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SELF-MOBILIZATION FOR WILDFIRE PREVENTION IN THE GOZIRI COMMUNITY, UPPER WEST REGION, GHANA

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ABSTRACT

Fire is commonly used for agricultural purposes, but in areas with a high amount of dry grass, uncontrolled handling of fire often causes wildfires, which can have many negative effects. Using a qualitative approach, this study explores how the Goziri community in the Upper West Region of Ghana developed their own approach to managing wildfires. The study found that wildfire management in the community began as a local initiative to address the seasonal shortage of grass for livestock grazing, due to wildfires. The whole community was actively engaged in creating and enforcing rules for wildfire management, consisting of fire prevention practices such as careful handling of fire and minimal agricultural burning, as well as enforcement measures. The approach to fire management was community based, and transformational leadership was an essential driver. Other drivers were community engagement, clear purpose and expectations from fire management, fulfilled expectations, use of inexpensive everyday equipment for firefighting and adapting fire management to the local context. It is argued that the fire management approach used in Goziri could be applied in other communities in the Upper West Region of Ghana and elsewhere in order to make wildfire management more effective and thus enhancing the agricultural yield and livelihoods of local farmers. Some recommendations built on this study are leadership training for community leaders, ensuring a clear purpose with wildfire management, and that community expectations are met. Also, it is essential to ensure community engagement with wildfire management and to adapt wildfire management to local contexts, including the use of simple equipment for firefighting. Moreover, research is needed on the effects of wildfire prevention on soil fertility.

Keywords: wildfire management, community engagement, leadership

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1. INTRODUCTION

The use of fire for agricultural purposes is known since prehistoric times and it can be a valuable tool for land management. It has traditionally been used for burning off grass and clearing trees for cultivation (Andreae 1991; Laris 2013) and for suppressing the invasion of woody plants in grasslands used for grazing (Andreae 1991; Laris 2013); Lofan et al 2007). Fire is also used for non-agricultural purposes such as hunting (Andreae 1991; Dube 2013). Hunters use fire to clear vegetation and to generate heat and smoke in order to force wild animals out of their habitat. Furthermore, fire is used for controlling the accumulation of plant litter (dead plant material) in order to reduce destructive fire events (Andreae 1991; Whelan 1995; Laris 2013) and for controlling reptile populations (Hough 1993). Bush burning is a cultural practice of some native peoples (FAO 2006) but also results from careless handling of fire by cigarette smokers and fire carried between houses for cooking purposes.

In hot, dry savanna areas with a high amount of plant litter, burning for cultivation purposes often results in fires escaping (FAO 2006), which, in addition to uncontrolled burning for other purposes, causes widespread wildfires (Dube 2013; Laris 2013). Such unwanted fires destroy crops on which farmers depend for survival (FAO 2006; Dube 2013). The fires also destroy young plants and hinder the regeneration of woody plants (Brookman-Ammissah 1980), deplete organic matter, reduce soil fertility and ecosystem functions such as photosynthesis, and nutrient and water cycling (Kugbe et al. 2012), which result in land degradation.

This is also the case in the northern part of Ghana, where uncontrolled burning off for cultivation and cooking fires on farms often result in fires escaping, which, in addition to burning by hunters, nomadic herders and for cultural practices, constitute the main known causes of widespread wildfires. The problem is aggravated by grass cover, a long hot dry season with strong winds and persistent traditional slash and burn agriculture (Brookman-Ammissah et al. 1980; Gyasi 1995; (MLFM [Ministry of Lands, Forestry and Mines] 2006). According to the Ministry of Lands, Forestry and Mines (2006), inadequate public knowledge of the effects of wildfires and unclear roles of institutions on wildfire management are some of the challenges the country has faced in its efforts to manage these fires. Other challenges cited by the Ministry include inadequate funding for wildfire management, failure to involve traditional authorities in bushfire policy making in the past and weak institutional coordination for wildfire management. Kugbe et al. (2012) suggest that wildfires in the northern part of Ghana have resulted in loss of organic matter, caused soil erosion in some areas and reduced the productivity of agricultural land.

To control wildfires, Ghana developed a national wildfire management policy in 2006 (MLFM 2006). However, after ten years of implementing the policy, Goziri is one of the few communities in the Upper West Region where vegetation has not been burnt for decades (Environmental Protection Agency [EPA] 2010), i.e. since before the policy was developed. The EPA notes that the community has its own rules on wildfires, which have been enforced to prevent outbreaks and that there is an active anti-wildfire committee which rapidly controls accidental wildfires from spreading. This relates to what Pretty (1995) terms as self-mobilization, which involves local people taking initiatives and retaining control over a process in order to change a system, though they may receive some support from external agencies.

That the community practices successful wildfire management is thus well known in the Upper West Region but how it became successful has not been studied and is not well understood.

This study therefore seeks to explore how the Goziri community developed their own approach to control and prevent wildfires. The objectives were to explore (1) how the community began to prevent wildfires, (2) how the community practices wildfire prevention now, (3) what challenges the community has faced in wildfire prevention and how they have addressed them, (4) how wildfire prevention benefits the community, and (5) what has driven the development of this approach to wildfire prevention. The goal of the study is to share knowledge on successful wildfire prevention with other farming communities and land management organizations in order to make implementation of wildfire management in the Upper West Region more effective. The overall goal is to enhance management of agricultural lands and to improve the livelihoods of farmers in other communities.

2. LITERATURE REVIEW

This section gives an overview of the failure and success factors of wildfire management, and the conceptual framework for studying how such fires are managed.

2.1 The challenges of wildfire management

How to manage wildfires is one of the challenging issues in land management. This is because such fires can be useful for agricultural and other land management purposes but can also cause land degradation if not managed appropriately. FAO (2011) suggests that multiple challenges related to incentives and organizational and community capacity account for ineffective management of wildfires in many countries. One of the challenges is that wildfire issues are often not well understood; as such, fires are mostly seen as harmful and requiring prevention. It is assumed that prevention consists of increasing community preparedness to control the spread of wildfires to areas where they are not wanted. Communication of such oversimplified information about wildfires to decisionmakers leads them to conclude that firefighting is the solution to harmful fires, and to focus resources on increasing community preparedness to fight fires, rather than addressing the underlying causes. Ghana's national wildfire management policy seeks to prevent and control wildfires, and one of the strategic objectives is: "Development and promotion of integrated wildfire prevention and control practices based on appropriate technologies and systems" (MLFM 2006, p. 8). There are no official publications evaluating implementation of Ghana's wildfire management policy. Nevertheless, having worked in the Upper West Region for over 13 years (since 2004), I have personal knowledge that the policy has been implemented through public awareness raising and formation, and training and supporting of community fire volunteer groups with equipment for firefighting, particularly as part of land management projects that are threatened by the risk of wildfires. This approach to wildfire management has not been effective enough. As Beatty (2011) observes, such an approach to implementation of fire management policy may fail to address the uncontrolled fire handling which causes such fires.

