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Assessment of forest fire risk perception at the fireshed level

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Abstract

Forest fires are increasingly affecting forest ecosystems, with severe ecological and socio-economic impacts on neighboring communities. In this context, evaluating the risk of fires at the fireshed level is considered a crucial step towards improving knowledge about fire risk management, therefore, minimizing potential damages of wildfires on people, properties, and natural resources. The aim of this study was to assess forest fire risk perception of communities at two firesheds in Lebanon. In-person surveys were conducted in areas of high fire risk within each fireshed. The analyzed data showed variability in opinions and challenges about fire risk management. Most of the provided recommendations included advocating for the increase of awareness about fire risk and safety, inducing training about fire-fighting and creating networks to facilitate communication within communities at risk.

1. Introduction

Forest fires represent an increasing risk not only to forests but also to the livelihood of neighboring communities (Verkerk et al., 2018). Accordingly, forest fire risk assessment is essentially needed to improve management of risk, therefore minimizing potential impacts of fires on vulnerable people, properties, and natural resources (Abedi Gheshlaghis et al., 2019; Çolak and Sunar, 2020). Various studies around the world have been conducted to assess forest fire risk and consequently identify fire susceptible regions (Abedi Gheshlaghi, 2019). This study aimed at assessing forest fire risk perception of communities at two firesheds in Lebanon. In this context, a fireshed takes into account all communities located within a specific watershed. More specifically, a fireshed is “an area where social and ecological concerns regarding wildfire overlap and are intertwined” (GSFFC, 2022).

2. Study area

The study area comprised both the Qadisha-Abu Ali watershed and the Hasbani watershed (Figure 1). All the villages included in the study were selected using a national fire risk assessment report (Mitri et al., 2019) that identified high risk areas and “priority sites” in the respective fireshed.

The Qadisha-Abu Ali fireshed is located in North Lebanon and it is characterized by a Mediterranean landscape with dense mixed forest which is mainly composed of broadleaf and coniferous trees (Figure 1). Its lowest altitude is at sea level and its highest mountain peak reaches 3080 asl. It is composed of 5 vegetation successions within a typical Mediterranean floristic ensemble (Figure 2).

The Hasbani fireshed is located in Southeast Lebanon and it is characterized by a pre-steppic landscape with sparse oak forests dispatched between agricultural lands, rangelands, and urban settlements. Its lowest altitude is 200 m asl and its highest elevation is 2810 m asl. It is composed of four vegetation successions distributed in a typical Mediterranean floristic ensemble (Figure 2). Forests at high risk are scattered in a steppingstone pattern between the urban settlements and the agricultural areas.

