

SUMMARY

InfiniteEARTH has joined Orangutan Foundation International struggle to preserve and protect the vanishing forests that provide a natural habitat for endangered orangutans in Central Kalimantan. To that end, InfiniteEARTH has established PT. Rimba Raya with 100,000 hectares of peat swamp forest in order to save it from total destruction by palm oil plantations. This conservation area is protected along its entire western border by the Tanjung Puting National Park and on its eastern border by the Seruyan River.

The high swamp forests that once covered PT. Rimba Raya have been reduced to a few remote sections and scattered fragments. Commercial loggings, wetland reclamation for transmigration and plantation development have been important factors in this transformation from the late 1960s to present. These remaining forests are at high risk from fires. Peat forests burning results in peat degradation, acidification of water, increase in flammability, substantial haze and carbon emissions, and loss of forest products and biodiversity. Once degraded and subject to continuous high human pressures, peat forests are difficult to regenerate.

Committed to protect the concession of PT. Rimba Raya, InfiniteEARTH is developing a fire prevention and suppression plan in the respect of the relevant government regulations No. 4 of 2001 and No. 45 of 2004. The document examines the present situation of the concession and its degraded peat swamp forest at high fire risk.

The technical aspects of fire prevention, pre-suppression, suppression and post-suppression are explained in detail. Fire prevention includes cooperative agreements, prevention infrastructures and fire information system. Fire pre-suppression covers pre-attack planning, fire management organization, standard operating procedures, task forces (crews, equipment and training), awareness campaigns and patrols. Fire suppression includes fire command system, mobilization, firefighting and rescue operations. Fire post-suppression covers identification of burnt areas, damage assessment and rehabilitation. Standardization of fire equipment and example of training materials will be given in annexes.

The preparation of the fire prevention and suppression plan for PT. Rimba Raya is carried out in the expectation that an implementation phase will follow the planning phase. For that purpose, a separate document will provide the budget estimates for a first step of implementation that should include the creation of fire management infrastructures, the purchasing of equipment and the training of fire crews from the concession and selected villages.

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1. INTRODUCTION

Background

The conservation area of PT. Rimba Raya is co-managed by InfiniteEARTH and Orangutan Foundation International in order to save it from total destruction by palm oil plantations. The 100,000 hectares of remaining peat swamp forest are located in Seruyan district, Central Kalimantan. This conservation area is bordered by the Tanjung Puting National Park on its west side, by the Seruyan River on its east side, by the Java Sea on the south side and by a new established palm oil plantation on the north side. The peat swamp forests of PT. Rimba Raya Reserve have been subject to repeated burning in the last decades. The fires are associated with logging activities, encroachment and agricultural fires spreading from the concession boundaries. Fire is an invaluable tool, in both agriculture and in the course of logging, hunting and fishing in the inhospitable swamp forests. Improper swamp management, primarily the building of canals, also plays a critical role in fire incidence.

InfiniteEARTH is developing a fire prevention and suppression plan for PT. Rimba Raya, in the respect of the relevant government regulations. Recommendations on fire management contained in this report are based on a field-level, 'hand-on' approach to the problem gained working with local communities, government institutions and private plantations. Subjects covered include fire prevention, pre-suppression, suppression and post-suppression activities. The fire plan should prepare a first phase of implementation that will focus on fire management infrastructures, purchasing of equipment and training of fire crews from the concession and selected villages.

Related Legislation

The government regulation No. 4 of 2001 concerns control of environmental damage or pollution resulting from forest and land fires. The concession holder has obligation to prevent fires with infrastructure and equipment (Article 14):

- Fire detection system,
- Fire equipment,
- Standard operating procedures,
- Fire prevention and suppression organization,
- Fire training on a regular basis.

Under the same regulation, the concession holder has obligation of surveillance to prevent fire occurrence and must report on these activities at least every 6 months (with hotspot data) to the Governor/Head of District (Article 15). He is responsible of any fire occurrence and has obligation of quick fire suppression in his area (Article 18).

The government regulation No. 45 of 2004 on forest protection regulates fire management at national, provincial, district and concession levels.

Article 20: Forest fire management activities cover prevention, suppression and rehabilitation. These activities are conducted at national, provincial, district and

concession levels, under the respective responsibility of the relevant Minister, Governor, Head of District and concession manager.

Article 21: Fire management programmes are established by the Minister at national level, by the Governor at provincial level, by the Head of District at District level and by the concession manager at concession level.

Article 22: Government creates forest fire management institutions at national, provincial, district and concession levels. These institutions are called Forest Fire Management Brigades, and have to prepare and implement the fire management programmes.

Article 23 describes the forest fire prevention obligations:

At national level, these prevention activities are: <ol style="list-style-type: none">1. National fire risk mapping;2. Fire information system;3. Cooperative agreement with local communities;4. Fire equipment standardization;5. Awareness campaigns;6. Fire training materials;7. Supporting and control.	At provincial level, these activities are: <ol style="list-style-type: none">1. Provincial fire risk mapping;2. Awareness campaigns;3. Training in fire prevention;4. Guidelines for fire suppression;5. Fire equipment purchasing;6. Supporting and control.
At district level, these activities are: <ol style="list-style-type: none">1. Assessment of fire risk areas;2. Awareness campaigns;3. Technical guidelines for fire suppression;4. Fire equipment purchasing;5. Supporting and control.	At concession/forest unit level, these activities are: <ol style="list-style-type: none">1. Inventory of fire risk locations;2. Inventory of fire causes;3. Establishment of fire crews;4. Standard operating procedures;5. Fire equipment purchasing;6. Creation of fire breaks.

Article 24 describes the forest fire suppression obligations. The concession manager must conduct the fire suppression actions as follow:

- a. Detection of the occurred fires;
- b. Use all the available resources;
- c. Creation of fire breaks to isolate the fire;
- d. Mobilization of local communities to facilitate fire suppression.

The concession manager has to: <ol style="list-style-type: none">a. Coordination with relevant institutions and local communities' organizations in order to facilitate fire suppression and evacuation, and to avoid a disaster;b. Reporting to the Head of District on fire occurrence and undertaken fire suppression actions.
Following the report from the concession manager, the Head of District has to undertake the actions below: <ol style="list-style-type: none">a. Detection of the occurred fires;b. Mobilization of the fire brigades and coordination with relevant institutions and local communities' organizations;c. Reporting to the Governor and the Minister on fire occurrence, undertaken actions and planned actions.

Following information and/or report from the Head of District, the Governor undertakes the actions below:

- | |
|---|
| <ol style="list-style-type: none">a. Detection of the occurred fires;b. Mobilization of the fire brigades and coordination with relevant institutions and local communities' organizations;c. Reporting to the Minister on fire occurrence, undertaken actions and planned actions. |
|---|

Following information and/or report from the Governor, the Minister undertakes the actions below:

- | |
|---|
| <ol style="list-style-type: none">a. Detection of the occurred fires;b. Coordination and mobilizations of personnel and fire equipment |
|---|

Article 27 describes the post-fire actions as follow:

- a. Identification and assessment;
- b. Rehabilitation;
- c. Law enforcement.

Article 28: The concession manager conducts identification (of the burnt area) and assessment (of damage) as follow:

- a. Collection of data and information on the occurred fire;
- b. Measurement and plan of the fire location;
- c. Analyse of the destructions and recommendations.

Article 30:

The concession holder is responsible for the forest fires occurring in his area.

Peat Swamps and Fire Risk

Rimba Raya is situated in Seruyan district, Central Kalimantan province, in riverine coastal lowlands similar to other major drainages in Kalimantan. The forest concession has extensive peats as shown in Wetlands International mapping, which are similarly extensive only along major rivers and in coastal areas. The 100,000 hectares of peat swamp forest are protected along the entire western border by the Tanjung Puting National Park and on the eastern border by the Seruyan River (Figure 1). The concession covers three sub-districts: Hanau (in the north), Danau Sembuluh (in the centre) and Seruyan Hilir in the south.

Intensively logged during the last decade, the concession is now endangered by the development of palm oil plantations. A field reconnaissance has been conducted in March 2009 to assess current land use activities in Rimba Raya (Bolik, 2009). Important findings include:

- A new 3.5 km canal has been constructed between Tanjung Hanau and the
- KUCC plantation which opens access to primary peat forest bordering the Seruyan river;
- The Seruyan public works department confirmed that construction is under way for a new harbour that will be located at the south border;
- 10 of 12 villages and 9 of 11 sub-villages lie on the west side of the Seruyan River;

- 15 canal access points have been mapped on the west side of the river, 12 of which are located south of Muara Dua;
- 18 river access points into Rimba Raya have been mapped, 17 of which are north of Muara Dua;
- Access to the interior of Rimba Raya remains difficult.

Villages are situated along the Seruyan River and people enter the peatlands mainly through the rivers and canals (Figure 2). Local communities and migrants use fire here to clear vegetation and improve access to the peatlands for hunting, collecting fish and other resources, and to enhance fish habitat by creating and expanding open floodplains areas and pools in the degraded peat forests.

Logging concession staff may have been partly responsible for fire ignition over the last decade. Logging has increased the fuel loads of dead trees and dense re-growing biomass, promoted rapid drying by opening up the canopy, and improved forest access through logging tracks. Draining has dried out the peat, altered the vegetation structure, and provided access through canals into remote peatlands (thus increasing overall human activity in these areas).

Direct company burning for conversion to palm oil plantations may have also played a major role in fire ignition in the peat swamps of Rimba Raya. Disputes between companies and communities over land-tenure can sometimes lead to arson, but in contrast, arson rarely occurs in oil palm plantations set up in partnership with local communities (Chokkalingam, 2004).

