

# **FIRE MANAGEMENT PLAN DERAMAKOT FOREST RESERVE**

Prepared by:  
Henry Solibun  
Peter Lagan

November, 1998

## **TABLE OF CONTENTS**

<b>Definitions</b> .....	<b>1</b>
<b>1. INTRODUCTION</b> .....	<b>2</b>
<b>2. OBJECTIVE</b> .....	<b>2</b>
<b>3. FIRE MANAGEMENT ZONES</b> .....	<b>2</b>
<b>4. FIRE PREPAREDNESS</b> .....	<b>3</b>
4.1 Fire Weather .....	3
4.2 Fire Danger Rating (Drought Indices).....	3
4.3 Prevention.....	3
4.4 Detection.....	4
4.4.1 Ground Patrols .....	4
4.5 Fire Fighting Equipment .....	4
4.6 Fire Crews - Fast Initial Attack .....	6
4.7 Training.....	6
<b>5. FIRE MANAGEMENT ORGANISATION</b> .....	<b>8</b>
5.1 Back up Unit .....	8
5.2 Centre of Operation .....	8
5.3 Preparedness .....	8
5.3.1 Monitor Daily Fire Danger.....	8
5.3.2 Activate Daily Preparedness Level .....	9
5.3.3 Activate Daily Prevention Level .....	9
<b>APPENDIX 1 - Recording Practices and Fire Danger Rating Calculations</b> .....	<b>10</b>
Recording Practices and Time of Observation .....	10
Temperature and Relative Humidity.....	10
Rainfall .....	10
Fire Danger Rating Calculation .....	11
When to start .....	12
<b>APPENDIX 2 - Fire Prevention and Control Forms</b> .....	<b>13</b>
Fire Weather Data Form .....	14
Evapo-transpiration Table.....	15
Keetch-Byram Drought Index Calculation Sheet.....	16
Initial Fire Report Form .....	17
Calculation of Fire Danger Rating based on the Keetch Byram Drought Index (KBDI) using Excel .....	18
<b>APPENDIX 3 FIRE MANAGEMENT MAP</b> .....	<b>21</b>
<b>APPENDIX 4 PREVENTION PLAN</b> .....	<b>22</b>
<b>APPENDIX 5 PREPAREDNESS PLAN</b> .....	<b>23</b>

## **Definitions**

*Fire Management Plan* - A systematic, technological, and administrative management process of determining the organisation, facilities, resources, and procedures required to protect people, property, and forest from fire.

*Fire Prevention* - Activities directed at reducing fire occurrence; includes public education, law enforcement, personal contact, and reduction of fire hazards and risk.

*Fire Suppression* - All activities concerned with controlling and extinguishing a fire following its detection.

*Initial Attack* - The action taken to halt the spread of potential spread of a fire by the first fire suppression resources to arrive at the fire.

**1. INTRODUCTION**

The degree to which areas of Deramakot Forest Reserve (DFR) are prone to fire depends on three major factors. The first factor is the source of fire. Humans are the major source of ignition and virtually all fires in Sabah are caused by human activities like hunting and slash-cure-burn method of land clearing for agriculture. Accidental fire escaping from land clearing activity and fire started by hunters are expected from villages and agricultural settlements adjacent to DFR. These are notable in the south along the Kinabatangan River and the north of DFR (refer attached map-**Appendix 3**). The second factor is the type of vegetation whilst the last factor is the fire weather conditions. This is namely the amount of precipitation, both annually and prior to fire season that will dictate whether or not fires will become a significant threat. Fires will be a threat if the vegetation is prone to fire and ignite easily.

As with the Forest Management Plan, the Forest Fire Management Plan is also subjected to revision in the five-year planning process.

**2. OBJECTIVE**

The objective of this fire management plan is to ensure that FMU 19A, commonly referred to as Deramakot Forest Reserve is prepared in the event of high fire danger.

**3. FIRE MANAGEMENT ZONES**

Fire management requires knowledge of the topography, existing vegetation structure, fuel loads, current atmospheric conditions, location of existing fire breaks, access and water bodies. Pre-conditioning these areas for fire allows for a greater degree of control.

DFR, which is part of FMU 19, is divided into 3 fire management zones (**refer map Appendix 3**) based upon the following:

- aspect/slope
- defensible boundaries (rivers, logging roads, ridges)
- fire suppression capabilities
- accessibility
- values at risk

A description of each fire management zone is given below.

ZONE 1	ZONE 2	ZONE 3
<ul style="list-style-type: none"> <li><input type="checkbox"/> Flat to undulating</li> <li><input type="checkbox"/> Water available during long drought</li> <li><input type="checkbox"/> Poor forest and rehabilitation compartments</li> <li><input type="checkbox"/> Road network extensive, good accessibility</li> <li><input type="checkbox"/> Adjacent to oil palm plantation in the north</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Infrastructure, base camp and main road 1 &amp; 2</li> <li><input type="checkbox"/> At present, main road one (1) only way in and out of Deramakot FR</li> <li><input type="checkbox"/> Good forest</li> <li><input type="checkbox"/> Few permanent water bodies</li> <li><input type="checkbox"/> Undulating terrain</li> <li><input type="checkbox"/> Concentration of harvesting and silviculture activities</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Extensively burnt in 1982</li> <li><input type="checkbox"/> 360 ha burnt in 1997 (Compartments 125, 126 and 128)</li> <li><input type="checkbox"/> Steep terrain</li> <li><input type="checkbox"/> Poor forest</li> <li><input type="checkbox"/> No permanent water bodies except the Kinabatangan river</li> <li><input type="checkbox"/> Settlements located on the fringes of the southern part of Deramakot FR making it a fire prone area</li> <li><input type="checkbox"/> Inaccessible in most parts</li> </ul>

## 4. FIRE PREPAREDNESS

Fire preparedness is the ability of an organisation to respond to fire situations successfully. It comprises activities which improve the state of readiness. These are:

### 4.1 Fire Weather

A critical component in making fire control decisions is knowledge of the drought and weather conditions. Important weather elements are:

- temperature
- rainfall

The instruments required to measure and record weather data needed for fire danger rating and which are employed in DFR are:

- thermometer
- rain gauge

### 4.2 Fire Danger Rating (Drought Indices)

Fire danger rating is a general term used to express an assessment of both fixed and variable factors of the fire environment that determine the ease of ignition, rate of spread, difficulty of control and, fire impact.