Another challenge is that the staff of most fire management agencies and members of local communities often lack adequate skills to conduct the participatory processes which are

required to understand local fire issues, and to plan and conduct training in wildfire management (FAO 2011). Other challenges are that information about effective wildfire management is not often communicated clearly to land managers and local communities, and funding is usually inadequate for implementation. Also, incentives such as clear land access and land use rights for local people to derive direct benefits from responsible fire use are often lacking.

In summary, this section has shown that institutional and community capacity challenges often account for ineffective management of wildfires.

2.2 Conceptual framework

This subsection presents two concepts related to institutional and community capacity, which apply to wildfire management.

2.2.1 Community-based fire management

In spite of the challenges related to wildfire management as presented in subsection 2.1, such fires have been effectively managed in communities where the community-based fire management (CBFiM) approach has been used (DeGrosky 2003; Ganz et al. 2003; FAO 2006, 2011). FAO (2011, p. 4) describes CBFiM as:

“... an approach to fire management in which local communities are actively engaged in the development, and in some instances the implementation, of fire management strategies designed to prevent, control or utilize fires in ways that will improve their livelihood, health and security.”

The lower case “i” in the acronym distinguishes it from community-based forest management (CBFM). Ganz et al. (2003) explain that fire management includes any fire prevention or management practice. According to them, the CBFiM process is controlled by the community, though external agents may be involved. In addition, members of a community tend to have different responsibilities, knowledge, expertise, leadership (FAO 2006) and interests, which can reflect in their inputs into fire management decisions (FAO 2011). CBFiM is based on the integrated approach to fire management, which involves:

- integrating all activities related to fire management, such as prevention, preparedness, suppression and restoration, into one coordinated process of fire management policy, planning and implementation;
- integrating the use of fire as a land-management tool and the management of devastating wildfires into one process, which involves the acceptance of fire use in certain situations;
- integrating all actors and sectors involved into the same process.

(FAO 2011, p. 7)

In practice, the CBFiM approach depends on several factors. According to FAO (2011), the existence of an adequate fire policy can serve as the basis to actively engage communities to

develop effective fire management strategies. In addition, clear land access and land use rights, which enable local people to derive direct benefits from fire management, tend to serve as enabling conditions for effective CBFiM (FAO 2011). Also, fire management institutions with requisite financial resources and staff with adequate expertise for fire management are needed. This expertise involves adequate knowledge about wildfires, and skills for effective communication and facilitation of participatory appraisals of local fire issues. Other required expertise is the skills for facilitating the planning and implementation of fire management programmes. This can lead to awareness of fire issues, such as risks of outbreaks, in a locality. Also, it can lead to identification of community knowledge and skills in fire use, existing community resources that can be utilized for fire management, and any existing organizational structures that can be used as channels to organize CBFiM activities. According to Kim and Hjerpe (2011), well established institutional arrangements can be used as platforms for sharing information, and for coordinating trust building for collective action. Moreover, Johnson and Brummel (2011) note that external agents play a vital role in activating the CBFiM process, while locally resident leaders play an essential role in mobilizing and stimulating the involvement and commitment of their followers to effectively manage wildfires. This suggests that CBFiM is fundamentally driven by transformational leadership.

2.2.2 Transformational leadership

“Transformational leaders...are those who stimulate and inspire followers to both achieve extraordinary outcomes and, in the process, develop their own leadership capacity. Transformational leaders help followers grow and develop into leaders by responding to individual followers' needs by empowering them and by aligning the objectives and goals of the individual followers, the leader, the group, and the larger organization.” (Bass & Riggio 2014, p .3)

Bass and Riggio (2014) suggest that the transformational leader is morally upright, respected and trusted by his or her followers. Also, the authors note that the transformational leaders often have a clear vision, which they communicate to their followers, including clarifying the benefits, if they accomplish the required actions. They observe that the leader then encourages and engages the followers to develop a shared vision, which, according to Kim and Hjerpe (2011), is essential for collective management of resources.

According to Bass and Riggio (2014), this type of leader often demonstrates personal commitment towards achieving the vision by serving as a role model and empathizing with the followers, paying attention to their needs, feelings and personal development. The authors observe that, in this way, the leader inspires others to follow his/her actions, and mentors them into leadership. This stimulates them to find innovative solutions to achieve results, accomplish personal goals, and get committed to the vision of the group. Such commitment then leads to effective wildfire management.

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3. METHODS

3.1 Study area

The study area was the Goziri community in the Nandom District of the Upper West Region of Ghana (Figure 1). The name of the community has been spelt in three different ways. The local people spell it as Goziir, the Nandom District Assembly, within which the community is located, spells it Goziiri, while in official communications, mostly by the Environmental Protection Agency, it is spelt as Goziri. In this study, I keep to Goziri.

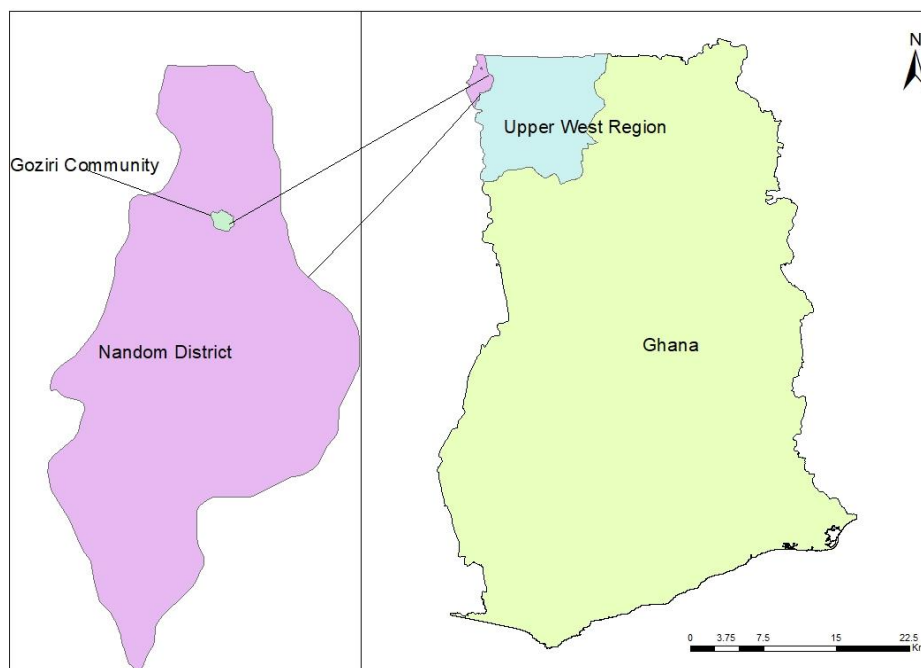


Figure 1: Location map of Goziri (Source: Birhane Etay, 29 July 2017)