Once degraded, peatlands are prone to recurring fires because they are more easily accessed and more flammable. People are quick to use the newly opened-up areas and the zone of degradation gradually expands from the rivers into interior peatlands. The drained peatlands become a major annual fire problem and repeated fires reduce the potential for re-growth and recovery. Repeated annual burning has occurred in many newly opened up areas, transforming partially burnt peat forests into open floodplains with removal of tree cover and collapse and loss of peat.

The forest fires in may pose a serious threat to wildlife in general. The 1997/98 fires have had a severe impact on orangutans in East and Central Kalimantan (Schweithelm and Glover, 1998). Orangutans are the primary flagship species for forest conservation in Borneo, and their numbers in their favoured habitats are an indication of the level of ecosystem health. Many of these great apes were driven from the forest by fire and smoke and lack of food and water. Hundreds of adults were killed by villagers, and similar numbers of infants were captured and sold as pets. Large areas of their preferred habitat of swamp and lowland forest have burned. Previous research has shown that orangutans adapt their diets to post-fire vegetation, but many primatologists believe that the 1997/98 fires will mark the beginning of a steeper downward trend in the already declining populations of Bornean orangutans.

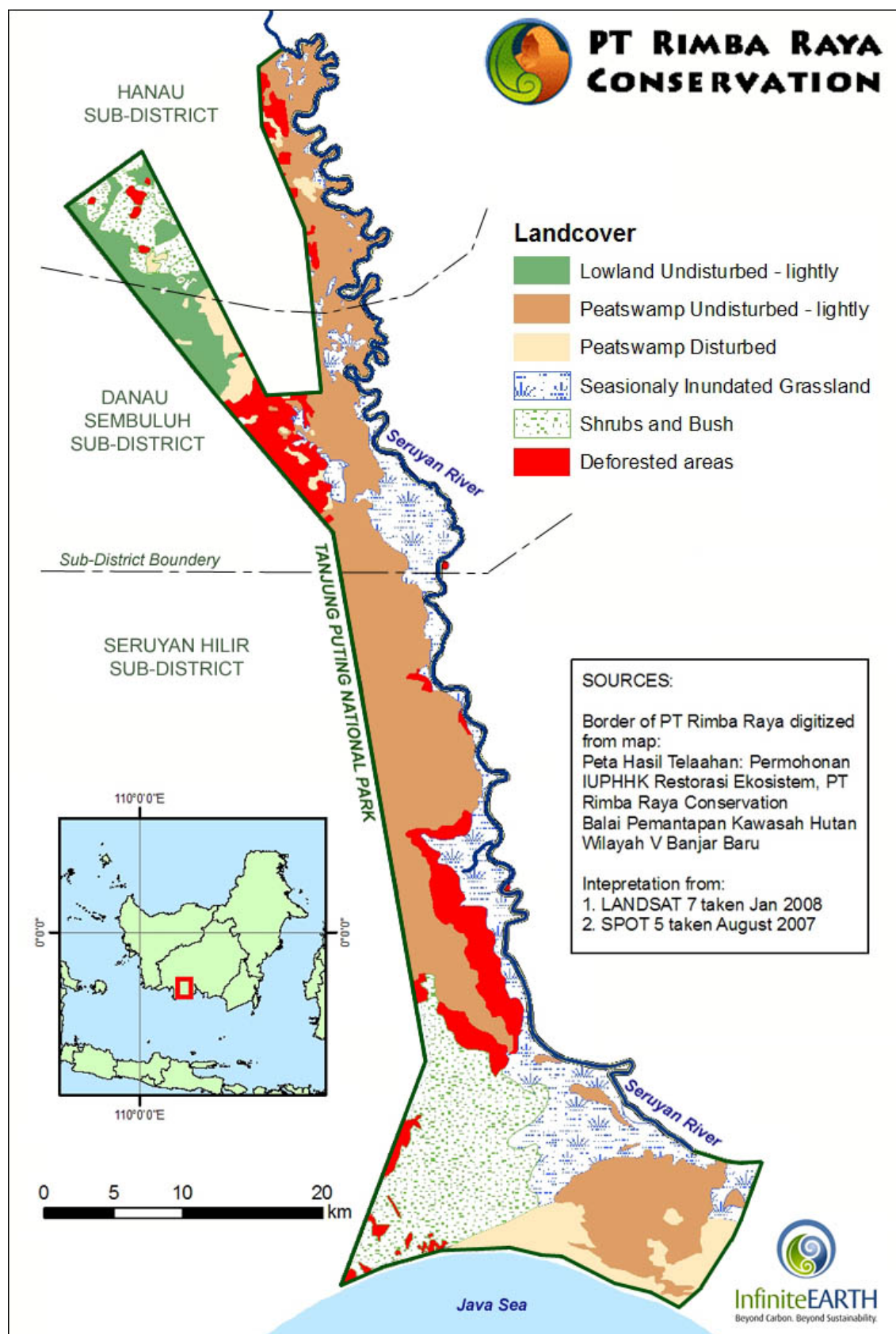


Figure 1. Land cover of PT. Rimba Raya, January 2008.

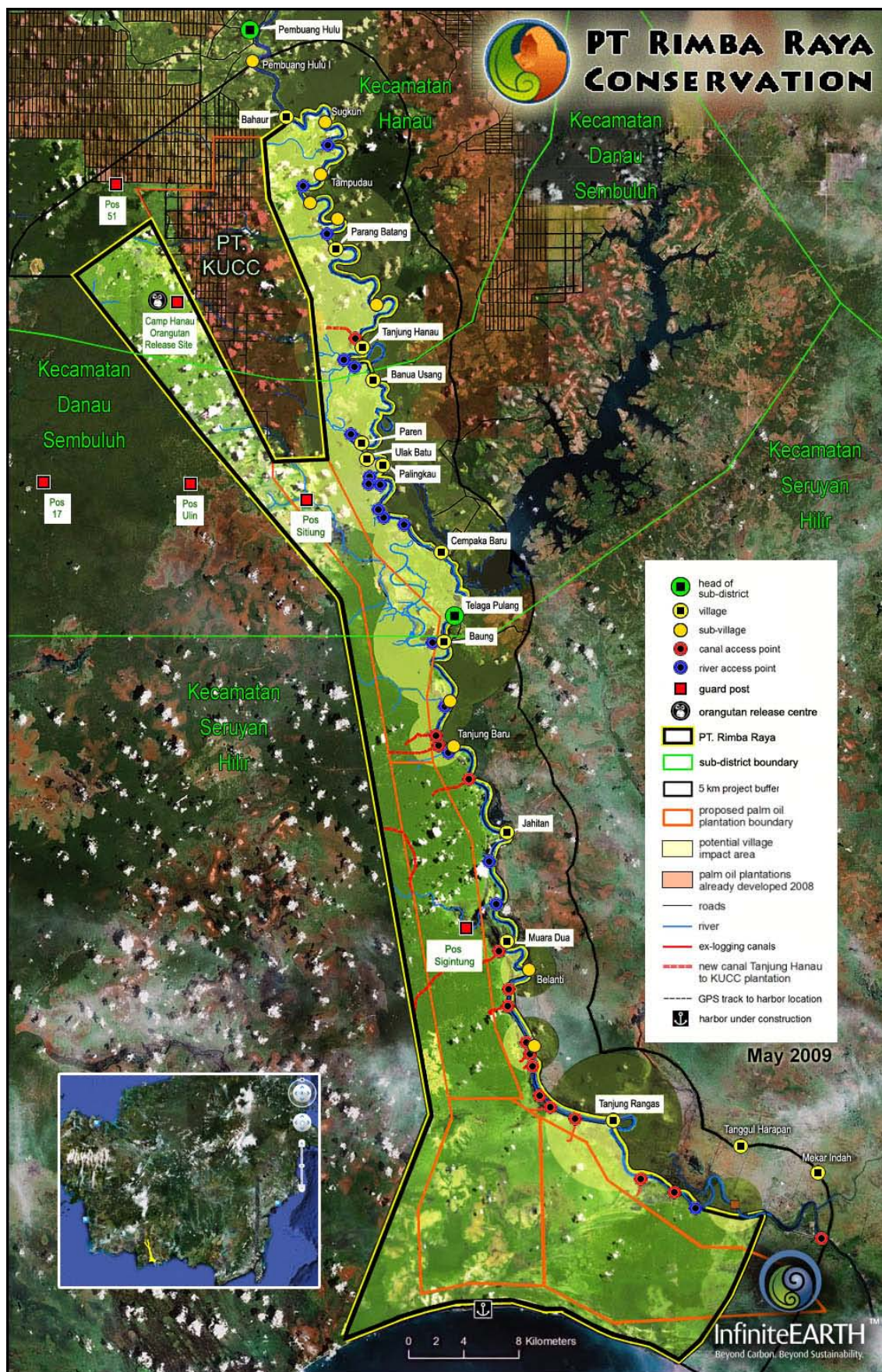


Figure 2: Land use of PT. Rimba Raya with locations of villages and access points, May 2009.

2. FIRE PREVENTION

Cooperative Agreements

Community-Based Fire Management

Banning fires and policing the ban is not a viable option, due to the inaccessible and difficult terrain, the large numbers of people using fire, and the importance of fire for resource extraction in the peatlands. Conservation and wise use of the Rimba Raya peatlands requires local values and needs to be harmonised with non-local interests. Community-Based Fire Management (CBFiM) represents an approach in which local communities actively participate and benefit from fire prevention and suppression activities (Nicolas and Faidil, 2000). The CBFiM strategy includes the following steps:

- Selection of priority villages from the three sub-districts (Hanau, Danau Sembuluh and Seruyan Hilir),
- Fire prevention and pre-suppression activities,
- Trained and equipped fire crews from priority villages,
- Networking with relevant stakeholders (Rimba Raya, plantations and government institutions).

