Forest Fires in the Asean Region: Data, Definitions and Disaster?

By PETER F. MOORE

The Conundrum

Over hundreds of years, fire has been viewed by many as an environmental horror. It has been linked with reduced soil fertility, destruction of biodiversity, global warming and damage to forests, land resources and of course, human assets. Contentions like these fail to make important distinctions about different types of fires and the wrong types of fires in the wrong places (Corner House Briefing, 2000).

Forest fires occur either because of anthropological or natural causes. Most fires around the globe are caused by human activity while lightning is probably the most common natural cause of fire. Annually, fires are estimated to burn up to 500 million hectares (ha) of woodland, open forests, tropical and sub-tropical savannahs, 10-5 million ha of boreal and temperate forest, and 20-40 million ha of tropical forests (Goldammer, 1995).

Fire is a paradox - it can kill plants and animals and cause extensive ecological damage, but it is also extremely beneficial, a source of forest regeneration and of nutrient recycling. Fire is nature's way of recycling the essential nutrients, especially nitrogen. For many boreal forests, fire is a natural part of the cycle of the forest and some tree species; notably Lodgepole Pine and Jack Pine are "serotinous" - their cones open and seeds germinate only after being exposed to fire. Mountain ash, a flowering eucalypt of temperate Australia, also requires a site to completely burn and be exposed to full sunlight for the species to regenerate. In such circumstances, fire is essential. Burning quickly decomposes organic matter into mineral components that stimulate plant growth, and may also reduce disease in the forest (Gorte, 1995). But fires under extreme weather conditions can also be devastating.

Fire causes severe damage to tropical forest ecosystems, such as those in Southeast Asia, which are characterized by high levels of humidity and moisture. These ecosystems do not normally burn and are extremely prone to severe fire damage. Research from the Amazon indicates that damage from fire, although not initially obvious, can be long-lasting on the tropical forest ecosystem (Nepstod et al., 1999; Cochrane et al., in press).

Just as too much fire can cause problems, so can too little. Some countries, notably the United States, have had a policy of suppressing most fires. Under these circumstances fire suppression can lead to unnatural conditions wherein forests, which have historically adopted to small intermittent fire episodes, would no longer burn, leading to a build up of fuels and altered tree species composition. When a fire does start, instead of being relatively small, would be much more intense and large-scale (Gorte, 1995). During the fires in the United States in 2000 where over three million hectares were burnt and the firefighting costs exceeded US$1 billion, this result of fire exclusion was evident, though not the only factor Fire has played, and will continue to play, a major role in shaping forest ecosystems throughout the world. In almost all forest ecosystems, humans have altered the natural fire regimes by changing the frequency and intensity of fires. People have excluded or introduced fires and changed the nature of the landscape so that a naturally occurring fire will not behave in the same way it would have in the absence of human impact. The interrelationship between humans, fire and forests is a complex one and has been the subject of countless studies and reports (Jackson and Moore, 1998).

People may start too many fires purposefully and yet there are too few circumstances where responsibility for planning, containing and using fires is clear. The benefits of good land management and of the costs of poor practice are too diffuse. The implications and impacts of forest fires remain unclear and poorly understood in most cases.

The Year the World Caught Fire

During late 1997 and early 1998, fires in Southeast Asia, South and Central America, Europe, Russia, China, Australia and the USA attracted world attention. A combination of the dry conditions caused by El Niño and uncontrolled burning practices took their toll on the world's forests. "Unchecked land, bush and forest fires in various parts of the world are rapidly becoming a disaster of regional and global proportions," said the United Nations (UNDAC Mission Report, 1998). It seemed, as the World Wide Fund for Nature (WWF) said at the
time, that in 1997 "the world caught fire" (Dudley, 1997).

From Papua New Guinea to Southeast Asia - Malaysia and Indonesia, fires have damaged hundreds of thousands of hectares of forest and other lands. They burned the most in Indonesia, with fires in Java, Borneo, Sulawesi, Irian Jaya and Sumatra affecting over 9.5 million hectares; of the area burned about 49% or 4,655,000 hectares was forested. The economic cost of the fires was estimated to be between US$ 5-10 billion. At the height of the fires, the smoke stretched over one million square kilometers adversely affecting over 70 million people's health.

Other tropical forests also burnt in 1997-98. In Brazil, an estimated 3.3 million hectares of land burnt of which 1.5 million was rainforest in the northern Amazonian state of Roraima alone, scene to some of the worst fires in the region. Further North in Mexico and Central America, 1.5 million hectares of forest were burnt, affecting numerous ecological reserves and national parks. Millions of people throughout the region, including the southern United States, suffered from the resulting pollution.