The population of Goziri was projected by the Ghana Statistical Service (unpublished) to be 1,468 persons (676 males and 791 females) in 2016. The inhabitants practice rain-fed subsistence crop farming and grazing, and use wood fuel for cooking (EPA 2010). No official information about the total land area exists. However, the land area was estimated to be 3.6 km² based on the interviews made in this study, where respondents described the community's wildfire prevention boundaries. They roughly fall within the land boundaries with neighbouring communities (see Figure 1). The community shares boundaries with Nandom (the district capital) to the east, Naapaal to the south-west, Puffion to the north, Betaglu and Walateng to the north-west, and Koggle to the south.

The area has a guinea savanna vegetation, consisting mostly of grass and scattered fire-resistant trees, and a semi-arid climate (Blench 2006) with annual rainfall ranging from 710 to 1,180 mm per annum, and temperature ranging from 22°C to 37°C (GMA [Ghana Meteorological Agency] 2017). The area has a long dry season (November–April) with dry harmattan winds, which are dust-laden north-easterly winds from the Sahara Desert (Gyasi 1995). The soils in the region are shallow and lateritic, with underlying iron pan formations in some areas and have low organic matter due to sparse vegetation. Gyasi (1995) also observes that compound

farming is the commonest farming system in the region. This consists of relatively permanent cropping around houses, followed successively by zones of short fallow and outer grazing areas.

3.2 Research methods

A qualitative approach was used for the study. This was because the data needed consisted of the knowledge and experiences of people about how bushfire prevention began, developed and has been practiced. As the current state of bushfire prevention represents change which resulted from a social process, this approach is appropriate because, as Esterberg (2002) notes, it seeks to understand a social process in context.

Two research assistants (both men) did the data collection. They were chosen because they have a first degree in integrated development studies, experience in community engagement, and their first language is Dagaare, the local language spoken in Goziri.

Semi-structured interviews were used for data gathering. This type of interviews allows interviewees to discuss any issues they consider important, including issues which the interviewers did not anticipate beforehand. In addition, focus groups (see Braun & Clarke 2013), were used to collect data from multiple participants simultaneously, in face-to-face meetings. Through the flexibility of this method, unanticipated issues were raised.

Purposive sampling (Braun & Clarke 2013) was used to select 10 interviewees for individual interviews, six men and four women, aged between 30 and 67 years. They were all farmers. The selection criteria were that they had experience of how wildfire management started and developed in the community, including the challenges faced and how they have been addressed. The number of men was larger than the women because most of the locally resident people who have experienced wildfire management from the inception are men, as most women with the same experience have relocated to other communities through marriage. The interviewees were selected by the traditional leaders from all the seven sections of the community: Duropuo, Nagnyaa, Begyineteng, Segrutaga, Nuruteng, Krateng and Newtown, which recently became part of the local administrative set-up of the community. Purposive sampling was also used to select 10 participants (five men and five women) for two focus groups. These participants were also selected by their traditional leaders, as described above.

The 10 individual face-to-face interviews were used to gather detailed information about the effects of wildfire prevention on individuals, which the respondents might not have expressed in a group. Four of the interviews were in English and six in Dagaare. The two focus groups were conducted separately for men and women in order to create an opportunity for the women to talk freely about domestic handling of fire in relation to wildfire risks, which might not have been possible in a mixed group with discussions dominated by the men. The men's focus group was in English and the women's in Dagaare.

At the beginning of each interview, the interviewers explained the purpose of the study and sought the respondents' consent to record the conversation. They then recorded all the interviews on a mobile phone, and made English translations of the Dagaare audios. Errors

might have occurred in the translations but should be minimal because the interviewers understand both languages very well. English translations of the Dagaare audios, together with the original English and Dagaare ones, were emailed to me. I then transcribed all the English audios.

Thematic content analysis (Burnard et al. 2008) was used to analyse the data. This involves verbatim transcription of interviews, open-coding and summary. The information was interpreted and themes identified, verified and categorized by repeatedly searching through the summaries and transcripts. While analysing the data I realized the need for additional information. I then prepared another interview guide on two occasions, which the research assistants used to conduct follow-up interviews with four individual respondents at the first instance and two at the second. They also phoned one respondent once to clarify some of the information he provided. In addition, the research assistants observed and took pictures of farming practices, livestock grazing and the condition of vegetation in the community. The photos helped me to get accustomed to the setting.

4. FINDINGS

In this section, findings on how the Goziri community developed their own approach to control and prevent wildfires are presented. Direct interview quotations are in italics, and bushfires means the same thing as wildfires.

4.1 The stage of uncontrolled wildfires

The Goziri community used to experience wildfires until around the early to mid-1980s, according to the respondents. They cited the following causes of these fires: Fires escaped from burning of grass and trees to clear land for cultivation, including women burning off thorns chopped from felled trees, when the wind was strong and fire belts were not wide enough. Also, hunters burned to expose and kill wild animals, such as rabbits, and smokers (all men) threw away unquenched cigarette butts. In addition, women and children fetched and carried naked balls of fire from neighbouring houses for cooking, and in the process, some pieces of the fire fell off during intense winds. Other fires were said to be from unknown sources (often attributed to dwarves) and, in general, wildfires were seen as allowed in the community as *there was no law*, according to a respondent.

The interviewees said that these fires had several negative effects. The fires destroyed litter and the thus exposed soil surfaces were subsequently eroded by water and then became dry within two to three days after a rainfall. As a result, crop yields were low, ranging from 200 to 300 kilograms per acre of maize, millet, groundnuts and sorghum (dorado). Due to these low yields, the farmers did not have enough food to feed their households sufficiently throughout the year. One farmer said that for about three to four months of the year (i.e. May to August) his household only had one to two meals per day.

According to the respondents, wildfires destroyed grass, which did not regrow in sufficient quantity until the beginning of the rainy season. This resulted in livestock migrating over long

distances to graze around the Black Volta River (about five to seven kilometres from the community) during the dry season and some getting lost in the process. As one of the men said:

“...there was not enough grass for our animals, particularly cattle, to graze during the dry season, so they went to the Black Volta River area to graze on fresh grass, and some of them never came back.”