Fire danger rating systems is used to interpret weather data. Drought indices that have been developed and applied for fire danger rating include:

Keetch-Byram Drought Index (KBDI)	USA
Mount's Soil Dryness Index	Tasmania, Australia
Canadian Drought Code	Ontario, Canada
Palmer Drought Index	USA

It is recommended that the KBDI be employed for fire danger rating in DFR. Besides providing information on drought index, it can also be applied to support other forestry operations such as road building, harvesting and planting.

The KBDI should be calculated and evaluated daily at 3 p.m. (1500 hrs) for the purposes of fire danger rating and these are governed by the following weather parameters:

- dry-bulb temperature
- precipitation

Details on weather observing practices and manual calculations are contained in **Appendix 1** and calculation using EXCEL in **Appendix 2**

### 4.3 Prevention

Forest fire prevention embraces a wide range of measures to be undertaken. Among others, modifying the fuels around or within the forest reserve by constructing fire breaks whereby all combustibles are removed and the mineral soil exposed with the objective of segregating, stopping and controlling the spread of wildfire. Therefore, all permanent logging roads and feeder roads and rivers within DFR are fire breaks in the event of a fire. The only setback to be expected is spotting (fires jumping over fire breaks) behaviour, but can be kept at bay by constant ground patrol. The others are a pro-active humanistic approach and enforcement through legislation.

The following describes some prevention measures that can be undertaken to reduce and/or prevent unwanted forest fires.

FIRE CAUSED	RESPONSIBLE GROUP	PREVENTATIVE MEASURES
land clearing through slash and burn for agriculture	<input type="checkbox"/> villagers <input type="checkbox"/> agricultural plantation owners	<input type="checkbox"/> legislation (monitor and enforce) <input type="checkbox"/> prevention programs <input type="checkbox"/> brochures and pamphlets <input type="checkbox"/> supervise burning
hunting	general public	legislation (monitor and enforce)
recreation	general public	<input type="checkbox"/> information and education <input type="checkbox"/> prevention programs <input type="checkbox"/> sign boards

#### 4.4 Detection

It is recommended that for effective forest fire detection in DFR, ground patrols should be established.

##### 4.4.1 Ground Patrols

The effectiveness of ground patrolling in detecting fires is dictated by adequate access. Therefore all permanent logging and feeder roads should be demarcated on a map and made usable at all times during fire season.

Ground patrols also provide a way to maintain rapport with villagers and plantation owners adjacent to DFR which is critical in spreading the prevention message. Ground patrolling activity should be carried out in areas with the highest probability of fires during fire season and personnel should be equipped with the following:

- Global Positioning System
- 1:50 000 Deramakot FR Fire Management Map
- initial fire report form (**Appendix 2**)
- pencils and pens
- transparent ruler
- notepad
- binoculars
- two way radio or cellular phone
- compass

#### 4.5 Fire Fighting Equipment

Equipment usable for fire fighting and currently available in DFR consist of the following:

TYPE OF HEAVY MACHINERY	QTY	CAPABILITY
Tractor/Bulldozers	5	Construction of fire breaks
Excavator	1	<input type="checkbox"/> Dig holes in ground to keep water for fire pumps <input type="checkbox"/> Construction of fire breaks
Dump Truck	3	Transportation of water and relay tanks
Back Hoe	1	<input type="checkbox"/> Dig holes in ground to keep water for fire pumps <input type="checkbox"/> Construction of fire breaks
TYPE OF LAND BOUND VEHICLE	QTY	CAPABILITY
Mini Lorry Dyna 2.9	1	Mobilising ground patrols, fire crews and transportation of water.
Toyota L/C – Pick Up	5	
Isuzu Invader – Pick Up	2	
Nissan Patrol – Pick Up	1	
Nissan Safari – Wagon	1	
Toyota Hilux – Twin Cab	3	
TYPE OF WATER BOUND VEHICLE	QTY	CAPABILITY
<i>Fibre glass</i> 30 horse-powered boat	2	Mobilising ground patrols and fire crews
<i>Fibre glass</i> 15 horse-powered boat	2	

In the event of high fire danger the following equipment is made available and fire ready.

HANDTOOLS	WATER DELIVERY SYSTEM	SAFETY	OTHERS
<input type="checkbox"/> Shovels <input type="checkbox"/> Pulaskis <input type="checkbox"/> Parangs <input type="checkbox"/> Axes <input type="checkbox"/> Hoes <input type="checkbox"/> Drip torches <input type="checkbox"/> Mcleod fire rakes or Fire swatters	<input type="checkbox"/> Water pumps <input type="checkbox"/> Handtank pumps <input type="checkbox"/> Water hoses – 1.5" x 100' (lined) – 1.5" x 100' (unlined) – 5/8" x 50' <input type="checkbox"/> 2" x 10' suction hose <input type="checkbox"/> Hose stranglers <input type="checkbox"/> Water thieves <input type="checkbox"/> Portable relay tanks <input type="checkbox"/> Pick-up truck with slip-on water tanks	<input type="checkbox"/> Goggles <input type="checkbox"/> Hard hats with ear muffs and face screen <input type="checkbox"/> First aid kit <input type="checkbox"/> Boots with fire resistant soles <input type="checkbox"/> Gloves	<input type="checkbox"/> Radios <input type="checkbox"/> Chainsaws

List all available fire equipment by location and assignment to crews or staff. Annual inventory reconciliation is required to ensure that equipment stocks are maintained.

#### 4.6 Fire Crews - Fast Initial Attack

Fire begins at a small size. The concept of "fast initial attack" is to quickly suppress any fire which starts and keep the burnt area to a minimum. This method of fire suppression minimises cost and damage. Three (3) "Fast Initial attack" crews of four (4) person have been identified in carrying out fire prevention and control in the 3 fire zones. Each crew are equipped with the following fire fighting tools.

