



**RESPONSIBLE ORGANISATION FOR  
FOREST FIRE CONTROL  
AND BASIC LAW ENFORCEMENT**

### 3. RESPONSIBLE ORGANISATION FOR FOREST FIRE CONTROL AND BASIC LAW ENFORCEMENT

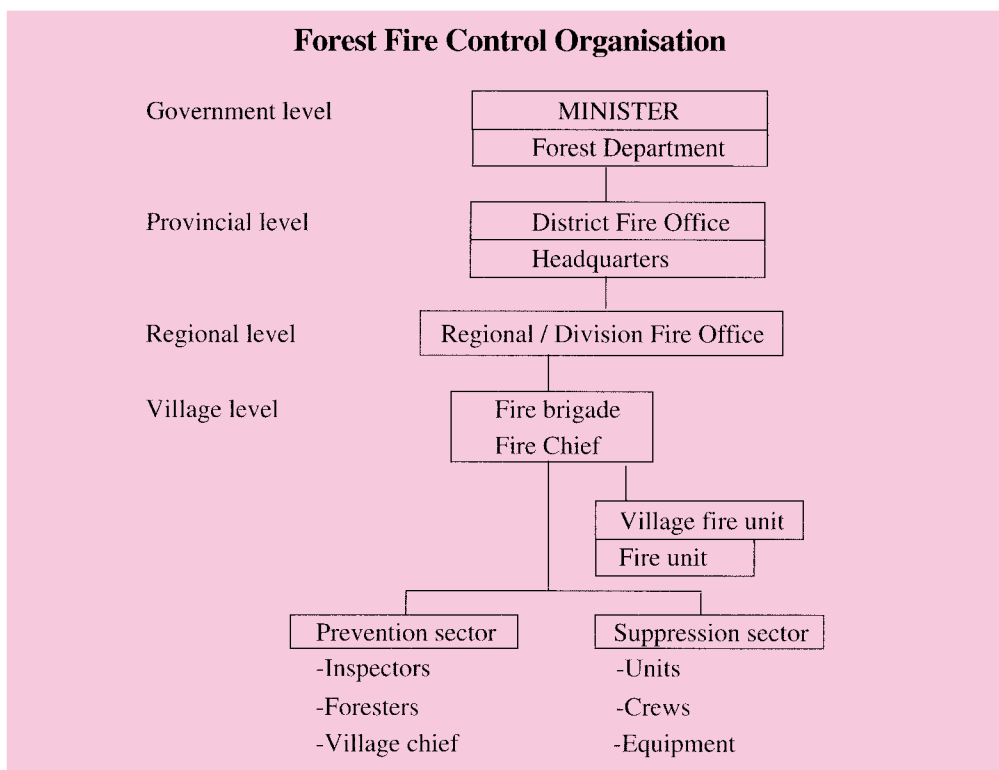
There are many variations in the ways to organise the fire control service. The laws, regulations, and duties of the responsible authorities may vary from country to country, depending on:

- the organisation of the government;
- local laws; and
- culture and traditions.

In this part of the manual some of the general principles for organisation and the steps to be taken to develop laws and regulations for forest fire prevention control are pointed out.

#### 3.1 Responsible Organisation for Forest Fire Control

The responsibility for forest fire protection has, by law or in a fire ordinance, to be assigned to a public organisation. The responsibility and authority for all duties must be clearly outlined to all responsible bodies, from village level to the highest level of government. The main responsibility for fire protection is generally under a ministry, which has to know exactly what its duties are and the objectives of the regulations.



It is important that the highest level of responsibility is placed upon a ministry, because forest fire protection will be organised by using government budgetary funds. Therefore it is also important that the responsible ministry is, at all times, kept well informed of the problems and activities of forest fire control.

The lowest level of responsibility in the forest fire protection organisation is placed at local or village level. These local or village level activities are also the most important basic link for all organisations involved in forest fire control.

In practice, most countries have two appropriate alternatives for the selection of the main responsible organisation for forest fire protection, which could be as follows:

- (i) A national forestry organisation or department which normally attends to all forestry activities. In general the forestry organisation carries out these duties very well because:
  - foresters have a good knowledge of all the forest areas, forest types, maps, accessible roads, and so on; and
  - the forestry organisation covers all the forest areas.
- (ii) The national fire organisation or department could also be suitable for this duty. As the fire organisation is usually situated in an urban area there could be a problem when considering the distance of the fire brigade from the forest area.

It is a more common practice for the Forest Department to take the prime responsibility for forest fire control. However, a combined organisation could be used. This means that the duties will be divided between the forestry department and the fire organisation.

Responsibilities can be divided at different levels or between different duties. If there is a combined organisation then the perimeters of the areas and duties must be made very clear.

## **3.2 Cooperation and Collaboration**

Very few fire services can afford or justify owning all the fire equipment nor be able to organise all the resources that are required to combat unusually large fires. Therefore, most districts depend on cooperation from other organisations, and in return cooperate with them. This cooperation takes many different forms, but it is a necessary part in the planning of any fire management strategy.

The most common of the organisations that cooperate in forest fire control are the:

- Police;
- Army;
- Air Force;
- Civil Defence;
- Public Works Department; and
- Department of National Parks.

The wildfire control services will often have to make a formal agreement of cooperation with one or more of the above organisations.

## **3.3 Law Enforcement and Regulations Affecting Wildfire Protection**

To lay the foundation for wildfire prevention and the organisation of forest fire protection the country must have special laws and regulations. The regulations and law enforcement must consider the local situation of living conditions, farming, etc. Generally, these basic laws and regulations should include the following:

- (§) Naming the responsible authority for the individual duties of wildfire protection, such as prevention and suppression. Also to state the different levels, such as government, provincial, district, and village.
- (§) Leadership in forest fire suppression activities and the authority of that leader.
- (§) Local regulations stating how, when, and in which areas domestic fires are allowed to be started, and also stating dangerous and non-dangerous conditions.
- (§) Rules and limitations for campfires, farm fires, slash fires, and other fires.
- (§) That it is the responsibility of all members of the public to report a forest fire or any smoke seen within a forest area.
- (§) That it is the duty of all members of the public to stop the spread of a fire and take part in any fire suppression activity.
- (§i) That a punishment should be enforced if somebody has, through carelessness or neglect, caused a forest fire.
- (§i) Designating responsibility for the mopping-up operations.
- (§) Responsibility and liability for payments in regard to prevention, fire suppression, and mopping-up operations. Also, the responsibility for payment in cases of fire damage caused by carelessness or neglect.

