

Indigenous Knowledge and Bushfire Prevention in Mopa Muro LGA, Kogi State, Nigeria

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ABSTRACT

Bushfires are a recurrent environmental hazard with severe ecological and socio-economic impacts across rural communities in Nigeria. Despite these risks, formal fire management often overlooks indigenous strategies. This study investigated the role of local knowledge (imo ibile) in bushfire prevention and control in Mopa Muro Local Government Area (LGA), Kogi State, Nigeria. Using structured questionnaires administered to 380 respondents, complemented by in-depth interviews and focus group discussions, the study assessed the effectiveness, transmission, and challenges of indigenous fire control practices. Results showed that 80.2% of respondents considered these methods effective, with 36.8% rating them highly effective and 43.4% moderately effective. Firebreak creation (odo ina) was the most common practice (50%), followed by early burning (ina tete, 25%) and communal monitoring (abojuto papo, 20%). Statistical analysis revealed a significant relationship between the use of indigenous knowledge and bushfire prevention effectiveness ($\chi^2 = 24.67$, $p = 0.001$). Logistic regression confirmed that respect for elders, communal values, and traditional beliefs strongly influenced adoption and transmission (odds ratios 2.321–4.528). Furthermore, 80.3% of respondents supported integrating indigenous and formal fire management, highlighting community preference for hybrid approaches. Key challenges included unpredictable wind patterns (26.3%), lack of youth involvement (23.7%), and resource constraints (18.4%). The study concludes that imo ibile remains a culturally embedded and adaptive system for bushfire management. It recommends policy frameworks that formally recognize and integrate indigenous practices to enhance resilience and community empowerment.

Keywords: Indigenous knowledge, bushfire prevention, fire control methods, socio-cultural factors, and Mopa Muro LGA.

INTRODUCTION

Bushfires, also known as wildfires, are uncontrolled fires that spread rapidly across vegetation-dominated landscapes, causing ecological, economic, and social disruptions globally. Regions such as Australia, California, and southern Europe have recently experienced some of the most destructive fires on record, leading to biodiversity loss, soil degradation, and community displacement (Bowman et al., 2022; Moreira et al., 2020). According to the Intergovernmental Panel on Climate Change (IPCC, 2021), climate change has amplified these risks, with rising temperatures, prolonged droughts, and erratic rainfall intensifying fire vulnerability and impacts on both human and natural systems. Beyond environmental degradation, bushfires undermine food security, public health, and livelihoods. The Food and Agriculture Organization (FAO, 2022) estimates that millions of hectares of cropland and grazing land are destroyed annually, threatening rural economies and global sustainable development.

In Africa, bushfires remain a frequent hazard, often linked to agricultural expansion, hunting, and land clearing. Historically, communities developed fire calendars and locally embedded regulations to balance fire use with ecosystem health (Archibald, 2021; Laris et al., 2020). However, modernization, population growth, and weakened communal governance have eroded these systems, giving rise to more destructive fire regimes. The resulting uncontrolled fires threaten biodiversity, forests, and rural livelihoods across savanna regions (Nantogmah et al., 2022). In Nigeria, bushfires are most pronounced during the dry season (November–March), when harmattan winds and low humidity facilitate fire spread. States in the savanna and Guinea savanna belts, including Kogi, Kwara, and Niger, experience recurrent bushfires that damage farmlands, destroy economic trees, and reduce soil fertility (Adeniyi & Olorunfemi, 2022; Owojori et al., 2023). Local knowledge, or *imo ibile*, which includes firebreak creation, early burning, communal monitoring, and culturally rooted restrictions, has historically played a critical role in mitigating fire risks (Ayantunde et al., 2021; Olawepo & Jimoh, 2022). Nonetheless, socio-economic change, rural-urban migration, and weakening traditional governance have reduced the effectiveness of these practices (Ogundele et al., 2023). While integration of indigenous and scientific knowledge has proven effective elsewhere (Moreira et al., 2020; Bowman et al., 2022), such hybrid approaches remain underdeveloped in Nigeria.

In Mopa Muro Local Government Area, bushfires are recurrent due to slash-and-burn agriculture, hunting practices, and land preparation during the dry season. The region's grasslands and scattered woodlands make it highly vulnerable to fire outbreaks. Although some indigenous fire control practices persist—such as early dry-season burning, collective patrols, and firebreak construction—their sustainability is increasingly threatened by changing land tenure, declining youth involvement, and inadequate formal support (Adebayo & Akintola, 2023; Olawepo & Jimoh, 2022). The socio-economic consequences are severe: farmland destruction reduces household income and food security, while vegetation loss accelerates erosion and long-term land degradation. Women, who depend heavily on small-scale farming and forest products, face disproportionate risks from bushfires (Ogundele et al., 2023).

Recent literature underscores the importance of examining bushfire drivers to understand how socio-ecological conditions interact with human practices to shape fire regimes. Globally, scholars attribute increasing fire frequency and intensity to climate change, land degradation, and unsustainable agricultural practices (Bowman et al., 2022; Moreira et al., 2020). In many African contexts, bushfires are associated with slash-and-burn farming, hunting, and land clearing. While fire remains historically embedded as a land management tool, the erosion of community fire calendars, population pressures, and modernization have transformed fire from a regulated practice into a destructive hazard (Akinsorotan et al., 2022; Laris et al., 2020). Recent evidence from Ghana and Burkina Faso highlights that bushfire are now more frequent and less predictable, with severe consequences for rural livelihoods and ecosystems (Nantogmah et al., 2022; Nkonya et al., 2023). Within Nigeria, scholars have emphasized that the persistence of bushfires is not only ecological but also socio-economic, tied to poverty-driven practices, weak environmental regulation, and inadequate extension services (Ogundele et al., 2023; Adebayo & Akintola, 2023).