EQUIPMENT	QUANTITY
4WD pickup truck*	1
Portable water pumps (small, 55 psi)	1
Portable water pumps (large, 160psi)	1
Shovels	2
Pulaskis	2
Parangs*	4
Hoes	2
Handtank pumps	1
Drip torches	1
Water hoses <ul style="list-style-type: none"> <li>❑ Discharge hose (Econoflo) 5/8" X 50'</li> <li>❑ Discharge hose (lined) 1.5" X 100'</li> <li>❑ Discharge hose (unlined) 1.5" X 100'</li> <li>❑ Suction hose (1 large and 1 small)</li> </ul>	10 rolls 2 rolls 5 rolls 1 units
Toolbox	1
Mini First Aid Kit*	4 units
Chainsaw (Stihl 038)*	1
Protection Gear <ul style="list-style-type: none"> <li>❑ Hard hats with ear muff and face screen</li> <li>❑ Leather gloves</li> <li>❑ Leather boots with fire resistant sole</li> <li>❑ Goggles</li> </ul>	} 4 sets
Portable Radio (Motorola Handie Talkie)	1 unit

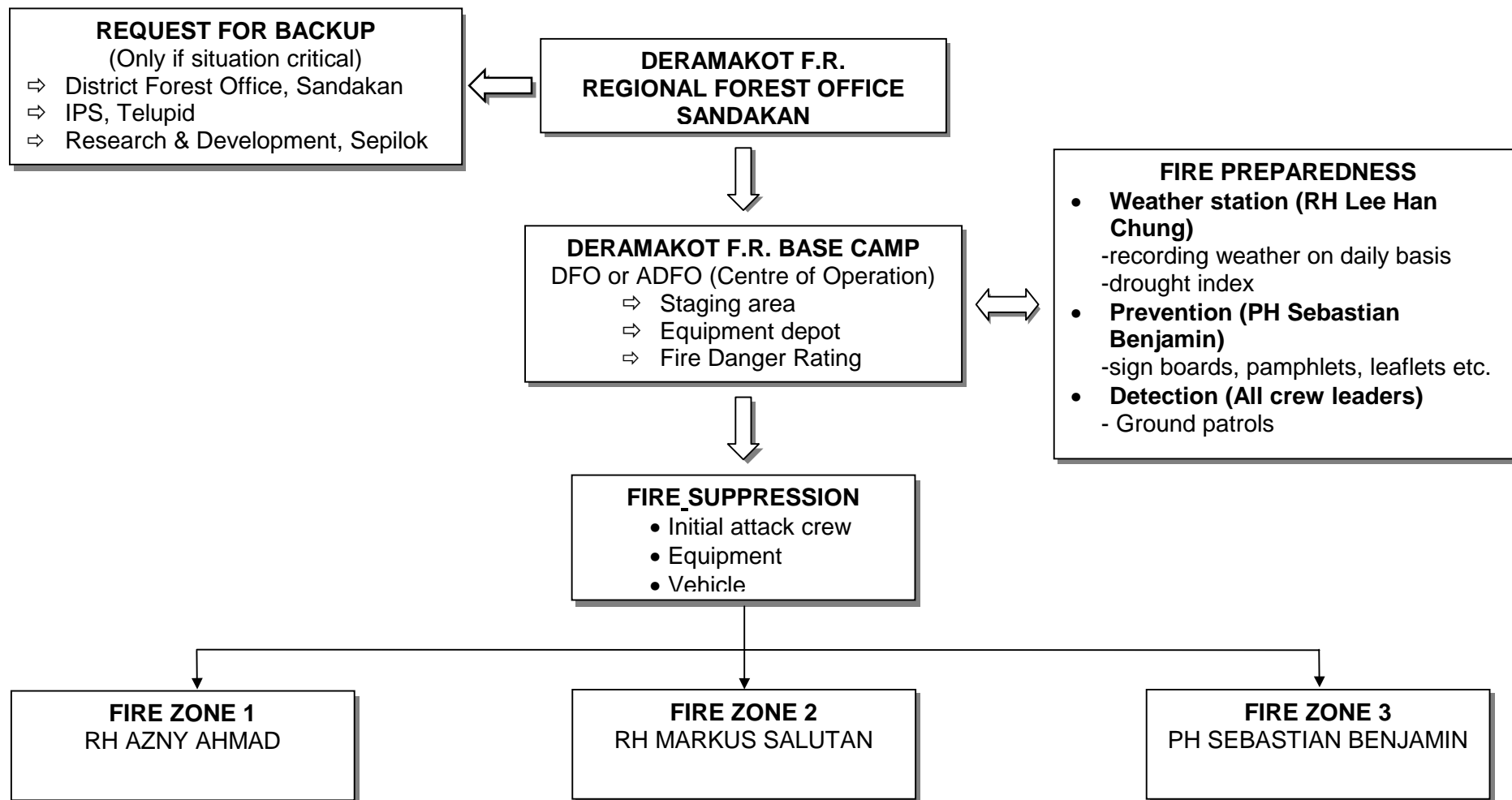
#### 4.7 Training

Fire training should encompass Fire Prevention and Fire Control. Listed below are the recommended training and is performed once a year or before an impending drought.

- ❑ safety and first aid
- ❑ fire suppression tactics
- ❑ fire guard construction
- ❑ burning off
- ❑ mop-up
- ❑ usage of handtools and maintenance
- ❑ manning portable water pumps
- ❑ water delivery systems and layout of water hoses
- ❑ communication with radios
- ❑ fire weather and fire behaviour
- ❑ fireline organisation
- ❑ fire assessment
- ❑ fire caused investigation

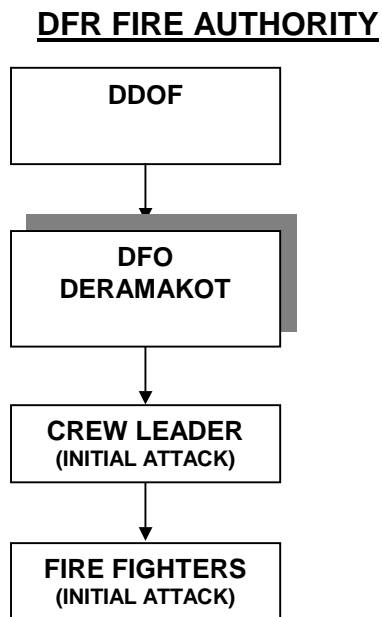


**FOREST FIRE ORGANISATION CHART  
DERAMAKOT FOREST RESERVE**



## 5. FIRE MANAGEMENT ORGANISATION

Fire control and prevention is essentially an emergency response function. It is essential that the management structure for a fire organisation in DFR be as direct and action oriented as possible.