Local Communities

Both parties benefit if the forest concession encourage local communities to participate in fire prevention. Participation does not simply mean posting signs that request care as fire danger rises, but the employment of local villagers as prevention aides. The route to success is to compensate local communities to prevent fires, as well as supporting them to form volunteer fire crews (Nicolas and Beebe, 1999). As a further incentive to community involvement, properly trained and equipped village fire crews can be paid to patrol close to the village and to maintain the fuelbreaks on the concession boundaries.

Through cooperative agreements, it is a major step forward if Rimba Raya integrates key-communities into the protection management of the forest. Key-communities are those with access to the area for hunting and for collecting fish and other resources, or simply because they are close to the concession boundaries. The priority villages need to be identified, trained and equipped, in order to include them in fire prevention and suppression. Field-level experience gained working with local communities demonstrates that the establishment of fire crews in selected priority villages drive local interest in reducing degrading fire use (Nicolas, 2007).

Neighbouring Plantations

Most fires may start outside the concession and enter as wildfires. As noted earlier, it is essential that local communities be involved in prevention and suppression efforts. If fire management is to be successful, it is also essential that Rimba Raya cooperates and coordinates with the neighbouring palm oil plantations (Figure 3):

- PT. Kharisma Unggul Centratama Cemerlang on the northern border,

- PT. Sumur Pandan Wangi and PT. Sawit Mas Nugraha Perdana, close to the north east border,
- PT. Salonok Ladang Mas, PT. Mega Ika Kansa and PT. Gawi Bahan Dep Sawit Mekar, close to the eastern border.

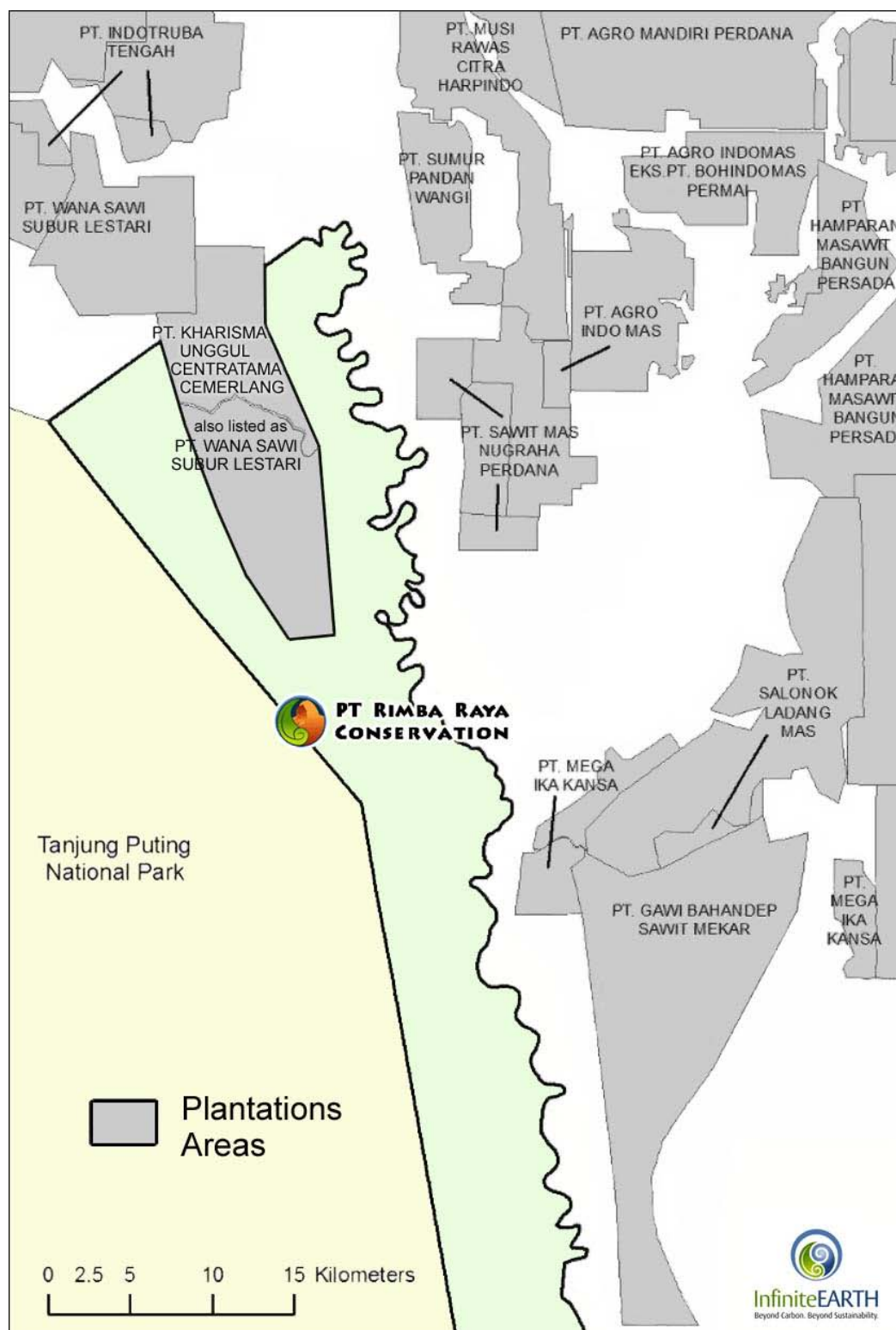


Figure 3: Location of the palm oil plantations, April 2009.

These private companies have obligation to organize fire prevention and fire suppression within their plantations. In addition, land clearing by fire is forbidden and severely punished by the Law (Act. 18 of 2004 concerning the estate crops). Therefore, once the palm oil plantations are established around Rimba Raya, they may become valuable partners for the fire prevention and suppression activities. Cooperation between forest concessions and plantations is absolutely essential to the overall fire management effort in the Seruyan area.

Operating agreements establish general guidelines for cooperative fire management and need to clarify:

- Communications to coordinate fire management operations,
- Early warning and fire danger issues,
- Plans to establish and safeguard fuelbreaks (patrolling) along the borders of the plantations,
- Approaches to and cooperation with local communities,
- Training and awareness campaigns,
- Sharing of equipment and personnel in the case of fire.

District Forestry Head Office

The districts are the keys to the formation of a competent institutional system of fire management within each province. Rimba Raya needs to establish strong links with the district forestry (and estate crops) head office of Seruyan (*Dinas kehutanan dan perkebunan kabupaten*) located in Kuala Pembuang.



Figure 4: Kuala Pembuang, seat of Seruyan district.

At times of medium or high fire danger, the concession puts his fire management organization on red alert and coordinates fire prevention activities with the village fire crews, the neighbouring palm oil plantations and the district forestry head office. During fire suppression, the concession manager must coordinate with relevant institutions and report to the Head of District on fire occurrence and undertaken fire suppression actions (Government regulation No. 45 of 2004, Art. 24). The concession has to report on fire management activities at least every 6 months (with hotspot data) to the Governor/Head of District (Government regulation No. 4 of 2001, Art. 15).

Fuelbreaks and Firebreaks

Fuelbreaks

A major aid to fire prevention in concessions is the engineering of *fuelbreaks* prior to the dry season. These fuelbreaks are readily defensible zones around an area to be

protected. The breaks will not in themselves stop a fire from entering a protection area but they do provide a site from which to more easily stop an advancing fire. Fuelbreaks can be planted with merchantable timber if the species are fast growing and form a dense canopy under which grasses and other flammable species are quickly shaded out (Nicolas and Beebe, 1999).

Fuelbreaks should be planted 50 – 100 m. deep along road lines or canals that allow fire patrols easy access; and on both sides to provide protection no matter where a fire originates. Road lines need to be planted-up within and outside the protection area. If a fire penetrates or begins within the protected zone, the damage can be more easily confined to a limited area. Fuelbreaks also need to be established to separate the entire concession from areas of high fire risk, such as neighbouring villages and plantations.

Fuelbreaks require regular cleaning prior to and during the dry season. Dead trees are removed and the litter that accumulates is piled and disposed of by burning or burial. Trees in the break are pruned of their lower limbs to deny fires that do burn in the break access to ladder fuels to climb into the canopy. Breaks need to be patrolled at times of high fire danger.

Slope greatly influences speed of fire spread. Fuel-breaks planted on hillsides are much more quickly burned through than those on flat ground. If it is an economic necessity to make narrower fuel-breaks, these should be restricted to flat areas. Width must not be compromised where the ground next to the road is steep. For the same reason, cleaning of the fuelbreaks should be most thorough where they are on slope.

Firebreaks

Firebreaks are a discontinuity in a bed of fuel and are used to segregate, stop and control the spread of fire; or to provide a control line from which to suppress a fire. Firebreaks differ from fuelbreaks in that they have a complete lack of combustibles down to mineral soil. Firebreaks are constructed in plantations to separate planting blocks.

A 25 m. wide bulldozed bare strip should run on both sides of strategic access roads to form a 50 m. wide firebreak. Places at greatest risk are boundaries with villages and palm oil plantations. Firebreaks are best constructed in strategic locations while not under pressure during the wet season rather than as a hasty necessity as a fire approaches.

Access Roads and Water Supplies

Access Roads

A reasonable network of access roads exists within the palm oil plantations, built to allow commercial exploitation. Roads are almost absent in Rimba Raya located within peat swamp area but access rivers are numerous and there is an extensive system of canals (Figure 2).

These access roads, rivers and canals and are an important part of the fire prevention plan. Easy access is essential to allow patrolling, early detection and, of course, to arrive as quickly as possible at a fire. When new access roads will be planned for Rimba Raya, these should be connected with the plantations' network roads to allow the exchange of fire suppression resources.

Water Supplies

Water has a high capacity to absorb heat and is therefore a very efficient agent to extinguish forest fires. Ready supplies from rivers, lakes or dams are needed to fill tanks, trucks and sources for pumps as well as for use in camp. Quantity and the accessibility are points to consider.