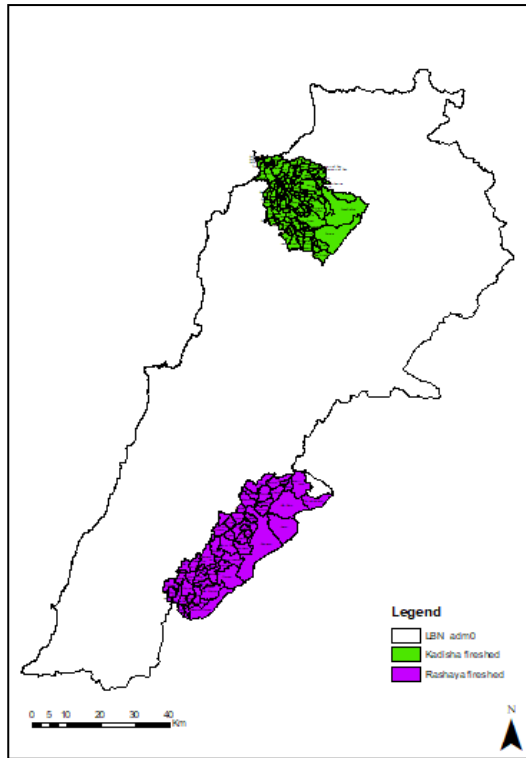


Figure 1: Geographic location of the fire-shedded

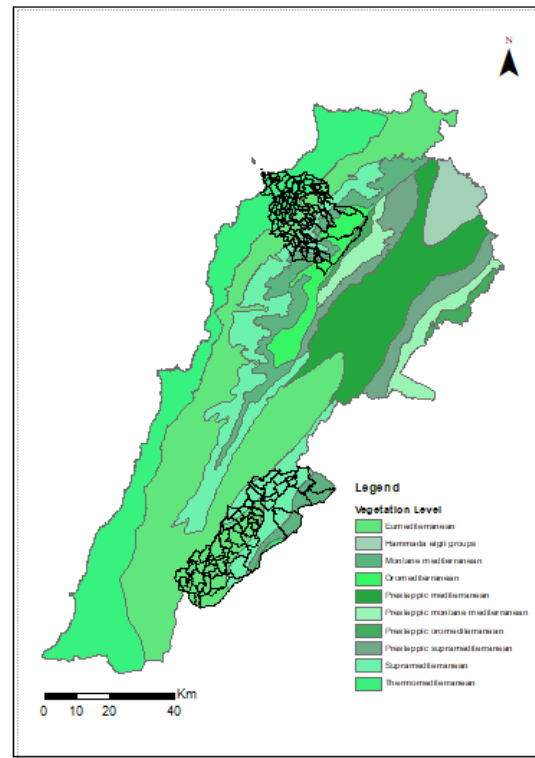


Figure 2: Vegetation levels succession in Lebanon

3. Methodology

Fire risk maps of the two targeted fire-shedded areas were generated using the Geographic Object-Based Image Analysis (GEOBIA) approach (Mitri et al., 2015). Fire risk represented the product of hazard and vulnerability. Priority zones of high fire risk villages were identified based on the risk map classes. Accordingly, field surveys were conducted in these priority zones of the two fire-shedded areas. A total of 100 participants were selected using a purposive-snowball sampling method while including representatives from local authorities and local community groups. The data was collected through direct interviews using the KOBO application (KOBO, 2020). The questions in the survey aimed to identify the respondent viewpoint on different aspects of fire risk such as causes/origin, damages, responsibilities and cost. The first set of questions aimed at evaluating exposure to fire events. The second set of questions revolved around forestry activity types and associated threats. The third set of questions were designed to recognize stakeholder's engagement towards managing risk. As for responsibilities, the fourth set of questions intended to assess people's judgment on who bears responsibility as well as costs.

4. Results and discussion

4.1. Exposure to fire events

Questions in this category tackled the perceived damage extent of forest fires and respondents' familiarity with the inherent threats and likelihood of fire occurrence.

The majority of respondents (88%) have witnessed at least one fire during the past ten years, and most of them witnessed a number of fire events varying between 1 and 10 fire events (Figure 3).

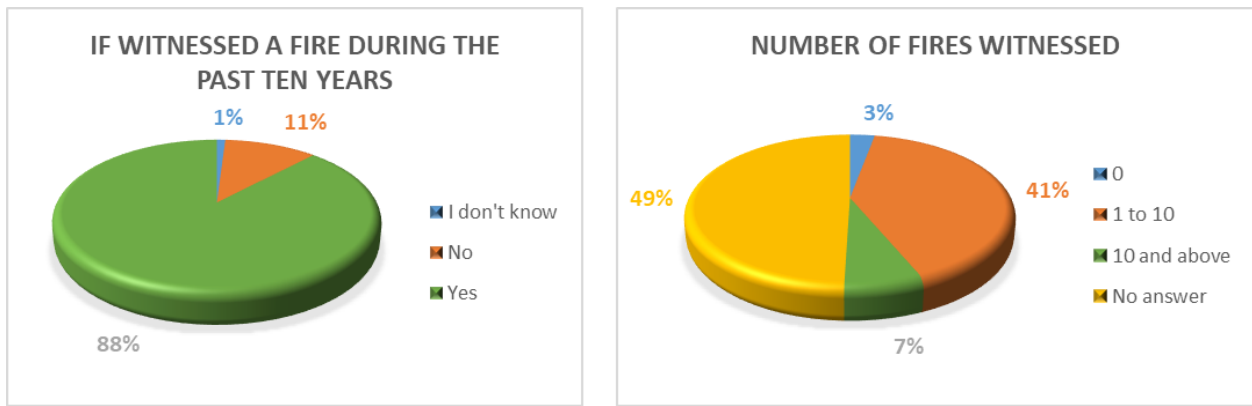


Figure 3. Numbers of fires witnessed by respondents

As for the likelihood of fire occurrence, the respondents' risk perception was very low. Only 10% of respondents indicated a high probability (Figure 4) even though the study was carried out in high-risk zones. This implied a relatively low awareness about fire risk.