**DDOF:** Deputy Director of Forestry (Operations)  
**DFO:** District Forest Officer

A fire boss or the District Forest Officer (DFO) of DFR has a mandate to act in anticipation of fire problems as well as to coordinate all fire control resources at his disposal within his jurisdiction. The DFO in consultation with the DDOF sets fire control priorities in DFR and controls the strategic deployment of fire control resources. Regardless of the fire size and complexity, lines of authority remain the same. The organisation must be flexible in order to cope with changing requirements of any forest fire.

### 5.1 Back up Unit

Back up units are additional fire fighting crews mobilised from other Forest Districts not affected by fire, if the fire situation in DFR gets out of hand.

### 5.2 Centre of Operation

The base camp at DFR is the centre of operation where supervisory and strategical planning work to combat forest fire is conducted. The office is responsible for monitoring the weather station required for fire danger rating.

### 5.3 Preparedness

#### 5.3.1 Monitor Daily Fire Danger

The drought levels in DFR must be monitored on a daily basis in the event of an impending drought at the base camp that operates the weather station. (Refer **Appendix 2** Calculation of Fire Danger Rating based on the Keetch Byram Drought Index (KBDI) using Excel)

### 5.3.2 Activate Daily Preparedness Level

Based on the daily danger level, the following preparedness levels should be activated. (Refer **Appendix 4**)

### 5.3.3 Activate Daily Prevention Level

Based on the daily danger level, the following prevention levels should be activated. (Refer **Appendix 5**)

## APPENDIX 1 - Recording Practices and Fire Danger Rating Calculations

### Recording Practices and Time of Observation

Whenever possible, observations should be recorded directly on the permanent record form (**Appendix 2**) so that copying errors are reduced to a minimum. Failing this, entries should be made into a proper field notebook, which can be referred to in case of questionable values. Original observation records should be initialed by the observer. Measurements must be taken at exactly 3 p.m. daily, and if for any reason there is a departure of more than 15 minutes from the regular observation this, this should be noted.

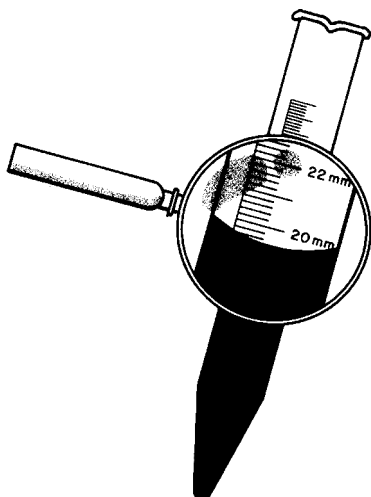
The preliminary fire danger system that has been established for Sabah requires that weather observations are taken in the afternoon at exactly 3pm (15:00 hr.). These observations should be indicative of the peak fire danger period during the day, and daily forecasts of maximum temperature, minimum relative humidity and maximum wind-speed can be applied directly to forecast fire danger.

### Temperature and Relative Humidity

Temperature (or dry-bulb temperature) principally affect the rate at which fine fuels dry after rain, and their equilibrium moisture content. Maximum temperature is one of the two parameters required to calculate the Keetch-Byram Drought Index. In Sabah, temperatures vary throughout the day and generally peak in the afternoon at approximately 3pm (15:00 hrs.). The daily maximum temperature can be obtained using a max/min thermometer, or it can be approximated by the temperature at 3 pm.

### Rainfall

Rainfall is measured in the open but its effects are related to fuel moisture within forest stands. Rain can be measured using a small, portable rain gauge. The rain gauge graduate is read to at least the nearest 0.2 mm, at the lowest part of the water's curved surface (meniscus).



Rain is the only way to reduce the drought index; the 24-hour rainfall total measured at 3 p.m. (15:00 hr.) must be in excess of 0.50 cm (0.20 inches) before a reduction in the drought code is incurred. The effectiveness of any given rainfall in reducing the drought index varies with the amount of rainfall, and the value of the index before the rain started. These variations are built into the system to reflect what is known about rainfall interception and rate of absorption.

In Sabah, the distribution of showers and rainfall can vary considerably across the landscape, and local showers are common. Hence rain may be recorded at a weather station site, but care must be taken not to assume that conditions are uniform and can be inferred over an extensive area. Fire Control officers should confer with local residents and field staff to determine how many days it has been since the area last received rain.

## Fire Danger Rating Calculation

The Keetch-Byram Drought Index (KBDI) is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture drying in deep forest litter, heavy fuel (logs), living vegetation and the upper soil layers (Keetch and Byram, 1968).

The following example illustrates daily calculation procedures:

- Obtain the maximum temperature and 24 hr total rainfall (mm) for the day:
- Yesterday's KBDI (Drought Index) 56
- Today's Maximum Temperature 34 °C
- 24 hr. Rainfall Measured at 3 pm 7 mm

Note that the daily maximum temperature can be estimated using the dry bulb temperature at 3pm (15:00), and forecast precipitation and maximum temperature values can be applied to forecast the Drought Index.