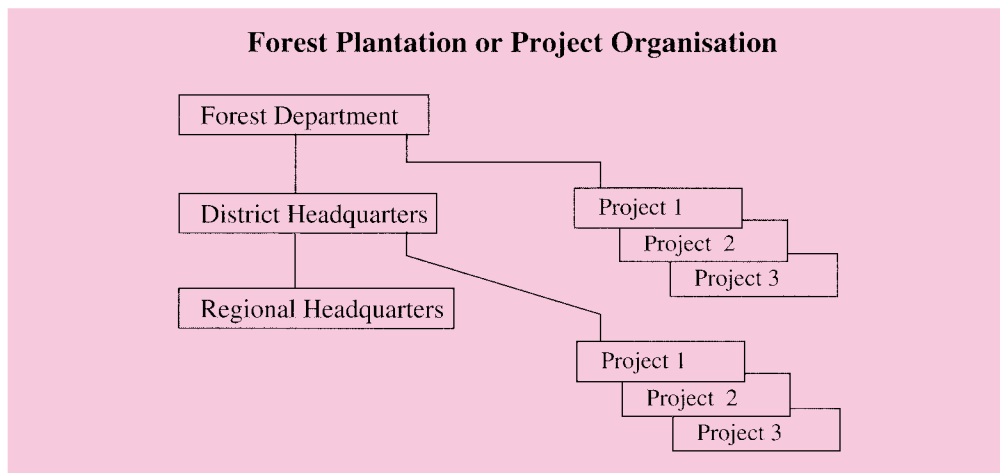
Naturally, the most effective way of fire protection is to educate the farming community, tourists, and the general public on the importance and value of the forests and the seriousness of the damage caused by fire. If the whole population understood this and took the necessary care when lighting a fire then most of the regulations would be redundant.

### 3.4 Plantation or Project Fire Organisation

In many countries the most important and most economic part of forestry development is the plantations and special forest projects. Because these areas are very valuable, with large amounts of the national forestry budget invested in them, it should be required by law to establish an effective fire prevention organisation for these areas.

Plantations and special forest projects can be placed within the framework of government:

- (i) under control of the Forest Department staff; or
- (ii) under control of the regional, provincial, or district headquarters.



### 3.5 Duties of the Responsible Authority in Fire Organisations

#### 3.5.1 Fire protection manager (field manager)

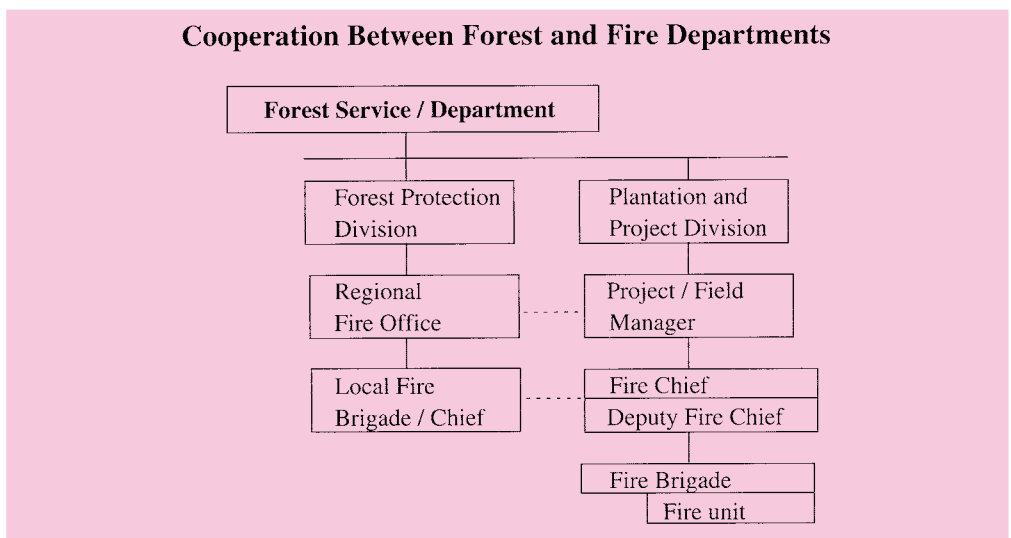
- Works out the fire plan, keeps it up to date, and makes sure that it is working.
- Makes proposals for emergency situations and develops the fire protection ability of the staff.
- Looks at the suitability of all the work methods applied and checks that any equipment purchased is suitable from the fire protection point of view.
- Looks after and supervises the fire service organisation and its future development.

#### 3.5.2 Fire chief

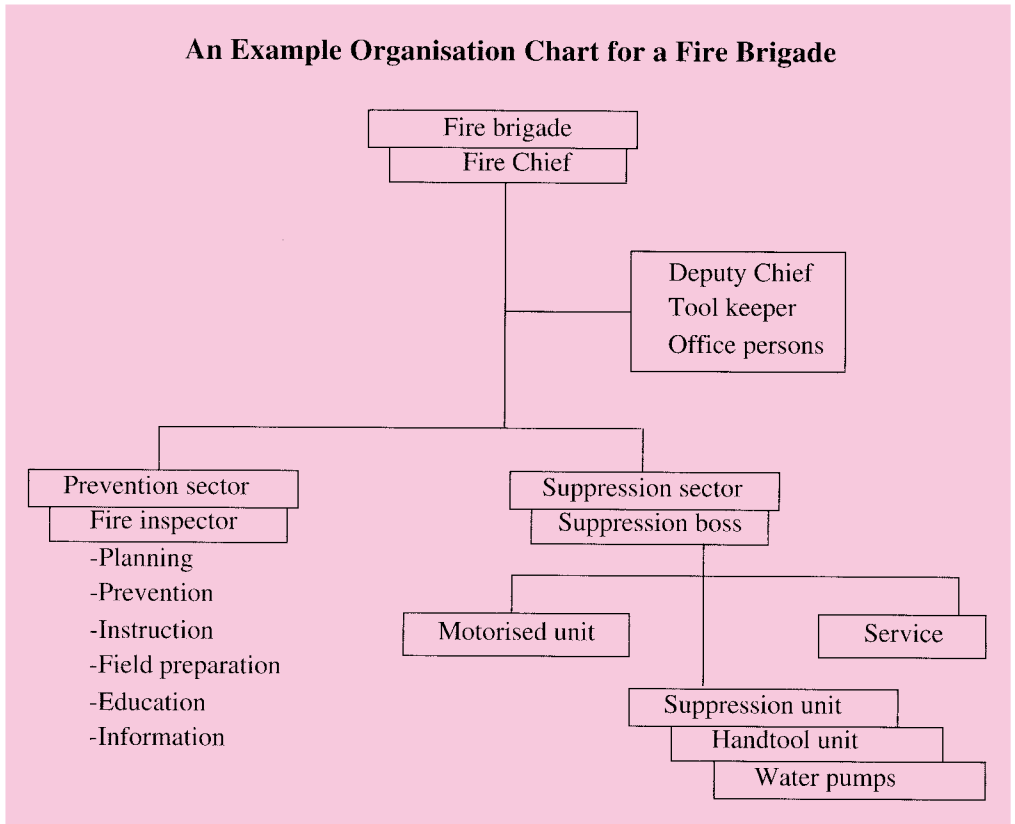
- Looks after fire security and protection methods, including observation and enforcement of the forest fire regulations.
- Makes sure that all fire risk conditions are minimised or removed.
- Makes sure that all fire prevention tools and equipment are in good condition and stored in the right place.
- Supervises fire prevention and pre-suppression activities as stipulated in the fire plan, such as grass cutting, controlled burning, preparing firelines and firebreaks.
- Prepares statistics and reports on all fires for submission to the correct authority.
- Leads the fire fighting units.
- Trains the fire brigade crews and fire fighting units.
- Makes proposals for intensive fire protection in general and increases the preparedness of all fire prevention units.