Indigenous knowledge has emerged as a critical dimension in bushfire prevention and control, rooted in generations of environmental observation and cultural regulation. Practices such as early burning, firebreak creation, and communal patrols are widely documented across African savannas (Ayantunde et al., 2021; Olawepo & Jimoh, 2022). Recent studies confirm that communities continue to rely on these measures, considering them cost-effective and context-appropriate (Eni et al., 2021; Ogundele et al., 2023). In Ghana, for instance, fire committees

grounded in indigenous practice have demonstrated significant effectiveness in reducing uncontrolled burns (Nantogmah et al., 2022), while in Burkina Faso, fire calendars still regulate agricultural burning despite pressures of modernization (Nkonya et al., 2023). In Nigeria, however, the transmission of these practices is threatened by rural-urban migration, declining communal authority, and weakening respect for cultural norms (Akinsorotan et al., 2022; Adebayo & Akintola, 2023). This has created intergenerational gaps, where youth often lack the knowledge or incentives to engage in traditional fire prevention. Nevertheless, evidence suggests that where respected elders, communal institutions, and cultural taboos remain intact, indigenous knowledge retains its effectiveness (Ayantunde et al., 2021; Ogundele et al., 2023).

Contemporary scholarship increasingly emphasizes the integration of indigenous knowledge with modern fire management systems to build resilience. Hybrid approaches have been shown to produce better ecological and social outcomes than reliance on either system alone (Moreira et al., 2020; Bowman et al., 2022). In southern Africa, co-management frameworks blending traditional fire calendars with satellite-based monitoring have improved fire prevention outcomes (Archibald, 2021; Laris et al., 2020). Nigerian scholars similarly argue for policies that recognize and formalize local practices within environmental governance structures (Eni et al., 2021; Alade & Bello, 2019). Yet, empirical evidence on how these hybrid systems function in rural Nigerian contexts remains scarce. Studies tend to document indigenous techniques descriptively but rarely assess their effectiveness quantitatively or explore the socio-cultural factors sustaining them (Olawepo & Jimoh, 2022; Ogundele et al., 2023). This gap limits the potential for scaling context-sensitive fire management frameworks that could bridge traditional knowledge with state-led interventions.

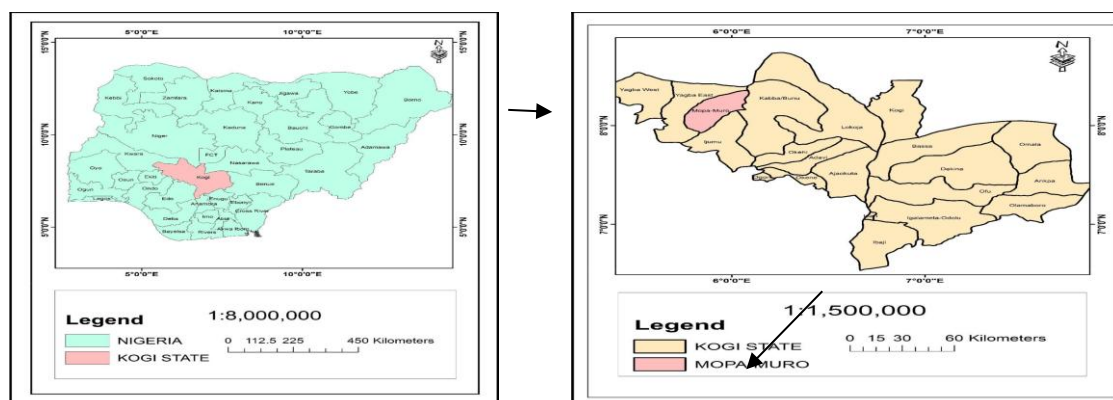
Theoretically, indigenous knowledge theory provides a foundation for understanding how locally developed ecological knowledge is accumulated, transmitted, and applied within communities. It situates indigenous knowledge not as static folklore but as a dynamic system of environmental management shaped by observation, experience, and cultural institutions (Ayantunde et al., 2021). Complementing this, the socio-ecological resilience framework highlights the adaptive capacity of communities to anticipate, respond, and reorganize in the face of environmental hazards such as bushfires (Folke et al., 2021). These perspectives jointly illuminate how practices like firebreaks and communal patrols persist or decline under changing socio-economic conditions. Applied to this study, they suggest that indigenous knowledge and resilience are mediated by socio-cultural variables such as respect for elders, communal values, and traditional beliefs. Linking these theoretical perspectives to the hypotheses, the study tests whether local knowledge significantly predicts bushfire prevention effectiveness and whether socio-cultural factors significantly influence the adoption and transmission of indigenous fire practices.

Despite the recognition of indigenous knowledge in environmental management and disaster risk reduction, empirical evidence on its current effectiveness, transmission, and integration with formal systems in rural Nigerian contexts remains limited. In Mopa Muro, bushfires persist and are increasing in severity, suggesting that traditional practices alone are insufficient, yet formal systems remain weak and poorly enforced. There is a lack of systematic research assessing how indigenous knowledge functions today, the socio-cultural factors influencing its sustainability, and how it can be integrated with modern fire management for resilience. This study therefore seeks to fill this gap by identifying and documenting indigenous fire prevention and control practices in Mopa Muro, assessing their effectiveness, analyzing the socio-cultural factors influencing their adoption and transmission, examining the challenges limiting their sustainability, and exploring opportunities for integrating these methods with formal fire management systems. The research is guided by questions concerning what indigenous fire

control methods exist in Mopa Muro, how effective they are, what socio-cultural factors shape their adoption, what challenges hinder their continued use, and how local and formal systems can be integrated. To test these, two hypotheses are proposed: first, there is no significant relationship between the use of indigenous knowledge and the effectiveness of bushfire prevention in Mopa Muro LGA; and second, socio-cultural factors do not significantly influence the adoption and transmission of indigenous fire control practices in the area.