Yesterday's Drought Index is first corrected for rainfall. Only rain in excess of 5 mm is applied to correct Yesterday's Drought Index for rain:

$56 - (7 - 5) = 54$  **Yesterday's Drought Index Corrected for Rain**

An evaporation or Drying Factor is then obtained using the evapotranspiration table (**Appendix 2**) based on today's forecast or actual maximum temperature and yesterday's Drought Index or that corrected for rain:

34 °C **Maximum Temperature**

54 **Yesterday's Drought Index Corrected for Rain**

<b>Evapo-transpiration Table</b> (Annual Rainfall 1501 mm or more)															
Maximum Temp. (°C) or Temp. at 3pm)	Drought Index Yesterday (or as reduced by rainfall)														
	0 to 12	13 to 25	26 to 36	37 to 51	52 to 63	64 to 76	77 to 89	90 to 101	102 to 114	115 to 127	128 to 139	140 to 162	163 to 178	179 to 193	194 to 200
	Evaporation Factor														
42+	20	20	20	20	19	17	15	14	12	11	9	7	4	2	1
40-41	19	18	17	16	14	13	12	11	9	8	7	5	3	2	1
39	17	16	14	14	12	11	10	9	8	7	6	4	3	2	1
37-38	14	12	12	11	11	10	9	8	7	6	5	4	3	1	1
35-36	12	11	11	10	9	8	8	7	6	5	4	3	2	1	0
34	10	10	9	8	8	7	6	6	5	4	4	3	2	1	0
32-33	9	8	8	7	7	6	6	5	4	4	3	2	2	1	0

8 **Evaporation Factor based on Evapotranspiration Table**

The **Evaporation Factor** is then added to **Yesterday's Drought Index** (as reduced by rainfall) to obtain Today's forecast or actual Drought Index:

$$54 + 8 = 62 \quad \text{Today's Drought Index}$$

The KBDI is thus tracked in a bookkeeping fashion on a daily basis, and this value is simply classified in order to obtain today's Fire Danger Rating.

### When to start

The KBDI cannot exceed a value of 200 so it can safely be assumed that 200 mm of rain in less than 30 days means that the KBDI is zero. Alternatively, if local creeks and catchments are monitored, the index can be set to zero and calculations commenced when run-off is observed.

The following table provides an indication of the implication of various KBDI index values

<b>Keetch-Byram Drought Index</b>	<b>Danger Rating</b>
<60	Very Low
60 - 99	Low
100 - 139	Moderate
140 - 179	High
180+	Extreme

## **APPENDIX 2 - Fire Prevention and Control Forms**

- ❑ Initial Fire Report Form
- ❑ Fire Weather Data Form
- ❑ Keetch-Byram Drought Index Calculation Sheet
- ❑ Evapotranspiration Table
- ❑ Keetch-Byram Drought Index Calculation Using EXCEL



## Fire Weather Data Form

Year \_\_\_\_\_ Month \_\_\_\_\_ Station Name \_\_\_\_\_

Day	Max. Dry bulb temperature (° C)	Wet bulb temperature (° C)	Relative humidity (%)	Wind speed (km/hr)	Wind direction (8pt card.)	24 hour rainfall (mm)	Drought Index (KBDI)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							



## Evapo-transpiration Table

(Annual Rainfall 2 000 mm or more)

<b>KBDI Range</b>	0 to 12	13 to 25	26 to 38	39 to 51	52 to 64	65 to 77	78 to 90	91 to 103	104 to 116	117 to 129	130 to 142	143 to 155	156 to 168	169 to 181	182 to 194	195 +
<b>Mean KBDI</b>	6	19	32	45	58	71	84	97	110	123	136	149	162	175	188	195
<b>Temp</b>	<b>KBDI Adjustment Factor</b>															
42	25	24	22	20	19	17	15	14	12	10	9	7	5	4	2	1
41	23	22	20	19	17	16	14	12	11	9	8	6	5	3	2	1
40	21	20	18	17	16	14	13	11	10	9	7	6	4	3	2	1
39	19	18	17	15	14	13	12	10	9	8	7	5	4	3	1	1
38	18	16	15	14	13	12	11	9	8	7	6	5	4	3	1	1
37	16	15	14	13	12	11	10	9	8	7	5	4	3	2	1	1
36	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
35	13	12	11	11	10	9	8	7	6	5	5	4	3	2	1	1
34	12	11	10	10	9	8	7	6	6	5	4	3	3	2	1	0
33	11	10	9	9	8	7	7	6	5	4	4	3	2	2	1	0
32	10	9	9	8	7	7	6	5	5	4	3	3	2	1	1	0
31	9	8	8	7	7	6	5	5	4	4	3	2	2	1	1	0
30	8	8	7	7	6	5	5	4	4	3	3	2	2	1	1	0
29	7	7	6	6	5	5	4	4	3	3	2	2	2	1	1	0
28	7	6	6	5	5	4	4	4	3	3	2	2	1	1	1	0
27	6	6	5	5	4	4	4	3	3	2	2	2	1	1	0	0
26	5	5	5	4	4	4	3	3	3	2	2	1	1	1	0	0
25	5	4	4	4	4	3	3	3	2	2	2	1	1	1	0	0
24	4	4	4	3	3	3	3	2	2	2	1	1	1	1	0	0
23	4	4	3	3	3	3	2	2	2	2	1	1	1	1	0	0
22	3	3	3	3	3	2	2	2	2	1	1	1	1	0	0	0
21	3	3	3	2	2	2	2	2	1	1	1	1	1	0	0	0
20	3	2	2	2	2	2	2	1	1	1	1	1	1	0	0	0

The Keetch-Byram Drought Index number expresses moisture deficiency in millimetres. It is reduced for each millimetre of rain in excess of 5 millimetres on the first day of rain. A 24-hour precipitation of 13 mm will reduce the index by 8 mm. Air temperature (dry bulb) in degrees Centigrade is either the maximum temperature or temperature measured at 3 pm.