#### 3.5.3 Storekeeper

- Keeps fire fighting tools and equipment in good working order, in a special fire tool store.
- Repairs or replaces all useless and broken tools and equipment.
- Makes regular inspections of the tools and equipment.
- Makes proposals for the purchase and delivery of new tools and equipment, and for their maintenance.



## An Example Organisation Chart for a Fire Brigade



### 3.6. Fire Protection Plans

#### 3.6.1 Purpose

The purpose of fire protection planning is to ensure that all state forests are adequately protected from fire by a continuing review of protection needs and organisational preparedness. A fire protection plan will provide in a readily accessible form all information required in organising a fire control operation. It will detail the existing protection system and incorporate recommendations for progressive improvement.

Information listed will include:

- (i) the effective access and firebreak system;
- (ii) the detection and communications system;
- (iii) the fire management plan;
- (iv) equipment and manpower resources; and
- (v) contingency plans for fire organisation.

Protection plans will be subject to regular review and will form the basis on which budget allocations for protection expenditure are determined.

### 3.6.2 Format

Plans need not conform to any rigid format. However, each plan should consist essentially of three parts:

- (i) A formal written plan detailing the existing protection system and incorporating recommendations for improvement.
- (ii) An organisation plan which will consist of a folder containing, in a clearly indexed form, all information likely to be required in an emergency (suggested content in 3.6.3.1).
- (iii) A map or series of maps showing all current information relevant to a fire control operation.

### 3.6.3 Content

Plans should include the following:

- (i) **Protection policy**
  - List all State Forests covered by the plan by broad forest types.
  - Define clearly the protection policy for each area.
  - Nominate the protection priority of each area covered by the plan
- (ii) **Existing road and firebreak system**
  - Outline the existing road and firebreak system.
  - Define the standards and specifications for roads and firebreaks particularly where there is any departure from the normal prescription.
  - Outline the annual maintenance requirement.
  - State the protection budget allocation.
  - List any planned improvements and allocate priority ratings of future works programmes.
- (iii) **Fire history**
  - A brief statement is required describing the incidence and severity of previous fires in the area and identifying historically high risk areas.
  - A map should be maintained showing all previous wildfires (location, area burnt, month and year of occurrence).
- (iv) **Fire management**
  - State the current hazard reduction burning policy for the various fuel types.
  - Describe the characteristics of local fuel types and comment on their burning characteristics.
  - Indicate the frequency and timing of hazard reduction burns.
  - List all areas which are burnt by ground crews.
  - List areas covered by co-operative burns (e.g. with villagers).
  - Record the current stage of the burning programme on the protection maps.
- (v) **Detection systems**
  - Outline the detection system - towers, other lookouts, blind areas, ground patrols.
  - Maintain maps showing areas seen from each tower or observation point.
  - Detail the formal system for deciding when towers are to be manned and when ground patrols or additional checks from observation points should be carried out.
- (vi) **Communication**
  - Indicate location of radio bases and telephone lines, and any deficiencies in the system.
  - Keep a list in the Fire Organisation Folder of each vehicle or officers having radios and the call sign of each.

- (vii) **Equipment** (including pumps, engines, water tanks, ploughs, and other equipment for making firelines)
  - List all equipment, indicating its age and condition.
  - Draw up a schedule for replacement.
  - Include check lists for vehicles and plant, equipment test procedures and personnel responsible for testing the equipment or ensuring the right equipment is on each vehicle.
- (viii) **Training**
  - State what training has been done and what is required, e.g. local training of tower observers, firecrews, truck drivers, tractor drivers, nominated fire bosses.
- (ix) **Contingency Plans**
  - Record information or procedures likely to be needed in an emergency situation. Most of it will be duplicated in the Fire Organisation Folder for ease of access. This should include the following:
    - (a) **Sources of external assistance**
      - List accurately what manpower and equipment is available in an emergency from villages, nearby plantations, fire brigades, other government departments, etc.
      - List names and how to contact people authorised to release such equipment.
      - List organisations which may be able to provide a service function such as supply of meals to fire fighters.
    - (b) **Formal crew dispatch system and initial attack standards**
      - Define levels of preparedness, automatic dispatch procedures and initial attack standards. All activities should relate to the Fire Danger Index, Drought Index and forest type.
    - (c) **Local command structure**
      - Define roles and responsibilities of staff required to act as:
        - (i) fire boss;
        - (ii) crew boss;
        - (iii) radio base operator; and
        - (iv) support staff (supply, records, liaison).

### 3.6.3.1 Suggested content of fire organisation folder

The fire organisation folder should contain all information likely to be required in organising a fire control operation or in organising to meet a changing fire weather situation.