STUDY AREA

Mopa Muro Local Government Area (LGA), situated in central Kogi State, Nigeria, lies roughly between latitudes $8^{\circ}10'N$ and $8^{\circ}25'N$ and longitudes $5^{\circ}55'E$ and $6^{\circ}10'E$, with Mopa town serving as its administrative and commercial center. Bordered by Ijumu, Kabba/Bunu, Yagba East, and Yagba West LGAs, the area benefits from road connections to Lokoja, the state capital, enhancing its regional economic interactions. The climate is tropical wet and dry, with a rainy season from April to October delivering 1,200 to 1,500 mm of rainfall annually and a dry season influenced by the Harmattan winds from November to March. Vegetation predominantly comprises derived savanna—a mix of scattered trees like locust bean and shea butter interspersed with grasses—reflecting both natural conditions and human activities such as farming and bush burning. The terrain is gently undulating, ranging from 300 to 500 meters above sea level, underlain by the Basement Complex geology of granite and schist, which shapes soil formation, drainage, and local construction. Soils are mainly ferruginous tropical types, moderately fertile but prone to leaching, supporting staple crops like yam, cassava, and maize. Land use centers on agriculture, with mixed cropping common alongside residential and commercial developments, while small-scale quarrying and sand mining also contribute to the economy. Socio-economically, over 70% of the population engages in farming, supplemented by trading, artisanship, and civil service. The area has active markets and traditional crafts, though modernization has reduced some artisanal practices. Infrastructure such as roads, schools, and health centers exists but requires further development. Strong cultural cohesion and traditional institutions continue to influence community governance and conflict resolution within the LGA.



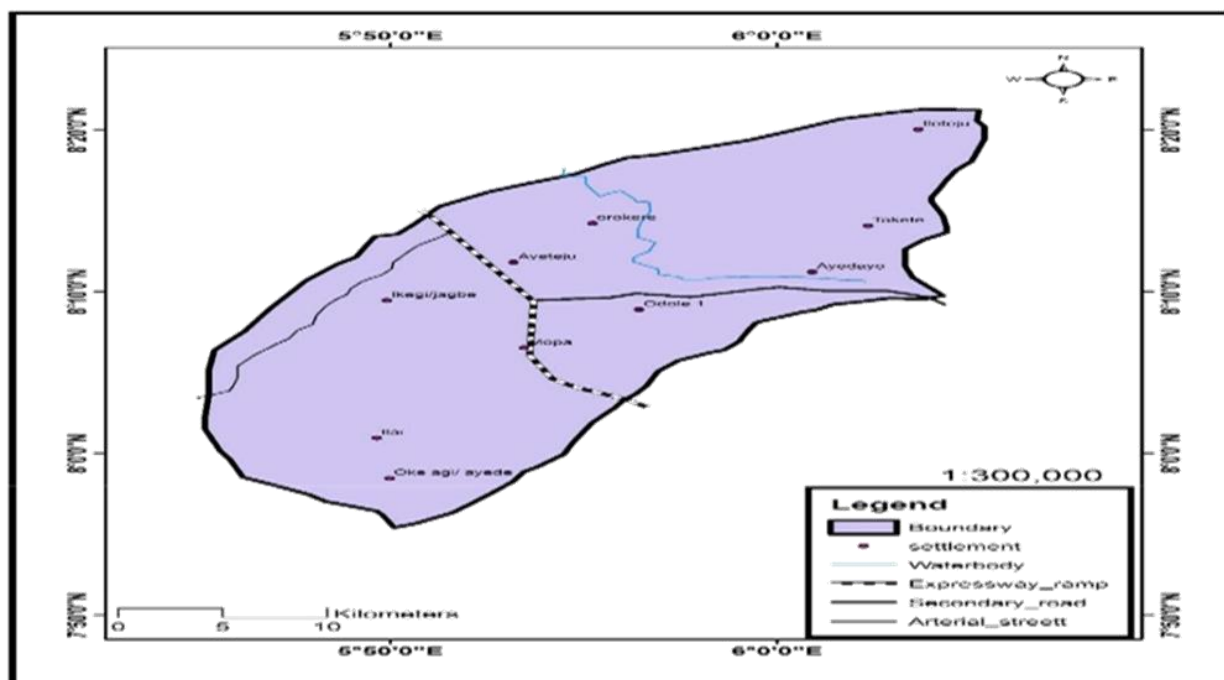


Figure 1: Mopa-Muro showing the study area

Source: Department of Geography and Environmental Studies, KSU, 2025.

RESEARCH METHODS

This study adopted a descriptive survey design to examine the role of local knowledge in fire control and bushfire prevention in Mopa Muro Local Government Area (LGA), Kogi State. The design was appropriate because it allowed both the quantification of bushfire-related practices and the exploration of socio-cultural meanings embedded in indigenous knowledge. A mixed-methods approach was employed, combining quantitative surveys with qualitative methods such as interviews, focus group discussions, and direct field observations. This integration enabled a more holistic understanding of traditional fire management while allowing for systematic comparison with modern fire control strategies. The study population was estimated at 55,000 residents, focusing particularly on individuals engaged in fire-related activities, traditional governance, and agricultural livelihoods. Using a multi-stage sampling technique, fire-prone communities were purposively selected, and within these, systematic random sampling was applied to identify household respondents. The sample size of 380 was determined using Cochran's formula, ensuring representativeness and statistical validity.

Data collection instruments included structured questionnaires for quantitative measurement, semi-structured interview guides, and focus group protocols to capture community narratives. The instruments were subjected to expert review and pre-tested in a pilot survey, after which necessary adjustments were made. Reliability was confirmed using a test-retest method, while triangulation across instruments enhanced credibility. Data collectors received training on ethical conduct and bias minimization, and informed consent was obtained from all participants, with community approval sought through traditional leaders. Fieldwork combined questionnaire administration, key informant interviews with elders and hunters, focus group discussions with youth and women, and direct observation of fire control practices. Preliminary findings were fed back to community representatives for validation, thereby strengthening trust and accuracy.