## Keetch-Byram Drought Index Calculation Sheet

Year \_\_\_\_\_ Month \_\_\_\_\_ Station \_\_\_\_\_

Day	<u>Col. 1</u> Yesterday Drought Index	<u>Col. 2</u> Rainfall Previous 24 hours	<u>Col. 3</u> Net Rainfall	<u>Col. 4</u> Max. Temperature (° C)	<u>Col. 5</u> Reduced Drought Index	<u>Col. 6</u> Drought Factor	<u>Col. 7</u> KBDI for Today
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							



## Initial Fire Report Form

<b>Report Number</b> _____ (####) <b>Date</b> __/__/__ <b>Time</b> __: __
<b>Person reporting fire:</b> _____ <b>Phone #</b> _____
<b>Lookout number:</b> _____ <b>Aircraft Identification</b> _____
<b>Person taking report:</b> _____ <b>Office:</b> _____
<b>Location</b> <b>Region</b> _____ <b>District</b> _____ <b>Kampong:</b> _____ <b>Description:</b> _____ _____ <b>Lookout</b> __ <b>Bearing</b> ____° <b>Verticle angle</b> ____ <b>Dist.</b> _____ <b>km</b> <b>Latitude</b> ____° ____' <b>Longitude</b> ____° ____' <b>Elevation</b> _____ <b>m</b>
<b>Directions to fire:</b> _____ _____ _____ _____
<b>What is burning?</b> <input type="checkbox"/> Grass/Shrubland <input type="checkbox"/> Slash <input type="checkbox"/> Disturbed Forest <input type="checkbox"/> Plantation (specify) _____ <input type="checkbox"/> Original Forest
<b>Size of fire?</b> <input type="checkbox"/> Campfire <input type="checkbox"/> House <input type="checkbox"/> Football Field <input type="checkbox"/> Bigger
<b>Type of fire</b> <input type="checkbox"/> Smouldering <input type="checkbox"/> Open Flame <input type="checkbox"/> Fast Moving
<b>Slope</b> <input type="checkbox"/> Flat <input type="checkbox"/> Moderate <input type="checkbox"/> Steep
<b>Water available?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>Distance:</b> _____ <b>metres</b>
<b>Distance to driving (road):</b> _____ <b>metres</b>
<b>Is anyone fighting fire?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<b>Are homes/buildings threatened?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<b>Comments/action taken:</b> _____ _____ _____ _____ _____

## Calculation of Fire Danger Rating based on the Keetch Byram Drought Index (KBDI) using Excel

**Step 1.** After being informed by the Fire Officer from SFD Headquarters about increasing fire danger, obtain the weather records of the last months from the hydrological section (see Appendix 1 for procedure).

**Step 2.** Identify a time period with heavy rain in the weather records. The KBDI can not exceed a value higher than 203, so it can be assumed that 200 mm of rain in less than 30 days means the soil is saturated with water and the KBDI starts at zero.

Fig.1 Example of a weather record

Day	DERAMAKOT STATION	
	Maximum Temperature	Rainfall Previous 24 hours (mm)
1	30	0
2	29	3
3	29	43
4	30	11
5	29	41
6	29	3
7	29	0
8	30	1
9	30	15
10	30	6
11	30	11
12	29	11
13	28	0
14	28	0
15	28	25
16	28	35
17	28	0
18	29	0
19	29	12
20	29	0
21	29	0
22	30	0
23	30	34
24	30	85
25	29	0
26	30	0
27	29	11
28	28	0
29	28	0
30	29	17
31	30	0

**Step 3.** Open the Excel file *KBDI2new.xls* currently located in DFO's computer in folder C:\KBDI.

Fig.2 Starting of the KBDI calculation

1	Keetch-Byram Dryness Index Calc. for Wx Station					Year	Month	2000	Mean Rainfall (mm)
2									
3	Day	Temp.	Prec.	adjusted KBDI	Date				
20	17	28	0	0	1.17				
21	18	29	0	8	1.18				
22	19	29	12	8	1.19				
23	20	29	0	15	1.20				
24	21	29	0	22	1.21				
25	22	30	0	29	1.22				
26	23	30	34	8	1.23				
27	24	30	85	0	1.24				
28	25	29	0	8	1.25				
29	26	30	0	16	1.26				
30	27	29	11	17	1.27				
31	28	28	0	23	1.28				
32	29	28	0	29	1.29				
33	30	29	17	23	1.30				
34	31	30	0	31	1.31				
35	32	28	0	36	2.1				
36	33	28	0	42	2.2				
37	34	28	0	47	2.3				
38	35	28	0	53	2.4				
39	36	28	23	40	2.5				
40	37	28	23	27	2.6				