The following information should be presented in a clearly indexed form to allow rapid extraction:

- (i) Current weather forecast, presented in loose leaf form at the front of the folder.
- (ii) Current stand-by arrangements. List staff actually on duty and those on stand-by. Detail location of tractor trucks, truck drivers and tractor operators and types of equipment they are authorised to operate, towers manned at the present time.
- (iii) Preparedness tables. Define level of activity in relation to Fire Danger Index and Drought Index. The duty officer on weekends requires such information to make any changes in stand-by arrangements in the event of changing weather situations.
- (iv) Radio call signs for all vehicles or officers with radios.
- (v) Telephone numbers of all staff (work and after hours for the local headquarters and neighbouring headquarters).
- (vi) List of regular and relief tractor drivers, truck drivers, and tanker drivers.



- (vii) List employees and how to contact them after work.
- (viii) Private hire arrangements (if any equipment is available for hire), including: dozers, trucks and low loaders, and aircraft.
- (ix) Checklists.
  - (a) Duty Officer
  - (b) Radio Base Operation
  - (c) Investigation Officer
  - (d) Dispatcher
  - (e) Fire Boss
  - (f) Vehicles
  - (g) Firefighters
- (x) Action plans.
  - (a) Dispatch system
  - (b) Strategic plans

### 3.6.4 Protection maps

Protection maps should include all information likely to be of value in determining fire suppression strategy.

The scale should be such as to allow all necessary information to be entered without cluttering. Each management area should be the subject of one single map if possible, but the map must not be too bulky for ease of field use at a fire.

All information entered on the map should conform to the standard map legend. Information of a temporary nature such as prescribed burning, firebreak maintenance, and recent logging or treatment is best recorded on one or more overlays on the base map. Annual updating of the overlays leaves the base map intact.

Plastic overlays may also be used to record the current fire situation and to plan suppression action. Such overlays will provide valuable records of fire development for post-fire analysis and reporting.

#### Standard map legend

- (i) Roads not presently recorded on the printed map
- (ii) Firelines, bladed tracks, and 4-wheel drive track.
- (iii) Natural scrub (forest) breaks or well developed village forest plots (dark green)
- (iv) Scrub (forest) breaks of limited effectiveness or areas where agroforestry is practised (pale green)
- (v) Any areas excluded from protection (red)
- (vi) Any huts, houses, dips, yards, pump sheds, or other improvements (YARDS)
- (vii) Permanent water points accessible by vehicle (W, blue)
- (viii) Fire towers (TOWER NO. 2, dk green)
- (ix) Lookout points (BAUPLE MT. LOOKOUT, dk green)

- (x) Areas of protection priority. Plantations should be adequately defined on existing maps by surveyed boundaries, year of planting, species and area. Other areas which need defining such as fire exclusion areas experiments, seed orchards, and so on can be shaded in yellow or any colour other than red or orange.
- (xi) High hazard areas which would produce abnormally severe fires should be shaded in orange, e.g. recent logging areas, unburnt alang-alang grass, etc. Such information is best recorded on an overlay as it is temporary in nature.
- (xii) Burning history. Areas on which co-operative burns, prescribed burns or buffer strip burns have been carried out are to be shown by cross hatching in red, together with date of burn on the map overlay, or by using a Standard Management Colour Legend as detailed below.

1980/81	Brown
1981/82	Red
1982/83	Orange
1983/84	Yellow
1984/85	Pale Green
1985/86	Dark Green
1986/87	Pale Blue
1987/88	Dark Blue
1988/89	Purple
1989/90	Black
1990/91	as for 1980/81

The simpler single colour system is preferred. Again, use of clear overlays is recommended for the purpose.

- (xiii) Other land users. Include lists of any person or organisation working or living in the forest area (e.g. farmers, gold-miners). Show the location of their activities on a map.

### 3.6.5 Protection plans - additional notes

The purpose of fire protection planning is to ensure that all state forests are adequately protected from fire by a continuing review of protection needs and organisation preparedness.

The following comments are made on the need for protection plans and the reasons for including the information listed:

- (i) **Protection policy**  
Without a suitable statement of protection policy for specific areas, officers could attend fires which are in no way threatening state forest, life, or substantial private property, while others might wait for fire to enter a state forest before taking suppression action.
- (ii) **Existing road and firebreak system**  
Detailing of the road and firebreak system on a protection map will show any weaknesses in the system. The logical sequence is for small discrepancies to be rectified almost immediately and for major works to be included in the works programme as soon as funds are available.
- (iii) **Fire history**  
Incidence and severity of fires should be factors in setting the level of preparedness which is required in a given area. Historically high risk areas which emerge from the

study should be investigated. Thus the preparation of a fire protection plan could lead to elimination of a potentially serious hazard, whether it be a physical feature or unauthorised burning by a neighbour of group of neighbours.

(iv) **Fire management**

Deficiencies in prescribed burning practices should be highlighted by proper map records. The timing, frequency, and intensity of fires is something that evolves with experience over a number of years and unless such information is recorded in the fire plan for the benefit of successive managers the lessons have to be re-learned.

The plan will show the newcomer which areas are to be aerially ignited, cooperatively burnt, or handled by forestry ground crews.

The use of annually replaced overlays and regular recording of progress should ensure that no areas are overlooked.

Repeated failure to complete the annual burning programme in the limited period between when the fuel is too wet and too dry should cause initiation of an investigation of why this is so. Are there sufficient breaks? Are the breaks of sufficient width and suitably located to allow rapid lighting with adequate control? Are the burning units the appropriate size to allow the maximum number of minimum sized crews to cover the whole programme in the limited time? Should duties be reorganised so that more staff are involved when the weather is ideal? What action can be taken if additional staff cannot be engaged?

(v) **Detection system**

By plotting areas visible from each fire tower a clear picture can be obtained of blind spots, areas covered only by one tower, and areas capable of one or more cross-bearings. Such information will be particularly useful to:

- plan tower construction and maintenance;
- where ground patrols or secondary observation points are needed; and
- to avoid unreasonable expectation of the tower-man's ability to pinpoint a fire.

(vi) **Communications**

With planning, deficiencies will show up under emergency conditions. Such can range from lack of mobile number lists in all vehicles to lack of radios. Insufficient communications at a major fire can be a disaster.

(vii) **Equipment**

Failure to systematically replace old items of equipment results in failure due to metal fatigue, usually when the equipment is subject to sustained use at a large fire, when it is of course most needed.

Obviously there is a need to assess types and numbers of suppression hardware, adequacy, condition, replacement and garaging so as to minimise deterioration by the elements, borrowing, accessibility, and so on before the fire emergency.

The small plant mechanic can assist in determining requirements and with the selection of suitable equipment and facilities required. This should be carried out early in the new year prior to the next fire season.