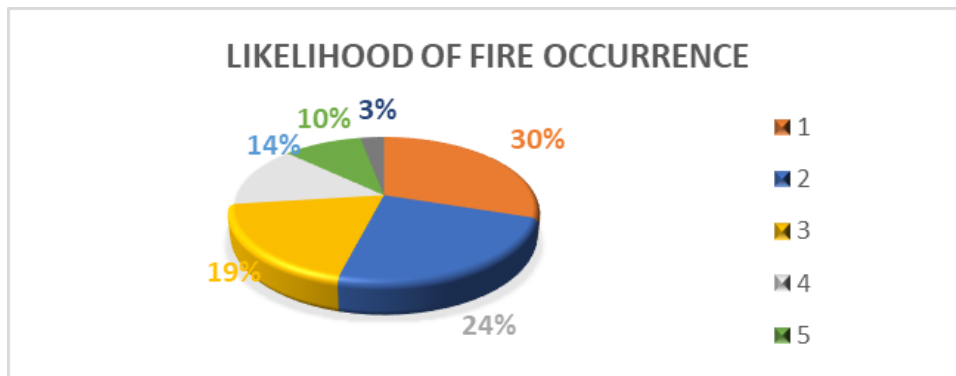


Figure 4. Likelihood of fire occurrence (1 - Not likely - 2 Unlikely - 3 - Neutral - 4 - Likely - 5 - Very likely)

4.2. Types of forest activities

The set of questions in this category revolved around the knowledge of respondents about forest activities usually undertaken to reduce fire risk and familiarity with related threats. To assess the awareness of the respondents about the main forest activities undertaken in their villages, the below matrix was produced crossing mostly identified activities with the type of land ownership. Most of the respondents linked forest activities to private lands (33%).

Table 1. The main forest activities and the type of land ownerships

Activities/Ownership	Mashaa	Government	Private	Waqf
Collection of wood or charcoal making	32	33	37	12
Charcoal making	33	34	38	12
Collection of non-wood forest products	41	42	52	14
Grazing	38	40	39	9
Tourism	38	31	39	9
Hunting	39	40	48	11
Religious ceremonies	16	15	18	9
Conservation/Preservation	34	33	32	10
Beekeeping	41	41	42	9

4.3. Engagement towards managing risk

Respondents were asked to identify measures taken in their villages to reduce fire risk. These mostly included equipping civil defense stations, increasing water sources, increasing firefighters' number, and organizing awareness activities as well as introducing forest management and other fire prevention measures such as roadsides cleaning, firebreaks, and trail opening, among others. Around 29% of the respondents were informed

about activities which were undertaken within their villages to reduce fire risk, while 71% did not refer to any activity of fire prevention (Figure 5). Nevertheless, when asked about their opinion to prioritize specific prevention activities, “awareness raising” came first with 33 answers, “equipping civil defense” followed with 28 answers (Figure 6). Whereas “forest management” came third, therefore entailing the need of creating more awareness about the importance of implementing forest management plans for reducing fire risk.

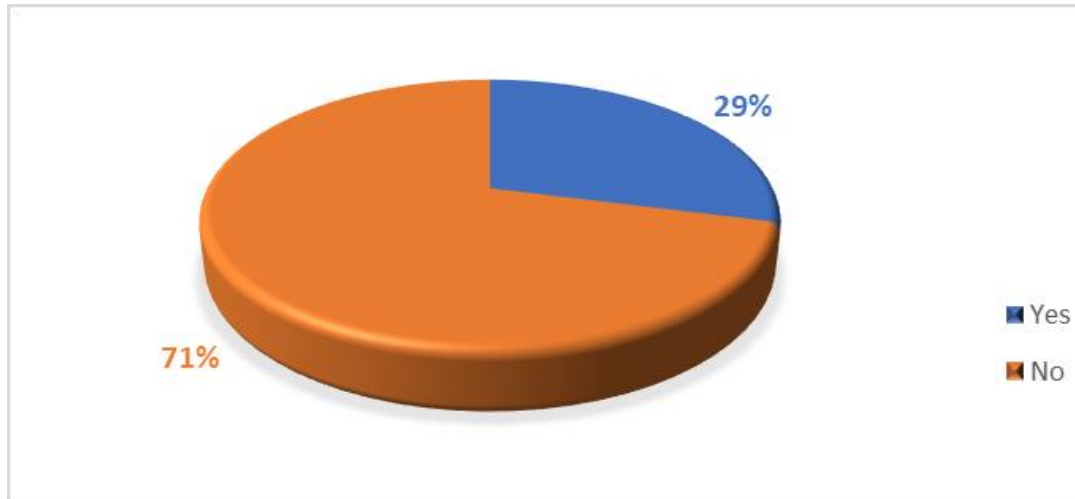


Figure 5. Feedback about fire prevention measures conducted in the respondents' villages

