiapas, Mexico (flimon@ecosur.mx)

Iokiñe Rodríguez, Associate professor, University of East Anglia, Norwich, UK (I.Rodriguez-Fernandez@uea.ac.uk)

Dante Arturo Rodríguez-Trejo, Professor, Universidad Autónoma Chapingo, Edo. de México, Mexico (dantearturo@yahoo.com)

Bibiana Alejandra Bilbao, Professor, Universidad Simón Bolívar, Caracas, Venezuela (bibiana.bilbao@gmail.com)

Guadalupe del Carmen Álvarez-Gordillo, Researcher, El Colegio de la Frontera Sur, Chiapas, Mexico (galvarez@ecosur.mx)

José Villanueva-Díaz, Researcher, Dendrochronology Laboratory, INIFAP CENID-RASPA, Durango, Mexico (villanueva.jose@inifap.gob.mx)