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Original Article

Forest Fires Outbreak and Their Implications on the Livelihoods of Peasants and Small-scale Timber Producers in Mufindi District, Tanzania

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Forest fires have prevailed in several parts of the world in history, posing effects ranging from economic loss to loss of lives. This study focused on exploring the livelihood implications of peasants and small-scale producers due to fire outbreak incidents in the Mufindi district. Data were collected from 95 respondents selected through a simple random technique. The study was guided by three objectives which are; to examine the causes of fire outbreaks; to assess the impacts of fire outbreaks on the economy and lives of local people and to suggest measures that could curb fire outbreak problems. The study was conducted through cross-sectional survey design where data for this study was collected using both primary and secondary sources. Primary data sources included questionnaires for household heads, while secondary data was collected through document review. The sampling techniques included both probability and non-probability sampling. Quantitative data were analyzed through SPSS version 25 while qualitative data were subjected to content analysis. The results revealed that lack of education among villagers was the main cause of fire outbreak incidents. The impacts of fire outbreak incidents included the destruction of farm products, deaths as well as dragging people into poverty. There is a need for collaborative efforts between community members, government, NGOs, CBOs, and CSOs in improving fire management practices among members of the community.

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INTRODUCTION

Forest fire is one of the primary causative natural drivers of biodiversity loss (Pérez-Cabello *et al.*, 2012), depletion of terrestrial ecosystem productivity, decline in soil fertility and subsequent crop production (Cerdà, 1998), escalation of air pollutants (Yin *et al.*, 2019). These unfavourable consequences incurred by forest fires often take place over large areas and sometimes may last for years or decades (Pellegrini *et al.*, 2018). Forest fires are now becoming a serious environmental concern in many countries across the globe due to the changing climate and associated local and regional warming (Taylor & Alexander, 1997; Littell *et al.*, 2016). Additionally, forest fires are now becoming a principal cause of forest degradation in India, especially in the dry deciduous forested region (Madhya Pradesh, Odisha, and Chhattisgarh), where the seasonal (April/May) forest burning is a common phenomenon due to abundant fuel load and low moisture content in soil (Chandra & Kumar, 2015). However, in the northeastern region of India, forest fires are mainly associated with traditional practices of shifting cultivation (Puri *et al.*, 2011). Satellite remotely sensed data is the only reliable source of forest fire assessment in India, as comprehensive statistical data on active forest fire loss is weak (Roy, 2003). Additionally, Kale *et al.*, (2017) have asserted that about 90% of the forest fires in India are human-made, which demonstrates the necessity of proper prevention measures and creation of forest fire vulnerable zones for averting the ever-growing problems of forest fires on the natural environment.

The other causative factors that could be responsible for forest fires are categorized into three major groups: (i) natural (ii) human deliberation, and (iii) unintentional/accidental human interference (Jaiswal *et al.*, 2002). Among the major forest types of India, the dry deciduous broadleaved forests are found to be highly

susceptible to forest fires compared to others. This could be due to the lack of soil moisture, especially during autumn and dry pre-monsoon periods (5–6 dry months), which is featured by a high level of surface and air temperature, low moisture content in the air, and abundant fuel loads composed in the substrate.

It is widely known that despite conservation efforts over the past 25 years, large portions of tropical forests have decreased, even though exact numbers reflecting the loss of forests are lacking (Keenan *et al.*, 2015). Of the 9,200 million tons of biomass destroyed by fire in 2000, 42% came from Africa, making it the most afflicted continent. This amounts to a loss of 7 billion Tanzanian shillings (FAO, 2011). Forest fires also significantly affect Tanzania when used in land preparation and hunting. According to FAO (2013), Tanzania experiences forest fires throughout the year whereby around 65,000 ha of plantation forests and other wooded areas are destroyed annually. The average forest plantation area burnt annually is 2466 ha (*Ibid*).

In the Mufindi district, forest fire outbreak incidents have been increasing each year, especially during the summer season when most of the peasants prepare farms for maize, beans, wheat, and peanuts production (Nyaganilwa, 2019). The practice of using fire in clearing bushes has for a long time brought effects not only to peasants themselves but also to small-scale timber producers who plant in most cases *pinus patula* and *eucalyptus saligna* tree species near the croplands.

