

Community-Based Fire Management in East and Southern African Savanna-Protected Areas: A Review of the Published Evidence

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Key Points:

1. Local empowerment and legitimate institutions are missing from community-based fire management in exclusionary savanna-protected areas.
2. Policies pursued under indirect and direct colonial regimes have contributed to the breakdown of local fire management systems.
3. Colonially derived early-dry season patch mosaic burns are characteristic of neo-colonial interventions to reinstate traditional burning.

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Abstract

The introduction of fire suppression policies and expansion of exclusionary protected areas in East and Southern African savannas have engendered a wildfire paradox. Outside protected areas, livestock have replaced fire as the dominant fuel consumer. Inside their boundaries, wildfire intensity has increased due to accumulating flammable biomass. Community-Based Fire Management (CBFiM) is recognised as an alternative fire management strategy to address the wildfire paradox and promote equitable fire governance across conservation landscapes. Yet, there has been little investigation into the implementation and effectiveness of CBFiM across East and Southern Africa's savanna-protected areas. Here we employ a social-ecological systems framework to develop a systematic map of the published literature on the framing and features of CBFiM in this context. We characterise the challenges and opportunities for their design and implementation, focusing on the relationship between governance systems and community participation in fire management. We find that CBFiM projects are commonly governed by the State and international NGOs who retain decision-making power and determine access to savanna resources and fire use. Existing CBFiM projects are limited to communal rangelands and are developed within existing Community-Based Natural Resource Management programmes prioritising fire prevention and suppression. Planned CBFiM projects propose an exclusive early-dry season patch mosaic burning regime to incorporate indigenous fire knowledge into modern management frameworks, but evidence of indigenous and local peoples' involvement is scarce. To provide equitable fire management, CBFiM projects need to address inequalities embedded in protected area governance, centralised suppression policies, and account for changing state-society and intra-society relations across the region.

Key Words: *community-based fire management, social-ecological systems, savanna fires, colonial regime, conservation, indigenous knowledge*

1. Introduction

Human fire use has significantly influenced the evolution of tropical savannas in Sub-Saharan Africa (Bond and Keeley, 2005; Bowman et al., 2011; Pooley, 2021), interacting with multiple ecological and climate variables to determine grass-woodland species ratios and distributions (Archibald et al., 2005; Donaldson et al., 2022). In recent history, changes in human fire use and land tenure arrangements have catalysed a pyric transition across this region (Kull, 2004), described as a wildfire paradox (Tendim et al. 2020). In East and Southern Africa, this paradox is characterised by extreme wildfires in protected areas uninhabited by humans and the absence of fires outside their boundaries where livestock have replaced fire as the dominant fuel consumer (Archibald, 2016; Probert et al. 2019). While livestock grazing is illegal in most protected areas across the region, encroachment along borders persists in the absence of effective exclusion mechanisms and is likely to increase as pastoralists rapidly transition towards commercial cattle ranching, reducing available biomass (Yurco, 2017; Lindsey et al. 2017a; Pekor et al. 2019). Declines in small-scale livelihood fires have reduced total burned area across African savannas (Andela et al., 2017; Zubkova et al., 2019). Juxtaposed with a wildfire-dominated fire regime that outstrips firefighting capacities, this has resulted in widespread bush encroachment (Gil-Romera et al. 2011), biodiversity loss (Veldhuis et al. 2019), ecosystem degradation (Pyne, 2020), socioeconomic vulnerability, and an increase in CO₂ emissions attributed to high intensity fuel combustion and reduced vegetation and soil carbon sequestration (Osborne et al., 2018; Loehman, 2020).

Disturbance-driven savannas in East and Southern Africa have historically supported the co-existence of humans and Earth's last remaining extant megafauna (Gowlett et al., 2016; Lindsey et al., 2017; Pennington et al. 2018), as well as significantly contributing to below-ground carbon sequestration (Coetsee et al. 2012; Dobson et al., 2022). However, the introduction of exclusionary protected areas and fire suppression policies by European colonial authorities displaced indigenous peoples and local communities (IPLCs) from their ancestral lands and imposed strict bans on traditional burning practices, disrupting the existing fire regime (Moura et al., 2019). Strong anti-fire narratives that frame local fire uses as "evil practice" (Eriksen, 2007), an example of "bad land management" (Alvarado et al., 2015), and a cause of "forest destruction" by transforming primary forest habitats into anthropogenic "species-poor" secondary savannas (Bloesch, 1999) or "deforested wastelands" (Stevens et al., 2022), have been sustained in independence and used to justify the expansion of exclusionary conservation areas and fire suppression operations in the absence of formal fire management (Rohde et al., 2006; Ritcher, 2016; Bergius et al., 2020; Phelps et al., 2022). Prolonged dry periods interspersed with heavy rainfall events have caused an accumulation of excess flammable biomass inside protected areas across East and Southern Africa

(IPCC, 2022). This poses a significant wildfire risk where chaotic and uncoordinated fire practices are pursued by local communities due to the breakdown of traditional land governance structures and ongoing antagonisms between local peoples and park authorities (see Supporting Information (SI)) (Bloesch, 1999; Kull, 2002; Adams and Hutton, 2007).

Community-Based Fire Management (CBFiM) is increasingly proposed as an alternative bottom-up approach to address the wildfire paradox, recognising the dual role of fire in savanna ecosystems and the importance of equitable local governance systems in sustainable resource management (Moore, 2004; Tendim et al., 2020). However, limited scrutiny of its defining features and divergent understandings of its objectives can compromise its effectiveness as a fire management approach across East and Southern Africa's savanna-protected areas. The lack of a clear framework defining CBFiM gives rise to discursive understandings of the level and nature of community participation required in decision-making and fire activities for projects to be considered *community-based* (Krah et al., 2020). CBFiM is currently used to describe projects where significant legal rights and authority over fire management are devolved to IPLCs, as well as projects enlisting select individuals as volunteers in centralised burning programmes, where their roles and responsibilities are regulated by government officials (FAO, 2011; Dube, 2013; Neale et al., 2019). At the same time, the concept of 'community' is often externally constructed and lacks specificity (Kumar, 2005), and terms including 'participatory', 'community-inclusive', 'adaptive', and 'collaborative' are arbitrarily used by external agents (Sihlongonyane, 2009; Cornwall and Eade, 2010). Their inconsistent use in local CBFiM frameworks can contribute to poor project design and implementation (Mansuri and Rao, 2004), threatening opportunities for equitable and sustainable bottom-up fire governance.