The farmers also mentioned that the fires burnt valuable trees such as shea (*Butyrospermum parkii*), dawadawa (*Parkia biglobosa*) and baobab (*Adansonia digitata*), which then produced less fruit, and destroyed some wild fruits that mature during the dry season. According to them, another problem was that wind often blew a lot of dust into their rooms during the dry season because the land was bare.

4.2 How the community begun to prevent wildfires

4.2.1 Initial arrangements

The interviews indicated that members of the Goziri community came to an understanding of the effects of wildfires on their livelihoods because of awareness raising programmes conducted during the 1980s by some governmental organizations and the local traditional council. A respondent said:

“The government used to campaign about bushfires and because our animals used to go to the Black Volta and never returned, we saw that what the government said was good.”

Some of the men mentioned that staff of the Ministry of Food and Agriculture were among those who educated the community about wildfires, including advising them that soil fertility would increase if they stopped burning crop residue. According to the farmers, it became clear to the community members that wildfires destroyed vegetation, caused loss of soil fertility, and low crop yields, which they did not want. In the words of a respondent:

“The community members realized that bushfire is not helping in the farming system and is killing most of the trees and destroying the vegetation. They did not want to lose land fertility which will not give a good yield.”

Information provided by one of the men, who said he was involved in wildfire prevention at the beginning, indicated that it was initiated in the late 1980s (*by 1987/88 we started*) by the late chief of Goziri, Naa Leo Amwaa Yiryel II. However, most of the farmers mentioned that it was started by the late chief but did not seem to know or remember exactly when, as they mentioned periods and years ranging from the early 1980s to late 1990s.

According to the respondents, the first action the late chief took to prevent wildfires was to summon the subchiefs of the then six sections of Goziri to a meeting. During that meeting, he declared his intention for the community to prevent bushfires, the reason for this, and how they should approach it. All the interviewees said that at the meeting, the chief told the subchiefs that cattle and sheep from the community went grazing as far as around the Black Volta River and got stolen because wildfires destroyed grass in their community. He also told them he

wanted the community to come together to make and enforce their own rules to prevent wildfires in order to stop the loss of their cattle and sheep, and they agreed. One of the men said:

“...so, the chief called us and said we should stop bush burning and see whether our animals will continue to go there and never return. So, we decided to stop bush burning so that the grass will be there for our animals to graze.”

According to the respondents, rules for wildfire prevention were made in a general meeting of the community, which was convened by the chief. One of the men said:

“Everybody took part in making bylaws for bushfire prevention, even children took part.”

These rules have not been documented but were narrated by respondents as stated in Box 1.

Box 1. Community rules on wildfire prevention in Goziri

- 1) Every cigarette smoker shall quench the left-over of the cigarette. If a person throws smoked cigarette away and fire is started around the place, the person shall be held responsible for causing the fire.
- 2) Parents shall not allow their children to fetch naked fire from one house to another.
- 3) Adults can fetch naked fire from one house to another but shall cover such fire to prevent it from falling off to cause bushfires.
- 4) If there is a bushfire, everybody in the community (except the aged, the sick and children) is obliged to join in putting it out, including any community member who arrives from somewhere to meet others putting out the fire.
- 5) A community member who sees fire burning when he or she is passing by, shall start quenching the fire. If not, the person shall be held responsible for causing the fire if this becomes known to the community members.
- 6) If a person refuses to come out of his or her house to join in putting out bushfire, the person shall be held responsible for causing the fire and fined accordingly.
- 7) A person shall report to the chief or any leader in the community, anyone he or she sees starting bushfire intentionally, such as lighting a match into the bush and running away.
- 8) An adult who causes a bushfire shall be find a minimum of Fifty Ghana Cedis (GHS 50.00) or higher, for unintentional burning, depending on the size of the area that is burnt. Part of the fine shall be used to buy refreshments for those who put out the fire and the rest put in the community’s development fund.
- 9) A person who causes a bushfire shall be brought before the chief, in the presence of the whole community, to explain the circumstances under which he caused the fire, and to be fined accordingly.
- 10) Immediately a bushfire has been put out, the subchief of the section where it occurred shall go along with the culprit, if there is one, to inform the chief about such a fire.
- 11) If fire occurs in a section of the community and the subchief fails to inform the chief, the subchief shall be fined for causing the fire if the chief gets to know about it. Such a fine shall be the same as for someone who burns the bush intentionally or unintentionally, depending on the area burnt.

4.2.2 How the community practiced wildfire prevention at the initial stage

The interview data shows that wildfire prevention started with the Goziri chief holding the culprits, and his subchiefs, accountable for such fires. One farmer said:

“The late Goziri Naa started by, when there was a bushfire in any section, they will invite the chief of that section to find out what caused the fire and when they get the person they fine the person in cash and if he or she cannot pay he is asked to provide labour and they will use the money to support those who quenched the fire.”

Some of the men said the chief was the first farmer in the community to stop using fire for clearing land for cultivation. The accounts of most of the farmers indicated that this led them to begin practicing safe burning themselves in the few agricultural activities that involved the use of fire, and to adopt careful handling of fire for the non-agricultural purposes in which careless handling of fire had often caused wildfires. The farmers said clearing of new land for farming was not common in the community because their land is small. In the few cases when new farms were established, land was cleared by pruning trees, because indiscriminate tree cutting was not allowed in the community. When necessary, before a farmer burnt branches of trees, such as those of thorny trees, on his farm, the person informed the chief who then often sent people to inspect and supervise the farmer to make a fire belt in order to prevent the fire from escaping. One respondent said he began to bury such thorns on his farm instead of burning them. Some of the farmers said, after harvesting crops, they no longer burnt the stubble, and the litter was ploughed into the soil.

One of the men said farm sizes are small in the community (about 4 acres on the average) and cultivated continuously with few areas left fallow.

In the focus group discussion, women said fire prevention started when a man threw an unquenched cigarette butt into the bush and it caught fire. After quenching the fire, the man was taken to the chief. The chief then imposed a monetary fine, which the offender could not pay. Instead, he was asked to collect three tipper truckloads of stone, which he did. The stones were sold, and the money paid into the community's development fund. According to the women, community members then realized that the chief was determined to enforce the rules on bushfires, and began to control their use of fire.

The account of most of the women indicate that, in order to avoid punishment, smokers subsequently began to quench cigarette butts before throwing them away. Also, women and children began to carry any naked fire they collected from a neighbour's house to theirs for cooking purposes in pots from which pieces of fire could not fall off.