Researchers have indicated a great economic loss to peasants who after the impacts caused by fire outbreak incidents are subjected to paying large amounts of money to other people whose properties including planted trees are affected. Recently, fire outbreak incidents have also resulted in the death of peasants who tried to manage fire to reduce the impacts of such fire

(Addai *et al.*, 2016). Thousands of forest hectares owned by small-scale timber producers and the government (SAO HILL FORESTS) are burnt almost every year as a result of fire outbreak incidents.

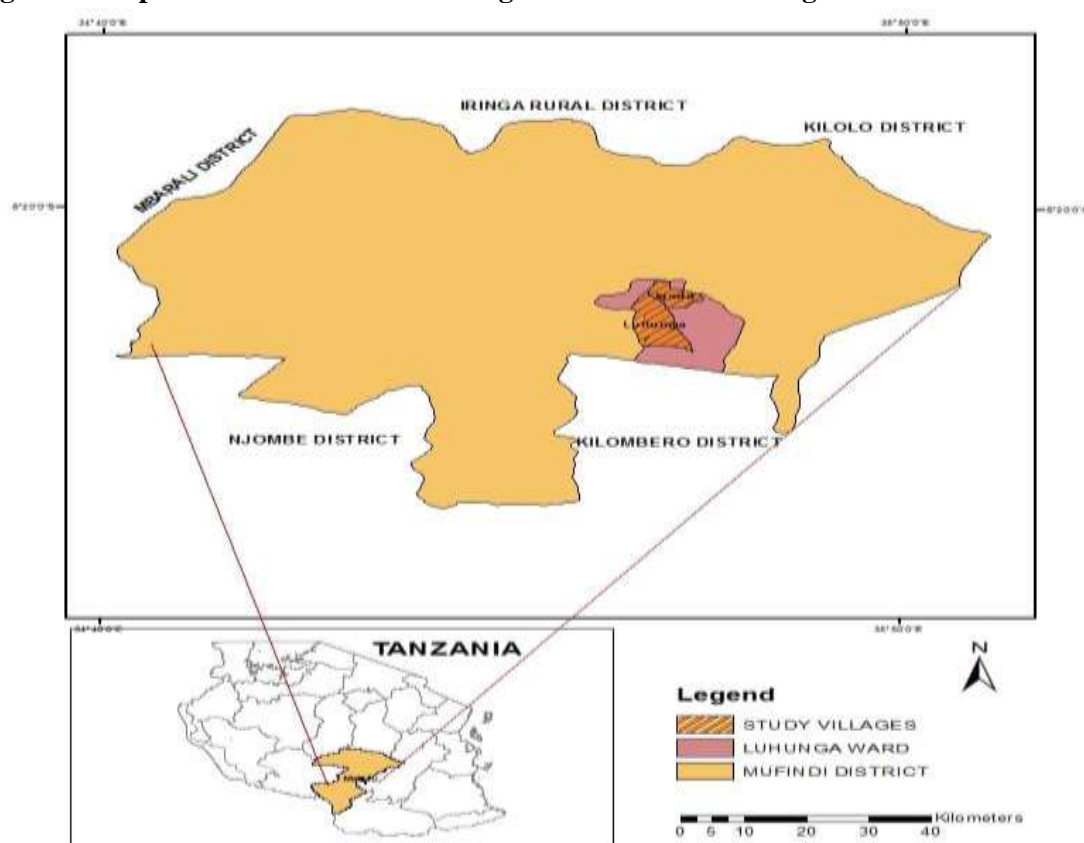
Several studies on the effects of fire outbreak incidents have been focusing on natural forests, where the impacts to the biodiversity, depletion of terrestrial ecosystem productivity and exhaustion of forest carbon stocks, decline in soil fertility and subsequent crop production, escalation of air pollutants, water quantity and quality (Vachula *et al.*, 2020), and increase in the magnitude of landslide susceptibility have been extensively researched. Studies that focus on the impacts of fire outbreak incidents on the trees planted by small-scale timber producers and the government plantation are in paucity. In order to fill the

existing gap, this study, therefore, focuses on the impacts of fire outbreak incidents on the peasants and small-scale timber producers in Mufindi. The study was guided by three objectives which are; to examine the causes of fire outbreaks; to assess the impacts of fire outbreaks on the economy and lives of local people and to suggest measures that could curb the fire outbreak problem.

METHODS

The study was conducted in the Mufindi district, Iringa Region. The study was conducted following a cross-sectional survey design. It was conducted in the Luhunga ward specifically in two (2) villages namely; Igoda and Luhunga all located in Iringa, Tanzania. This area was selected as it experiences many fire outbreak incidents each year resulting in economic loss and death of people.

