3. THE THEORY OF FIREFIGHTING

Donors regularly send trainers with considerable forest fire knowledge to Indonesia to run basic firefighter training courses. However, experience shows that the best training results come when Indonesians instruct other Indonesians. Hence, the first requirement of any extensive training exercise is to develop a skilled and experience cadre of local instructors.

Basic fire training should be mandatory for anyone who will regularly take part in organized firefighting. Training needs to last five days; two days of classroom study and three days to practice the acquired knowledge. After completion, students will be ready to form effective, disciplined fire crews.

Fire Terminology

Studies of forest fire behaviour and firefighting begin with an explanation of terminology. The list below gives examples of basic terms that must be understood before discussing forest fires and suppression techniques. Further definitions are given in Appendix *Fire Management Terminology*.

- *Fuel;* the grass, shrubs and trees - alive and dead - that a fire burns.
- *Head;* the front of a fire where the flames are highest.
- *Tail;* the back end of a fire where the flames are lowest.
- *Flank;* the side of a fire.
- *Fireline;* a path dug through the grass, shrubs or trees around a fire to stop it.
- *Wetline;* a fireline made by squirting water on a fire rather than by digging.
- *Tanker;* a truck with a tank of water on the back and a pump and hose.
- *Direct attack;* suppression action taken right on the fire's edge.
- *Indirect attack;* suppression action carried out at a distance from the fire.
- *Fire boss;* the person who is in charge of a fire at the fire scene.

The Fire Triangle

Trees, grass, and brush burn only when air and sufficient heat are also present:

Fuel – Air – Heat make up the Fire Triangle

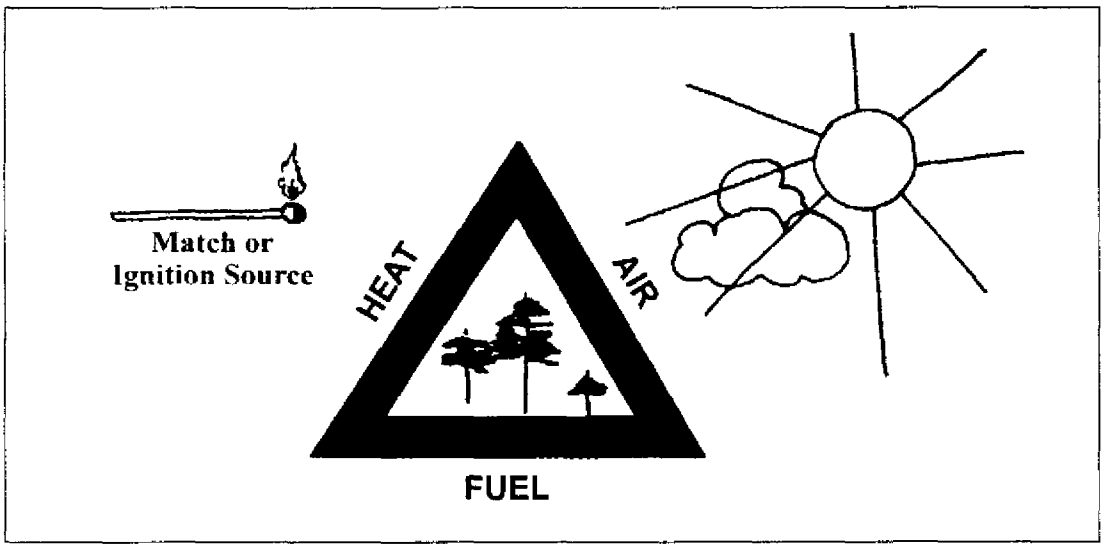

Figure 6 The fire triangle.

Without any one of the sides of the triangle, a fire cannot burn. There must be dry fuel, sufficient heat to ignite the fuel – a match, a coal seam, a cooking fire, a spark from a chainsaw – and air, without which a fire cannot breathe.

The Fire Triangle also indicates how to fight fire. To extinguish it, remove fuel, heat or air. Fuel is removed by building a fire line where the fire runs out of things to burn; heat by spraying on water, and; air by throwing on dirt.

Fuels, Weather and Topography

The ease or difficulty of controlling a forest fire depends on many things. Most important are the types of *fuels* that are burning, the *weather*, and the *shape of the land* – the topography.

Fuels: A knowledge of what is burning is the first consideration when trying to answer the question, "How can we put out the fire?"

- What *kinds* of plants are burning? Trees, shrubs or grass? Standing trees and logs lying on the ground burn more slowly than grass or shrubs, but give off more heat when they do burn. Are the plants mostly alive or dead? Dead plants burn more easily and hotter than live ones. And *how much* fuel is there? Have some trees been removed for firewood or has some of the grass been raked away? The more fuel there is, the hotter a fire burns and the harder it is to control.

- How much *moisture* is in the plants that are burning? Living plants will burn if they are very dry, and dead plants will not if they are very wet.

- How are the burning plants *arranged*? Is the grass standing or matted? Are the trees standing or lying on the ground? Are the fuels spread evenly throughout the

field or are they clumped? Standing fuels generally burn hotter than lying fuels as more air can reach them. Unevenly spread fuels reduce fire spread.

