

# Assessment of Forest Fire Management in Jebel Marra

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## Abstract

A study was conducted in Jebel Marra, which is one of the places in Sudan richest in biodiversity and of high scenic value. Natural forests and plantations are embedded in a high fire-prone environment.

The overall objective of the study was to identify and recommend measures leading to minimize the adverse impacts of wildfire on the environment of Jebel Marra, through the identification of wildfire causes, determination of the period of fire season in different forest districts, assessment of the existing fire management practices and provision of recommendations on how to improve fire management practices.

In addition secondary data such as reports, records and former studies were collected and reviewed. A questionnaire was prepared to collect primary data from village leaders, teachers, farmers, livestock holders, district managers, overseers, forest guards and labourers. Also a group discussion was held in each of Golol, Boldong and Murtagello to clarify some points and to reach a kind of agreement in other points.

The study concluded that although Jebel Marra is a fire-prone area and subjected annually to severe wildfires – with an increasing trend -, yet a written and approved fire management plan does not exist and the work of wildfire control is not well organized.

The establishment of *Cupressus lusitanica* plantations in this highly fire-prone environment and under the existing fire management practices involves a high risk of failure and loss of investments.

The study recommended to develop an Integrated Fire Management Plan with emphasis on the participation of local people. It also recommended provision of training for forestry staff and local people on wildfire management activities and supplying them with the needed tools to enable them to perform their work safely and easily. It also emphasized the important role of extension in eliminating or reducing occurrence of wildfires and the necessity of attracting participation of the local people in fire fighting.

## 1. Introduction

There is limited awareness in Sudan on problem of wildland fires and very limited actions are taken to prevent and suppress fires. The situation in the country is briefly described by Stauber (1995) as follows: "Responsibility for fire suppression has been clearly assigned to the Forests National Corporation (FNC) for Forest Reserves. Fires set by farmers or nomads are unchallenged in most of the natural rangelands of Sudan. The rangeland seems to be everyone's property and therefore no one's responsibility. The Range and Pasture Administration (RPA) is only able to build a limited number of firebreaks. The most difficult fire problems facing FNC forests occur in Jebel Marra. The steep terrain and valuable forest combine to present a challenge to the local foresters and the villagers. Fortunately, or as a

result of the problems, this location has the most active and experienced fire suppression personnel."

As a consequence of this situation a research project was initiated to explore the causes of fire, the fire environment and the possible solutions to reduce the negative effects of wildfires.

## 2. Research Methods

The overall objective of the study was to identify and recommend measures leading to minimize the adverse impacts of wildfire on the environment of Jebel Marra, through the identification of wildfire causes, determination of the period of fire season in different forest districts, assessment of the existing fire management practices and provision of recommendations on how to improve fire management practices.

Several meetings with forestry officials were held and the former reports, records, workshops and studies were reviewed. A questionnaire was prepared for data collection and 72 respondents were interviewed. The target groups were Local village leaders, teachers, farmers and herders, foresters (district managers, overseers, forest guards and labourers). SPSS software was used to analyse the collected data. The frequencies and percentage of the values of each variable is calculated. The variable Chi-square test is performed to check whether the differences of its values were significant or not. Crosstabs between pair of some variables were performed to study the relationship between them.

## 3. Results and Discussion

### 3.1 Frequency of Forest Fires

The results of investigating the frequency of the wildfire occurrence are presented in the following Table 1.

**Table 1.** Respondents' estimate of the number of years between occurrence of large-scale fires.

<b>Fire Occur in Large Scale Each:</b>	<b>Respondents Percent</b>
Year	66.7
2 Years	27.8
3 Years	5.5

The reason that 66.7% of the respondents said fire occurs in large scale each year may be attributed to frequent fires incidences. This result is reasonable and acceptable since the plantations are situated in midst of highly fire-prone environment and the natural vegetation of the area is largely characterised by open tree savannah and grasslands as observed by the writer and stated by Goldammer (1991).