Here we examine the framing, nature, and extent of CBFiM across East and Southern Africa's savanna-protected areas to evaluate inconsistencies in the understanding and implementation of CBFiM across the region. We apply a social-ecological systems framework to review the published literature on its application, focusing on the impacts of governance arrangements in projects encouraging community involvement in wildfire management. We assess multiple social-ecological governance variables to identify commonalities and inconsistencies across projects and characterise challenges facing their practical application in protected areas (Gatiso et al., 2022).

The findings highlight the variable roles and responsibilities of IPLCs in current CBFiM applications. We argue this variation can be attributed to the historical and institutional inequalities inherent of protected area tenure arrangements and natural resource management that prevent the transfer of management rights to local peoples (Leach et al., 1999; Donald et al., 2022). The results raise the

need for careful and nuanced approaches to the development of CBFiM projects in local contexts to avoid reproducing local injustices in community-based projects.

2. Methods

We applied the Collaboration for Environmental Evidence's Version 5.0 review and synthesis protocol to systematically review the published evidence on CBFiM governance systems across East and Southern African savanna-protected areas (see SI) (CEE, 2018). To explore geographical and representation inequalities in scientific knowledge production (Demeter, 2020; Amarante et al. 2022; Kowal et al. 2022), we only included peer-reviewed literature in this study and documented the first authors' country of origin and institutional affiliation (Blicharska et al., 2017). Exploring described processes of coloniality in scientific knowledge can help understand the drivers of policy solutions and outcomes in local contexts worldwide (Beinart et al., 2009; Ndlovu, 2018). We used a qualitative Population, Interest, Context framework (Aromataris and Munn, 2020) to structure the review, and carried out the following search in Scopus and Web of Science under the Topic Subject of Title, Abstract, and Keywords:

("community-based" OR "community" OR "traditional" OR "indigenous" OR "local" OR "integrated" OR "comanag*" OR "co-manag*" OR "bottom-up" OR "bottom up" OR "coloni*" OR "pastoral*" OR "governance" OR "institution*" OR "poli*" OR "management") AND ("fire*" OR "burn*" OR "wildfire*") AND ("savanna*" OR "grass*" OR "wildland*" OR "grazing land*") AND ("Africa*" OR "Angola" OR "Botswana" OR "Burundi" OR "Ethiopia" OR "Kenya" OR "Lesotho" OR "Madagascar" OR "Malawi" OR "Mozambique" OR "Namibia" OR "Rwanda" OR "Somalia" OR "Somaliland" OR "South Africa" OR "Swaziland" OR "Eswatini" OR "Tanzania" OR "Uganda" OR "Zambia" OR "Zimbabwe")

Relevant articles were retrieved using a test-list and applying a pre-established set of inclusion and exclusion criteria (see SI). For each of the papers included in the analysis, we extracted and coded information on the studied savanna-protected area and its management structure, the CBFiM project design, community context, fire policy and legislation, wildfire events, land-use and burning practices, and impact of fire and wildfire in the landscape. Information was recorded in a systematic map which includes a full description of extraction categories and coding variables (Crocker, 2023. See Open Research section).

Table 1 outlines the first, second, and third-tier governance systems variables adapted from the social-ecological systems framework developed by Ostrom (2009) and expanded by McGinnis and Ostrom, (2014) and Delgado-Serrano and Ramos (2015). Information on project design was organised under four first-tier variables to understand the type of governance regime, and nature and extent of community involvement (Ganz et al., 2003; Ostrom, 2010). Information on savanna property-rights systems (i.e., excludability and subtractability), and community context, such as

whether communities' socio-cultural norms, fire strategies, and extant local institutions and rules are key attributes of the governance system, were also extracted.

To account for the role of colonial institutional legacies in resource governance, we considered the following themes in the review's design and data analysis: (i) representation of countries, cultures, and IPLCs, (ii) (neo)colonial and post-independence influences on fire suppression policies and resource management (Njoh, 2000), (iii) state, market, and (agro)pastoralist relations, and (v) increasing anthropogenic pressures on fire use.

3. Results

3.1 Literature Identified

The systematic search identified 1,682 published papers and book chapters. 1,593 of those were excluded during title and abstract screening stages as they did not examine the social aspects of fire management. Sixty-nine papers were removed during full-text screening due to duplication or failure to meet the inclusion criteria. The final sample contained 20 papers that were included in the systematic map (Crocker, 2023). A full record of papers excluded at full-text screening is provided in the Supporting Information.

The small number of retrieved papers highlights the predominance of biogeophysical research in fire ecology and the limited number of studies focusing on the social dimensions of fire and local knowledges in management (Trollope, 2007; Sousa et al., 2022). Disconnection between physical and social fire research has sustained institutional silos targeting wildfire challenges, such as between national governments and local social processes governing fire use (Kuligowski, 2016; Smith et al., 2016; Shuman et al., 2022).

3.2 Spatial Distribution of Research

Of the 20 papers, 16 referenced specific East and Southern African countries and four focused broadly on Sub-Saharan, East, and Southern Africa. Figure 1 shows the number of studies focusing on a specific country. No papers on CBFiM focused on South Africa, likely due to its long history of

prescribed fire experiments in protected areas which have significantly influenced the development of early-dry season fire management across the region (see SI) (van Wilgen et al., 1998; Nieman et al., 2021; Pooley, 2022).

Seven studies were first authored by individuals from East and Southern Africa. Three were first authored by Kenyan (Kamau and Medley, 2014), Ugandan (Nangendo et al., 2002), and Zimbabwean (Mapaure et al., 2009)

nationals conducting research on their country of origin but affiliated with institutions in the USA, the Netherlands, and Namibia. These studies were co-authored with researchers from Australia and South Africa, respectively. Authors of 15 studies were first-affiliated with institutions outside of Africa, 13 of which were in Western countries classified as developed (IMF, 2022), and two in Brazil (Alvarado et al., 2018; Moura et al., 2019). In only three studies were the focus country, nationality of the first author, and institutional affiliation aligned: Botswana (Dube, 2013), Mozambique (Ribeiro et al., 2019), and South Africa (Trollope, 2011).