Quantitative data were analyzed using SPSS, with descriptive statistics employed to summarize demographic features, perceptions, and adoption levels of indigenous fire control methods. Inferential statistics included chi-square tests to assess associations between the use of local knowledge and fire prevention outcomes, ANOVA to examine differences across demographic groups, and logistic regression to identify socio-cultural predictors of indigenous knowledge adoption. The selection of these tests was justified by their suitability in analyzing categorical variables, comparing group means, and modeling binary adoption outcomes respectively. Qualitative data from interviews and focus groups were transcribed, coded thematically, and analyzed through content analysis to identify recurring patterns such as respect for elders, communal cooperation, and cultural beliefs shaping fire management. Coding followed both inductive and deductive strategies, with themes compared against quantitative results to highlight convergences and divergences.

RESULTS AND DISCUSSIONS

1 Socio-demographic Characteristics of Respondents

Table 4.1: Socio-demographic Characteristics of Respondents

<i>Characteristics</i>	<i>Frequency</i>	<i>Percentage (%)</i>
<i>Age (years)</i>		
18–30	85	22.4
31–45	130	34.2
46–60	110	28.9
61 and above	55	14.5
<i>Gender</i>		
Male	245	64.5
Female	135	35.5
<i>Marital Status</i>		
Single	90	23.7
Married	250	65.8
Widowed/Divorced	40	10.5
<i>Educational Level</i>		
No formal education	75	19.7
Primary	120	31.6
Secondary	130	34.2
Tertiary	55	14.5
<i>Occupation</i>		
Farming	180	47.4
Hunting	60	15.8
Trading	80	21.1
Civil service	35	9.2
Others	25	6.5
<i>Years of Residency</i>		
Less than 10	40	10.5
10–20	105	27.6
21–30	150	39.5
Above 30	85	22.4

Source: Field survey, 2025.

Table 1 shows that most respondents (34.2%) are aged 31–45 years, followed by 28.9% aged 46–60 years, indicating that a large portion are in their productive years and likely active in

agriculture and community management. Additionally, 14.5% are above 60 years, representing elder knowledge holders vital for passing down indigenous fire control practices. Males made up 64.5% of respondents, reflecting traditional gender roles where men engage more in farming, hunting, and fire management. However, women's 35.5% presence highlights their supportive roles in land preparation and post-fire activities.

Most respondents (65.8%) were married, suggesting stable social structures that aid knowledge sharing within families. Educationally, 34.2% had secondary education, 31.6% primary, 19.7% no formal education, and 14.5% tertiary education, emphasizing the need for fire management programs tailored to diverse literacy levels and openness to integrating modern and traditional knowledge. Occupationally, farmers dominated at 47.4%, followed by traders (21.1%) and hunters (15.8%), underscoring the relevance of fire control in agricultural and hunting activities. Regarding residency, 39.5% had lived in their communities for 21–30 years, and 22.4% over 30 years, indicating strong local attachment and accumulated ecological knowledge.

Overall, the socio-demographic profile reflects a community with deep ecological connections, significant indigenous knowledge, and varying education levels, providing a strong foundation for community-driven fire management strategies aligned with local realities.

2 Local Knowledge and Perceptions of Bushfires

This section examines respondents' understanding, beliefs, and attitudes towards bushfires (*ina igboro* or *ina oko*) in Mopa Muro LGA. It highlights how traditional ecological knowledge (*imo ibile*) informs their perceptions and response strategies.

Table 4.2: Respondents' Awareness of Bushfire Causes

<i>Causes of Bushfires</i>	<i>Frequency</i>	<i>Percentage (%)</i>
Uncontrolled farm clearing	180	47.4
Hunting activities	90	23.7
Charcoal production	55	14.5
Accidental/Negligence	35	9.2
Spiritual or cultural reasons	20	5.2
Total	380	100

Source: Field survey, 2025.

As shown in Table 2, the majority of respondents (47.4%) identified uncontrolled farm clearing (*sisẹ oko lai to*) as the main cause of bushfires, underscoring the need for farmer education and sustainable land preparation practices. Hunting (*igba ere*, 23.7%) and charcoal production further confirm that most bushfires are human-induced, pointing to the importance of awareness campaigns and livelihood alternatives.

A smaller group (5.2%) linked bushfires to spiritual or cultural causes, such as ancestral displeasure (*ibinu awon baba nla*) or ritual cleansing (*ina isẹ iwẹfa*). While limited, these beliefs highlight the cultural depth of fire knowledge and the need for prevention strategies that respect traditional values. Overall, the findings suggest that bushfire management must address human drivers while also using cultural transmission pathways—such as elders' authority and local rituals—to strengthen prevention practices. Policies that blend scientific approaches with indigenous knowledge will likely gain stronger community acceptance and effectiveness.

Table 3: Respondents' Perceptions of Bushfire Impacts

Perceived Impacts	Frequency	Percentage (%)
Destruction of farmlands	215	56.6
Loss of wildlife	60	15.8
Soil fertility reduction	55	14.5
Damage to properties	30	7.9
Threat to human lives	20	5.2
Total	380	100

Source: Field survey, 2025.

Table 3 shows that most respondents (56.6%) saw farmland destruction (*iparun ile oko*) as the most severe impact of bushfires, reflecting the community's dependence on agriculture for livelihoods and food security. Loss of wildlife (15.8%) and declining soil fertility (14.5%) highlight awareness of both ecological and long-term environmental consequences. Property damage (7.9%) and threats to human lives (5.2%) were mentioned less often, suggesting that economic losses outweigh casualty concerns in local perceptions. These findings reveal that bushfire knowledge is closely linked to survival needs, and effective management strategies must align with livelihood priorities while promoting sustainable land use practices.

Table 4: Relationship Between Educational Level and Perception of Bushfire Risk (Chi-square Test)

Variables	Chi-square Value	df	p-value
Educational level & perception of bushfire risk	18.52	6	0.005

Source: Field survey, 2025.