**Step 4.** On day 17, which in this example is the 17 of January, set the KBDI in column "ADJUSTED KBDI" to 0.

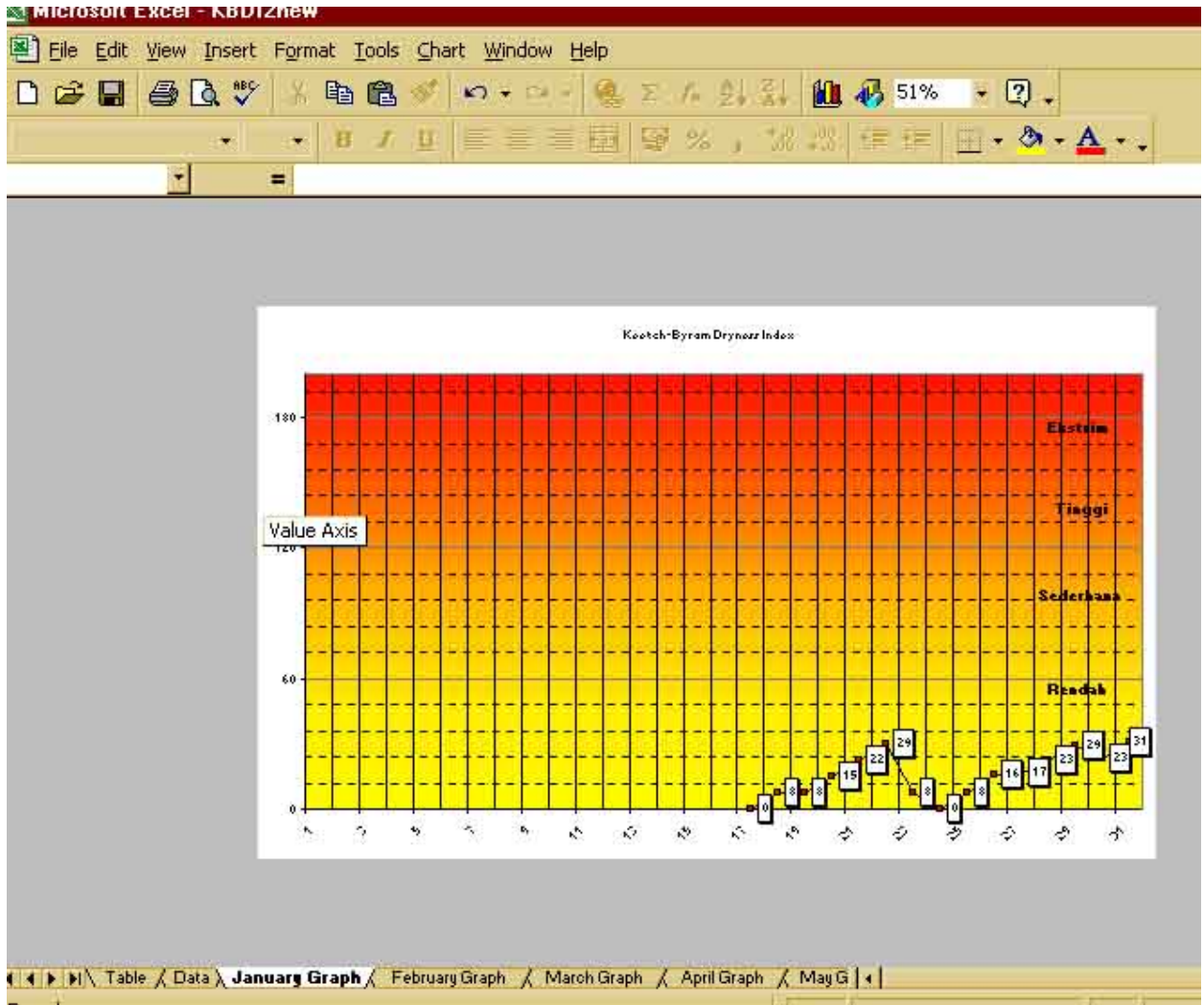
**Step 5.** From this day on measure **EVERY DAY** the dry bulb temperature at 3 pm (15.00hrs) and the rainfall for the previous 24 hour.

**Step 6.** Record measurements in the column "TEMP." for Temperature and "PREC." for precipitation (rainfall).

**Step 7.** The Excel Spreadsheet will automatically calculate the drought index in column "ADJUSTED KBDI".

**Step 8.** Activate the graph with the work sheet for the respective month to visualize the result.

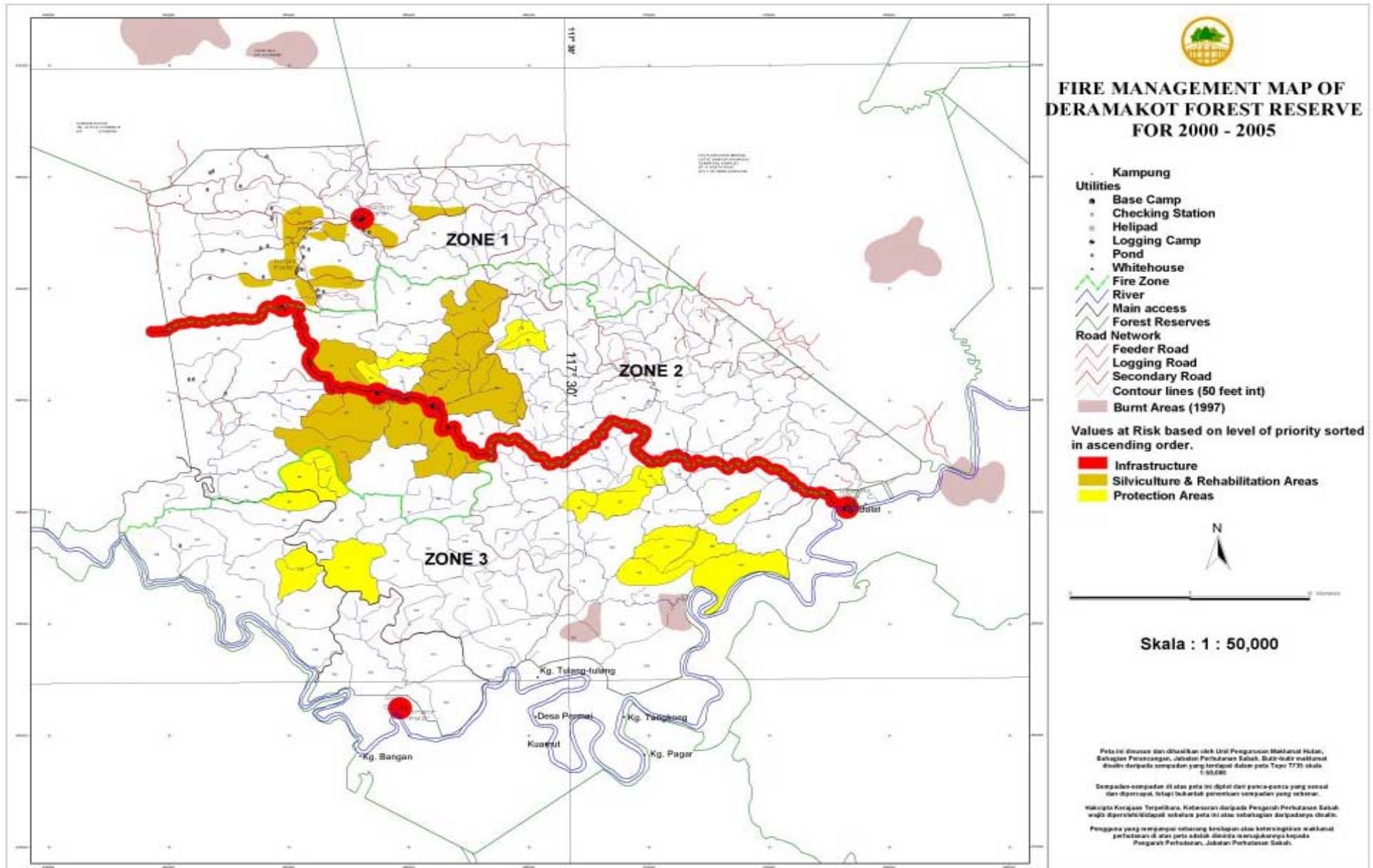
Fig.3. Graphical Output of the KBDI calculation



**Step 9.** Print out the page every week and post it on a very visible place within the office. At the same time adjust the fire danger sign board in the base camp accordingly.