3.3 Temporal Distribution of Research

All but one of the papers were published after 2000, 13 since 2010, and seven since 2015. The gradual increase in CBFiM research follows the expansion of fire-related research across East Africa (van Wilgen, 2009; FAO, 2011), driven by intensifying wildfire challenges and ecosystem degradation (Prior and Eriksen, 2013; Krah et al., 2020). It is also consistent with the evolution of discourses over indigenous rights and key events promoting IPLC representation in environmental governance systems (Dominguez and Luoma, 2020; Donald et al., 2022). Figure 2 presents the evolution of literature over time and some key events.

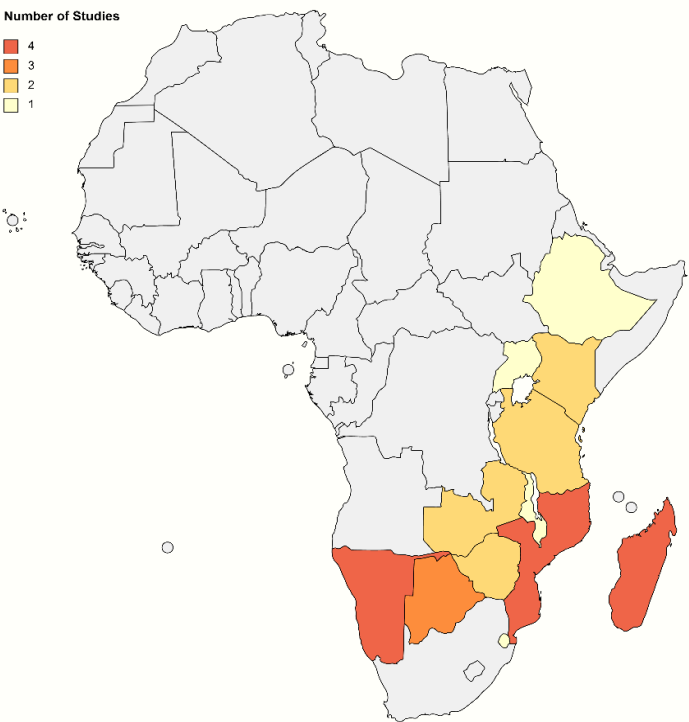


Figure 1. Focus countries of studies included in the published evidence base on community-based fire management in East and Southern African savanna-protected areas.

Table 1. First, second, and third-tier social-ecological governance systems variables adapted to extract information on the savanna-PA's property-rights system, CBFiM project design, and community context (Ganz et al., 2003; Ostrom, 2009; McGinnis and Ostrom, 2014; Delgado-Serrano and Ramos, 2015)

Extraction category	First-tier variables	Second-tier variables	Third-tier variables	Description
Savanna-PA - Property-rights systems: excludability and subtractability				
	Resource ownership			
	Resource use			
Project Design - Regime type: democratic and polycentric values				
	Establishment	Initiation		
		Year of establishment		
	Sponsorship and donorship	Sponsorship organisations		
	Decision-making	Scale		
		Rule-making organisation(s)	International organisations	
			Governmental organisations	
			Non-governmental organisations	(non-profit)
			Private sector organisations	(for-profit)
			Community-based organisations	
			Hybrid organisations	
		Rules-in-use (<i>level of community involvement in institutional layers of rules</i>)	Operational	Local rules defining access to local natural resources
			Collective-choice	Rules set by involved actors depending on local environmental, political, and economic conditions
			Constitutional	Regional and governmental rules defining legal framework
		Number of actors		
		Level of community involvement		
		Nature of community involvement		
	Participation	Level of active community participation		
		Willingness of active community participation		
Community Context				
	Norms and strategies	Project approach		Engagement with local cultural traditions and beliefs
		Project support		Support of local cultural traditions and beliefs in management
	Historical continuity	Local governance institutions		Existing local governance institutions

3.4 Current Framing of CBFiM

The use of the term CBFiM varies across the evidence base. Its interchangeable use with Integrated Fire Management, Community-Based *Integrated* Fire Management, and Community-Based *Forest* Management (Hoffmann, 2013; Krah et al., 2020) is symptomatic of the inconsistencies in its interpretation and guiding principles. Though CBFiM recognises local fire practices, its current framing remains embedded within cross-sectoral, hierarchical Integrated Fire Management frameworks aiming to standardise fire suppression and prevention operations and enhance technical capacities through state-regulated Incident Command Systems (see SI) (Dube, 2013; Tendim et al., 2020). The assumption that early-dry season burning practices are representative of traditional fire management systems worldwide continues to inform the adoption of CBFiM into government policy (UNU-IAS, 2015; Humphrey et al., 2021), limiting scope for decentralised fire management (Ekblom et al., 2019).

3.5 CBFiM Project Types

Twenty-one projects focusing explicitly on fire management or broader community-based conservation and natural resource management were discussed in 15 papers. Nine of those projects were already implemented and 12 were proposed. Five papers did not refer to a specific project, instead they examined the social-ecological and institutional evolution of local fire use and policies (Nangendo et al., 2002; Butz, 2009; Gil-Romera et al., 2011; Trollope, 2011; Ekblom et al., 2019). This included the relationship between biocultural heritage and processes of reterritorialization in communal rangelands, changes in state-market-society relations and pastoral socio-economic organisations, distinctions between commercial and communal fire management systems, and scientific progress in savanna fire ecology.