Table 4 reveals a significant relationship ($p = 0.005$) between respondents' education level and their perception of bushfire risk. The chi-square value of 18.52 shows that those with secondary and tertiary education have a deeper understanding of risks like soil fertility loss, ecosystem balance, and climate impacts compared to those with primary or no formal education who focus mainly on immediate farm losses. This suggests that formal education enhances local knowledge and can strengthen traditional fire management.

Findings from Tables 2 to 4 indicate that local knowledge in Mopa Muro LGA combines practical, experiential, and spiritual insights. Community members recognize human causes of fires and prioritize farm impacts, with environmental awareness varying by education level. Effective bushfire control should build on this indigenous knowledge by integrating modern techniques while respecting cultural beliefs. Using local language and incorporating proverbs and metaphors in community education can boost acceptance and collective action, ultimately protecting livelihoods, ecosystems, and social cohesion.

3 Indigenous Techniques for Fire Control and Prevention

Table 5: Common Indigenous Fire Control Techniques Used by Respondents

Techniques	Frequency	Percentage (%)
Creation of firebreaks (<i>odo ina</i>)	190	50.0
Early burning (<i>ina tete</i>)	95	25.0
Communal monitoring (<i>abojuto papo</i>)	55	14.5
Controlled burning (<i>ina alakoso</i>)	30	7.9
Use of traditional rituals (<i>eto isese</i>)	10	2.6
Total	380	100

Source: Field survey, 2025.

As shown in Table 5, half of the respondents (50.0%) identified the creation of firebreaks (*odo ina*) as their main indigenous fire control technique. This method involves clearing vegetation in strategic strips to act as barriers that stop or slow down the spread of fires. Its popularity underscores its effectiveness and practicality in preventing large-scale bushfire damage, particularly in farmlands and forest edges.

Early burning (*ina tete*), reported by 25.0% of respondents, involves deliberately setting small, controlled fires at the beginning of the dry season when vegetation is still slightly moist. This practice reduces fuel load and mitigates the intensity of potential uncontrolled fires later in the season. The widespread use of early burning reflects a proactive fire management mindset, showing that local people understand the importance of timing and ecological conditions.

Communal monitoring (*abojuto papo*), noted by 14.5%, highlights the communal approach to environmental management. In this practice, community members organize patrols or group surveillance during peak fire risk periods, emphasizing collective responsibility (*iduro papo*) and solidarity. Controlled burning (*ina alakoso*) and the use of traditional rituals (*eto isese*) were reported by smaller proportions of respondents, indicating that while these methods are still valued, they are less common due to changing social dynamics and possible decline in traditional authority influence.

Table 6: Perceived Effectiveness of Indigenous Techniques

Effectiveness Rating	Frequency	Percentage (%)
Very effective	180	47.4
Moderately effective	135	35.5
Less effective	45	11.8
Not effective	20	5.3
Total	380	100

Source: Field survey, 2025.

From Table 6, nearly half of the respondents (47.4%) rated indigenous fire control techniques as very effective (*pupọ ni ipa to lagbara*), suggesting strong confidence in traditional methods. Additionally, 35.5% believed these methods were moderately effective, indicating that a large majority (82.9%) still trust in the value and impact of indigenous knowledge for bushfire management. A smaller group, 11.8%, perceived these techniques as less effective, while only 5.3% found them not effective. The latter groups often cited increasing environmental changes, such as stronger winds or unpredictable dry season patterns, which sometimes render traditional practices less reliable.

The overall perception underscores that local techniques are still widely respected and relied upon, even in the face of modern environmental challenges. This collective faith in indigenous practices supports the argument for incorporating *imo ibile* into contemporary fire prevention policies rather than replacing them outright. Understanding community perspectives on effectiveness is crucial in designing interventions that will be widely accepted and sustained.

Table 7: Relationship Between Years of Residency and Use of Indigenous Techniques (Chi-square Test)

Variables	Chi-square Value	df	p-value
Years of residency & use of indigenous techniques	21.33	6	0.002

Source: Field survey, 2025.

The results presented in Table 7 indicate a statistically significant relationship ($p = 0.002$) between years of residency and use of indigenous fire control techniques (*imo ibile lati koju ina*). The chi-square value of 21.33 suggests that long-term residents are more likely to adopt and maintain traditional practices compared to newer community members.

Respondents who have lived in the area for over 30 years demonstrated a higher reliance on methods such as firebreak creation, early burning, and communal monitoring. This reflects a deeper familiarity with local environmental conditions (*imo ayika*) and stronger cultural ties (*asopo asa*). Conversely, those with fewer years of residency were more likely to adopt modern fire-fighting approaches or rely on government interventions.

This finding has significant implications for community-based environmental programs. It suggests that elders and long-term residents are key custodians of *imo ibile* and should be prioritized in capacity-building and training efforts. Additionally, engaging these experienced members as knowledge transmitters (*akowe imo*) can help bridge the gap between generations and prevent the erosion of traditional practices.

The combination of results from Tables 5 to 4 demonstrates that indigenous fire control and prevention techniques in Mopa Muro LGA are not only diverse but also contextually effective and culturally rooted. The strong perceived effectiveness and the link to long-term residency indicate that traditional knowledge is still a central pillar in local environmental governance. These findings suggest that integrating *imo ibile* with modern scientific methods would lead to more comprehensive, culturally accepted, and sustainable fire management strategies. Moreover, involving community elders and long-term residents in policy design and implementation will enhance the credibility, acceptability, and success of intervention programs.

4 Effectiveness and Challenges of Local Methods

Understanding both the strengths and the limitations of local fire control methods is critical for designing integrated strategies that respect and build upon *imo ibile* (indigenous knowledge). While these methods have proven effective in many respects, they also face significant challenges, especially in the face of modern environmental changes and socio-economic pressures.