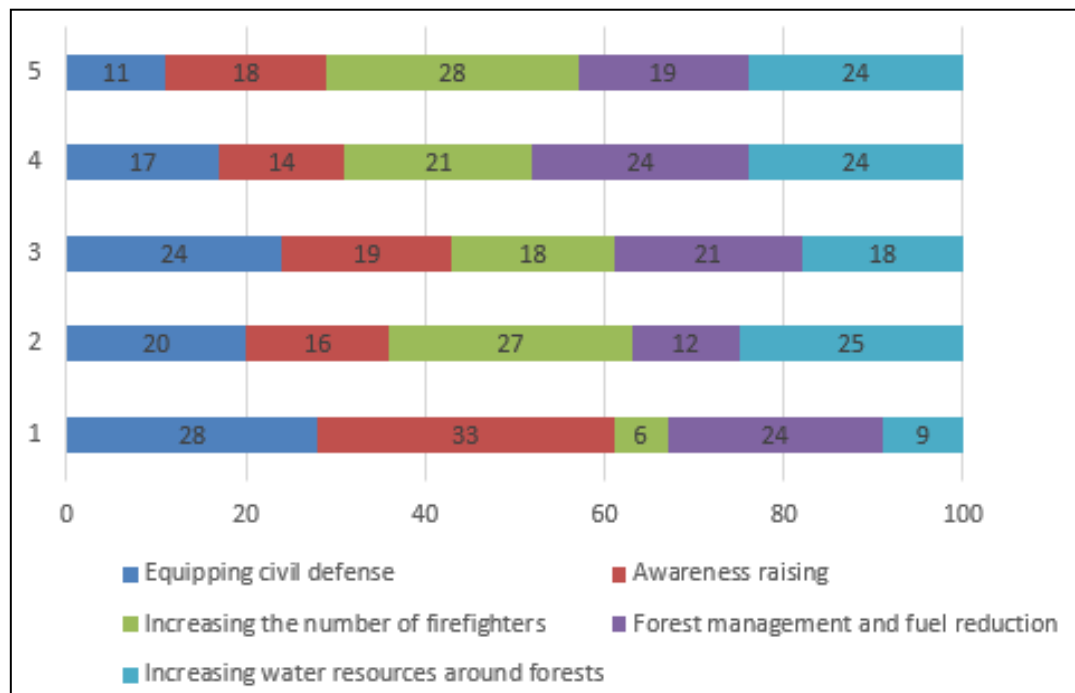


Figure 6. Rank of priorities of fire prevention activities

4.4. Responsibilities and cost

The last set of questions addressed public understanding of responsible bodies for 1) the main damages caused by fire and 2) the main fire-fighting operations. Also, it included inquiries for cost estimation of fire-fighting operations. When asked to estimate a cost of 1-day of fire-fighting in a potential fire incident occurring in their village, 33 % of the respondents were unaware of incurred costs (Table 2). The majority of respondents expressed that local municipalities and civil defense centers were in charge incurred costs.

Table 2. Cost estimation of 1-day of fire-fighting

Cost range	Percentage of answers
Between \$2,500 and \$5,000	12%
Between \$5,000 and \$10,000	9%
Between \$500 and \$2,500	22%
I don't know	33%
Less than \$500	9%
More than \$10,000	15%
	100%

As for post-fire direct and indirect impacts, responsibilities were mostly misperceived. The respondents did not grasp that such fire incidents were mostly attributed to human impact on nature in addition to environmental changes. Stakeholders and future fire managers could benefit from knowledge about how current actions and choices may influence future events and beliefs instead of focusing on a single solution at a time (McCafrey, 2013).

5. Conclusions

Understanding key characteristics of the complex social dynamics behind forest fire incidents could greatly facilitate fire management, decrease future risks and dangers, and benefit the ecology of forests. In this study, there seems to be a lack of awareness around the rising issues of climate change and increasing fire risks; nonetheless, the respondents clearly exhibited the willingness to learn more about risks associated with their current activities and choices and how to reduce economic and environmental costs. Most of the recommendations included advocating for increase of awareness about fire risks and safety, induction of training about firefighting, and creation of networks to facilitate communication among the stakeholders. Future studies will target more respondents from different socio-economic backgrounds and different sectors.

6. References

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