The farmers said, as usual, they practiced free grazing during the off-farm season (i.e. dry season) by leaving their sheep, goats, cattle and donkeys to move around. During the farming season (rainy season) grazing was controlled by tying livestock on farmers' own uncultivated lands to keep them from destroying crops. The study did not collect comprehensive data on the number of grazing livestock kept by farmers, but information provided by three respondents showed that each of them currently keeps only a small number, as presented in Table 1.

Table 1. Number of grazing livestock kept by three of the respondents.

Respondent	Number of grazing livestock				
	Cattle	Sheep	Goats	Donkeys	Total
1	5	1	5	0	11
2	0	8	10	1	19
3	2	0	4	1	7

In addition, the respondents said, hunters in the community, who were mostly group hunters, begun to hunt and kill wild animals easily without burning the bush. Instead of burning to drive out wild animals, the hunters now looked around to see animals, such as rabbits, hiding in the grass and then hit and killed them with sticks. If a rabbit escaped and started running after being hit by a hunter, others were able to kill it because it could not run fast in the dry grass.

The interviews indicated that, around this time, there were still outbreaks of wildfire because smokers threw away cigarette butts without quenching them first, and fires also encroached from neighbouring communities that did not prevent wildfires.

Most of the respondents said that at this stage, community members used simple everyday things and tools they had at hand to put out fires, such as machetes, buckets, tree branches with fresh leaves, and water. They said, when a fire broke out, the first person who saw it shouted, *fire, fire, bring water*, and ran from house to house to call people. Community members who were around ran to the scene of the fire. Women and children fetched water in buckets from homes. Some men pumped water from the community’s boreholes and, together with women and children, carried it to the fire scene. Men used their machetes to cut tree branches with fresh leaves. Men and women used these tree branches to stamp the fire at its base and poured water until they quenched it. The respondents said all community members were involved in putting out fires and that when it was burning in any section of the community, people from the other sections came to assist.

4.2.3 Challenges the community faced in wildfire prevention at the initial stage and how they addressed them

The interviews reveal several challenges in bushfire prevention at the beginning. The community was faced with frequent encroaching fires from the neighbouring communities, which were not subject to the bushfire management arrangements of Goziri and often did not accept responsibility for such fires when members of the Goziri community asked them about them. One of the men said:

“We share boundaries with other communities. When it [wildfire] starts from their section into your section, you will not even know how it started. When we go to find out how it started, they will tell you it did not start from their area, it started from somewhere and you will have squabbles.”

Also, the farmers said putting out wildfires was slow for many reasons. Some people had no machetes and waited for others to cut tree branches for them and the community members did not have skills in firefighting. They said pumping water from boreholes delayed the quenching of fire and some of the water was wasted because firefighters poured water at some distance away from the burning grass. They could not get as close to the fire as they needed because they had no wellington boots to protect their feet from the heat of the fire. One of the women said some people used to be barefoot or wear slippers to quench fire and were therefore exposed to risk of snake bites as these reptiles often rushed out of the burning grass. Some of the men said some young men did not like being involved and often complained that it should be the responsibility of the section of the community where the fire had occurred to put it out alone.

Information provided by the interviewees showed that the community used several measures to address the challenges they faced in bushfire prevention. The traditional leadership of chieftaincy and its administrative set-up was a key factor. The interviewees mentioned that at monthly general meetings of the community, which the head of each section had been organizing, they began to remind everyone about their responsibilities for bushfire prevention, especially during the dry season. When the dry season was approaching, the chief convened a general meeting of the community and reminded everyone about such responsibilities. A respondent said:

“When the dry season is coming, the chief invites us to a meeting and reminds everybody to be alert, to prevent bushfires. It is a warning to everybody.”

Also, after putting out a fire, they looked round to see who had not come out to take part. The subchief of the section where the fire occurred then reported every fire outbreak to the chief. The subchief’s report included information about the culprit, if the person was known, and any person who did not take part in putting out the fire. The chief then summoned the offenders to his palace in a general community meeting at which fines were imposed.

Some of the men said that around the early 1990s, to control encroaching fires from neighbouring communities, the chief of Goziri reported the sources of such fires to the paramount chief of the Nandom Traditional Area. In a meeting he organized to address the problem, the paramount chief warned that he would sanction the chief of any community which continued to be the source of such fires. As a result, some of the neighbouring communities began to prevent bushfires. In the words of one respondent:

“Nearby communities we share a boundary with, they will burn their area and it will burn into our community. So, we reported the case to Nandom Naa, and he invited all the communities we share boundaries with, and told them that anytime fire is coming from their community to enter Goziri, that chief will be sanctioned. So, if you want to burn make sure it does not enter Goziri. So, some of the communities we share boundaries with, do not burn the bush now.”

Information provided by the farmers also shows that the chief and people of Goziri were flexible in their enforcement of bushfire rules, by making the fines affordable. One farmer cited that six children were fined one tipper truck load of stones around the mid-1990s when the fire

they used to roast groundnuts around the house escaped and burnt a portion of the vegetation before it was put out. According to him, it took several weeks for the six children to gather the stones, and because they got very tired, they began to control their fire use. The stones were sold to a contractor and the money paid into the community's development fund. The farmer said one elderly man was also fined GHS 30.00 for not taking part in quenching a fire. This is how he described the event:

“If fire is burning and we are quenching and you are coming from town. It happened to one of the elders. He came from town and saw that we were quenching fire and he told one of the fire guards that he would go and quench his thirst before he can come back. So, after we have finished quenching the fire, he never returned. So, we summoned him before the chief and he fined him to show that the rules work.”

In addition, the interviewees said one elderly man was pardoned by the chief for threatening to commit suicide due to shame, when the fire he was using to roast yam on his farm escaped and caused a wildfire.

Further, the interviews revealed that the community received some external support, consisting of technical advice, training and firefighting equipment. The community was recognized and awarded with certificates by an NGO at the gathering of a local festival called “kakube”, and at the district level forum of the National Farmers Day celebration. Some of the organizations that became aware then supported the community with equipment to improve firefighting. A respondent said:

“When Goziri got recognition for not burning, we had people coming just to see the place and at times they gave support.”

According to a respondent, around this time, the personnel of the Ghana National Fire Service (GNFS) advised the community to form fire volunteer groups to be trained to supervise the fire-fighting. The chief then organized a meeting in which the community decided to form a fire volunteer group in each of the six sections. Men and women were asked to register to become members if they were interested. According to some of the men, many people registered and then 10 people were selected from each section to form the six fire volunteer groups. They were trained around 2002 by personnel of GNFS. A man, who said he witnessed the event, told that the training was sponsored by the Upper West Regional Office of Environmental Protection Agency (EPA). The community has also received equipment from various organizations, as presented in Table 2. According to some of the interviewees, the chief gave the equipment to the subchiefs for distribution to their fire volunteers.