Where natural sources of water are limited, the installation of man-made sources is a part of fire management planning. Fixed water tanks should be of 10,000 l. minimum capacity, along the access roads. The building of dams or reservoirs is another alternation for the strategic locations. In coastal swamps, holes (2 x 2 x 2 m.) may be dug before the dry season to help ensure a water supply in drought years (Nicolas and Bowen, 1999).

Fire Posts and Lookout Towers

Fire Posts

Fire posts are the places where the fire crews from PT. Rimba Raya will be based with their equipment. It is suggested to select the most strategic locations of the planned guard posts for the fire posts positioning. Then the construction should combine the two functions, with the same personnel; in these posts, the forest guards will be part of the fire crew. Fire posts must offer a command room with radio communication equipment (Figure 5) and a warehouse for fire equipment (Figure 6).

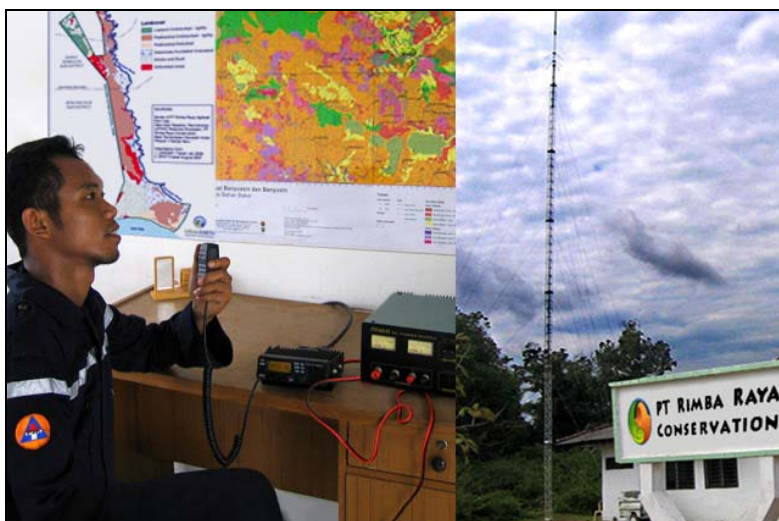


Figure 5: A fire post with radio communication equipment.

Considering that each fire crew must have 10 to 15 firefighters, it is suggested to establish the fire posts at a priority village in order to get personnel from its fire crew.

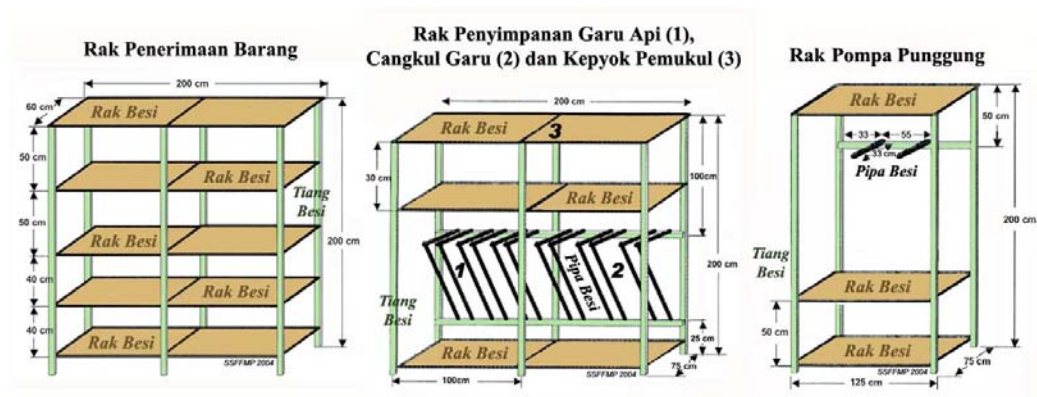


Figure 6: Racks for the storage of hand tools and jet sprayers.

Lookout Towers

Lookout towers are used in many parts of the world as a way of providing early warning of fire occurrence. In Indonesia they are useful in plantations where the area to be protected remains unchanged from year to year and where there is always some risk of fire from the time of seedling establishment right through to harvest.

Usually fire towers are built on hill top sites to increase the area of view, but the flat peat swamps of Rimba Raya do not offer significant elevation. Planners must bear in mind that lookouts are expensive to build and are rendered pointless when smoke levels rise; new fires cannot be seen. Therefore the towers should offer other functions: installation of the radio communication antenna and fauna observation.

Fire Information System

Fire Danger Rating System

The Indonesian National Institute of Aeronautics and Space (*Lembaga Penerbangan dan Antariksa Nasional - LAPAN*) has developed a Fire Danger Rating System (FDRS) based on remote sensing data. LAPAN website provides daily complete fire information for all the districts of Borneo and Sumatra islands (Figure 7a and 7b):

- Fine Fuel Moisture Code (FFMC) which is a numeric rating of the moisture content of litter and other cured fine fuels. This code is an indicator of the relative ease of ignition and the flammability of fine fuel,
- Drought Code (DC) which is a numeric rating of the average moisture content of deep, compact organic layers. This code is use indicator of seasonal drought effects on forest fuels and the amount of smouldering in deep duff layers and large logs,
- Initial Spread Index (ISI) which is a numeric rating of the expected rate of fire spread. It combines the effects of wind and FFMC on rate of spread without the influence of variable quantities of fuel,
- Fire Weather Index (FWI) which is a numeric rating of fire intensity. It combines the initial spread index and build-up index. It is suitable as a general index of fire danger,
- Maximum temperature information, and
- Rainfall information.

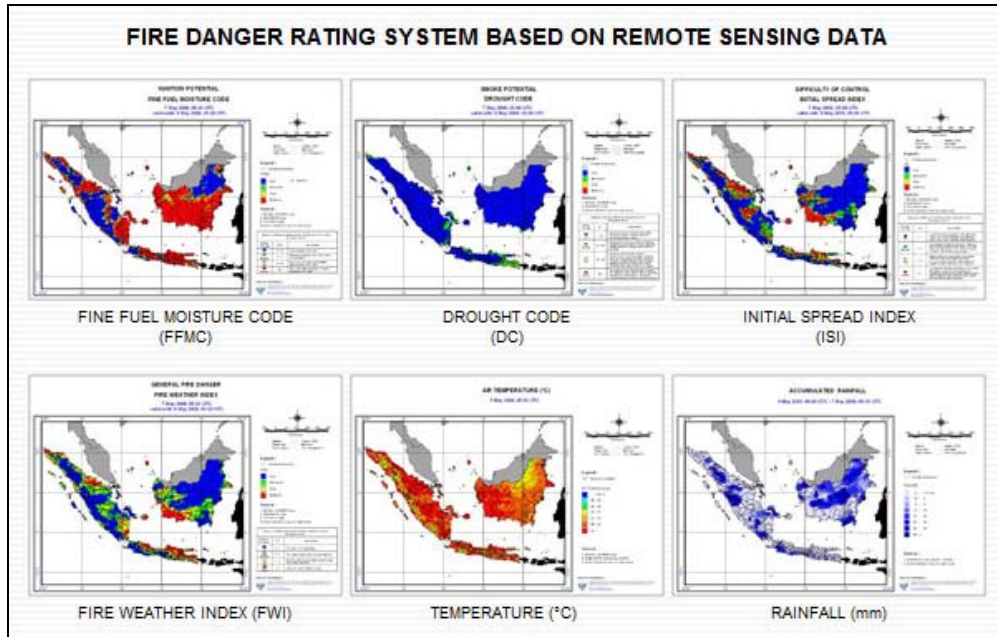


Figure 7a: FDRS provided daily by LAPAN website.

For easy interpretation, the fire danger is divided into four classes:

- Fire danger low (blue),
- Fire danger moderate (green),
- Fire danger high (yellow),
- Fire danger extreme (red).

KELAS	FFMC	INTERPRETASI (INTERPRETATION)
Rendah (Low)	0-72	Kemungkinan terjadinya api sangat rendah (Low probability of fire starts)
Sedang (Moderate)	73-77	Kemungkinan api terpacu pada daerah kering dan terisolasi (Moderate probability of fire starts in areas of local dryness)
Tinggi (High)	78-82	Bahan bakaran halus sangat mudah terpicu; kemungkinan terpicunya api tinggi (Grass fuels becoming easily ignitable. Higher probability of fire starts)
Ekstrem (Extreme)	83 +	Bahan bakaran halus sangat mudah terbakar; kemungkinan terpicunya api tinggi (Grass fuels highly flammable. Very high probability of fire starts)

KELAS (CLASS)	ISI	INTERPRETASI (INTERPRETATION)
Rendah (Low)	0-1	Penyebaran api rendah dari intensitas kebakaran yang rendah (Low fire intensity. Fire will spread slowly or be self-extinguishing. Grassland fires can be successfully controlled using hand tools)
Sedang (Moderate)	2-3	Penyebaran api sedang dari intensitas kebakaran yang sedang (Moderate fire intensity in grass. Hand tools will be effective along the fire's flanks, but water under pressure (pumps, hose) may be required suppressing the head fire in grasslands)
Tinggi (High)	4-5	Penyebaran api tinggi dari intensitas kebakaran yang tinggi (High fire intensity in grass. Direct attack at the fire's head will require water under pressure, and mechanized equipment may be required to build control lines. (e.g.: bulldozer))
Ekstrem (Extreme)	6 +	Penyebaran api sangat tinggi dari intensitas kebakaran yang sangat tinggi (Very high fire intensity in grass. Fire control will require construction of control lines by mechanized equipment and water under pressure. Indirect attack by back-burning between control lines and the fire may be required)