### 3.2 Trend of Fire Occurrence

According to the trend of fire occurrence 83.3% of respondents said fire severity is increasing each year. This may be attributed to the increasing tribal conflicts in the area, which play one of the major causes of wildfires.

### 3.3 Wildfire Statistics

Non-existence of standard records keeping system for wildfire information was observed during records and reports reviewing. Stauber (1995) stated that fire statistics are nonexistent. Significant fires may be documented in narrative reports.

### 3.4 The Season of Fire Occurrence

According to the group discussions beginning of the fire season is determined in different localities of Jebel Marra as shown in Table 2. These differences are attributed to the variation in the altitude of each locality and hence the rate of the fuel drying.

**Table 2.** Start date of the fire season for different locations

Location	Date of the Beginning of the Fire Season
<i>Thur</i>	15 <sup>th</sup> October
<i>Murtagello</i>	15 <sup>th</sup> December
<i>Golol (Badia)</i>	First of February
<i>Boldong Forest</i>	First of February

Also the discussion revealed that fire season ends after the start of the rainy season around mid of June.

### 3.5 Months of Most Fire Hazard

March, April and May are the months of high fire hazard as stated by 52% of the respondents. This result may be attributed to the dryness of the grasses in almost all parts of Jebel Marra within March, April and May. Within these months May is the most fire hazardous period because the farmers start burning to clean their agricultural land.

With increasing tribal conflicts in the last years and the farmers burn their fields immediately after harvesting to keep nomads away from their villages in order to avoid any conflict with them, this increases fires incidence during January, February and March.

### 3.6 Causes of Wildfire

#### 3.6.1 Results of the Enquiry

The results of investigating fire causes are presented in Table 3.

**Table 3.** The different type of fire causes and their percentage of causing fire in Jebel Marra.

<b>Fire Cause</b>	<b>Percent</b>
Honey collection	24%
Cleaning of agricultural land	23%
Tribal conflict between farmers and nomads	22%
Live stock holders	11%
Poachers	10%
Smokers	4%
Arson	3%
Others	3%

All fires in the area are human-made and no evidence of natural fire ignition.

Honey collection, cleaning of the agricultural land and tribal conflicts are the common causes of the fire in Jebel Marra.

### **3.6.2 Underlying Causes and Example of Prevention Measures**

Protective cloths and artificial cells (boxes) for bees breeding were introduced to the local people in order to help them to collect honey without causing fires. Unfortunately the local people did not adopt this type of cells although many of them are convinced that the new method is more productive and easy to handle than the traditional method. This may be due to the following reasons:

- There is no source in the area for supplying the local people with the boxes and the protective clothes.
- The price of the boxes and the protective clothes, when available, were not suitable for the poor people.
- The boxes are easily stolen.
- The new method is not well disseminated in the area and many people are still not recognizing it.

Fire caused by cleaning of the agricultural land can be largely reduced if the following measures are followed:

- Burn at night or early morning because these periods are characterized by minimum wind speed and maximum relative humidity.
- Collect slashes into heaps and burn them separately.
- Clean firelines around the agricultural lands specially if it was fallow.
- Burn the neighbouring lands at the same day.
- Inform the forest authorities and the local leaders with the day and time of burning, so that fire fighters with their equipments to be ready in case fire becomes out of control.

The tribal conflict increased during the last decade and especially during the last three years. The farmers usually burn the grasses to keep the nomads away from their fields in order to avoid the destruction of their crops. The conflict now evolved into politically complicated situation rather than land use problem.

Poachers are usually camping inside the forest and they are responsible for causing several fires. In Boldong when the natural forest around the plantation was burned then the larger Kudu existing in the area collected inside the plantation for more than one week because no range was available outside the plantation. During this critical period till the grasses and bushes in the natural forest sprout again, the poachers increase their activities to hunt the maximum number.