Figure 1: Map of Mufindi District Showing the Location of Luhunga Ward



Source: Geographical Information System (GIS) Laboratory (IRA, 2024)

Data for this study was collected using both primary and secondary sources. A sample size of 95 respondents was used for this study. The

distribution of respondents included 47(49%) respondents from Igoda village and 48 (51%) respondents from Luhunga village. Primary data

sources included questionnaires for household heads and in-depth interviews with key informants, while secondary data was collected through document review.

The review followed the Preferred Reporting for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Cresswell, 2009). Peer-reviewed articles, books and book chapters published between 1 January 2015 and 30 May 2024, which examined local livelihood implications as a response to fire outbreak incidents were considered. The studies were sourced from various databases using specific keywords, synonyms, and search phrases. The

sampling techniques included both probability and non-probability. In probability sampling, simple random procedures were employed specifically for household heads. While in non-probability, purposive sampling was used to select key informants.

RESULTS AND DISCUSSION

Respondents' demographic characteristics

This study included respondents of all genders. However, the majority of the respondents 63 (66.3 %) were female whereas 32 (33.7%) were male. Table 1 summarizes the findings on the demographic characteristics of the respondents.

Table 1: Respondents' Distribution by Gender, Age and Occupation

| Gender | Frequency | Percentage |
|--------------|-----------|------------|
| Male | 32 | 33.7 |
| Female | 63 | 66.3 |
| Total | 95 | 100 |

| Age | Frequency | Percentage |
|--------------|-----------|------------|
| 10-20 | 0 | 0 |
| 20-30 | 9 | 9.5 |
| 30-40 | 23 | 24.2 |
| 40-50 | 39 | 41.1 |
| 50 and above | 24 | 25.3 |
| Total | 95 | 100 |

| Occupation | Frequency | Percentage |
|-------------------------------|-----------|------------|
| Peasants | 65 | 68.4 |
| Civil servants | 13 | 13.7 |
| Employed in private companies | 6 | 6.3 |
| Self-employed | 11 | 11.6 |
| Total | 95 | 100 |

| Education Level | Frequency | Percentage |
|--------------------------|-----------|------------|
| No formal education | 24 | 25.3 |
| Primary education | 39 | 41.1 |
| Secondary education | 23 | 24.2 |
| Post-secondary education | 9 | 9.4 |
| Total | 95 | 100 |

Source: Field data (2024)

The findings in Table 1 revealed that the majority of the respondents 39 (41.1%) were aged between 40-50 years. This was followed by 24 (25.3%) of respondents whose ages were above 50 years. The

age group of 30-40 years comprised 23 respondents equivalent to 24.2%. The remaining 9 (9.5%) respondents were between 20-30 years old. These findings suggest that substance

farming and small-scale timber production in Mufindi are practised by mature people when compared to other age groups. These findings concur with NBS (2005) and URT (2006), which stated that economically active working people are those who are in the age group of 15 to 64 years.

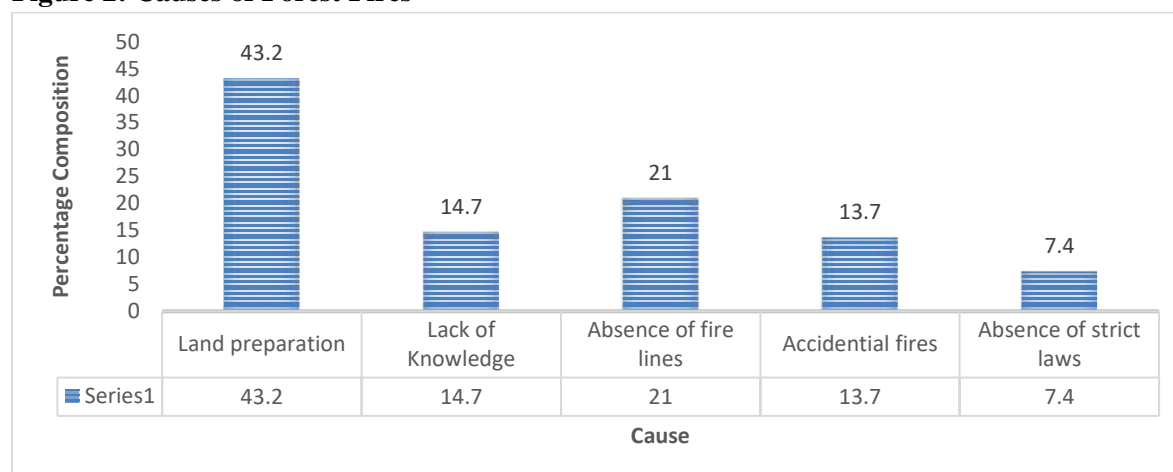
Concerning the occupation of respondents, the majority of the respondents 65 (68.4) were peasants. A group of civil servants comprised of 13 respondents or 13.7%. This was followed by 11 respondents (11.6%) who were self-employed. A few respondents 6 (6.3%) were employed in private companies. The interpretation of these findings is that the sample size was made up of people who depended much on crop cultivation and timber production as their main source of livelihood (Nyaganilwa, 2019). On the education