KELAS	DC	INTERPRETASI (INTERPRETATION)
Rendah (Low)	< 140	Kondisi musim basah, kabut asap tidak terjadi (Typical wet-season conditions and severe haze periods are unlikely. More than 30 dry days until DC reaches threshold at which point severe haze is highly likely)
Sedang (Moderate)	140-260	Kondisi normal pertengahan musim kering, pembakaran harus dipantau (Normal mid dry-season conditions. Between 15 and 30 dry days until DC reaches threshold. Burning should be regulated and monitored as usual)
Tinggi (High)	260-350	Kondisi normal puncak musim kering, seluruh pembakaran di atas lahan gambut dilarang (Normal dry season peak conditions. Between 5 and 15 dry days until DC reaches threshold. All burning in peatlands should be restricted. Weather forecast and seasonal rainfall assessments should be monitored closely for signs of an extended dry season)
Ekstrem (Extreme)	>350	Kondisi bahaya kekeringan, pembakaran sepenuhnya dilarang (Approaching disaster-level drought conditions. Less than 5 dry days until DC reaches threshold, at which point severe haze is highly likely. Complete burning restriction should be enforced)

KELAS	NILAI FWI	INTERPRETASI (INTERPRETATION)
Rendah (Low)	0-1	Kebakaran akan padam dengan sendirinya (Fires will be self-extinguishing)
Sedang (Moderate)	2-6	Kebakaran dapat dipadamkan dengan peralatan tangan sederhana (Fire can be easily suppressed with hand tools)
Tinggi (High)	7-13	Kebakaran dapat dipadamkan menggunakan pompa dan alat berat (Most fire can be successfully controlled using power pumps and hose)
Ekstrem (Extreme)	>13	Kebakaran sukar dipadamkan (Some fires will be difficult to control)

Figure 7b: FDRS provided daily by LAPAN website.

NATIONAL INSTITUTE OF AERONAUTICS AND SPACE
REMOTE SENSING AFFAIRS, JAKARTA, INDONESIA
<http://lapanrs.com/SMBA/smba.php?hal=3&kat=fd&per=hr>

Early Warning System

The ASEAN Specialised Meteorological Centre (ASMC) is hosted by the Meteorological Services Division, National Environment Agency of Singapore. ASMC website provides daily information and satellite imagery (hotspot and haze maps) on the weather and smoke haze situation in the Borneo Island (Figure 8).

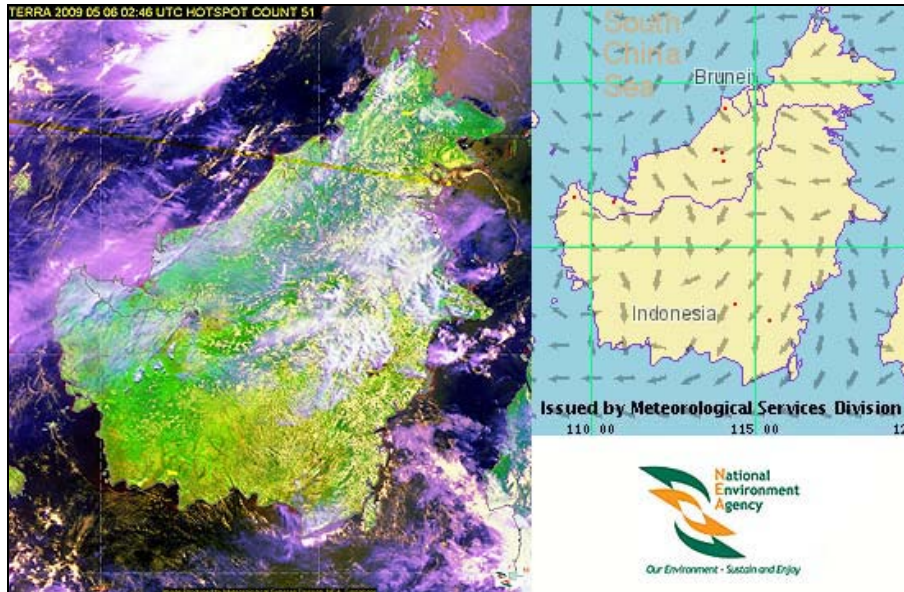


Figure 8: Hotspot and haze maps provided daily by ASMC - NEA website.

The hotspots and smoke haze are identified by employing selected electromagnetic spectral bands of sensors onboard satellites and highlighting them. ASMC antenna stations receive data from the following satellites: NOAA, EOS Terra and Aqua (polar-orbiting satellites), MTSAT-1R and FY-2C (geostationary satellites). To help identify and highlight different features such as hotspots, smoke plumes/haze and clouds, the data from a combination of spectral channels are used to form a multi-spectral image. A hotspot is a mark on an infrared image that contains the spectral signature of high temperature bodies on the ground such as land and forest fires, straw burning after a harvest, and industrial targets such as waste gas flares. The dimension of each hotspot corresponds to the spatial resolution of the spectral channel used to detect the hotspot e.g. 1.1 km by 1.1 km at the sub-satellite point for the NOAA-series satellites.

ASEAN SPECIALISED METEOROLOGICAL CENTRE
NATIONAL ENVIRONMENT AGENCY OF SINGAPORE
METEOROLOGICAL SERVICES DIVISION
<http://www.weather.gov.sg/wip/web/ASMC/home>

3. FIRE PRE-SUPPRESSION

Pre-Attack Planning

Pre-attack fire plans for each designated block of forest and land address a number of points. The International Tropical Timber Organization (ITTO, 1997) lists;

- the location of fire lines, base camps, water sources and helicopter landing spots,
- transport availability, probable travel time to a fire for all types of attack units and, constraints to travel,
- the need to construct additional fire lines, the probable rate of this construction and, topographic constraints to construction.

In addition, forest type, fuel type, fuel amount and fuel arrangements are analyzed to assess the fire risk faced by the concession. This first assessment is then modified according to,

- topography,
- number of access roads,
- access to natural and man-made water sources,
- water availability during dry spells,
- villages within or near the concession, and
- risky land clearance practices near the concession (e.g. pulp or palm oil plantations).

URAIAN KEGIATAN	STATUS SIAGA / BULAN											
	HIJAU			KUNING			MERAH			BIRU		
	Mart	April	Mei	Juni	Juli	Agus	Sept	Ok	Nov	Des	Jan	Peb
I. PER SIAPAN PER SIAPAN SIAGA												
A. Persiapan Prasarana dan sarana												
1. Prasarana (Pemeliharaan & Pembangunan)												
a. Prasarana penghubung : Jalan, jem batan, gorong-gorong	✓	✓	✓									✓
b. Prasarana deteksi : Menara api, pos jaga, pos monyet	✓	✓	✓									
c. Prasarana sumber air : Check dam, bendungan, embun (kantong air), kolam	✓	✓	✓	✓	✓						✓	✓
d. Sekat bakar, ilaran api dan jalur bebas bayang (pembersihan bahu jalan)	✓	✓	✓	✓	✓							
2. Sarana (Inventarisasi, Reparasi & Penambahan)												
a. Sarana komunikasi : Pesawat HT, Rig, SSB, Telepon, Fax	✓	✓	✓									
b. Sarana mobilisasi : Mobil pic-up, truk, dump-truk, sp motor	✓	✓	✓	✓								
c. Sarana alat berat : Wheel-tractor, bulldozer, wheel-loader, tanki, bajak	✓	✓	✓	✓								
d. Sarana mesin-mesin : Pompa TO HATSU, pompa Robin, Chain-saw, dll	✓	✓	✓	✓								
B. Persiapan Alat/Perlengkapan												
1. Alat/Perlengkapan penyuluhan dan kampanye pencegahan kebakaran												
a. Papan-papan penyuluhan, larangan, himbuan, peringatan bahaya api	✓	✓	✓									
b. Papan tingkat kerawanan kebakaran	✓	✓	✓	✓								
c. Brosur, leaflet, edaran, poster tentang bahaya api	✓	✓	✓									
2. Alat/Perlengkapan pemadaman												
a. Alat/Perlengkapan personil : Seragam, helm, parang, peples, masker, sepatu, dll	✓	✓	✓									
b. Alat/Perlengkapan pemadaman												
- deteksi : Kompas, teropong, peta, dll	✓	✓	✓									
- penyerangan : Kepyok, pacitan, garu api	✓	✓	✓									✓
- pendukung : Linggis, cangkul, sekop, kapak, senter, dll	✓	✓	✓									
3. Alat/Perlengkapan lain : Selang kain, selang spiral, nozzle, dll	✓	✓	✓									
C. Persiapan Satuan-Satuan Tugas Siaga Api												
1. Konsolidasi satuan khusus	✓	✓										
2. Pembentukan satuan-satuan pendukung : Satuan inti, Satuan bantuan, Satuan jaga, dan logistik, Satuan cadangan, Satuan pagar betis	✓	✓	✓	✓	✓							
3. Training, pelatihan, uji coba pendadakan, pemantapan sistem dan mekanisme kerja pemadaman api terpadu, dll	✓	✓	✓	✓								
II. PENDEKATAN KE MASYARAKAT												
A. Kampanye dan Penyuluhan												
1. Kampanye ke sekolah-sekolah (SD, SMP)	✓	✓	✓	✓								
2. Penyebaran brosur, leaflet, poster tentang bahaya api	✓	✓	✓	✓								
3. Pemutaran film tentang kebakaran hutan	✓	✓	✓	✓								
4. Pemasangan baliho, papan peringatan, papan larangan, papan himbuan tentang bahaya api	✓	✓	✓	✓								
5. Pemasangan papan tingkat kerawanan bahaya kebakaran	✓	✓	✓	✓								
6. Penyuluhan secara langsung di talang, dusun, desa, pemukiman, transmigrasi dan kantong-kantong pemukiman lain	✓	✓	✓	✓								

Figure 7: Annual calendar for fire management activities.

The end result is a schedule of activities geared to the approach of the fire season and which covers routine staff preparation, fire prevention, equipment maintenance, etc. Each concession needs to prepare its own calendar; an example is shown in Figure 7.