Table 8: Respondents' Assessment of Local Method Effectiveness

Assessment	Frequency	Percentage (%)
Highly effective	140	36.8
Moderately effective	165	43.4
Slightly effective	55	14.5
Not effective	20	5.3
Total	380	100

Source: Field survey, 2025.

Table 8 indicates that a considerable proportion of respondents (36.8%) assessed local fire control methods as highly effective (*o munadoko gan*), while 43.4% found them moderately effective (*o munadoko die-die*). This suggests that most community members still place great trust in these traditional techniques for bushfire (*ina oko*) control.

The combined 80.2% who considered the methods either highly or moderately effective reflects a strong belief in community-led solutions, grounded in long-standing cultural practices and ecological understanding. Only a small fraction found them slightly effective (14.5%) or not effective at all (5.3%), citing challenges such as changing weather patterns, reduced communal cooperation (*aşepo agbegbe*), and younger generations' preference for modern approaches.

This high level of perceived effectiveness reinforces the potential for integrating *imo ibile* into contemporary environmental management plans, emphasizing the need to support and strengthen these traditional practices rather than undermine them.

Table 9: Identified Challenges of Local Fire Control Methods

Challenges	Frequency	Percentage (%)
Unpredictable wind patterns (<i>afefe aişese</i>)	100	26.3
Lack of youth involvement (<i>aikopa awon odo</i>)	90	23.7
Insufficient resources	70	18.4
Declining communal spirit (<i>idinku işokan</i>)	65	17.1
Encroachment and land conflicts	55	14.5
Total	380	100

Source: Field survey, 2025.

Table 4.9 shows that the most significant challenge identified was unpredictable wind patterns (*afefe aişese*), reported by 26.3% of respondents. This reflects community awareness of environmental changes affecting fire control reliability, as sudden gusts can cause controlled fires (*ina alakoso*) to escape, leading to unintended destruction.

Lack of youth involvement (*aikopa awon odo*) emerged as the second major challenge (23.7%). Many elders lamented that younger generations are becoming detached from traditional practices, preferring modern technology and external interventions. This generational gap threatens the sustainability and intergenerational transmission of *imo ibile*.

Insufficient resources (18.4%) and declining communal spirit (*idinku işokan*) (17.1%) further highlight structural and social challenges facing indigenous approaches. Respondents noted that communal labor, which historically ensured effective firebreak creation (*odo ina*), has diminished due to migration, economic pressures, and shifting social values.

Encroachment and land conflicts (14.5%) also hinder effective application of traditional methods, as disputed boundaries and increasing competition for land reduce cooperation in managing shared fire risks.

These challenges underline the importance of reinforcing social cohesion, engaging youths through targeted educational initiatives, and providing necessary support (e.g., tools and incentives) to strengthen communal fire management practices.

The findings from Tables 8 and 9 paint a complex picture of indigenous fire control methods in Mopa Muro LGA. While widely viewed as effective and grounded in a deep understanding of local ecology and culture, these methods are under pressure from environmental variability, socio-economic shifts, and generational disconnections.

The strong perceived effectiveness suggests that integrating *imo ibile* with modern fire management strategies can offer a more holistic approach to bushfire control (*işakoso ina oko*). However, to sustain these methods, there is a pressing need to address the identified challenges. Strengthening community unity (*imudara işokan*), fostering youth participation (*imudara ikopa odo*), and supporting adaptation to new climatic realities are all essential steps.

Policymakers and development practitioners must recognize that any intervention that undermines cultural foundations risks losing community trust and effectiveness. Instead, promoting participatory frameworks that respect and elevate indigenous voices will ensure both ecological resilience and cultural continuity.

5 Integration with Formal Fire Management Systems

Table 10: Respondents' Perception of Integrating Indigenous and Formal Systems

Perception	Frequency	Percentage (%)
Very beneficial (<i>anfani pupo</i>)	160	42.1
Beneficial (<i>anfani</i>)	145	38.2
Not sure (<i>mi ò mọ daadaa</i>)	50	13.2
Not beneficial (<i>ko ni anfaani</i>)	25	6.5
Total	380	100

Source: Field survey, 2025.

Table 10 reveals that a majority of respondents (42.1%) perceived the integration of indigenous and formal fire management systems as very beneficial (*anfani pupo*), while 38.2% saw it as beneficial (*anfani*). Together, this represents an overwhelming 80.3% who support the idea of combining both approaches. This strong endorsement demonstrates community openness to innovation and willingness to complement traditional practices with formal interventions, provided these respect cultural values.

A smaller proportion of respondents (13.2%) were unsure (*mi ò mọ daadaa*), indicating uncertainty about how such integration would work in practice. Only 6.5% felt it would not be beneficial (*ko ni anfaani*), reflecting fears that formal systems may overshadow or replace traditional authority (*agbara awon agba*).

These findings suggest a favorable foundation for policy frameworks that aim to merge local and formal systems. However, they also highlight the need for clear communication, participatory planning, and respect for community autonomy to ensure genuine collaboration rather than imposition.

Respondents noted that integrating *imo ibile* with formal fire management systems can enhance effectiveness, improve resource mobilization, and strengthen community trust in environmental policies. Traditional techniques such as firebreak creation (*odo ina*), early burning (*ina tete*), and communal monitoring (*abojuto papo*) can be complemented by modern tools like weather prediction technologies, rapid response fire brigades, and formal land use regulations.

Elders emphasized that government agencies should recognize the wisdom embedded in traditional knowledge, describing it as "*ogbon agba kii tan lori irin*" (the wisdom of the elders never fails). This reflects a strong cultural belief that indigenous practices are not just rituals but tested ecological strategies.

However, respondents also expressed concerns about potential conflicts between community autonomy and formal bureaucratic control. There were fears that formal systems might impose

rigid rules without understanding local realities, potentially undermining communal spirit (*isokan agbegbe*) and local leadership (*asa adari agbegbe*).

6 Hypotheses

Hypothesis One

H₀₁: There is no significant relationship between the use of local knowledge and the effectiveness of bushfire prevention in Mopa Muro LGA.