The arsonist actions are suspected to be in Badia, because there is a land use problem between the FNC and the local people. Badia is very rich in high quality grass production, which attracts many people for work in grass collection and trade. The collected grass is processed into mats (Shargania) and transported to Nyala to be used in house construction. Each time FNC attempted to establish a conifer plantation in Badia, the newly established plantation was burned. Maybe these fires were intentionally ignited because the local people have the feeling that the establishment of the plantation will prohibit them from utilizing the grasses.

Livestock holders set fires to encourage the growth of new fleshy grasses and also to control diseases and ticks.

By the sides of the asphalt road passing through the area, the passengers usually cause fires by throwing cigarettes. Also some old model lorries, due to some mechanical defect, often produce sparks which often cause fires alongside the roads.

### **3.7 Investigation of the Current Fire Management Activities**

There is no written fire management plan, but there are some activities undertaken each year to control fire such as cleaning firelines, patrolling and backfiring.

#### **3.7.1 Fire Detection and Initial Attack**

The radio communication network that covers the area may explain the reason that 69.4% of the respondents said that fires are detected early.

In each of the four forest districts there is a radio in the office and about three to four mobile radios for the patrolling forest guards. Unfortunately in the recent years the radio system coverage shrank due to defect of some units. For example the units of Murtagello and Boldong offices are not working and the majority of mobile radios are no longer functioning, e.g. due to exhausted batteries.

According to 80.6% of the respondents the time lag between fire detection and initial fire suppression is rather long. This may be attributed to the absence of a fire management plan and the fact that people are not organized into groups to perform prescribed actions when wildfire occurs. The following points also can be considered:

- Usually there are no ready vehicles or lorries to transport the fire fighters.
- There is not enough accessible road networks and easy walk areas.

#### **3.7.2 Fire Prevention**

According to the records there was no extension program held in order to reduce or eliminate fire incidence through educating the people and raising their awareness about wildfire prevention.

There was only one lookout tower installed in Badia. However, this tower may not last for a long period because of improper construction.

The patrolling exists with only few forest guards and it is confined to certain areas and at daytime only.

Among the acts and activities prohibited in a reserved area under S. 15(1) of the Forest Act of 1989 is the kindling, keeping, carrying or causing of fires.

The Forest Act of 1989 obliges the people to provide reasonable help in fire fighting. If these laws and regulations were adhered to properly, fire prevention would have improved reasonably.

### **3.7.3 Cleaning of Firelines**

Cleaning of firelines is a difficult operation as 80.6% of the respondents mentioned. The reason may be attributed to the rough terrain; tall grasses, large piecework and long distance which they need to walk till they reach the place of the work.

There is full agreement among the respondents that money paid for firelines cleaning is less than the amount of the work done, which may be attributed to the low man-day paid by FNC compared with others government units and also to the general low salaries of the government.

The wages for firelines cleaning is usually delayed, which may indicate that there is lack of money in Jebel Marra Forests Circle (JMFC) during the period of firelines cleaning which usually start in October each year. The extraction of sawn timber is usually stopped during the rainy season and consequently the revenues of JMFC are reduced during this period and they are usually supported by FNC headquarters to enable them to run urgent activities such as firelines cleaning, but sometimes this support dose not reach in time.

The work on firelines cleaning sometimes ends late after fire season start.

Such delay may be attributed to the late in receiving of the budget from FNC headquarters and consequently the delay in starting the work of firelines cleaning.

Firelines are effective in fire control and the local people have successful experience in using firelines to set backfires to stop wildfires.

### **3.7.4 Fire Suppression**

More than 85% of the respondents mentioned that the equipments and tools used are not effective enough to perform the work properly. This may be attributed to the reason that they only use the branches of the trees as swatters, spades to throw soil, limited number of backpack water pumps and unavailability of fire engines to help in case of high-intensity fires. The equipments they are using can help in controlling moderate surface fires, but are not helping in controlling intensive surface or crown fires.