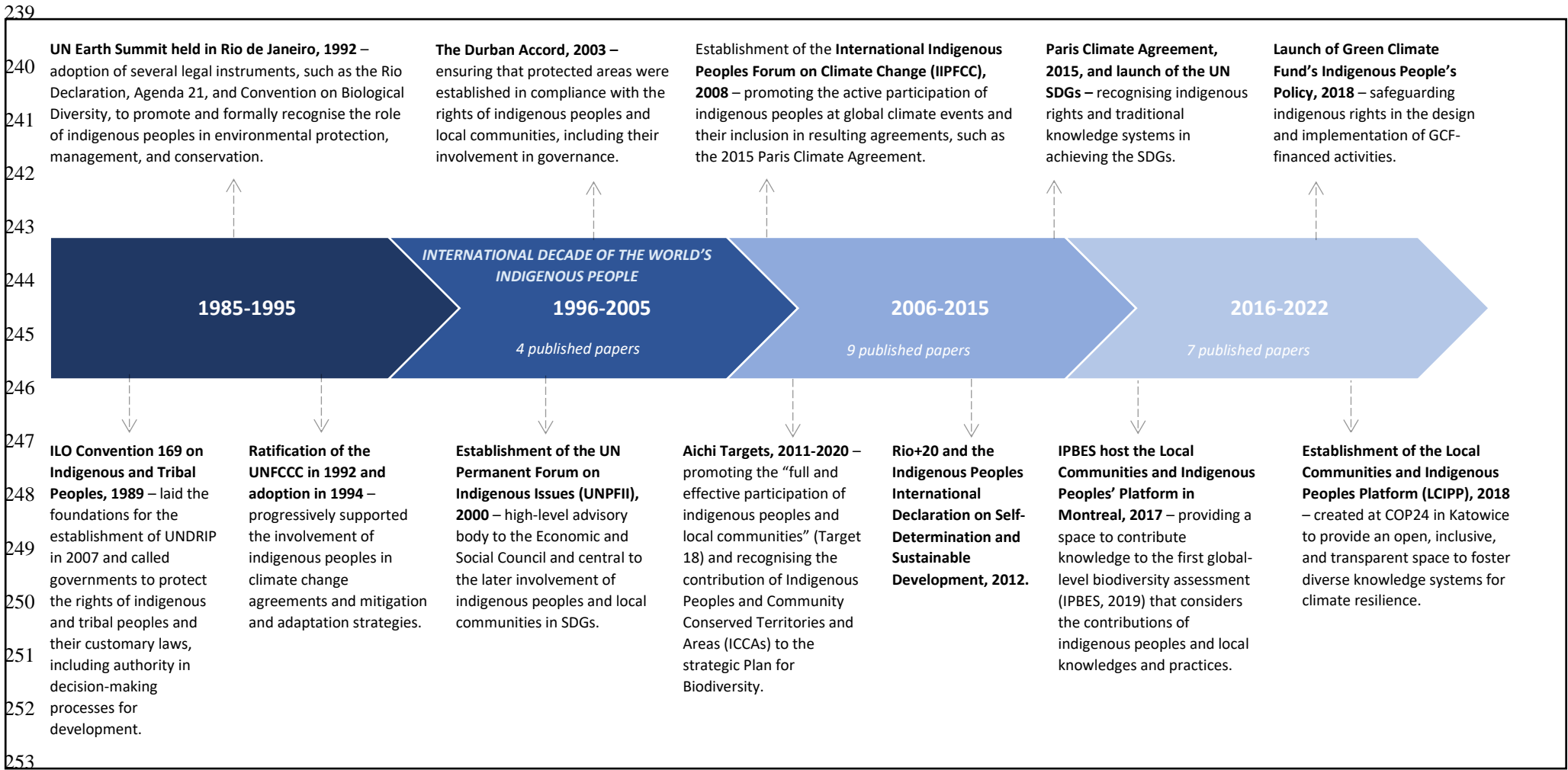


Figure 2. Key events that have influenced the recognition and representation of indigenous peoples and local communities in environmental management and governance systems since 1989. All papers included in the evidence base on CBFIM in East and Southern African savanna-protected areas have been published since 1999.

Implemented Projects

Customary rights and communal land tenure arrangements were key components in early conceptualisations of CBFiM. However, implemented projects have been frequently overridden by state forestry departments, particularly in protected areas where local management practices are incompatible with national laws that prioritize fire suppression (Reyes-Garcia and Benyei, 2019).

Three implemented projects discuss the 2007-2011 Eastern Caprivi Integrated Fire Management programme and its success in involving community-based organisations in the development of fire prevention legislation, being used as a model to develop CBFiM projects in tropical savannas worldwide (Jurvelius, 2004; Humphrey et al., 2021). While the Namibian government implemented a community-based *integrated* fire management policy to decentralise decision-making (Russell-Smith et al., 2017), this was limited to communal lands where customary rights over natural resources are already well established, and was not extended to protected areas where the Ministry of Tourism reserves all decision-making rights (MET, 2016). Similarly, the Gestion Locale Sécurisée (GELOSE) laws introduced by the Malagasy government in 1996 to decentralise resource management through community-based projects were incorporated into Madagascar's national forestry policy and environmental management plan in 1997, limiting local decision-making in CBFiM (Bloesch, 1999; Kull, 2002). The transfer of practical fire management activities to local communities living around protected areas can be viewed as a centralised approach to mitigate conflicts across park borders and extend control over local fire use (Pollini and Lassoie, 2011). Failure to decentralise decision-making in CBFiM projects is further evidenced in Zimbabwe's Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) and the Namibian Communal Area Conservancies (Moura et al., 2019).

Community-based natural resource management frameworks can provide a platform for CBFiM policy development. However, asymmetries in local, national, and international resource politics introduce contentious hierarchies into rural governance systems (Petty et al. 2015). Ambition to protect commercial resources risks subverting local rights and responsibilities in community-based projects (Donald et al., 2022), with land set apart from humans to meet the growing resource demands of the global economy (Lind et al. 2020; Winkler et al. 2021).

Proposed Projects

Community decision-making power, autonomy, and rights vary across the projects reviewed in the evidence base. All proposed projects focus on incorporating traditional fire knowledge into existing scientific frameworks, advocating a temporal shift in fire seasonality from the late- to the early-dry

season (Tendim et al., 2020). The aim is to reduce the frequency of intense late-dry season fires and reintroduce perceived traditional fire regimes which support savanna biodiversity (Shaffer, 2010; Humphrey et al., 2021). Community involvement is intended to address translational challenges across worldviews that prevent the incorporation of indigenous knowledge in formal science (Tuhiwai Smith, 2012; Millhauser and Earle, 2022). However, the role of IPLCs in constructing this discourse remains to be seen as their involvement in project design and implementation is uncertain (Huntington, 2000; Laris and Wardell, 2006). Where IPLCs are active in carrying out burning activities but are not assigned decision-making authority over fire use, participation is likely reduced to labour supply (Ganz et al., 2003).