Fire Management Organization

The structure outlined below shows the essence of a fire management organisation; it is the various duties that are important, not the structure *per se*.

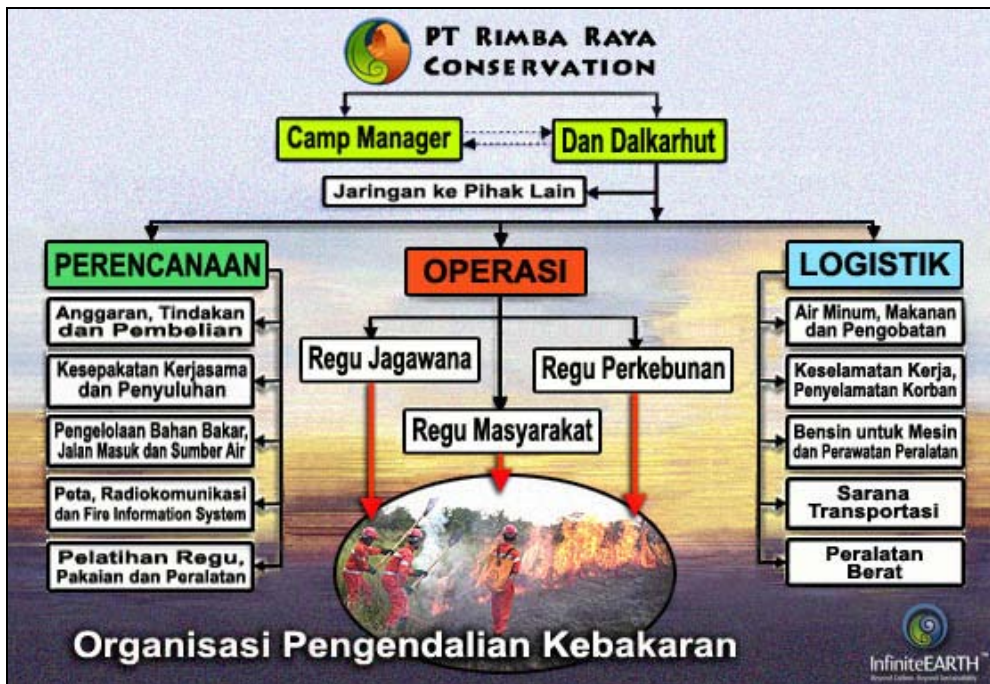


Figure 8: Example of a fire management organization.

Camp Manager

- ultimately responsible for all fire management activities, and
- directly supervises the Fire Management Officer (*Dan Dalkarhut*).

Fire Management Officer

- directs all fire management activities,
- supervises the Planning, Operations, and Logistics Section Chiefs, and
- looks for deficiencies in the overall fire management programme, and rectifies these through his Planning, Operations and Logistics Chiefs'.

Planning Chief

- oversees the training of firefighters before the arrival of a dry season,
- oversees training of stakeholders outside the concession,
- maintains the fire information system that monitors the dry season fire danger rating,
- plans the system of fuel breaks and sees that they are constructed and maintained, and

- implements other aspects of the prevention plan; e.g. works with local communities and nearby palm oil plantations, and spreads the message as fire danger rises.

Operations Chief

- with the Planning Chief, sees that the crew bosses and firefighters are trained before the arrival of the dry season,
- with the Planning Chief, sees that all firefighters previously trained receive refresher courses as the dry season approaches,
- ensures that his firefighting forces has adequate equipment as the dry season approaches,
- responsible, with the Planning Chief, for setting up an organization of crew bosses, handcrews and motor pumps sufficient to provide protection for the concession,
- oversees firefighting operations for the duration of the fire season, and
- directly commands firefighting resources when fires involve multiple crews and resources.

Logistics Chief

- acquires and maintains fire equipment,
- plans, tests, and maintains the base station and handheld communications systems,
- provides sufficient transport for the firefighting resources, and maintains these outside the fire season, and
- provides food and water to firefighters while firefighting.

Standard Operating Procedures

Fire management Standard Operating Procedures (SOPs) for prevention and suppression depend on the current and expected short-term fire danger rating. The intent is that drought, a rising fire danger and weather forecast when taken together, trigger pre-planned fire prevention, pre-suppression, and/or suppression activities. The method tells managers exactly what they need to do given a particular set of weather and fire danger rating parameters. This takes the guesswork out of preparing for a period of high fire risk. Five distinct combinations can be pre-planned.

Fire Danger Low (dry season is not expected to be severe)

- fires can still occur during coming dry season, especially in grasses or recently slashed areas,
- equipment checked, maintenance current,
- previously trained firefighters refreshed,
- no patrols necessary,
- new equipment obtained, and
- fire danger rating evaluated weekly.

Fire Danger Low (severe dry season expected)

- fires likely in coming dry season, beginning in grasses and slashed areas,

- spreading to undisturbed forest and mature second growth,
- equipment tested during refresher training of experienced firefighters,
- new firefighters trained,
- purchase of new equipment expedited,
- fire danger rating evaluated weekly,
- patrol plan prepared,
- fire teams formed: teams a balance between experienced and new firefighters, and
- readiness inspection carried out: simulated fire to test out patrols, rapid response, communications and logistics.

Fire Danger Moderate

- though generally wet, fires can occur in *Alang-alang* on hot days,
- fire danger updated daily,
- fuel breaks cleaned, and
- daily patrols begin.

Fire Danger High

- fires can occur in forest/plantation slash,
- patrol plan implemented, patrols out several times a day,
- fire danger updated daily,
- put out word to local communities of high fire hazard,
- community fire prevention patrols begin,
- firefighters on 30-minute dispatch alert,
- fire equipment on dedicated standby for firefighting, and
- update maps of water sources as dry season advances.

Fire Danger Extreme

- consider scaling back forest/plantation operations to reduce chance of causing fires,
- patrols out continuously,
- firefighters on 5-minute dispatch alert,
- fire danger updated daily,
- fire equipment pre-positioned near protection area, staffed all hours, and
- update maps of water sources as drought worsens.

Fire crews, fire equipment and training

Fire Crews

Preparedness includes staffing, equipping and training prior to the start of a fire. Properly trained and equipped personnel at the proper locations will increase the effectiveness of any programme.

A Rimba Raya firefighter crew will consist of:

- One crew boss,
- Two squad bosses, and
- Fifteen firefighters, either male or female.

Fire crews are the foundation of any system to prevent and control forest fires in Rimba Raya. The primary need is to form, train, and equip crews at the forest concession level. As the crews, the crew bosses and the squad bosses become more successful, they will earn the recognition from the authorities and the community that is so necessary to gain and maintain high motivation and good results (Nicolas and Beebe, 1999a).

Because of transportation arrangements, a crew cannot exceed 18 members. A fire crew will not normally be dispatched for an assignment with less than 15 members. Squad Bosses are expected to take care of all duties concerned with crew activities on fires, in fire post and en route to and from fires. They must have demonstrated their leadership ability by performance on fire assignment.

Fire Equipment

Providing proper equipment to firefighters is the basic. Personal protective equipment such as hardhats, gloves, resistant clothing and high-top leather boots should be considered an essential requirement of the programme. Availability of high pressure water pumps (Figure 11) and handy-talkie radios are two essentials when equipping a successful firefighting organization in the peat swamps of Rimba Raya.

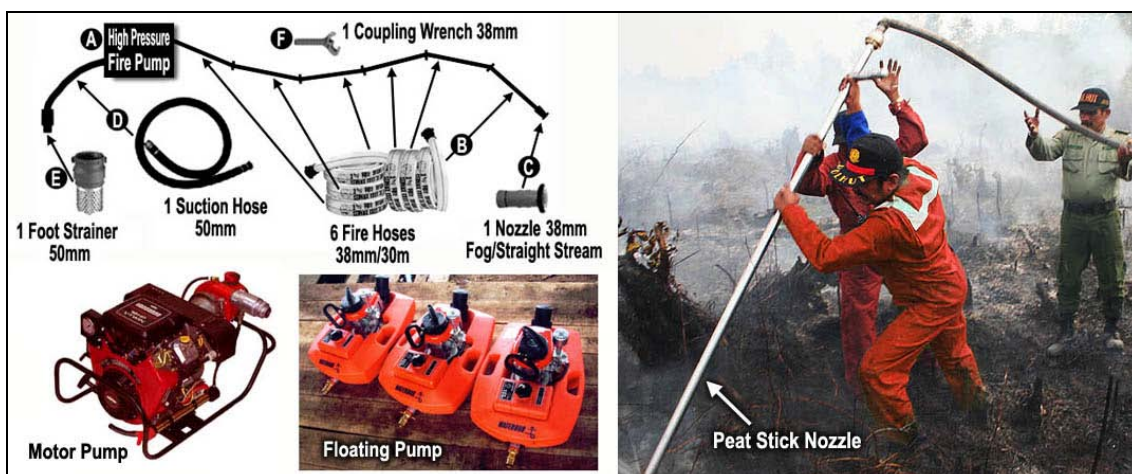


Figure 11: Example of motor pump, floating pump and peat stick nozzle.

A good guideline is to supply a minimum of three high pressure motor pumps (with hoses and nozzles) and three handy-talkie radios per one fire post (18 firefighters). Table 1 lists the necessary equipment for one fire post. Depending of the available access, pick-up vehicles and/or small canal boats (*Klotok*) are necessary for the transportation of fire crews and their equipment (Figure 12). Rimba Raya must also have heavy equipment to clear and maintain access roads and firebreaks.