A respondent, who said he was a fire volunteer, mentioned that an NGO called Centre for Indigenous Knowledge Development sponsored training of the fire volunteers and donated wellington boots, as specified in Table 2. The trained fire volunteers were given identity cards. One interviewee said that aged and deceased members of the fire volunteer groups have since been replaced with younger ones. The Ghana National Fire Service later awarded the community with five bags of fertilizer and some firefighting equipment (Table 2). The fertilizer

was not enough to be shared among community members so it was sold and the money put into the community’s development fund.

Table 2. Equipment provided by external agencies for bushfire management in Goziri.

Organization	Equipment		
	Machetes	Wellington boots	Whistles
Environmental Protection Agency	15	18	
Ghana National Fire Service	30	5	6
Centre for Indigenous Knowledge Development (NGO)		14	

4.3 The current state of bushfire prevention

The findings also showed how bushfires are being prevented in the Goziri community now. In many ways, conditions are similar to what they were during the initial stages. There is continuous education on bushfires. There are monthly sectional and general meetings at which all community members are reminded about their responsibilities for bushfire prevention. All fire volunteer groups hold periodic general meetings at the chief’s house to make decisions about bushfire prevention.

There is ongoing reduction of the risk of fire through continuous cultivation and grazing, with minimal and controlled use of fire for agricultural and non-agricultural purposes. Most of the farmers said that fire is no longer used for clearing land for cultivation because bush burning is not allowed in the community. One farmer said:

“We don’t burn crop residue, we don’t use fire in our farms. Here, bushfire has been prohibited for over 20 years now. I inherited the farm from my father. We don’t have large farms which we leave to fallow. I don’t have a new land anywhere to go and plough and start planting. If you clear your farm and you want to burn some grass, you have to inform the chief. He will delegate some people to follow you to your farm to see and help you to burn so the fire does not spread.”

The farmers said they practice free and controlled grazing of sheep, goats, cattle and donkeys, as described in section 4.2.2. One of the women said burning for hunting has ceased as *men hunt but do not use fire* and cigarette smokers quench the leftover before discarding it. Also, most of the women said fetching naked fire from a neighbouring house for cooking is minimal because most women now have matches and that, when fetched, such fire is carried in clay pots to prevent particles from falling off to cause bushfires, as indicated earlier.

The data reveal that the community is now more committed and efficient in fire management. Volunteers and community members watch out for signs of fire outbreak (i.e. smoke) on a daily basis during the dry season. One farmer said:

“Fire guards are there, always hovering around, when you want to hide and burn they will get you and punish you.”

When there is a fire outbreak, the first person who sees it blows a whistle, if she or he is a fire volunteer (who often carry whistles), shouts or makes telephone calls to assemble people: Fire guards have been trained and they go around watching. If they see fire burning the bush they blow a whistle to call people to put out the fire.

Furthermore, the women have composed a special song which is now sung to alert people to gather for firefighting. One of the men said that:

“...we have a song composed by women, any time you hear it, it means fire is burning and they will sing the song even to the pito house [house in which the local beer, pito, is brewed and sold] to call people to quench the fire.”

In addition to pouring water directly on the fire and stamping it out with tree branches, knapsack sprayers are now used for spraying water on the burning grass to quench the fire quickly. According to one of the men, every farmer in the community now has a knapsack sprayer, which they bought under a zero-tillage project implemented in the community by Care International, from 2011 to 2014.

One respondent mentioned that the fire volunteers now check the direction of the wind, and where necessary, create a fire belt (an area cleared of vegetation) across the path of the fire. During the beginning of the dry season, they now make fire belts around their boundaries with neighbouring communities. Some farmers also create fire belts around their farms. When fire burns up to the fire belt, it is quenched automatically while any escaping fire is stamped out immediately. The farmers said that those who have not come out to take part in firefighting are still fined, as indicated earlier.

In addition, the findings suggest that community members have become committed to putting out fires. One farmer said:

Everybody is a fire volunteer member because when there is a fire, everybody goes out. When they sing that song, you see the smoke where the fire is burning and everybody, even in the night, you have to wake up and go, except the old women and old men who cannot walk. And they are always happy because they know the benefits that they derive from it.

In the words of one of the men:

“The community is united and everyone understands that if there is bushfire you have to participate to quench it. The community is in agreement and when it happens everybody is always ready.”

Another respondent mentioned that:

“It is in our spirit, it is within the people now, so the moment they see smoke at any point, they come out, we call, we just link up and the people come out to control the fire.”

Furthermore:

“They are committed, they just don’t want their community to be engulfed by fire. Whenever, there is any alarm of bushfires, they will come out. I like the spirit of community. We show interest.”

4.4 Current challenges and how they are being addressed

The interviews indicate that the community still faces some challenges in bushfire prevention. Bushfires often encroach from the neighbouring Puffion community. Pumping water from boreholes is slow and sometimes, the amount of water in the community’s two boreholes is so low that they have to pump for a while before getting water. Through the Assembly Member, the community has appealed to the Nandom District Assembly to provide a dug out (small dam) to quicken the drawing of water for putting out fires.

Also, the respondents mentioned that cutting of tree branches for stamping out fire is still quite slow because not everyone has a machete, while other machetes are old and worn out.

Through the chief of any neighbouring community from which wildfire encroaches, the Goziri chief now summons and fines the culprits, if they are known. One farmer said, in 2016, a woman in a neighbouring community burnt some garbage around the house when the fire spread and encroached into Goziri, where it was put out. She was fined GHS 60.00, which her husband paid.

4.5 How wildfire prevention benefits the community

The findings show that wildfire prevention has benefited community members in several ways. One farmer said that litter is now left to decompose on farmlands. According to him, this has resulted in observed increase in soil moisture, soil nutrients (including the addition of droppings of cattle, sheep, goats and pigs), crop resistance to drought and yield levels. In his words:

When there is drought in Goziri for two to three weeks, crops do not wilt because of moisture content in the soil due to non-burning. Farm residues are left to decompose. Yields have increased because of soil fertility that has been increased.

Other farmers said that increased soil nutrient level has reduced the requirement for fertilizers for cultivating crops. One of them said they no longer need to apply sulphate to their soils. Another farmer said: *sometimes we don’t use fertilizer and we get more harvest than before.* One of the men indicated that community members keep preventing bushfires because they are benefiting from it. He said:

“We got good yield because soil fertility has been increased. So, we the individuals also benefit from non-burning. So, no joke burning the bush.”