(viii) **Training**

A formal plan should list all forms of training from tanker crew and hand crew drills to fireboss organisation and strategy sessions. It should also include fire brigade training.

Training is simply a means of spreading what experience there is in the organisation to as many people as possible. Formal records of what training has been done and what needs to be done will result in economy of effort as well as improved performance at fires.

(ix) **Contingency plans**

These are simple pre-determined procedures likely to be needed in an emergency situation and should allow deficiencies to be detected and rectified, besides educating the staff.

After analysing our own resources, those other bodies should be listed so that a fireboss is not doing basic research work at the height of a fire emergency.

Formulation of initial attack standards and crew dispatch systems should take the guess work out of organising a fire suppression effort and protect more junior officers from adverse criticism if they have to act in the absence of more senior staff. This presupposes regular maintenance of weather data (Fire Danger Index and Drought Index). This noon data should be broadcast in each area as a matter of course to alert field workers to the current fire danger. All preparedness levels should relate to the risk of a fire starting and its potential to spread and do damage. Otherwise the organisation will be “under-insured”, neither of which is desirable.

**Revision of plans**

ANNUAL REVISION of plans will ensure a compulsory refresher course for staff involved. The only disadvantage is the time required, but this is outweighed by the chaos which can result from lack of preparation.

**3.6.6 Example of a fire protection plan from Indonesia for the Riam Kiwa trial and pilot plantation area**

- Contents:**
- 1 Purpose of the plan
  - 2 Protection policy
  - 3 Existing road and firebreak system
  - 4 Fire history of the area
  - 5 Fire management
  - 6 Detection system
  - 7 Communications
  - 8 Equipment
  - 9 Training
  - 10 Contingency plans

- Appendices:**
- 1 Map of plantations in Riam Kiwa
  - 2 Fire protection plan map
  - 3 Report of the wildfire in 1991
  - 4 The course program for the fire crew and local training
  - 5 The course program for the training course for prevention and control
  - 6 Rainfall in Riam Kiwa, monthly averages 1989 - 1992 and long term average of 17 years

**1 Purpose of the plan**

The purpose of this fire protection plan is to ensure that the Riam Kiwa Trial and Pilot Plantation Area of the Reforestation and Natural Forest Management Project is adequately protected from fire. Since the project only works on reforestation trials, having a relatively

small area for demonstrating large scale operations, the plan does not intend to be a comprehensive example for industrial plantations. However, the plan will give some useful information and guidelines for further developing fire protection in Riam Kiwa area and also for the development of fire protection in a wider area in the South Kalimantan grasslands.

## **2 Protection policy**

The fire protection policy of the project is to maintain an adequate preparedness for fire protection through efficient fire prevention and suppression methods. This will be gained only through sufficient supplies of equipment and training of staff.

### **Areas and forest types**

The Riam Kiwa Trial and Pilot Plantation Area consists of a great number of species, with provenance and silvicultural trials on species promising the rehabilitation of alang-alang grasslands and the production of wood for various purposes.

The total area to be protected is 1000 ha. The area so far planted is approximately 650 ha out of which approximately 260 ha burnt in a major wildfire in October 1991. The area is split into many small patches, each having different fire behaviour characteristics. This makes the fire protection more demanding than the protection of plantations of only one or two species.

The area is dominated by strong growth of alang-alang (*Imperata cylindrica*) grass that formerly covered the whole area. There are also many alang-alang areas still within the trial plantations, causing an additional hazard to the main plantations. The aim is to reduce these areas to a minimum with plantations.

### **Methods**

Development of fire protection is the most important part of plantation establishment in South Kalimantan as well as in other parts of Indonesia. Fires are almost always caused by people living in the area, thus the extension work among local people is an essential part of the fire protection policy. If a plantation resource is to be established and maintained to maturity, fire protection must be allotted top priority.

It is widely acknowledged that, except in the most abnormal seasons, fire problems are associated with the presence of alang-alang. Where there is no alang-alang there is no fire problem. Therefore, suppression of alang-alang is the most important activity in the fire protection activity.

Fire prevention involves the following components:

- proper silvicultural practices, aiming at a fast closure of canopies to suppress the grass through shading and through mechanized and chemical methods for weed control;
- control of grass;
- the follow up and development of a fire hazard rating system to better alert the people of the fire hazard;
- fire line and fire break maintenance, together with hazard reduction burnings in alang-alang areas adjacent to plantations;
- supply of equipment and material for controlled burning and fire suppression;

- training of personnel for fire protection and extension work among the people living in neighbouring villages;
- promotion of agroforestry practices in areas with high risk of fires; and
- continuous fire detection from towers and by use of motorbikes.

Suppression methods involve:

- fast initial attack with a 4 wd vehicle with a slip on unit and six man crew with hand tools;
- direct attack with water; and
- indirect attack (backburning).

### **Priorities**

The priority areas to which most care is addressed in prevention are the trials holding most scientific interest and which are to be followed and analysed regularly by measurements. The failed trials and plantations established with inferior species or provenances are of secondary importance and will be soon replaced with better ones.

## **3 Existing road and firebreak system**

### **Roads**

There is a quite dense road network in Riam Kiwa now. The existing roads, even though not of the best quality, offer access to all plantations by vehicles. The total length of these roads is nearly 20 km, a density of 20 metres / km.

The main roads are classified and described in the following manner:

Hendratna road passing the project area in the north in a west-east direction

Hendratna 1 from the main road to the Impres area

Hendratna 2 stoned road from the main road to the new road

Hendratna 3 from the main road to the crossing near the previous location of tower no. 2

Utama road from the mosque to the seed stand

Utama 1 from the camp, passing species trials

Utama 2 starting from the heliport leading to the new plantations

Utama 3 leading to tower no. 3

Utama 4 new road

The roads are regularly maintained by grading and the main roads are gravelled to be passable all year round. However, the access road and the roads within the area do not allow for 2wd traffic other than trucks during drier times.

### **Firebreaks**

Due to the importance and diversity of trials and pilot plantations there are altogether some 25 km of maintained fire lines in the plantation area. Fire lines are usually 5 m wide and maintained as bare earth by ploughing or with a tractor back blade twice a year, the first time in May-June and the second time in August-September. Maintenance is to be continued only until the canopy is closed and the internal hazard reduced. On steep slopes and other areas where tractors cannot be operated, fire lines are constructed by manual means.