Recent CBFiM proposals recommend savanna burning emissions abatement schemes that exclusively apply early-dry season burns to limit biodiversity loss, increase opportunities for climate change mitigation, and build resilient local communities (Tear et al., 2021). Given that savanna burning is an accountable emissions reduction activity under the 1997 Kyoto Protocol, these schemes present an opportunity for national governments to achieve emissions reduction targets whilst generating carbon credits that can be traded in international carbon markets (UNU-IAS, 2015). Three studies (Russell-Smith et al., 2017; Moura et al., 2019; Russell-Smith et al., 2021) propose CBFiM abatement schemes modelled on Northern Australia's West Arnhem Land Fire Abatement (WALFA) project (see SI). Given the success of savanna burning schemes registered on Aboriginal lands under freehold and joint Native Title arrangements in Northern Australia (Lipsett-Moore et al., 2018; Edwards et al., 2021), CBFiM projects that adopt similar methodologies for fire-prone savannas are of increasing interest worldwide (Crocker et al. 2023). In East and Southern Africa, savanna-protected areas that are larger than 1,000km² and sustain low human population densities have been identified as suitable sites for CBFiM (Lipsett-Moore et al., 2018). However, governance challenges restricting IPLCs' involvement in fire management limit their effectiveness (Laris, 2021). Though framed as indigenous-led CBFiM projects, abatement schemes demand top-down institutional regulations and accounting methodologies, prioritising emissions objectives over local empowerment. The implicit assumption that pastoral societies employ homogenous burning practices worldwide overlooks the diverse reasons socio-culturally distinct IPLCs use fire and influence local fire regimes, reducing these groups to a singular identity and discounting the need for project developers to carry out nuanced inquiries in local contexts (see SI, Table S4) (Catley et al., 2013; UNU-IAS, 2015; Muller et al., 2019).

3.6 CBFiM Project Design

The design of CBFiM depends on the projects' geographical context and regime type. Five key variables can be used to determine the degree of polycentricity and democratic principles in CBFiM governance regimes (Table 1): the project's objectives, developers, financiers, implied decision-making processes, and participation mechanisms (Ganz et al. 2003). All projects in the evidence-base are initiated, funded, and managed by agencies external to the local community, typically in hybridised arrangements between governments, international NGOs, and private investors (Bloesch, 1999; Ribeiro et al., 2019). The level of community involvement varies with the participation of other actors in management and the degree of authority exercised by central governments (Kull, 2002; Shaffer, 2010).

Development and funding conditions

Only one implemented (Jurvelius, 2004) and two proposed projects (Eriksen, 2007; Kamau and Medley, 2014) allude to community involvement in their initiation to support the co-development of fire policy and adaptive co-management. Projects relying exclusively on external funding from fixed-period grants or the government face increased risk of survival in the medium to long-run, as funding is exhausted and policy priorities change (Kull, 2002; UNEP, 2022). Encouraging joint local-external funding structures could mitigate some of the risk. Nevertheless, only four projects support internal funding structures together with external sponsorship (Dube, 2003; Jurvelius, 2004; Eriksen, 2007; Russell-Smith et al., 2017).

Internationally funded conservation-development programmes can financially assist CBFiM projects and provide in-kind support (Bloesch, 1999; Smit and Pilifosova, 2001). However, foreign donors often institute green conditionalities on national governments in Africa, providing support conditional on recipients pursuing specific policies to achieve fixed objectives (Bryant and Bailey, 1997; Eriksen, 2007). The introduction of NGO and corporate partners to oversee the establishment and management of protected areas has rearranged local governance systems within which CBFiM policies are developed (WCS, 2003; Virah-Sawmy and Gardner, 2014), creating new "private indirect government" arrangements that enable external agencies to retain authority over local fire users (Brockington et al., 2008). Alternatively, existing community resource management organisations can provide a basis for establishing revenue generating CBFiM projects (Dube, 2003; Russell-Smith et al., 2017). For example, Dube (2003) and Russell-Smith et al. (2017) propose CBFiM approaches where locally led fire management units and savanna burning schemes generate their own finances through fire levies on land-users' internal funding structures to generate long-term financial benefits.

Decision-making processes and participation

Centralised or decentralised institutional arrangements were present in nearly all CBFiM projects, with rule-making organisations for fire use reserved to the state and hybridised state-private partnerships. The limited ability of IPLCs to influence legal frameworks governing fire use suggests that these rules likely reflect the interests of more powerful socio-political coalitions (Cox et al., 2010; Schwarts, 2011).

The participation of IPLCs in determining the rules is mostly limited to the operational level, negotiating who, what, why, when, and how burning takes place in a specific location with limited or no influence on defining policy and legislation (Table 1). Tokenistic forms of participation in decision-making are reflected across the evidence base where state agencies collaborate with locally devolved institutions to promote participatory intercultural governance in CBFiM (Humphrey et al. 2021). Though this approach has the potential to recognise multiple perspectives on landscape burning to support biological and cultural diversity (Mistry et al. 2018), local participation is often passive and consultation-based. This might provide more powerful actors the ability to judge the legitimacy of recommendations made by local communities (Arnstein, 1969).

Five projects implied some local involvement in determining collective-choice rules to achieve broader social-economic outcomes (Eriksen, 2007; Humphrey et al., 2021; Jurvelius, 2004; Moura et al., 2019; Russell-Smith et al., 2017). Only one CBFiM approach recommended the incorporation of local experiences into international environmental politics on fire management (Eriksen, 2007), but acknowledged that local determination of rules-in-use is limited by the global political ecology of fire use that is informed by the experience of large uncontrolled wildfires. Scepticism over indigenous fire use continues to prevent the proactive participation of IPLCs in project design and decision-making at operational and institutional levels. For example, CBFiM projects implemented in Ibity and Itremo Newly Protected Areas, Madagascar (Alvarado et al., 2018), and proposed for Sengwa Wildlife Research Area, Zimbabwe (Mapaure et al., 2009), advocate for the inclusion of local communities in national fire management to limit local fire use and change their behaviour.