Temperate forests burned as well. Over five million hectares of forest were affected in the United States and Canada. In Russia, the UN estimated that the total area burned by fires was 2 million hectares. For 1997 and 1998, over 22 million hectares of land, of which some 14 million was forest, were impacted by fire that adversely affected over 130 million people's health (Table 1).

Table 1. Global Figures and Estimates of Damage for 1997/98

<table>
<thead>
<tr>
<th>Area impacted (million hectares)</th>
<th>Forest area impacted (million hectares)</th>
<th>Protected areas affected</th>
<th>Indigenous people affected</th>
<th>Population affected by haze</th>
<th>CO$_2$ produced (tons)</th>
<th>Economic impacts (US$ billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southeast Asia</td>
<td>8-10</td>
<td>4.66</td>
<td>19</td>
<td>60-80,000</td>
<td>70 million</td>
<td>11 million</td>
</tr>
<tr>
<td>Amazon</td>
<td>3.3</td>
<td>1.5</td>
<td>N/A</td>
<td>22,000</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Russia</td>
<td>2</td>
<td>-2</td>
<td>4</td>
<td>9,000</td>
<td>1 million</td>
<td>30 million</td>
</tr>
<tr>
<td>Central America</td>
<td>-1.5</td>
<td>1.48</td>
<td>2</td>
<td>N/A</td>
<td>At least 50 million</td>
<td>N/A</td>
</tr>
<tr>
<td>Northern America</td>
<td>5.6</td>
<td>At least 4.7</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>At least $0.5</td>
</tr>
<tr>
<td>Southern Europe</td>
<td>0.24</td>
<td>0.105</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Incomplete Totals</td>
<td>22.64</td>
<td>14.4</td>
<td>25</td>
<td>121,000</td>
<td>130 million</td>
<td>41</td>
</tr>
</tbody>
</table>

Fires in the ASEAN countries

All the countries of the ASEAN region have experienced forest fires. But the extent and obvious impacts of those fires have not gained the same profile or attention as have the fires in Indonesia, dramatically captured on film. The following brief summaries for each country are adopted from the Global Fire Monitoring Centre country profiles.

Cambodia. Fire, though not widespread nor considered a serious threat to the forests of Cambodia, could become a threat if forest degradation continues at the current rate, creating favorable conditions for large-scale forest fire. Fires occur annually in the natural hardwood forests, pine forests, bamboo forests and forest plantations during summer months.

Lao PDR. An estimated 90% of forest fires in Lao PDR originate from slash-and-burn cultivation practices and traditional hunting methods. No reliable statistics are available.

Malaysia. Forest fires in Malaysia have been reported especially in pine plantations in the 1970s and in Acacia mangium plantations in the 1980s. Due to the lack of systematic reporting procedures, only recent statistics are available, and only for Peninsular Malaysia. Fires occur sporadically in natural forests, and are prone to occur in secondary forest areas, particularly those adjoining cultivated sites. The chances of fire occurring and the severity of a fire are greater in monocultures or in heavily disturbed forests. Most fires are caused by human
activities, escaping during prolonged hot and dry weather, although often stopping in undisturbed forest.

**Myanmar.** Foresters of Myanmar have traditionally emphasized prevention over suppression of forest fires. The need to manage teak regeneration and the understanding that forest fires are more difficult to suppress supported this approach. The forests are predominantly natural, damp and the undergrowth mostly moist and green. Forest fire fuels have been managed (reduced) by prescribed burning where other fires had not consumed them.

**Philippines.** Forest wildfires in the Philippines are all human-caused (carelessness, negligence, accident and incendiarism). There have been no known wildfires caused by lightning. Some 290 forest fires occurred in 1995, the majority (52%) of unknown cause. About 197 forest fires, or 68%, occurred in the central and northern part of the country. Representatives from various sectors of the community, local government units, non-government organizations (NGOs) and institutions have united with formal government forest protection efforts through Multi-Sectoral Forest Protection Committees established in both the regional and municipal levels of the country.

**Thailand.** Control of forest fires in Thailand is the responsibility of the Royal Forest Department, carried out by a network of Forest Fire Control Centres with 14 Forest Fire Control Stations, and 20 Forest Fire Control Projects that were initiated by His Majesty the King. The strategies applied in forest fire control include forest fire awareness campaigns (mobile campaign units, mass media, school programs, exhibitions, billboards) and forest fire suppression. Of the total forested areas, about 12% (20,000 km²) are covered by forest fire control and concentrated north of the country since 1993. Of the areas under control, only about 0.5% (100 km²) is affected by fire annually, compared to about 15% nationwide. Fire prevention and control efforts, which include training of staff and local volunteers in fuel management, fire detection and reporting, fire suppression and low enforcement and rescue operations, seem very effective where these are applied.