Fire lines are constructed and maintained only where and while there is an identified hazard (i.e. expanses of alang-alang) or a recognized source of ignition (e.g. a farm or village).

The fire lines will be supplemented by controlled burnings of the width of at least 60 m adjacent to alang-alang areas. The maintenance of fire lines will be more intensive in the southern side of the area from where the winds blow during the fire season.

### **Natural fuel breaks**

Fire line construction and maintenance is expensive. The creation of natural fuel breaks is a less expensive long term alternative. Fuel breaks are areas of non-flammable or low flammable fuels, e.g. well developed natural forest, *Acacia mangium* stands with closed canopy, and agricultural crops (e.g. tumpangsari). Growing of low-flammable cover crops reduces the fire hazard.

## **4 Fire history**

Before the plantation programme was started fires occurred frequently in the area, preventing the grassland from turning into forests or even bushlands. The alang-alang burns on an annual basis unless fire protection is well taken care of. Under most conditions in Indonesia, alang-alang is the fuel type which burns most readily. However, provided that men and equipment can be quickly mobilised onto such fires they are relatively easy to control. Once conditions become very dry however, belukar can burn, and fires which are well alight in belukar are harder to put out than fires burning in alang-alang. There is a continuous record of minor fires burnt in Riam Kiwa trial plantations but only one major wild fire, in October 1991. This occurrence was due to the coincidence of all factors creating a situation where an uncontrolled fire is possible. The area burnt was 265 ha.

## **5 Fire management**

### **Fuel types**

**Alang-alang** - Observations in Riam Kiwa and several reports conclude the following features of alang-alang:

- Average fuel weights in alang-alang unburnt for 12 months will be in the range 10-15 tons/ha.
- 100% green alang-alang will not burn readily and if it does burn only a low intensity fire results. The accumulation of some dead material (either as residue from a previous incomplete burn or as material which has grown and died since the last fire) appears necessary to allow significant fire activity.
- After a complete burn it takes approximately 3-5 months (dependent on weather conditions) to accumulate sufficient dead material to carry a fire.
- By 9 months after a complete burnt the fuel burns readily and will carry a fire within two days of even heavy rain.

### **Forests**

Selection of species is, among other criteria, very important in terms of fire protection. In this pioneer phase of the rehabilitation of alang-alang areas it is necessary to select species which can quickly suppress the grass.

The other important criterion is the rate of susceptibility to fire. Even though much effort is put on fire prevention there is a high risk of fire. Thus it is advisable to select fire tolerant species for reforestation of alang-alang lands.

Acacias, such as *Acacia mangium*, *Acacia crassicarpa*, and *Acacia auriculiformis*, as well as *Gmelina arborea*, *Dalbergia latifolia*, *Cassia siamea*, and *Paraserianthes falcataria* are favoured in this phase.

### **Hazard reduction burning**

The fire hazard is associated with the presence of alang- alang grass. This is why alang-alang areas adjacent to plantations are burnt under controlled conditions.

Controlled burning should not be started too early. The best time for the controlled burning is when the consumption of fuel by fire is more than 80%. This time may be difficult to predict. Controlled burning can be tried in mid June on a smaller scale and if the fuel consumption is big enough the burning can be extended. It is important not to start burning too early to avoid the need to burn twice. However, some of the areas may have to be burnt twice, especially if the drought period is prolonged.

Prescribed burning for fuel reduction within the plantation will not be done due to the susceptibility of grown species to heat damage.

For farmers' "ladang" burnings outside the trial area the project will supply tools and possibly personnel. Extension work will be done to promote cooperation between the project and farmers.

High risk areas can be seen on the fire protection map attached to the plan.

### **Water points**

There are several improved water points in the area. The target for water points is one per 200 ha of plantations. On top of this there are three concrete water tanks in the area, each of which contains 7,5 m<sup>3</sup> of water. During the worst drought period, dams may be constructed to increase the volume of natural water points.

The accessibility to the water points should be maintained by road repair. The location of water points is indicated on the maps attached to the plan.

## **6 Detection systems**

At present there are three fire detection towers in the trial area. This is a clear overcommitment to needs. Only tower no. 2, which covers the entire trial area, is manned at day time; on high hazard days during the period of June to October, starting at 8 am and ending at 6 pm.

Tower no. 1, nearest the camp, is used for detection in the evenings, from 6 pm until 12 pm. During that time the likelihood for fires is smaller.



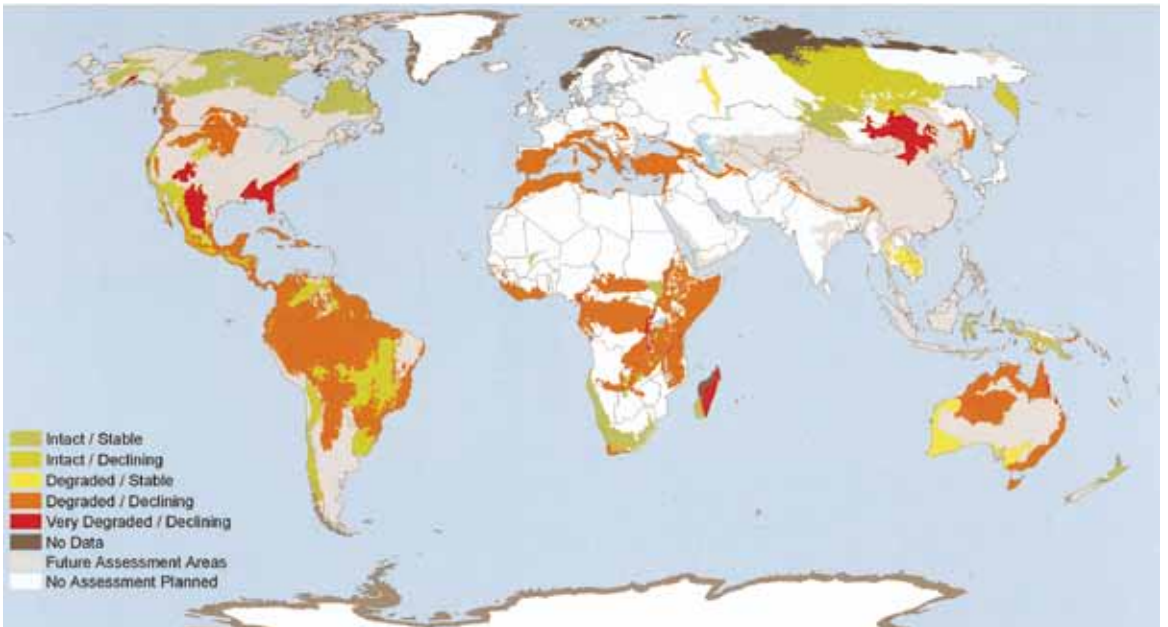


Fire weather indicator, Indonesia



Set of basic high quality hand tools for forest fire control, Sri Lanka

From page 245.