All the respondents revealed that since they started preventing bushfires in the community, the yields of their crops have increased. Crop yield data gathered from interview statements are presented in Table 3.

Table 3: Crop yields during two contrasting fire regimes in Goziri as estimated by interviewees.

Crop	Average yield in kilograms per acre	
	Period of uncontrolled wildfires (early 1980s)	Period of wildfire prevention (in 2016)
Maize	200-300	700
Millet	200	400
Dorado	300	800-1,100
Groundnuts	200	400-500

The farmers said they have been able to produce more food under bushfire prevention than previously when such fires were not controlled and are now able to provide sufficient food for their families throughout the year.

According to the respondents, vegetation cover has increased in the community since they stopped bush burning. One of the interviewees said:

“When we stopped burning, by second year we saw that when rains set in, within two weeks, we see the vegetation change completely. If you compare Goziri with communities we share boundary with, you see that our vegetation is ahead of those we share boundary with.”

The interviews also indicated that there is now sufficient grass within the community where their livestock can graze all year round and they no longer get stolen because they do not move far away. In general, the respondents expressed their satisfaction about bushfire prevention in the community.

Due to the benefits, the interviewees recommended that other communities should follow their example, and that authorities see to more education and provide support for this purpose.

5. DISCUSSION AND RECOMMENDATIONS

5.1 Discussion

This study showed that by 2017, the whole Goziri community was actively engaged in wildfire prevention and control. About 30 years of applying their approach to wildfire management had

led to improved agricultural yields, which in turn had enhanced the livelihoods of the farmers and their families. Wildfire prevention had resulted in increased amounts of grass, which made year-round grazing possible within the community. Just as predicted by the chief at the outset of the community's fire management effort, this had indeed reduced the theft of community members' livestock. Also, instead of burning crop residue, the plant material had been used to improve soil fertility, which had led to increased crop yields and availability of sufficient food for household consumption. This shows that the community members' expectations with participating in the fire management effort had been met. Meeting participants' expectations is an important factor of participatory ventures. According to Pretty (1995), participants have to experience joint gains from the project, and it has to produce a lasting positive effect for those involved. This can lead to increased stakeholder ownership of the process in question, which is important for it to last. Built on the findings of this study, it can be argued that this was the case in Goziri. The results showed that community involvement, joint responsibility and committed leadership were key factors for achieving this success.

Other authors have stressed the importance of community involvement for successful fire management, e.g. DeGrosky (2003) and Ganz et al. (2003). The Goziri approach has many traits in common with the Community Based Fire Management (CBFiM) described by FAO (2006, 2011). One such trait is the active engagement of local communities in the development of a fire management strategy. The findings showed that the whole Goziri community was engaged in making the rules and their fire management strategy sought to involve the whole community in wildfire management. Another feature of CBFiM is active involvement of local communities in the implementation of a fire management strategy. In Goziri, the whole community took part in fire prevention by handling fire for domestic and agricultural purposes carefully. All inhabitants, who were physically fit for it, also participated in fire quenching, using mainly their own simple equipment. The community had, however, also received training and equipment support from external agencies. Built on this technical advice, they had formed fire volunteer groups. Also, a key feature of CBFiM is that it is designed to improve the livelihoods of the local community. In the case of Goziri, the strategy was designed to increase grass for grazing within the community, with the intention of keeping livestock from migrating and being stolen. Furthermore, a CBFiM strategy covers both fire prevention and management practices, which the Goziri strategy also did. Moreover, community control of the fire management process, was one of the features observed in Goziri. Even though the community leader coordinated the whole process, the community members not only made, but also took part in enforcing their own rules, e.g. pointing out culprits and deciding on fines. Knowledge was another key aspect of CBFiM, which was observed in the community. Community members' knowledge of fire handling practices and how it affected their livelihoods was evident and an important basis for designing their fire management strategy. New facts and experiences were used as the basis for addressing challenges and making improvements of the management strategy. In Goziri, the chief's actions were instrumental in actively engaging the community members in problem solving, careful fire handling, and to use simple equipment for fire-fighting. This is in line with Evely et al.'s (2011) observation that the ability to engage people to deliver certain resource management practices leads to learning. Furthermore, in CBFiM, community members' interests can reflect on their decisions, and in the case of Goziri, the results showed that the wildfire rules they made were reflections of their interest in livestock production. Finally, CBFiM uses an integrated approach for coordinating all fire management

activities and actors into one process. In the Goziri case, fire prevention, firefighting activities, and use of fire for land management, by inhabitants of both Goziri and neighbouring communities, were brought under one coordinated process. It is clear from these features that wildfire management in Goziri was an excellent example of CBFiM.

An important benefit of using CBFiM, as described by FAO (2011), DeGrosky (2003) and Ganz et al. (2003), is that local communities can decide on, and effectively implement a fire management practice that is in their own interest in order to improve their livelihoods. The results showed that, in Goziri, this was the case. However, there are also several challenges with the FAO (2011) description of CBFiM. It focuses on technical expertise, adequate knowledge of local fire issues, and adequate financial resources, as some of the main factors for achieving active community engagement in fire management. However, the Goziri example suggests that, rather, it is the ability to actively engage community members that can lead to acquisition of adequate knowledge of fire issues and skills for fire management. Also, the Goziri example of CBFiM shows that such engagement can lead to innovative use of domestic items, inexpensive technology and even local cultural traditions, for example the women's fire song, for fire management, and thus help to address the financial challenges that often confront fire managers. This emphasizes the importance of competent leadership for the success of CBFiM.

According to Johnson and Brumel (2011), the ability of a local leader to organize and engage community members is an essential driver of effective management of wildfires. Leadership is also an essential aspect of CBFiM (FAO 2011). It was clear that, in Goziri, leadership played a major role in initiating their fire management and maintaining community engagement. The leadership demonstrated resembles what Bass & Riggio (2014) name transformational leadership. According to them a transformational leader has a clear vision which he or she clarifies to the followers, and engages them to develop a shared vision. In Goziri, the whole fire management process started with the chief clarifying his vision, or purpose and expectations with wildfire management to the community. It became the shared purpose of the community, which encouraged the community members take part in creating their own rules for wildfire management. The transformational leader should also demonstrate personal commitment towards achieving the vision by acting as a role model, and empathizing with followers. This trait could be seen in the accounts of the late chief. He was the first to stop agricultural fire use and he showed empathy by making fines affordable or payable in kind rather than money. The data also revealed that the chief stimulated and inspired the community members to develop their own leadership capacity, another transformational leadership trait. This was evident, for example, in the joint responsibility for enforcing the rules. Also, the community members trained as fire volunteers demonstrated leadership.