Table 11: Chi-square Test on the Relationship Between Local Knowledge Use and Bushfire Prevention Effectiveness

Variables	Chi-square Value	df	p-value
Local knowledge & prevention effectiveness	24.67	6	0.001

Source: Field survey, 2025.

Table 11 shows that the relationship between the use of local knowledge (*imo ibile*) and the effectiveness of bushfire prevention (*munadoko lati koju ina oko*) in Mopa Muro LGA is statistically significant, with a chi-square value of 24.67 and a p-value of 0.001. Since the p-value is less than 0.05, the null hypothesis (H_{01}) is rejected.

This implies that there is a strong and significant association between adopting indigenous fire control methods, such as firebreak creation (*odo ina*), early burning (*ina tete*), and communal monitoring (*abojuto papo*), and the successful prevention of bushfires. Respondents who frequently used these techniques reported fewer incidents of large, uncontrolled fires, reinforcing the practical relevance and reliability of traditional practices.

The significance of this relationship underscores the importance of not neglecting or sidelining *imo ibile* in contemporary environmental management policies. Instead, it supports calls for integrating indigenous practices into official frameworks as a sustainable, culturally rooted strategy to enhance community resilience (*agbara agbegbe*).

Hypothesis Two

H₀₂: Socio-cultural factors do not significantly influence the adoption and transmission of indigenous fire control practices in Mopa Muro LGA.

Table 12: Chi-square Test on the Influence of Socio-cultural Factors on Adoption and Transmission of Indigenous Practices

Variables	Chi-square Value	df	p-value
Socio-cultural factors & indigenous practice adoption	27.84	6	0.000

Source: Field survey, 2025.

Table 12 indicates that the relationship between socio-cultural factors (*awon idi asa ati ise*) and the adoption and transmission (*itan ati ikowe*) of indigenous fire control practices is highly significant, with a chi-square value of 27.84 and a p-value of 0.000. Given that the p-value is less than 0.05, the null hypothesis (H_{02}) is rejected.

This suggests that socio-cultural factors, including respect for elders (*ibowo fun agba*), communal values (*isokan agbegbe*), traditional leadership (*asa adari ibile*), and spiritual beliefs (*igbagbo esin ibile*), strongly influence how fire control practices are adopted and passed on to younger generations. Communities that maintain strong cultural ties and active

traditional structures showed higher levels of adherence to and transmission of practices like communal burning schedules (*eto ina papo*), traditional early burning rituals, and sacred forest protection (*igbo mimo*).

This finding highlights the integral role that culture and social structures play in sustaining environmental practices. Without active socio-cultural frameworks, indigenous techniques risk becoming obsolete, as younger generations might view them as outdated. Therefore, programs aimed at strengthening bushfire prevention should prioritize reinforcing these socio-cultural foundations to ensure the continuity of *imo ibile*.

The rejection of both null hypotheses reinforces that indigenous knowledge systems and socio-cultural factors are crucial determinants of bushfire prevention effectiveness in Mopa Muro LGA. It suggests that policy frameworks that ignore these elements may struggle to gain community support or achieve sustainable outcomes.

Incorporating community elders (*awon agba*), using local languages (*ede Yoruba*), and respecting spiritual and cultural norms are not optional but essential for successful fire management. These findings advocate for hybrid models that honor traditional wisdom while integrating modern science for more comprehensive and resilient solutions.

Table 13: ANOVA Test on Educational Level and Perception of Indigenous Techniques' Effectiveness

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F-value	p-value
Between groups	225.47	3	75.16	8.21	0.000
Within groups	1445.60	376	3.84		
Total	1671.07	379			

Source: Field survey, 2025.

Table 13 presents the results of an ANOVA test examining the influence of educational level (*ipo eko*) on respondents' perceptions of the effectiveness of indigenous fire control techniques (*imo ibile lati koju ina*). The analysis yielded an F-value of 8.21 with a p-value of 0.000, which is highly significant ($p < 0.05$).

This result indicates that there are statistically significant differences in perception across educational levels. Respondents with higher educational attainment tended to appreciate not only the traditional functional value but also the broader environmental benefits (*anfani ayika*), such as soil fertility protection (*abojuto agbara ile*) and ecosystem balance (*iwontunwonsi ayika*). In contrast, respondents with lower educational backgrounds mostly focused on immediate, tangible benefits like farmland protection (*abojuto oko*). This suggests that education serves as a key factor in shaping how indigenous knowledge is perceived, highlighting the need for integrating environmental education in local languages (*ede Yoruba*) to broaden understanding and promote intergenerational transmission of *imo ibile*.

Table 14: Logistic Regression on Socio-cultural Factors Predicting Adoption of Indigenous Practices

Predictor (Socio-cultural factors)	Coefficient (B)	SE	Wald	p-value	Odds Ratio (Exp(B))
Respect for elders (<i>ibowo fun agba</i>)	1.235	0.410	9.080	0.003	3.437
Communal values (<i>isokan agbegbe</i>)	0.842	0.305	7.618	0.006	2.321
Traditional beliefs (<i>igbagbo ibile</i>)	1.510	0.530	8.098	0.004	4.528
Constant	-2.567	0.680	14.266	0.000	0.077

Table 14 presents a logistic regression analysis showing how socio-cultural factors predict the adoption of indigenous fire control practices. The coefficients for respect for elders (*ibowo fun agba*), communal values (*isokan agbegbe*), and traditional beliefs (*igbagbo ibile*) are all positive and significant ($p < 0.05$).

Respect for elders ($B = 1.235$; $OR = 3.437$) indicates that respondents who highly respect elders are over three times more likely to adopt indigenous practices than those who do not. Communal values ($B = 0.842$; $OR = 2.321$) show that a strong sense of community cohesion significantly promotes adoption. Most strikingly, traditional beliefs ($B = 1.510$; $OR = 4.528$) have the highest odds ratio, suggesting that deep cultural and spiritual connections strongly motivate individuals to uphold and transmit fire control techniques.