**Figure 2** Priority Ecoregions and Dominant Fire (TNC, 2004. Fire, Ecosystems & People: A Preliminary Assessment of Fire as a Global Conservation Issue, The Nature Conservancy; (<http://www.nature.org/initiatives/fire/science>).



Prescribed burning crew constructing black line. The crew consists of professional burners as well as of trained HIV-orphans in the Working on Fire (WoF) programme in the Republic of South Africa.



Fire pick-up Attack Unit with crew; equipped with light motorized pump (capacity 80 l/min), knapsacks and fire swatters, Indonesia

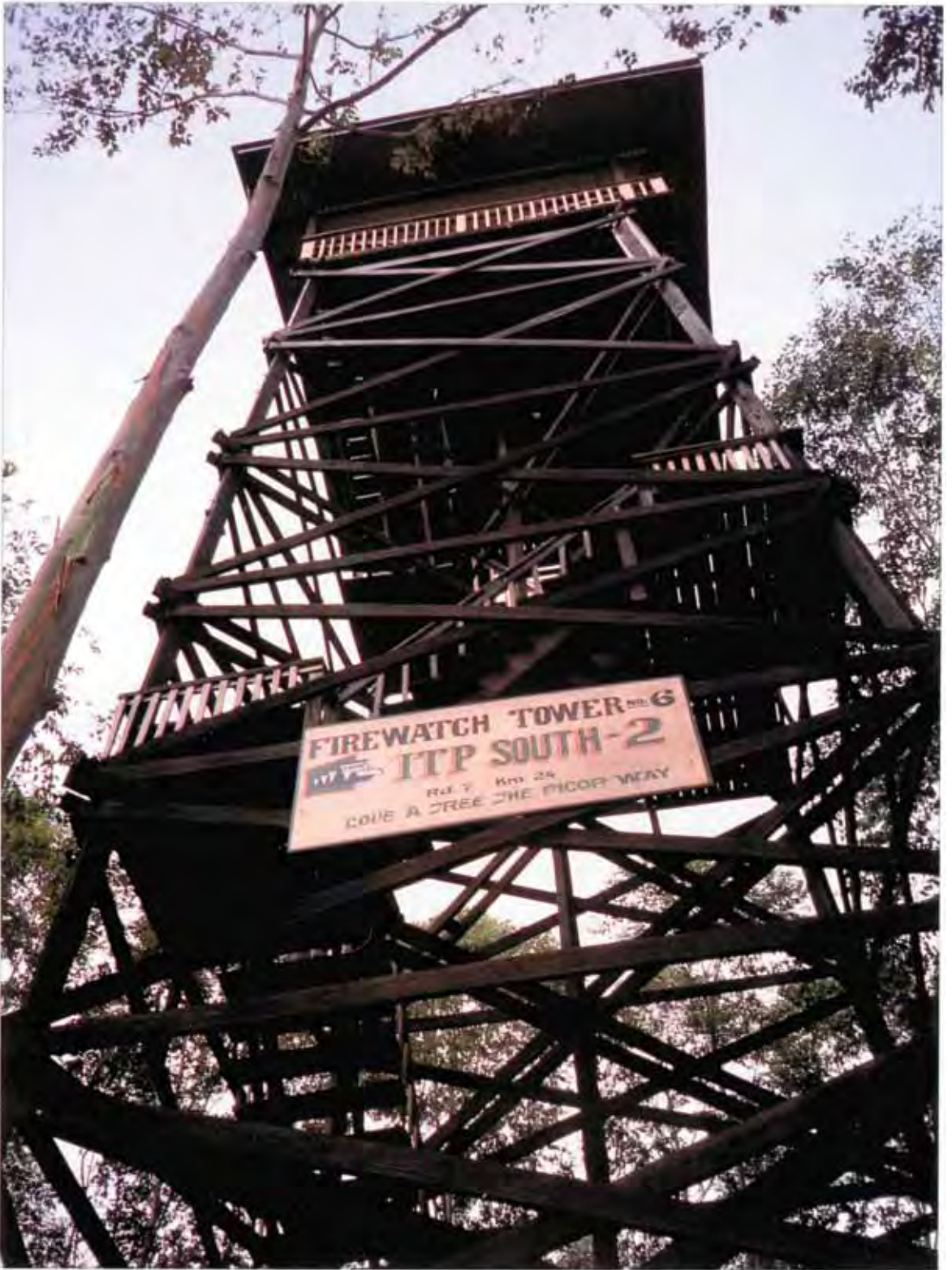




Community theatre performing fire awareness drama play for children and adults, method selected due to low (20 %) literacy rate among local women, Zambezia, Mozambique.



Large fire line dividing plantation compartments, Zimbabwe



Wooden fire watch tower in tropical rain forest area, the Philippines





Fire survey among local women to find out their perceptions, beliefs and attitudes towards fire and burning, Katima Mulilo, Namibia



Mopping up with light motorized centrifugal pump (capacity 600 l/min), Thailand



Torch man setting fire to mixed along-alang grass (*Saccharum spontaneum* and *Imperata cylindrica*) for making a creeping edge during a controlled burning practice, Indonesia



Course on Training of Instructors in Community Based Fire Management (CBFiM), Zambezia, Mozambique.





Burning snag, Canada

Inspection of fuel break (constructed by burning) by members of local community; fuel load 11.000 kg/ha, grass height 4 metres, flood plains of Zambezi River, Namibia.



Controlled burning practice, note edges of fire; Indonesia



Overview of a succesful extinguishing of a large fire in natural pine forest, note the trees felled as a fire break, Finland



Overview of the world's largest area of burnt natural tropical rain forest (3,8 million ha) in Bukit Soeharto, Indonesia



Tower no. 3 is used for occasional check ups.

Blind spots near tower no. 2 will be checked on foot hourly by the person responsible for fire detection in the tower. Fire detection from the tower is supplemented by patrolling by motorbike.

At night there is no fire detection.