Thus, the results showed that that the ability of the chief to organize and engage the community members was a main factor for effective management of wildfires in the community. The leadership was beneficial in several respects. By involving community members to make their own rules, the leader encouraged them to feel that their ideas were valued (Evely et al. 2013) and thus encouraged them to get involved in wildfire management. Also, through flexible rule enforcement, the leader showed that he was open to new information, and thus encouraged learning and problem solving. This is in line with Evely et al.'s (2013) observation that the

ability to solve problems, related to resource management, leads to increasing stakeholder engagement. Thus, leadership was crucial for engaging community members in wildfire management in Goziri.

The results have shown that CBFiM and leadership were intertwined in the Goziri case, because transformational leadership was crucial for engaging the community in wildfire management. Thus, transformational leadership drove both the community controlled development and the implementation of their fire management strategy. The findings showed that, while the leader engaged the community at the development phase, the community members now drive the implementation process. That wildfire management has met their expectations seemed important for their commitment. This is in line with Bass and Riggio's (2014) view that a transformational leader inspires others to follow his or her actions in order to achieve joint expectations and personal goals, and to maintain long-term commitment to the vision of their group. However, such skilful leadership is not the norm in many communities in Ghana but it can be learned.

Wildfire management in Goziri offers important lessons which can be applied in other communities in the Upper West Region of Ghana. First, competent leadership was crucial for engaging community members to effectively manage wildfires. Second, wildfire management was based on a clear purpose and expectations, which were aligned to the interest of community members and fulfilled during implementation. Third, community engagement and commitment were crucial for effective wildfire prevention and control. Fourth, it was based on a strategy which was varied at the implementation stage to reflect the local realities and interests. Thus, it was based on learning from experience. This was important for addressing challenges related to enforcement of the rules, including collaboration with neighbouring communities for controlling wildfires. This is in line with Failing et al. (2013) who argue that it is essential to adjust the implementation of a resource management plan on the basis of new evidence. Furthermore, the community members' use of simple everyday equipment for fire-fighting demonstrated that adapting wildfire management to the local context can address the challenges of funding. Finally, the wildfire management strategy addressed the causes of wildfires, not only the consequences.

This study was based on a small case study but I believe many of the aspects that were important for the success in Goziri could be adapted and introduced to other communities, and even other regions, dealing with the wildfire problems. This could make their fire management more effective which would in turn enhance management of agricultural land and improve the livelihoods of farmers and their families.

5.2 Recommendations

Built on the findings of this study, the following recommendations can be made for enhancing wildfire management in other communities:

1. Local leaders should be encouraged to develop their leadership skills. For that purpose, leadership training should be made available to them.

2. Ensure a clear purpose with wildfire management and that community expectations are fulfilled.
3. Ensure community engagement for wildfire management.
4. Adapt the wildfire management to local contexts.
5. Encourage the use of simple, inexpensive and locally available equipment for wildfire management.
6. Support communities with equipment and training for wildfire management.
7. Conduct further research on the effects of wildfire management on soil fertility in the Goziri community.

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APPENDIX 1. Interview guide for research on managing bushfires for land restoration in Goziri

This interview is conducted on behalf of the Head of the Nandom Area Office of the Environmental Protection Agency. He is participating in the United Nations University Land Restoration Training Programme at the Agricultural University of Iceland. As part of this training, he is studying how the Goziri community successfully prevents bushfires in order to share this knowledge with other communities to improve land management. The information you provide will be used for this purpose only. It will not be disclosed to other people and your name will not be mentioned in the report. We need your permission to record the interview. Please, feel free to tell us, if you decide to decline from answering any of the questions we will be asking you.

Section 1: Background

1. Name (optional) or code (such as leader 1, leader 2, woman 1, woman 2, man 1, man 2, focus group 1, focus group 2, etc)
2. Age
3. Sex (write without asking)
4. Where do you live (section of Goziri)?
5. Position (such as chief, *tendana*/land owner, assembly member, women leader etc)
6. Former position and role (if applicable)
7. What do you do for a living in these community? (indicate whether farming, livestock rearing, hunting etc)
8. Do you use fire in any of these livelihood activities?
9. Are there other activities that involve the use of fire?
10. How do you use fire in these activities?
11. Are there any challenges in the way you use fire in these activities?
12. How do you address these challenges?
13. Do you have bushfires in this community now?

Section 2: How the community started bushfire prevention/control

- 14 Has this community ever experienced bushfires in the past?
- 15 When was this? (how many years ago, since you experienced bushfires?)
- 16 Can you tell us more about these fires?
- 17 Can you tell us what caused these fires?
- 18 How did these fires affect you?
- 19 Do you still experience bushfires in this community?
- 20 If no? How did you start preventing and controlling bushfires?
- 21 When was this (how many years ago)?
- 22 How did bushfire prevention start in this community?
- 23 Who started it?
- 24 How was bushfire prevented and controlled at the beginning?
- 25 Which tools were used for bushfire prevention and control?
- 26 How were such tools acquired?
- 27 Which people were involved?
- 28 How did they get involved?

- 29 What challenges did you encounter in bushfire prevention and control at the beginning?
- 30 How were these challenges addressed?
- 31 Did you get any external assistance to address these challenges?

Section 3: How the community practices bushfire prevention

- 32 Can you tell us about bushfire prevention and control in the community these days?
- 33 What tasks are performed to prevent and control bushfires now?
- 34 Who performs these tasks?
- 35 How did you acquire skills to perform these tasks?
- 36 How were these tasks assigned to those involved?
- 37 Do men and women perform different tasks in bushfire prevention and control?
- 38 Who ensures that these tasks are performed?
- 39 How do you keep on preventing and controlling bushfires?

Section 4: Challenges the community faces in preventing and controlling bushfires and how these challenges are addressed

- 40 Have you faced any challenges in preventing and controlling bushfires these days?
- 41 Are these challenges different from those you faced when you started bushfire prevention in the past?
- 42 How have you addressed these challenges?

Section 5: Why the community continues preventing bushfires

- 43 What are the benefits of preventing bushfires?
- 44 Have there been any changes in your land (including farmland, grazing areas or forest) since you started preventing and controlling bushfires?
- 45 What are these changes?
- 46 How have these changes benefited you?
- 47 Are these benefits different for men and women?
- 48 Are there some effects of these changes which you do not like?

Section 6: Conclusion

- 49 How do you feel about the way bushfires are controlled and prevented in this community?
- 50 What advice would you give to another community that has not started preventing bushfires?
- 51 What advice would you give to authorities involved in managing bushfires?

Thank you for your contribution