3.7 Community Context

The nature of bottom-up governance in CBFiM projects across diverse local contexts was evaluated based on the following characteristics: dependence on savanna resources; the presence of traditional fire knowledges, beliefs, and institutions; market integration and available technology; and policies and social rules regulating burning practices. All studies acknowledge high local dependencies on savanna resources and the role of traditional fire practices in achieving livelihood and land management objectives (see SI). However, fire practices are mostly described in their historical context, rather than as components of CBFiM projects.

Traditional fire governance and social rules

Local fire regulations are more common where traditional local leaders and governance institutions are present. Nevertheless, descriptions of their precise functions are limited and inconsistent across the evidence base. All studies carried out in Madagascar mention the role of *dina* in governing community burning practices, referring to the set of rules defined by community elders to resolve conflicts when fire escapes its intended boundaries. Other studies reference traditional institutions and authorities of social, political, ritual, and religious importance as retaining significant jurisdiction over local fire use, despite national bans on burning (Eriskien, 2007; Shaffer, 2010; Dube, 2013; Kamau and Medley, 2014; Gil-Romera et al. 2011). However, there is limited evidence of extant local governance systems being incorporated into externally developed CBFiM projects. Instead, their top-down appropriation to expand centralised control over fire use and natural resource management in rural contexts can change their legitimacy and utilisation at the community level (Kull, 2002; Gil-Romera et al., 2011). For example, *dina* was legally formalised in 1960 and incorporated into GELOSE law in 1996 and national forestry policy in 1997. *Community dina* for GELOSE contracts are required to conform with existing anti-fire legislation which makes no concession for the needs of marginalised agro-pastoral livelihoods (Bloesch, 1999; Kull, 2002).

Only three CBFiM projects (Jurvelius, 2004; Russell-Smith et al., 2017; Humphrey et al., 2021) and two proposed frameworks (Kamau and Medley, 2014; Moura et al. 2019) actively engage with local traditions and support the inclusion of fire knowledges in savanna management frameworks. Kamau and Medley (2014) and Moura et al. (2019) focus on colonial legacies in their investigations of anthropogenic fire use, highlighting the relationship between the emergence of a subaltern politics across protected area landscapes and increasing use of fire as a form of everyday agrarian resistance against extra-local authorities. Both studies recommend the development of shared learning experiences for building adaptive collaborative fire management approaches, asking IPLCs early in the planning stages to evaluate the potential contribution of their fire knowledge to management activities undertaken by other authorities. This approach can assist in legitimising local knowledges in formal institutions and empower communities in the development of inclusive and locally relevant policy (Thrupp, 1989; Donald et al., 2022).

Traditional fire knowledges are declining across East and Southern Africa. This can be attributed to (neo)colonial interventions and the subsequent breakdown of local land-use systems historically organised around resource politics and ritual practices (Lyver et al., 2019). These interventions include a rise in the political power of the Christian church (Okoye, 2021), government policies harnessing extant customary rules (Kull, 2002), the establishment of Incident-Command systems for

418 firefighting (Tendim et al., 2020), and disengaging younger generations from local traditions (Ekblom
419 et al., 2019). Government resettlement schemes and the rapid expansion of large-scale land
420 acquisitions for agriculture, conservation, and development continue to displace and exclude rural
421 communities from their ancestral and seasonal grazing lands (Thompson and Homewood, 2002; Gil-
422 Romera et al., 2011; Lind et al. 2020). As resource availability decreases and locals seek exclusive
423 property-rights over land, migration, fragmentation of holdings, and trends towards sedentarisation
424 increase (Mwangi, 2007a; Archibald, 2016). These processes contribute to the cultural and
425 geographic assimilation of diverse traditional societies and disempowerment of traditional
426 governance systems, weakening the social, cultural, spiritual, political, and economic significance of
427 local fire use. Burning is increasingly regraded as an unacceptable land management tool,
428 particularly around homesteads and farms (Butz, 2009; Kamau and Medley, 2014).

429 **Markets and technologies**

430 Land use and tenure change, population growth, and climate change, have forced many local
431 communities to rapidly modify their socio-economic activities with little consideration over long-
432 term planning. Aided by the remittance industry and increasing access to mobile technologies, IPLCs
433 are increasingly engaging in Africa's growing informal cash economy to meet immediate survival
434 needs (Mkandawire, 1986; ILO, 2021). Increasing dependencies on market exchanges have created
435 greater dichotomies between modern market-based and traditional land management systems, as
436 IPLCs transition from pastoral activities to cash-crop farming or tree-planting for charcoal production
437 (Kull, 2002; Gil-Romera et al., 2011; McAfee, 2016).

438 **Fire policies**

439 Strict no-burn policies first established by Europeans in all countries represented in this review,
440 except for Ethiopia (Trollope, 2011), have been sustained in independence by leaders educated in
441 colonial institutions and wildlife management practices aiming to eliminate fires to improve
442 conservation outcomes (Kamau and Medley, 2014; Alvarado et al., 2018; Moura et al., 2019). Twelve
443 studies directly attribute changes in the dominant fire regime to European colonisation and fire
444 suppression policies. Four studies do not explicitly reference colonialism, but attribute changes in
445 the fire regime to suppression policies, the exclusion of humans and livestock from savanna-
446 protected areas, and the breakdown of traditional land-use systems (Alvarado et al., 2018; Butz,
447 2009; Russell-Smith et al., 2021; Shaffer 2010). Since Ethiopia was never formally colonised by a
448 European power, Gil-Romera et al. (2011) refer to bans on local burning practices in conservation
449 areas without reference to colonialism. Five studies reference legislation that indirectly supports the
450 enforcement of centrally directed fire policies and bans (Kull, 2002; Eriksen, 2007; Shaffer, 2010;

Dube, 2013; Humphrey et al. 2021). The three remaining studies do not mention colonialism nor fire suppression policies in their accounts of CBFiM, despite recognising the imperative to “to maintain (fire) disturbances” (Nangendo et al., 2002) through the recovery of “traditional practices” (Ribeiro et al., 2019) and “inclusion of surrounding communities in the overall fire management programme” (Mapaure et al., 2009).