Smelling of pesticide from some backpack water pumps is evidence that these pumps have been used to spray pesticides. If improperly handled this is considered a threat to the health of people.

### **3.7.5 Participation of Local People in Fire Fighting**

The local people are participating in fire fighting, but only this mentioned by 50% of the respondents. This may be explained by the shortage in fire fighters sometimes.

The participation of the local people is decreasing each year, this may be attributed to the following reasons:

- There are no extension services to make the people aware of the negative impacts of the fire to their environment.
- There is no incentive to encourage the local people to participate in fire fighting.
- The shortage of drinking water and food during fire fighting, which may take several days in some cases.
- The problem of insecurity discourages the local people to participate in fire fighting, especially at night.
- The local people lack training and tools necessary to perform the job of fire fighting safely and easily.

### **3.8 Socio-economic Impacts of Fire**

In the group discussions the participants mentioned the following negative impacts:

- Loss of job opportunities that would have been available if the forests were not burnt
- Missing chance of timber trading obtained prior to forest burning
- Reduction in food due to the reduction in some edible trees fruit, e.g., *Cordia africana*
- Destruction of the private forests
- Destruction of houses and other properties
- Burning of grasses available for animals fodder, huts construction and trading
- Destruction of available firewood
- Death or injuries of fire fighters
- Reduction in the amount of the summer water available from springs.

### **3.9 Ecological Impacts of Fires**

In the group discussion the participants also mentioned the following negative ecological impacts:

- Soil erosion due to burning of the grasses, debris and humus.
- Changing species composition of the forest toward the fire resistant species, for example *Ziziphus spina christi* and *Acacia seyal*. Note: Goldammer (1991) stated "A fire-free environment will provide niches for species (both flora and fauna) sensitive to a fire environment".
- Disturbance of wildlife habitats.

#### 4. Recommendations

- Provide training to the FNC staff and the local people on the basic tactics of wildfire control.
- Preparation of a written fire management plan that suits the situation of Jebel Marra and contains the following plans:
  - Fire detection plan
  - Fire prevention plan
  - Pre-suppression plan
  - Suppression plan
- Integrate the role of the local people participation into the fire management plan. They are the main wildfire cause and at the same time they are the fire fighters.
- FNC should prepare the budget of firelines cleaning before the beginning of October each year in order to finish the work early before the grasses become fully dried. This would give a chance to implement early burning (prescribed burning) to safely reduce the amount of the fuel.
- The money paid for the firelines cleaning piecework should be reasonable enough to attract labourers for work.
- Cleaning the internal firelines of the *Cupressus* plantations and separate their extensions with strips of less inflammable trees to work as fuel breaks.
- At 10 m by the sides of the roads and firelines, the *Cupressus* trees should be pruned and widely spaced to remove ladder fuel and stop crown fires that could occur.
- Studying the possibility of integrating the production of some agricultural crops on the firelines in order to solve the problem of their cleaning, i.e. planting firelines with potato which need soil turning to be harvested and at the same time this operation clean the fireline.
- Dissemination of the new method of honey production (boxes) and the protective cloths to reduce or eliminate wildfires that occur due to honey collection with traditional methods.
- Organizing the processes of agricultural land cleaning and involve the local leaders in this matter.
- Tribal conflicts should be solved through obvious laws that organize the activities of the farmers and the nomads.
- Process of road construction should continue to facilitate quick access in case of wildfire occurrence and also to allow the local lorries entering the *Cupressus* plantations to collect the remaining of the thinning otherwise it will remain inside the forest and cause fire hazard.
- At least 20 of backpack water pumps should be in each forest district and some strong people trained to use them effectively.
- Develop recording system to keep statistics of wildfire occurrence and causes in order to help in future planning.
- Install meteorological station in each forest district to help in predicting the situation of the fire hazard.
- Forestry camps and specially Toge camp should not be left as deserted sites because in case of wildfire, this would enable the nearest fire fighters to come from the camp and render quick aggressive initial fire attack.



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