levels of the respondents, the findings revealed that the majority of the respondents 39 (41.1%) had primary education while those without formal education were 24 (25.3). Others, 23 (24.2%) respondents had secondary education while 9 respondents, equivalent to 9.4%, had post-secondary education. The interpretation of these findings is that respondents in the study area had either primary education or no formal education. The findings concur with FDT (2015) which reported that timber producers of the Southern Highlands are characterized by low levels of educational attainment.

Causes of Forest Fires

The results revealed that the fire outbreak in Mufindi was a combination of a number of reasons. The findings on the causes of fire outbreak incidents are summarized in Figure 2.

Figure 2: Causes of Forest Fires



Source: Field data (2024)

The findings in Figure 2 depict that forest fires were due to the uncontrolled burning of bushes during the preparation stages of farm plots for the cultivation of crops such as maize and beans (43.2%). A lack of knowledge of fire management was suggested by 14 respondents equivalent to 14.7%. The absence of fire lines around the farms was another cause suggested by 21% of respondents. Likewise, other respondents (7.4%) reported that the absence of strict laws was a cause of fire outbreak incidents.

Natural factors (accidental fires) such as wind action were other reasons for fire outbreak

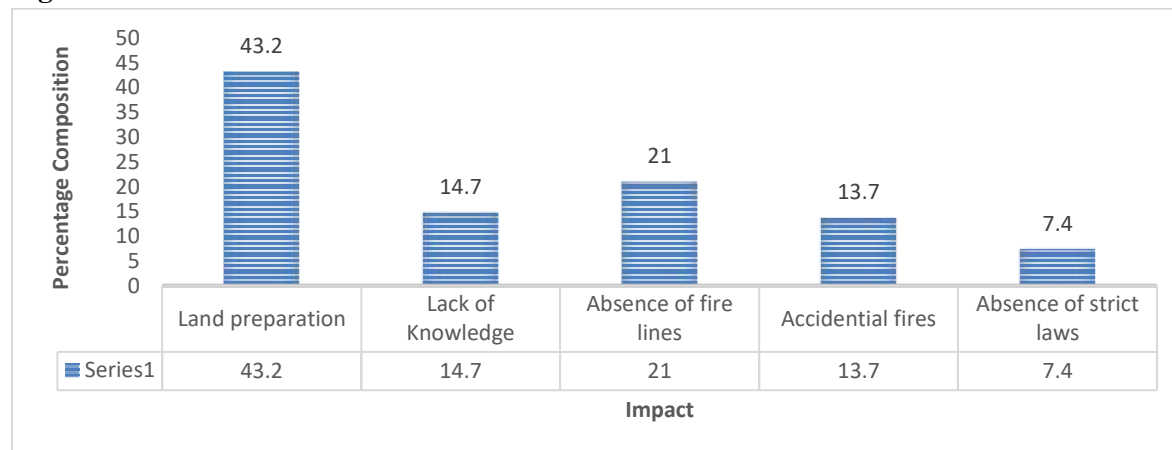
incidents which accounted for 13.7%. It was also observed that the process of preparing farm plots is done by a few people sometimes a single person. Thus, when a fire outbreak occurs the ability of such a small group of people or a single person to manage fire becomes inadequate. Therefore, when fire escapes and becomes unmanageable spreads to other surrounding plots and burns the crops as well as tree species like pine trees or eucalyptus trees Jua'rez-Orozco *et al.*, (2017). Considering the nature of pine trees, for instance, when fire burns in a relatively short period of time, thousands of trees become burnt in

just a few hours resulting in economic loss for the burnt trees and sometimes death of people due to fire outbreaks (Plucinski, 2014).

It was similarly imperative to ask respondents about the effects of forest fires. The findings on this aspect are summarized in Figure 3.