**Vietnam.** The country covers a total land area of around 33 million ha, of which approximately 9.3 million ha are classified as forested lands (8.6 million ha natural forests, ~ 700,000 ha forest plantations). Fire problems include: regularly occurring fires in seasonally flammable deciduous forests; wildfires in pine forest ecosystems and in other natural and degraded vegetation; fires used in shifting agriculture and deforestation as well as in intensively treated agricultural land. The peak of burning activities in Vietnam, is during the mid to late dry season (January to April). Recent efforts to allocate forested lands to households who use them for grazing and growing commercial trees, have reduced the number of fires and improved the management and protection of forests. In some areas, natural forest cover is returning.

**What is known about Fires in ASEAN region (and elsewhere)?**

The impact of fires on the forest depends on the scale (extent), frequency, distribution (or patchiness), intensity and seasonality of the fires. These elements combine to produce distinct fire regime. Varying any one of these elements will alter the fire regime, which can result in long-term impacts on biological diversity and change the forest's capacity to provide ecological services. To characterize the fire regime of an area country, we must have data collected over some years, which includes appropriate data that enables analysis, and for which the terms and definitions of collection are clear.

For all countries in the ASEAN region, the information available on rest fires is incomplete, with measurement parameters and definitions generally unavailable. In some countries, the information includes:

- Date of the fire;
- Area burnt and
- Location of the fires.

These data would enable the calculation of the number of fires per year, the area burnt and the distribution of fires throughout the year (seasons). Generally, where it is available, this information is not systematically collected across the entire land base of the countries of the region. Apart from Vietnam, the other countries do not seem to collate or publicly report their data. The available data would allow the analysis of the geographic characteristics of forest fires. As successive Years of data are collected, a picture of the characteristics of fire for a country can be developed. For example, while Indonesia has the largest extent of forest fires in the region, some of its provinces have very few 'uncontrolled' fires at all (West Papua, Java) while others seem to have many (Riau, Jambi, East Kalimantan).

An important aspect of forest fires that is not addressed well enough (in most parts of the world) are the key questions: Who started the fire and why? The motivations for people lighting fires is a critical element that must
be understood in order to identify opportunities to influence change in the regime of fire that is present, if a change is agreed to be desirable. In most cases, fires that are lit in the ASEAN region are deliberately set to achieve a management purpose (whether endorsed, positive or neither). It is critical to know which fires are important and to whom. There may actually be very few, if any, "uncontrolled" fires in Southeast Asia, except in extreme drought years when deliberate fires may exceed the preferred boundaries of those who light them. In some cases, there may be little or no opportunity to change the frequency, area burnt or location of fires due to the motivations for starting the fires and the alternatives to fire that might be available.

This circumstance of inadequate data (inconsistently collected and poorly defined) is not restricted to the region. Experience with China, Portugal, Russia, the Mediterranean nations, the European Union and the efforts of the Food and Agriculture Organization (FAO) of the United Nations over decades has provided some information but demonstrated that completeness and consistency remain little more than a (perhaps) desperate dream.

Some Perspectives on Fire

Forest Fire is the concern of many actors in local, provincial, national and international societies. It is worth considering briefly the different perspectives that some major stakeholders may hold on forest fires.

Fire as the user perceives it. For majority of the people who use it, fire is:

- One of the oldest, most familiar tools available and has been used as a management technique in land clearance and management for centuries;
- The obvious mechanism for thousands of farmers, ranchers and plantation owners on the edge of the agriculture frontier pushing into forests; and
- Normally the least expensive and most effective way of clearing vegetation and of fertilizing nutrient poor soils.

Fire as the fire manager perceives it. For the people allocated the responsibility for managing fire, there are many questions:

- What prevention activities are appropriate?
- What pre-suppression activities and preparation are needed?
- Who do I need to work with?
- Where is the fire now?
- What is the weather now?
- Where will the fire be at a given time in the future?
- What will the weather be then? Do I need a crew, machinery, divine intervention or a stiff drink?
- Has the fire report been done?
- What are the restoration steps to be taken after the fire?
- Has the annual fire analysis and report been done?