Equipment	Number
Overall protective clothing (<i>Werpak pelindung</i>)	18
Cotton tee-shirt (<i>Kaos katun</i>)	18
Protective hardhat (<i>Helm pelindung</i>)	18
Headlamp (<i>Senter helm</i>)	18
High-top leather boots (<i>Sepatu boot PDL</i>)	18
Socks (<i>Kaos kaki</i>)	18
Leather gloves (<i>Sarung tangan kulit</i>)	18
Plastik glasses (<i>Kaca mata plastik</i>)	18
Red scarf (<i>Slayer SAL merah</i>)	18
Webb belt (<i>Kopel hitam</i>)	18
Water canteen (<i>Peples air minum</i>)	18
Fire cap (<i>Topi pet</i>)	18
Knapsack (<i>Tas punggung</i>)	18
Fire rake (<i>Garu api</i>)	8
Mac Leod tool (<i>Cangkul garu</i>)	8
Fire swatter (<i>Kepyok pemukul</i>)	8
Pulaski axe-hoe (<i>Kapak dua fungsi</i>)	3
Backpack pump jet sprayer (<i>Pompa punggung</i>)	5
Chain saw (<i>Gergaji mesin</i>)	2
High pressure motor pump with hose and nozzle (<i>Pompa mesin tekanan tinggi dengan selang dan nosel</i>)	2
High pressure floating pump with hose and nozzle (<i>Pompa apung tekanan tinggi dengan selang dan nosel</i>)	1
Peat stick nozzle (<i>Nosel jarum gambut</i>)	3
Handy-talkie radio (<i>Radio HT</i>)	3
First aid kit (<i>Kotak P3K</i>)	2

Table 1: Equipment set for a Rimba Raya fire post (18 firefighters).

Field experience gained in Borneo and Sumatra islands has shown the necessity to keep equipment simple, compatible and adaptable (Nicolas, 1998). Overly complex equipment is never used or is quickly broken. Equipment, especially pumps, should not be distributed without training in its use.

The equipment standardization (Annex II) prevents money from being wasted on equipment that is too complex or cumbersome to use, that is incompatible with other equipment, and that is potentially hazardous to firefighters.



Figure 12: Canal boat for the transportation of fire crews.

Training

While fire danger rating systems can help firefighters anticipate risks, in many places there are no fire crews in the field to help. Far too little importance was placed on organization, training and equipping at the field level. It must be remembered that;

- Firefighting depends on well-trained crews kept in practice with regular theoretical and practical courses.
- Managerial staff needs more advanced training in forest fire management, forest firefighting and 'tactical reasoning'. They also need a radio system adapted for use in fire management. A strategic pyramidal organization and a tactical chain of command are concepts which remain to be developed, but whose absence must not hinder field level development.
- First aid knowledge and training is essential. Firefighters must be able to rescue their injured colleagues and wounded civilians.
- Discipline is necessary during firefighting campaigns that require numerous personnel for many days. Fire control must be conducted with military methods and discipline.

Annex III shows examples of training programme developed at basic level (Nicolas, Pansah and Saharjo, 2007) and at managerial level (Nicolas, Pansah and Komara, 2007). The theoretical and practical training of firefighters is best carried out by local instructors. The first step is thus to train-the-trainers. The second is to spread the knowledge within to ensure the establishment of the organization.

Topics covered include the terminology and theory of firefighting, the chain of command, the need to anticipate and the importance of communications. Practical components covered are intended to acquaint trainees with the essentials of fire behaviour and fire suppression techniques. Hands-on experience in the use of equipment under controlled conditions is seen as an essential pre-requisite before

new recruits face a wildfire. Firefighting is dangerous and physically demanding. Safety is stressed and a module on first aid included.

Awareness campaigns

Fire awareness and educational activities can be very effective in involving the community and other groups in a fire management programme and in engaging the community as a responsible partner. A well-informed public will be more likely to use fire carefully and to adhere to policy and legal boundaries. It can assist in the prevention, detection and reporting of fires, work with fire personnel to control unwanted fires, and provide a source of local and traditional knowledge (FAO, 2006).

A programme of awareness and education can be provided to schoolchildren through a structured set of lessons and learning objectives. Other programmes should be developed for adults and communities to educate and to communicate changes in policy or in the understanding of the role of fire and the impact of unplanned fires on ecosystems and resources.

FIRE SUPPRESSION

Safety When Firefighting

Burning particles from surface peat fires fly up to 100 m. and spread the fire with extreme rapidity. The numerous new 'spot-fires', in turn, quickly become sizeable fires. A two metre wide water ditch will check the original fire but is not a barrier to its propagation. The greatest care must be taken not to isolate firefighters from a way of retreat. (Nicolas and Beebe, 1999a).



Figure 13: Safety is paramount when fighting the peat fires.

Underground peat fires produce copious heavy smoke with a high concentration of carbon monoxide. They are thus a danger to firefighters. These sub-surface fires also burn hidden holes in the peat and the over-lying crust is liable to collapse without warning under the weight of a man. Consequently, firefighters must move carefully and wear safety equipment of adapted clothes, boots, gloves, and a helmet and hood for breathing protection (Figure 13).

Organization and Command

One person – the *fire boss* – takes charge of all the people working on a fire. The most dangerous and least efficient ways to fight a fire is for everyone to work by himself or in small groups. But, it is the job of everyone to watch out for himself and the rest of the team to make sure that no one gets hurt.

The job of the fire boss is to take charge of everyone, to plan strategy and tactics, to insure safety, and to tell local forestry officials how the work is progressing. A single crew is sufficient to put out a small fire, and the crew boss can also be the fire boss.

For a large fire, firefighters are grouped into numerous crews (Figure 14). Each crew has a *crew boss* who reports to and receives instructions from the fire boss. The fire boss himself does not need to himself talk to every firefighter. A single person is unable to keep track of more than eight firefighters while also scouting the fire, planning strategy and reporting to authorities.

At a large fire, the fire boss gives authority to crew bosses to instruct and keep track of their own crews and to make limited decisions, particularly when the safety of their crew is threatened.



Figure 14: Safety is paramount when fighting the peat fires.

Communications

Communication takes place at many levels during a fire. The fire boss gives clear instructions to his crew bosses. Crew bosses talk to their firefighters and other crew bosses to give instructions and warnings if conditions become dangerous. Firefighters talk to one another so that they can pass along instructions from the crew boss or ask for help (Figure 15).

Everyone at the fire must be able to be contacted quickly – by radio, voice, or messenger – if conditions become unsafe and firefighters have to run for safety. The fire boss needs also to be able to communicate with forest authorities to request help and report progress. This progress report passes details of size, fuels, numbers of people and equipment being used, and an estimated control schedule. It is transmitted by radio, through a messenger sent to a telephone, or directly by messenger.

The International Civil Aviation Organization (ICAO) radio communication code is used to ensure uniformity and enhance audibility (see Appendix Fire Management Terminology).

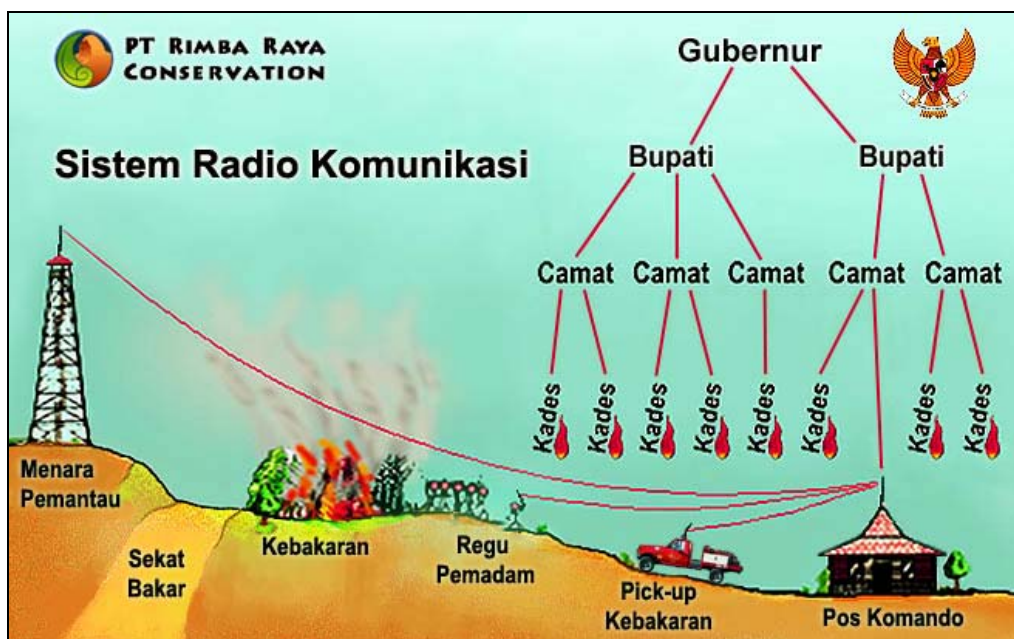


Figure 15: Radio communication network for fire suppression.

Fire Reporting

The fire boss completes a report after each fire in the concession. It forms the official record and is used to obtain a picture of numbers over time and the impact of each fire. Reports also help ensure the continuous improvement of fighting capability and the understanding of fire behaviour. Table 2 shows an example of fire report sheet.

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ANNEX I. FIRE MANAGEMENT TERMINOLOGY

The terminology used in this paper follows the standards set by the Food and Agricultural Organization of the United Nations (FAO, 1986) and the English-speaking countries (McPherson *et al.*, 1990; Chandler *et al.*, 1991).

Anchor Point: Point of Attack: An advantageous location, generally a fire barrier, from which to start constructing a fireline. Used to minimize the chance of being outflanked by the fire while the line is being constructed.

Attack Line: Line of hose, pre-connected to the pump and ready for immediate use in attacking a fire.

Back Fire: Fire spreading, or more often deliberately ignited to spread, against the wind or down slope. [A fire spreading on level ground in the absence of wind is a backing fire.]

Backpack Pump: Knapsack pump: A portable sprayer with hand-pump fed from a container fitted with shoulder straps.

Bulldozer : A crawler tractor with a scraper blade attached.