The constant term is negative and significant, suggesting that without these socio-cultural factors, the likelihood of adopting indigenous practices diminishes considerably. This analysis underscores that *imo ibile* is not merely a technical set of practices but is deeply intertwined with cultural values and identity. Any intervention or policy aiming to promote or integrate indigenous techniques must recognize these socio-cultural dimensions (*ipin asa ati esin*), or risk being ineffective.

7 Discussion of Findings

The findings reveal a deeply embedded system of local knowledge (*imo ibile*) guiding bushfire (*ina oko*) control in Mopa Muro LGA. Among 380 respondents, 80.2% rated indigenous fire control methods as highly or moderately effective, with half citing firebreak creation (*odo ina*) as the most widely used technique. As one elder explained, “*We cut wide paths before the dry season so that the fire will not jump into our farms. This is how our fathers protected the crops, and it still works today.*” The preference for early burning (*ina tete*), noted by 25% of respondents, reflects long-standing West African practices where carefully timed burns reduce fuel build-up and help preserve soil fertility and biodiversity (Amoako et al., 2022; Díaz et al., 2023). Another farmer observed, “*If we burn early, the grass is weak, and the fire will not be too strong. If we wait too long, the fire will be angry and destroy everything.*” These perceptions underscore the empirical finding that 56.6% of respondents saw farmland destruction as the most severe bushfire impact, revealing that agricultural priorities dominate community fire management concerns (Crocker et al., 2023).

Respect for elders (*ibowo fun agba*) and communal values (*isokan agbegbe*) strongly shape the adoption of indigenous fire control practices. Logistic regression showed that traditional beliefs had a high odds ratio (4.528) in predicting adoption of these methods. A youth respondent remarked, “*If the elders tell us not to burn yet, we must wait. They know the signs of the wind and the season better than us.*” This reflects socio-ecological resilience theory, where cultural

authority and intergenerational transmission sustain adaptive practices (Kirschner et al., 2023). The statistically significant chi-square result ($p = 0.001$) linking indigenous knowledge to fire prevention effectiveness reinforces the argument that cultural norms are not peripheral but central to community governance (FAO, 2025).

Key challenges identified include unpredictable wind patterns (afẹfẹ aiṣeṣe), noted by 26.3% of respondents, which complicate traditional calendars based on seasonal cues. One farmer lamented, *"Before, we could look at the sky and know if burning was safe. Now the wind changes suddenly, and fire escapes our control."* This aligns with recent studies showing that climate variability increasingly undermines local knowledge of fire regimes (Wimberly et al., 2024; Oliveras Menor et al., 2025). Lack of youth involvement (aikopa awọn ọdọ), reported by 23.7%, also threatens knowledge continuity. An elder commented, *"The young ones prefer school and city jobs. They no longer follow us to the bush to learn the old ways."* This resonates with African research that modernization and migration weaken intergenerational knowledge transfer (Amoako et al., 2022).

Education level emerged as another key factor, with ANOVA results ($F = 8.21$, $p < 0.001$) showing differences in perceptions. Respondents with higher education recognized ecosystem-wide benefits, such as maintaining soil fertility and ecological balance (iwontunwonsi ayika). A schoolteacher explained, *"Bush burning does not only destroy farms; it also kills the animals, reduces the soil's power, and changes the rain."* This supports findings that formal education can strengthen adaptive capacity while broadening ecological awareness (Nhemachena & Hassan, 2020; Ifejika Speranza et al., 2021).

Spiritual beliefs also played a role, with 5.2% attributing bushfires to ancestral displeasure or spiritual punishment. As one community leader put it, *"Sometimes the fire comes because we did not perform the sacrifice to our land spirits. Fire is not only a natural thing but also a message from the ancestors."* Far from being irrational, such beliefs provide legitimacy to communal regulations and enhance compliance, consistent with arguments that spirituality is integral to indigenous environmental governance (Neger et al., 2024; FAO, 2025).

Support for integrating indigenous and formal fire management systems was strong, with 80.3% of respondents in favor. A farmer noted, *"Government should help us with tools and training, but they must also listen to our ways. If they ignore us, the people will not follow."* This aligns with hybrid governance models documented in Africa and elsewhere, which show that blending scientific and traditional knowledge enhances compliance and ecological outcomes (Croker et al., 2023; Oliveras Menor et al., 2025).

CONCLUSION AND RECCOMENDATIONS

This study concludes that indigenous knowledge systems (imo ibile) remain central to bushfire (ina oko) control and prevention in Mopa Muro LGA. The findings demonstrate that community practices such as firebreak creation (odo ina), early burning (ina tete), and communal patrols (abojuto papo) are not only widely used but also perceived as effective, with over 80% of respondents rating them highly. These practices are sustained by socio-cultural factors—respect for elders, communal values, and spiritual beliefs—while education emerged as a significant determinant of awareness and adaptive capacity. The study therefore contributes empirical evidence showing that indigenous fire control practices retain both ecological and cultural relevance in contemporary rural Nigeria.

Despite these strengths, challenges persist. Climate variability disrupts traditional fire calendars, youth disengagement threatens intergenerational transmission, and resource limitations constrain implementation. Land tenure conflicts and declining communal spirit

further weaken the social fabric that sustains collective fire management. These findings underscore that while indigenous practices are effective, they cannot stand alone without support and integration into broader governance systems.

Practical recommendations include the active incorporation of indigenous knowledge into local and state fire management frameworks, ensuring traditional leaders, women, and youth are meaningfully involved in decision-making platforms. Educational programs that combine formal curricula with indigenous fire wisdom can help bridge generational gaps and enhance youth participation. Provision of material support—such as fire control tools, weather information, and training—will strengthen traditional practices. Addressing socio-economic challenges such as land disputes and poverty is also critical for rebuilding communal solidarity and enabling collective fire governance.

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