**Step 10.** Monitor daily the fire danger rating and if index is HIGH or EXTREME activate prevention and preparedness plan.

### APPENDIX 3 FIRE MANAGEMENT MAP



## APPENDIX 4 PREVENTION PLAN

DANGER RATING INDEX	LEVEL OF PREVENTION	ACTION
<i>BLUE (LOW)</i> <60	No activity	
<i>GREY (MODERATE)</i> 60 - 99	<ol style="list-style-type: none"> <li>1. Visit village head (once a week) and inform about impending drought and usage of fire for land clearing for agriculture and hunting to all villages situated on the fringe in the south of DFR along the Kinabatangan river. <ul style="list-style-type: none"> <li>❑ Balat</li> <li>❑ Tangkong</li> <li>❑ Pagar-Pagar</li> <li>❑ Kuamut</li> <li>❑ Desa Permai</li> <li>❑ Tulang-Tulang</li> </ul> </li> </ol> <p>Mapped out areas designated for clearing and burning in the Fire Management Map.</p> <ol style="list-style-type: none"> <li>2. Monitor the usage of fire and/or open burning for agriculture and hunting.</li> </ol>	DFO <sup>1</sup> , ADFO <sup>2</sup> , PU <sup>3</sup> and all staff of DFO <sup>4</sup>
<i>YELLOW (HIGH)</i> 100 - 179	<ol style="list-style-type: none"> <li>1. Step up awareness as to usage of fires to all villagers and contractors.</li> <li>2. Phone/Fax/e-mail, timber/agricultural land of stakeholders adjacent to DFR about high fire danger once a week.</li> <li>3. Supervise and monitor all open burning activities for agriculture by villagers.</li> <li>4. Activate ground/river patrols on the three fire zones of DFR.</li> <li>5. Inform DFO staff and all forest workers of respective contractors in DFR to smoke in safe place and/or completely extinguish cigarettes.</li> </ol>	DFO <sup>1</sup> , ADFO <sup>2</sup> , PU <sup>3</sup> and all staff of DFO <sup>4</sup>
<i>RED (EXTREME)</i> 180+	<ol style="list-style-type: none"> <li>1. Ban any form of open burning in DFR namely the base camp and makeshift camps of the respective contractors and enforce.</li> <li>2. Phone/Fax/e-mail, timber/agricultural land of stakeholders adjacent to DFR about high fire danger twice a week.</li> <li>3. Inform DFO staff and all forest workers of respective contractors in DFR to smoke in safe place and/or completely extinguish cigarettes.</li> <li>4. Activate ground/river patrols daily covering the three fire zones of DFR.</li> </ol>	DFO <sup>1</sup> , ADFO <sup>2</sup> and all staff of DFO <sup>4</sup>

<sup>1</sup> District Forest Officer

<sup>2</sup> Assistant District Forest Officer

<sup>3</sup> Protection Unit

<sup>4</sup> Deramakot Forestry Office



## APPENDIX 5 PREPAREDNESS PLAN

DANGER RATING INDEX	LEVEL OF PREPAREDNESS	ACTION
<p><b>BLUE</b> <b>(LOW)</b> &lt;60</p>	<p>Identify location of permanent water bodies</p>	<p>ADFO<sup>6</sup> and all staff of DFR</p>
<p><b>GREY</b> <b>(MODERATE)</b> 60 – 99</p>	<ol style="list-style-type: none"> <li>1. Identify Fire Crews for the 3 fire zones.</li> <li>2. Acquire fire equipment and test for fire readiness and place in an easily accessible store.</li> <li>3. Conduct fire drills.</li> <li>4. Warn and inform villagers/SFD staff/Forest Workers of respective contractors of impending drought and ease of ignition.</li> </ol>	<p>DFO<sup>5</sup>, ADFO<sup>6</sup>, KUBK<sup>7</sup> and all staff of DFR</p>
<p><b>YELLOW</b> <b>(HIGH)</b> 100 – 179</p>	<ol style="list-style-type: none"> <li>1. Full Alert, every Monday short briefing on area of high fire risk and measures to be taken.</li> <li>2. Start fire detection by ground patrols for the 3 fire zones.</li> <li>3. Check equipment (water pumps, hoses for leaks, etc.) daily.</li> <li>4. Warn and inform villagers/SFD staff/Forest Workers of respective contractors of impending drought and ease of ignition.</li> </ol>	<p>DFO<sup>5</sup>, ADFO<sup>6</sup>, KUBK<sup>7</sup> and all staff of DFR</p>
<p><b>RED</b> <b>(EXTREME)</b> 180+</p>	<ol style="list-style-type: none"> <li>1. No vacation/leave allowed.</li> <li>2. Fire detection by ground patrols on daily basis of the 3 fire zones.</li> <li>3. Check equipment (water pumps, hoses for leaks, etc.) daily.</li> <li>4. Report Fire Incident and ensure success of fire suppression.</li> <li>5. Warn and inform villagers/SFD staff/Forest Workers of respective contractors of drought and ease of ignition on daily basis.</li> <li>6. Fire crews on full standby.</li> <li>7. Maintain daily communication with adjacent stakeholders and Fire Operations Office, SFD Headquarter.</li> </ol>	<p>DFO<sup>5</sup>, ADFO<sup>6</sup>, KUBK<sup>7</sup> and all staff of DFR</p>

<sup>5</sup> District Forest Officer

<sup>6</sup> Assistant District Forest Officer

<sup>7</sup> Workshop