Effects of Forest Fires

Figure 3: Effects of Forest Fire



Source: Field data (2024)

According to the findings presented in Figure 3, the majority of the respondents 41 (43.2%) reported that fire outbreak incidents resulted in the loss of farm products. Fire outbreak incidents also implied increasing poverty levels 21 (22.1%). Furthermore, fire outbreak incidents triggered conflicts among community members 18 (18.9%). Unemployment especially for people who are employed in overseeing the planted trees was

suggested by 7 (7.4%). Occurrence of deaths was suggested by 8 (8.4%) respondents.

All these affect the livelihoods of those who depend on the planted trees for their survival and those who are their dependents die due to fire outbreaks (Doerr & Santi (2016). It was also observed that forest fires dragged people into poverty (Chinamatira et al., 2016; Narita *et al.*, 2020).

Figure 4: The General Ecosystem and Planted Destroyed by Forest Fires in Igoda Village



Source: Field Data (2024)

Figure 5: Forest Compartment Affected by Fire during Land Preparations in Luhunga Village



Source: Field data (2024)

Measures for Addressing the Fire Outbreak Problem

In order to effectively manage fire outbreak incidents, the majority of the respondents suggested that local communities need to be provided with proper farm management education through seminars, training, and other ways 46 (48.4%) so as to ensure that fire incidents are minimized. Also, 25 (26.3%) respondents suggested that the village authority should impose fines and penalties on those who will not abide by the established bylaws. It was also reported by 11 (11.6%) respondents that in order to address the

challenge, there should be a collaboration in clearing bushes with fire. In addition, 5 (5.3%) respondents suggested that during the preparation of farms for cultivating food crops it is imperative that farmers are issued with permits from the authorities before starting fire. On top of that, 8 respondents (8.4%) said Non-Governmental Organizations (NGOs), Civil Society Organizations (CSOs) and Community-Based Organizations (CBOs) should assist the government in managing fire outbreak incidents. They can help in providing education and devising more effective measures for managing fire outbreaks (WWF, 2006 and FAO, 2013).

Table 2: Measures of Addressing the Fire Outbreak Problem

| Measure | Frequency | Percentage |
|---|-----------|------------|
| Provision of proper farm management education | 46 | 48.4 |
| Imposition fine and penalties Relatives | 25 | 26.3 |
| Collaboration in clearing bushes with fire | 11 | 11.6 |
| Issuing permits | 5 | 5.3 |
| Support from NGOs, CSOs and CBOs | 8 | 8.4 |
| Total | 95 | 100 |

Apart from the above findings, it was found that the only mechanism that local people in the Mufindi district used to manage fire outbreaks before the occurrence was the preparation of fire lines around the plot and planted trees. The existing measures for managing fire outbreaks included mobilizing the local community to use local methods like the use of dust or tree branches which only functioned when fire was at a manageable level (Mgina & Wawa, 2021). In addition, the village government claimed that there were bylaws regarding fire including prohibiting people from starting fires on their farms during daytime. Even during evening and night, local people were to be issued with village government permits to start fire upon inspection of the area by the leaders. However, there were some local people who were reluctant to the established bylaws as they had a tendency to start fires during the daytime or during the evening without notifying the authorities so as to be issued the permits (Lulandala *et al.*, 1995). This situation also contributed to fire outbreaks leading to economic loss and loss of people's lives, impacting the livelihood of the local communities.

CONCLUSIONS

The study revealed that fire outbreaks were mainly due to uncontrolled land preparations and a lack of knowledge of fire management. The impacts of fire outbreak incidents included poverty, loss of farm products as well as death of people. On the measures of addressing the problem of forest fire outbreaks, it was found that small-scale timber producers did not have effective measures to deal with such shocks. Instead of having some ineffective measures in place, small-scale timber producers depend on speculations that a fire outbreak would not occur, and when it occurs, it becomes a major disaster. On top of that, farms were not insured to deal with losses caused by fire outbreaks.

Recommendations

Based on the findings of this study, the following recommendations are made:

- Land preparation should be monitored by ensuring that areas are inspected accordingly before starting a fire. This should be followed by the issuance of permits to start fires from the village government.
- In order to prevent escaping fire from burning the trees, land plots with planted trees should have fire lines.
- All stakeholders should coordinate harmoniously through a participatory process to ensure that forest fires are managed effectively.
- There should be the use of Remote sensing techniques such as Geographical Information Systems (GIS) to facilitate early detection and hence timely suppression of forest fires.

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