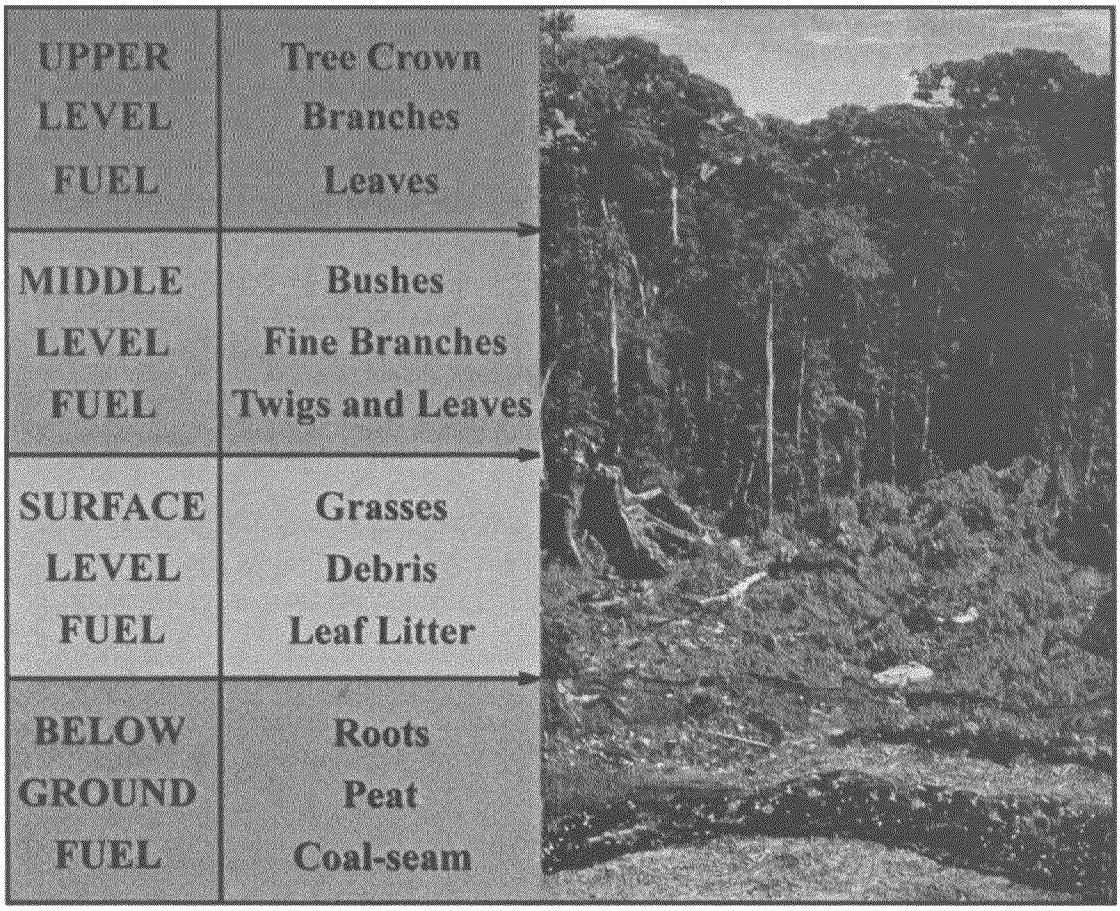

Figure 7. Knowledge of fuel of fuel types is of great importance.

Weather: The weather before and during a fire determines how it burns.

- *Temperature* is important. The hotter the weather in the weeks before and during the fire, the easier it is for a fire to grow and the harder it is to control.

- The stronger the wind, the harder the fire is to control. Wind bends the flames so that they touch the fuel ahead of the fire and help it to spread. And wind carries embers to fuel ahead of the fire and sometimes across firelines to start new spot fires. Wind also provides more air to the fire and makes it burn hotter. Wind helps to dry fuels so that they burn more easily.

  Thunderstorms often bring gusty storm winds that speed a fire and can change its direction more than once. In the morning light winds usually move uphill; in the evening downhill, as the ground warms and cools with the rising and setting of the sun. All winds cause problems for fire control.

- *Rain* and *high humidity* make fuel wetter, and thus a fire moves more slowly and is easier to control. Light fuels (grass) wet and dry quickly - trees and shrubs more slowly.

Topography: The shape of the land is important in fire control. Hills and slopes bring difficulties that flat country does not; they and other features affect how a fire burns and how it can be extinguished.

- Rising *slopes* raise flames closer to fuels ahead and the fire moves more quickly than on the flat. Plants above the fire are warmed before the fire reaches them and they ignite more easily. The steeper the rising slope, the faster the fire spreads and the harder it is to control. Firelines on a slope above a fire need to be wider than those below or on the sides of a fire.

  Slope also allows burning objects - logs or seeds - to roll across a fireline and cause fires below.

- Slope *aspect* is important. Slopes that face east heat up earlier in the day than those that face west, which warm up in the afternoon and evening. A fire on a west facing slope is more difficult to control late in the day than one on a hill facing east.

- Natural barriers help fighting. Small rivers, rocks, and patches of bare earth can all slow a fire and can be used to help control it. Man-made paths, roads and clearings serve the same function.

The Ten Standard Fire Orders

Every firefighter should learn and remember ten standard orders;

1. **F**ight fire aggressively but provide for safety first.
2. **I**nitiate all action based on current and expected fire behaviour.
3. **R**ecognize current weather conditions and obtain forecasts.
4. **E**nsure instructions are given and understood.
5. **O**btain current information on the status of the fire.
6. **R**emain in communication with crew members and your fire boss.
7. **D**etermine safety zones and escape routes.
8. **E**stablish lookouts in potentially hazardous situations
9. **R**etain control at all times.
10. **S**tay alert, calm, think clearly, act decisively.