Fire as the forest ecosystem perceives it. The impact of fires on the forest depends on:

- Scale (extent). How big is the fire?
- Frequency. How often do fires occur in the some area?
- Distribution (or patchiness). What proportion of the forest is burnt in any one fire?
- Intensity. How "hot" was the fire? How long did it take to burn the area it covered?
- Seasonality. What time or season of year did the fire take place?

Fire as the researcher perceives it. Research sets out to test hypotheses and works to improve understanding. This approach generally requires detailed information that would assess the influence of the variables being monitored and the assumptions made. Researchers are often interested in "accurate" fire measurement including the:

- Rate of perimeter spread (meters per unit time, direction);
- Dimensions and shapes of flames (height, length, depth);
- Fire temperatures (at various heights above ground over time and perhaps under the soil surface);
- Residence and burn out times (how long was the fire burning in one spot); and
- Rate of energy release (kilowatts per meter of flame front per second).

In many cases these attributes of fires are very difficult to collect, particularly for high intensity fires.
Fire as the media perceives it. The media does not normally report forest fires unless above a ‘threshold’ of size, impact or concern. This threshold may vary with the quality of visual material available and the profile of competing items of news or current affairs. Often the messages conveyed by the print, radio and visual media present a very simple picture of a complex situation. For example, the media tends to report that:

- All forest fires are harmful (not true);
- Forest fires are caused by El Niño and weather (not necessarily true); and
- Forest fires are important only when they happen (not true).

The perspective of the media is perhaps best reflected in the adjectives used in reporting forest fires such as:

- Disasters and Catastrophes that Rage across the landscape and lead to;
- Devastation and Destruction which is due to;
- Arson, Corruption and Big Business impacting upon the;
- Ecosystem, the Poor, the Innocent and the Indigenous.

Notably while all these terms may be in part pejorative, the last two sets are potentially accurate

What Data do We Have?

While the search for datasets on fires has enabled broad conclusions about the lack of them, there is a need for a systematic data gathering exercise. A review of existing sources of data should examine not only the official information held by government agencies (including non-forest agencies and provincial and local governments), but also the information collected by NGOs (Global Fire Monitoring Centre), projects (Bowen, and ARCBC Workshop on Minimizing the Impact of Forest Fires on Biodiversity in ASEAN) and third parties such as the excellent work done by Liew Soo Chin of the Centre for Remote Imaging, Sensing and Processing (CRISP).

What are the Data Requirements?

Development of fire management systems, approaches to fire planning, integrated and sustainable forest management and biodiversity conservation where fire is a factor have been preceded by significant efforts in:

- Analysing fire causes and locations - to enable a focused and directed approach to the fire problem;
- Understanding and predicting fire behaviour - to define and manage appropriate levels of fire response and fire use; and
- Developing fire danger rating systems - to support planning and operations.

These developments all depend, in major part, on the fire data collected that would permit analyses, correlation and improved understanding. In the ASEAN region at present there are some sound and exciting initiatives, including those done by Bowen (2001) and Soo Chin (2001). Timely as they, and other efforts are, in the absence of data on fires, there will be a limit to their utility and a restriction on further development and evolution. The process of defining the useful data to be collected as a standard set of information about forest fires has been addressed many times over the years by a great number of people with relevant interest and expertise, among them experts gathered together by the Food and Agriculture Organization (FAO) and the International Tropical Timber Organization (ITTO).

How do we meet Data Requirements?

Suggestions for consistent collection of data by countries and for the collection of a standardized set of ‘core’ data have been recommended to FAO (FAO, 1999), ITTO (ITTO, 1997) and the Consultative Group on Indonesian Forests (Dieterle, 1997), among others. The series of recommendations and proposals by many organizations do not yet appear to have been implemented in any instance. The potential importance of the information to all the affected and responsible stakeholders should be socialized and opportunities to demonstrate the value of the collection of simple sets of data for fires taken.

Conclusions

Fire characteristics in the ASEAN region that are required for the development of sound practices and solutions to the negative impacts of forest fires, are not well known. Few countries worldwide consistently collect the necessary information or make it available. The minimum fire data required may include:
Maps of fires, weather parameters and data on fire behavior would enable a more sophisticated analysis. The questions with respect to this issue would appear to be:

- Why has the collection of fire data not become routine practice?
- What can be done to bring it into routine practice?

Project Fire Fight Southeast Asia is very interested in any ideas and input about the issue of data and its collection for forest fires.

Peter F. Moore is the Coordinator of Project Fire Fight Southeast Asia, an initiative of IUCN-The World Conservation Union and WWF International funded by the European Union.

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