The fire detection tower has a compass and a map for locating the fire with the cell grid or cross bearing system. There is also a pair of binoculars for observation and a radio receiver in order to make the stay in the tower more comfortable. Listening to the radio does not disturb fire detection.

At the base camp there are maps and a radio to receive information on fires.

For confirmation of the fire's location it is agreed to use names for blocks as follows:

- Impres
- Block Keminting
- Block Awu
- Block Murai
- Block 86
- Block Tengah

All these names are well known by the fire crew and help to avoid mistakes in locating the fire.

The following information is given from the tower when fire is detected:

- location of fire;
- much or little smoke;
- whether in trial area or outside.

## **7 Communications**

There is a main radio in the base camp and six portable radios for communications. There are no telephone lines in the area. The portable radios are used as follows:

- |   |             |
|---|-------------|
| - Stand by for the fire crew members in base camp | 2 pcs       |
| - Tower   | 1 pcs       |
| - Truck   | 1 pc        |
| - Pick-up   | 1 pc        |
| - Fire boss                                       | <u>1 pc</u> |
|   | Total 6 pcs |

To avoid losses the portable radios are numbered and a responsible person nominated for each of them.

## 8 Equipment

### Vehicles and implements:

- Truck equipped with a pump, hoses and hand tools for transportation of 15 man fire crew and water	1 pc
- 4 wd pick-up truck with a 400 litre slip-on unit, Honda / Davey pump, a 19 mm water hose with jet and hand tools for six men	1 pc
- Motorcycles	4 pcs
- Bicycle	1 pc
- Farm tractor, 4 wd, 120 hp	1 pc
- Farm tractor 4 wd, 80hp with front-end loader	1 pc
- Farm tractor, 4 wd, 80hp	1 pc
- Tractor trailers	3 pcs
- Disc ploughs	2 pcs
- Disc harrows	2 pcs
- Rotavators	3 pcs
- Back blade of tractor	1 pc
- Tractor roller	1 pc

### Pumps, hoses, and jets:

- Tractor pumps, Esa tractor	2 pcs
- Portable Mini Esa pumps	2 pcs
- Portable Kubota GS 300 pumps	3 pcs
- Portable Kubota GS 160 pumps	3 pcs
- Back pack sprayer, Mako	10 pcs
- Back pack sprayer, local	16 pcs
- Back pack sprayer, Fedco	12 pcs
- Canvas hoses, ½ ” diameter, 20m	42 rolls
- Canvas hoses, 3 ” diameter, 20m	13 rolls
- Suction hose, bigger	4 pcs
- Suction hoses for Mini Esa pumps	1 pc
- Suction hoses for Kubota GS 160 pumps	3 pcs
- Suction hoses for Kubota GS 300 pumps	3 pcs
- Couplings for canvas hoses	3 pcs
- Jets for Mini Esa pumps	12 pcs

### Water tanks:

- Trailer tank with Honda/Davey pump, 800 l	1 pc
- Trailer tank, 1500 l	2 pcs
- Trailer tank, 2000 l	1 pc
- Truck tank, 4000 l	1 pc
- Stainless steel tank, 4000 l	1 pc

#### Hand tools:

- Parangs, long	16 pcs
- Parangs, short	2 pcs
- Brush hooks	20 pcs
- Axes	5 pcs
- Bow saws	6 pcs
- Chain saws, big	2 pcs
- Chain saws, smaller	2 pcs
- Clearing saws	4 pcs
- Drip torch, big	3 pcs
- Drip torch	3 pcs
- Swatters	40 pcs
- Rake hoes	30 pcs
- Rakes	20 pcs
- Hoes	15 pcs
- Shovels	16 pcs
- Log tongs	16 pcs
- Protective clothes, shoes, helmets, gloves	20 sets
- Binoculars	2 pcs
- Compasses	5 pcs
- Tools and spare parts for:	
- pumps	
- chain saws	
- clearing saws	
- hoses	

#### Meteorological instruments:

- Hygrothermograph	1 pc
- Hygrometer	2 pcs
- Wind velocity indicator	1 pc
- Maps	

## 9 Training

The permanent project staff have already participated in several training courses on fire protection during previous years of plantation establishment in Riam Kiwa. In 1991 the fire protection strategy was revised by an Australian fire protection consultant. His development work in Riam Kiwa was followed by slight changes in fire protection practices and some new material purchases. Following this work a team of project staff made a study tour to New South Wales and Queensland, Australia studying bush fire protection there. The results of this development are being introduced to the fire control of Riam Kiwa. Two training courses will be arranged to train the personnel in new methods and the use of new tools and equipment.

Training will also be arranged as formal courses prior to the fire season and refresher training as on-the-job training during control burning and whenever the need arises. Two courses will be arranged as follows:

- A four day training course on fire protection for the fire crew of the project and people living in nearby areas.
- Training course on grassfire prevention and control. This course will be arranged for the Fire Chief level personnel of different forest companies and public sector forestry institutions.

## **10 Contingency plans**

### **Sources of external assistance**

Seventy five families live in the three villages nearest the project area. In case of a big fire some 40-50 people from the villages are available for fire control. It will take approximately 20 minutes to get them into the area. There are very few other people living in Riam Kiwa. The cacao project in the vicinity employs some 15 people who assist when the need arises.

Next, help can be sought in Desa Lima, which lies about 7 km away. It takes about one hour to get more helpers from there. According to experience it is possible to get up to one hundred people to fight the fire within a reasonable time. Tools and supplies will be reserved accordingly.

During fires the base camp cooks and other catering personnel will take care of serving meals and pure drinking water to fire fighters.

### **Formal crew dispatch system and initial attack standards**

During fire hazard days the fire crew will be stationed at the base camp. They are given light work at the camp during stand-by times. The fire boss is responsible for ensuring the preparedness of the crew to control fire at all times. During times when there is no fire hazard the plantation officer may appoint fire crew members to other jobs in the trial area.

Once a fire is detected the person in the tower immediately notifies the base camp. The person on duty at the radio in the base camp informs the fire boss of the location of the fire and other relevant information. The fire boss immediately dispatches the pick-up unit with six fire fighters for initial fire suppression.

The fire boss also promptly mobilises the truck with fifteen more crew and the tractors with water tanks. The fire crew has to suppress the fire using the appropriate methods, as learned in the training courses. After the fire is suppressed the fire crew prevents the fire from spreading again by mopping-up. The fire boss makes notes on the fire and gives permission to the crew to return to the camp when the fire is mopped-up. The fire boss is responsible for calling for additional assistance as needed.