Burn: An area over which fire has run.

Chain of Command: Order of rank and authority in the organization.

Command: The act of directing, ordering, and/or controlling firefighting forces by virtue of legal, administrative or delegated authority.

Contain a Fire: Take fire suppression action which can reasonably be expected to keep the fire within established boundaries under prevailing conditions.

Control a Fire: To complete a control line around a fire and cool-down all hot spots that threaten the control line until it can reasonably be expected to hold.

Control Line: A comprehensive term for all the constructed or natural fire barriers and treated fire edges used to control a fire.

Crew Boss: A person in supervisory charge of usually 5 to 20 firefighters and responsible for their performance, safety and welfare.

Crown Fire: A fire that advances from the top of one tree to the next more or less independently of the surface fire.

Direct Attack: Any treatment of burning fuel at a fire's active edge in an effort to control a fire (e.g. wetting, smothering, physical separation of burning from non-burning fuel).

Dead Fuels: Fuels having no living tissue and in which the moisture content is governed by atmospheric moisture (relative humidity and precipitation), air temperature and solar radiation.

Drip Torch: A hand-held tool for igniting prescribed burning or back fires by dripping flaming fuel on the materials to be burned.

Early Burning: Prescribed burning carried out at the dry season before the undergrowth is completely dry or the leaves are shed; as an insurance against more severe fire damage later on.

Escape Route: A route away from danger spots in a fire; should be pre-planned.

Escape Fire: A fire that has exceeded initial attack capabilities.

Fire Behaviour: The manner in which a fire reacts to the variables of fuels, weather and topography.

Fire Boss: Incident Commander: The person responsible for all fire suppression and service activities at a fire.

Firebreak: A natural or constructed discontinuity in a fuelbed used to segregate, stop and control the spread of fire; or to provide a control line from which to suppress a fire; characterized by a complete lack of combustibles down to mineral soil.

Fire Crew: A general term for 10 – 20 firefighters organized to work as a unit.

Fire Front: That part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified it is assumed to be the leading edge of the fire perimeter.

Fire Guard: General term for a firefighter, lookout, patrol, prevention guard or other person directly employed to prevent and/or detect and suppress fires.

Fire Hazard: A fuel complex, defined by volume, type, condition, arrangement, and location, that determines the degree both of ease of ignition and difficulty of suppression.

Fireline: Generally, any cleared or treated strip used in fire control; more specifically, that portion of a control line from which flammable materials have been removed by scraping or digging down to mineral soil.

Fire Management: All activities required to protect the forest from fire; and the use of fire to meet land management goals and objectives.

Fire Pre-suppression: Activities undertaken in advance of fire occurrence to help ensure more effective suppression. Includes over-all planning, recruitment and training of fire control personnel, procurement and maintenance of firefighting equipment and supplies, fuel treatment, and creating, maintaining and improving a system of fuelbreaks, roads, water sources and control lines.

Fire Prevention: All measures taken in connection with fire management, forest management, land use and the general public which may result in the prevention of outbreak of fire or the reduction of fire severity and spread.

Fire Pump: An engine-driven pump, usually gasoline-powered, specifically designed for use in fire suppression, that may be carried by a person or transported on skids or a trailer.

Fire Rake: Long-handled combination rake and cutting tool, the blade of which is constructed of a single row of three or four strong, sharpened teeth.

Fire Report: Official record of a fire, generally including information on cause, location, action taken, damage and costs from start of fire until completion of suppression action.

Fire Suppression: Fire Control: All the work and activities connected with fire-extinguishing operations, begins with discovery and continues until the fire is extinguished.

Fire Swatter: Fire Beater: Fire suppression tool, sometimes improvised, used in direct attack to beat out flames along a fire edge; may consist merely of a green branch or

wet sacking, or be a manufactured tool (e.g. a flap of belting fabric fastened to a long handle).

Fire Tool Cache: Fire cache: Supply of fire tools and equipment assembled in planned quantities and/or standard units at a strategic point for exclusive use in fire suppression.

Fire Triangle: An instructional aid in which the side of a triangle are used to represent the oxygen, heat and fuel necessary for combustion and flame production. When any one of these factors is removed, flame production ceases.

Foam: Compounds introduced into a stream of water (by special nozzles or pre-mixing) to develop a stream of air bubbles surrounded by a tenacious film of water and foaming agent capable of smothering fires; the product of such equipment.

Fuel: All combustible organic material in forest, other vegetation types and agricultural residue.

Fuelbreak: Generally wide (20 – 300 m.) strips of land on which the native vegetation has been permanently modified so that fires that burn into them can be more readily controlled. Some fuelbreaks contain firelines (e.g. roads, hand lines) which can be quickly widened with hand tools or by burning-out.

Fuel Management: The practice of controlling the flammability and reducing the resistance to control of forest fuel through mechanical, chemical or biological means, or by fire.

Fuel Type: An identifiable association of fuel elements of distinctive species, form, size, arrangement or other characteristics that will cause a predictable rate of fire spread or difficulty of control under particular weather conditions.

Ground Fire: Fire that burns the organic material in the soil layer (e.g. peat) and often along with it, the surface litter and low-growing vegetation.

Hand Crew: Ground Crew: Fire crew trained and equipped to fight fire with hand tools.

Hand Line: Fireline constructed with hand tools.

Handie-Talkie: Walkie-Talkie: Two-way radio hand-set used for fire communications.

Hose-Lay: Arrangement of connected lengths of fire hose and accessories on the ground; begins at the first pumping unit and ends at the point of water delivery.

Hot Spot: A particularly active part of a fire.

ICAO Code: For radio communications, the code from the International Civil Aviation Organization (ICAO) is used to enhance audibility and clarity.

A: ALPHA	J: JULIET	S: SIERRA
B: BRAVO	K: KILO	T: TANGO
C: CHARLIE	L: LIMA	U: UNIFORM
D: DELTA	M: MIKE	V: VICTOR
E: ECHO	N: NOVEMBER	W: WHISKEY
F: FOXTROT	O: OSCAR	X: X-RAY
H: HOTEL	P: PAPA	Y: YANKEE
G: GOLF	Q: QUEBEC	Z: ZULU
I: INDIA	R: ROMEO	

Indirect Attack: A method of fire suppression in which the control line is located a considerable distance from the fire's active edge; generally used in a fire with rapid rate of spread or high intensity to utilize natural or constructed firebreaks or fuelbreaks and favorable discontinuities in topography. Intervening fuel is often burned-out but occasionally, depending on conditions, the main fire is allowed to burn to the control line.

Indirect Attack: A method of suppression in which the control line is located some considerable distance away from the fire's active edge.

Initial Attack: First Attack: The first actions taken to suppress a fire; resources initially committed to an incident.

Large Fire: For statistical purposes, a fire burning more than a specified land area, e.g. 100 hectares; a fire burning with a size and intensity such that its behavior is determined by interactions between its own convection column and weather conditions above the surface.

Lookout Tower: Structure that elevates a person above nearby obstruction to sight fires; generally capped by a hut.

McLeod Tool: A short-handled combination hoe and rake, with or without replaceable blades.

Mopping Up: Mop-Up: Making a fire safe after it has been controlled by extinguishment or removal of burning material along the control line, by the felling of snags, the trenchment of logs, etc.

Natural Barrier: any area where lack of flammable material obstructs the spread of forest fires.

Plan of Attack: The selected course of action and organization of personnel and equipment in fire suppression; applied to a particular fire or to all fires of a specific type.

Point of Attack: See Anchor Point.

Portable Pump: Small gasoline-driven pump that can be carried to a water source by one or two firefighters over difficult terrain.

Prescribed Burning: Controlled application of fire to vegetation carried out under specified environmental conditions which allow the fire to be confined to a predetermined area and at the same time, produce the intensity of heat and rate of spread required to attain planned resource management objectives.

Pulaski: Combination chopping and trenching tool widely used in fireline construction which has an axe blade and a narrow trenching blade fitted to a straight handle.

Reinforced Attack: Support: Those resources requested in addition to the resources for initial attack.

Running Fire: A fire spreading rapidly with a well-defined head.

Sector: A designated segment of fire perimeter or control line allocated to the suppression-work unit for two or more crews under one leader.

Slash: Unusual concentrations of fuel resulting from natural events, such as wind and fire, or human activities such as logging and road construction.

Slash and Burn Agriculture: Farming (usually small-scale) in which plots are prepared for planting by cutting and burning of the vegetative cover.

Slip-on Tank: A tank, a hose-reel, an auxiliary pump and an engine combined into a one-piece assembly that can be slipped onto a truck bed or trailer.

Span of Control: Maximum number of subordinates that can be directly supervised by one person without loss of efficiency. In fire suppression the number varies by activity but is generally between five and ten; up to 20 for hand crews.

Spot Fire: Fire set outside the perimeter of the main fire by a flying spark.

Surface Fire: Fire that burns only surface litter, other loose debris of the forest floor and small vegetation.

Tanker Trailer: Trailer able to mount a tank, fire pump, hose and ancillary equipment.

Uncontrolled Fire: A fire that threatens to destroy life, property or natural resources; a fire not burning within the confines of firebreaks, or; a fire burning with such intensity that it can not be readily extinguished with the tools available.

Undercut Line: Trench: A fireline below a fire on a slope. Should be trenched to catch rolling material.

Volunteer Firefighter: Irregular, legally-enrolled firefighter under the fire management organization regulations who devotes time to community fire service for monetary compensation.

Wetting Agent: Surfactant: An additive that reduces the surface tension of water or other liquid causing it to spread and penetrate more effectively.

Wildfire: Wildland fire: Any fire that is not meeting management objective and thus requires suppression.

ANNEX II. STANDARDIZATION OF FIRE EQUIPMENT

ANNEX III. PROGRAMMES FOR TRAINING IN FIRE AND RESCUE