Colonial fire suppression policies were not formally legislated. This is likely why fire regime and management changes are not attributed to colonial legacies uniformly across the evidence base. The lack of long-term planning is consistent with European colonial priorities, focusing on resource extraction rather than pursuing administrative objectives (Mostert et al., 2019; Kohli, 2020; van de Walle et al., 2020). Without institutional and legal frameworks, the enforcement of fire rules has been arbitrary and largely repudiated in rural areas, particularly where they do not align with communities’ social, cultural, and economic practices, or are enforced by state-appointed local leaders without community approval (Shaffer, 2010). Plans drafted for specific conservation areas by external agents including NGOs and industry can have greater local salience and authority over community practices, provided they accept fire as a land management tool (Kull, 2002).

4. Discussion

CBFiM projects developed within existing natural resource management frameworks are mostly harnessed by state forestry departments and international NGOs to mitigate inter-group conflicts along park boundaries, aiming to limit local fire use and reduce wildfire risk. Focusing on the destructive rather than regenerative potential of fire in savanna ecosystems has hindered the decentralisation of fire use decision-making to local communities (Archibald, 2016). Proposed projects are consistent with the broader literature on community-based natural resource management in that they recognise the importance of local land tenure as critical to the success and legitimacy of CBFiM. However, they do not actively address the historical and institutional barriers that prevent IPLCs from accessing and owning land in protected areas (Agrawal and Gibson, 1999; Swatuk, 2005; Measham and Lumbasi, 2013; Cassidy, 2020).

The incorporation of traditional fire knowledges into modern management frameworks to revitalise cultural burning in CBFiM projects is increasing across the world, such as in savanna burning schemes in Northern Australia and tribal-federal forest management partnerships in the U.S. (Smith and Mistry, 2021). However, the prevailing assumption that prescribed early-dry season patch mosaic burning is representative of traditional fire use worldwide does not pay attention to the historical ecology and institutional evolution of this approach (see SI) (Petty et al., 2015; Humphrey et al., 2021). Such projects are often state-mandated, governed by public and private organisations,

and involve extensive local training programmes to achieve a set of predetermined objectives including wildfire emissions mitigation, fuel reduction, forest protection, and biodiversity conservation, as well as reducing “careless and damaging” indigenous fire practices (Laris and Wardell, 2006). Research aiming to highlight certain benefits of pyro-diverse indigenous burning necessary to counter strong anti-fire wisdoms has inadvertently contributed to the formalisation of patch mosaic burning in community-based and indigenous-led fire management approaches (Parr and Andersen, 2006). While this might show a step in the right direction towards recognising the social-ecological importance of fire use, it is indicative of colonial and more recent global climate policy which seeks a systematic approach to fire management (Laris and Wardell, 2006; Tendim et al. 2020). In local contexts, the strict prescription of early-dry season burns based on arbitrary seasonal boundaries might be considered a neo-colonial intervention in controlling indigenous fire use (Laris and Jacobs, 2021).

Western interpretations of indigenous communities as homogenous and territorially bounded social organisations continue to shape the understanding of pre-colonial land management systems (Kumar, 2005; Neale and Vincent, 2017; Murove, 2018). This has enabled external agencies to restrict access to the decision-making process, while adjudicating on the validity of local knowledge (Kull, 2002; Demeter, 2020). This has led to the decentralisation of responsibilities (i.e., labour and time), rather than the transfer of management rights in CBFiM projects (Kull, 2002; Schafer and Bell, 2002; Ndumeya, 2019).

The expansion of bureaucratic power in local fire governance is observed in projects implemented across communal rangelands where IPLCs hold some land rights (Kull, 2002; Dube, 2013; Humphrey et al., 2021). This is likely to be greater in savanna-protected areas where opportunity for local power in decision-making is institutionally constrained (Twyman, 2005). For example, the Namibian Communal Area Conservancies framework and the Eastern Caprivi CBFiM program are referenced as empowering rural communities in decision-making (Wenborn et al. 2022), and as being essential for “developing community fire management ownership” (FAO, 2011), respectively. Yet, community committees are required to define fire management objectives in compliance with government agencies who primarily aim to control, prevent, and suppress fire (Forest Act 2001; MET, 2016). In Botswana, decentralised decision-making rights are reserved for locally elected fire brigades trained by external authorities according to their land management objectives (Dube, 2013; Hoffman, 2013), while in Madagascar, communities must be granted permission to burn by the Forest Service (Kull, 2002; Ramamonjisoa et al., 2012).

CBFiM projects are susceptible to elite capture across protected areas where exclusion rights are transferred to select members of the community, including traditional leaders and elected officials (Saito-Jensen et al., 2010). Often, political coalitions between government agencies and traditional authorities are used to promote congruence in fire management, particularly where agrarian resistance fires threaten protected area management objectives (Antona et al., 2004; Agrawal and Ostrom, 2001). Exclusion rights can redistribute bargaining power to local elites who are able to redefine operational rules-in-use, managing natural resources for individual political and economic advantage and promoting an authoritarian governance regime (Thompson and Homewood, 2002; Eriksen, 2007; Nygaard, 2008). As observed in fire-related payment for ecosystem services and carbon credit schemes (Croker et al. 2023), this can drive privatization and the accumulation of benefits amongst a privileged minority (Kapoor, 2002). Where historically rooted forms of community governance and social rules are present, legal frameworks to transfer management rights to local communities and regulate elite behaviour could facilitate self-organisation in democratic decision-making over fire use (Cox et al., 2010; Arnall et al., 2013; Marshall et al., 2017). However, without secure tenure rights, and where new CBFiM institutions established by external authorities do not account for local forms of accountability and legitimacy, community members possess little power to challenge traditional authorities and opportunities for collective action are limited (Mutua and Kiruhi, 2021).

The legacy of European colonisation on fire use and wildfire is recognised in the literature (Moura et al. 2019). However, there is limited discussion on the role of colonial regimes in reorganising local communities, power dynamics, and traditional knowledge systems. “Divide and rule” policies were pursued under both indirect and direct colonial regimes in Africa to control local populations and prevent insurgencies. Yet, the approaches adopted to achieve this varied across colonial governments, reflecting their wider political-economic goals and administrative styles (Young, 1994; Njoh, 2000).

British indirect rule relied on a system of native administration and territorial exclusion whereby traditional authorities were empowered, forced, or invented by the colonial government to manage day-to-day affairs in rural localities where centralised administrative control was limited and costly (Crowder, 1964; Christopher, 1988). Traditional authorities evolved into a new cadre of intermediaries (Rodgers, 2021), often motivated by political-economic imperatives rather than the interests of their community (Okoye, 2021; Rash and Horan, 2020). Given their inherited role in public office, CBFiM projects that engage local chiefs and elders on behalf of entire communities need to consider the limitations this might impose on the opportunities for bottom-up governance (Mansuri and Rao, 2004), particularly with respect to representation, procedural justice, and the

distribution of project benefits. Random fire use for individual management preferences has increased across East and Southern Africa, while community cooperation has declined (Dube, 2013; Humphrey et al., 2021). Therefore, burning practices currently exercised by local elites might reflect individualistic ambition rather than the wider communities' general sentiment or management objectives (Thompson and Homewood, 2002; Eriksen, 2007; Klein et al., 2021).

The direct approach to governance pursued by the French and Portuguese colonial governments relied on assimilationist policies to vertically stratify ethnic groups into a singular social system controlled by the central administration (Njoh, 2000). Cultural divisions of labour and new social classes were introduced along ethno-linguistic lines (Young, 1994), resulting in a socio-politically and economically distinct elite trained in European culture and peasant majority consisting mainly of laborers. The reservation of power to elites in independence has enabled strong colonial anti-fire wisdoms to persist in resource management (Kull, 2004).

The breakdown of traditional land management systems and loss of fire knowledge in countries historically under indirect colonial administration has also been directly attributed to the presence of Christian missionaries spreading Western cultural norms in rural localities (Eriksen, 2007; Gil-Romera et al., 2011). New types of intra-group conflict and inter-personal distrust emerged between traditional religious leaders and community members who separated themselves from their pre-colonial beliefs and societies (Okoye, 2021), often due to instilled fears of bewitchment or punishment for practicing witchcraft (Gershman, 2016). The prominence of Western NGOs in international politics since the end of the Cold War and their influence over conservation-development projects in post-independence Africa has received some criticism for reinforcing missionary paternalistic approaches to local development (Hearn, 2007; Manji and O'Coill, 2002; Oloka-Onyango, 2002), such as the need to empower and educate local communities (Nelson, 2003). Banks et al. (2015) found that the expansion of NGOs rarely strengthens or empowers IPLCs in community-based projects due to the conditionalities imposed on them by donors who overlook or do not understand local governance systems and societal organisations. Therefore, we need to question whose knowledges are represented in externally governed CBFiM projects (Reyes-Garcia and Benyei, 2019), how far local knowledges can be regarded as traditional or pre-colonial, and what the purpose is, or implications are, of seeking out this knowledge in local contexts.

While complex relationships between external agencies and local communities in fire management have been acknowledged in the literature, their historical and institutional context, and impacts on intra-community dynamics, remain under explored. The disruption of local power dynamics between land chiefs, religious leaders, and community members under both indirect and direct colonial

regimes have instituted various challenges in decentralizing decision-making processes over fire use to local communities in CBFiM projects. For example, conflicts between local peoples over fire use objectives has promoted a chaotic fire regime across East and Southern Africa, thus precluding harmonious management arrangements (Bloesch, 1999; Kull, 2002).

5. Conclusion

This review highlights the discursive ways in which CBFiM has been framed in the literature and the lack of consistency in the level and nature of local community involvement in fire governance for CBFiM projects to be considered *community-based*. Though secure land tenure of IPLCs and management rights over nature resources are essential requirements for CBFiM, no study actively addresses these challenges in exclusionary, state-owned, and externally managed protected areas. This limits IPLCs from gaining real decision-making power over fire in these landscapes. Participation of IPLCs in proposed CBFiM projects is assumed through the integration of their traditional knowledges in modern management systems. However, diverse ILPCs burn year-round for a variety of land management and livelihood objectives, while prescribed early-dry season patch-mosaic burns more closely resemble colonial fire experiments developed within protected areas throughout the 20th century (see SI). Tokenistic forms of participation in CBFiM are apparent across the evidence-base, with select members of the community employed in decentralised integrated fire management programmes governed by state agencies and international NGOs often acting in compliance with national or international conditionalities, rather than in response to the local context (Dominguez and Luoma, 2020). Additionally, the increasing intensity of wildfires in protected areas continues to reinforce reactive, centralised Incident-Command systems for firefighting due to the risks they pose on commercial resources and GHG emissions targets (Moore, 2004; Shaffer, 2010; Huffman, 2013).

The effectiveness of CBFiM in providing a bottom-up fire management framework in East and Southern African savanna-protected areas can be improved if IPLCs acquire management rights over savanna resources and have significant control over decision-making processes. This requires a long-term, historical social-ecological perspective and interrogation of the strong colonial legacies that influence received wisdoms, resource management, and power hierarchies (Petty et al., 2015). Particular attention needs to be given to how our understanding of community has been constructed and what institutional legitimacy and empowerment means to IPLCs in specific local contexts (Clover and Eriksen, 2009). To do this, the dominant focus on community needs to shift towards a focus on institutions, exploring how political-economic relationships are continuously renegotiated at the local level and interact with national and international resource politics (Berkes,

2007; Nygaard, 2008). This can highlight opportunities for external institutions to provide capacity building support for long-term community fire management (Krah et al., 2020; Fisher et al. 2021). It can also reveal challenges emerging from both state-society and society-society exchanges that might preclude sustainable fire management, thus assisting in political and legal reform necessary to formalise customary land titles and the development of locally legitimate and inclusive CBFiM (Dominguez and Luoma, 2020).

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Open Research

The systematic map is available at figshare via <https://doi.org/10.6084/m9.figshare.21976316.v1> CC BY 4.0.

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