"Burning as Usual"

The Causes and Effects of
Deliberate Fire Burning
A Case Study Within the Province
of Chiang Mai, Northern Thailand
(Feb-March 2009).

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Executive Summary

During February and March 2009 a professional study was undertaken exploring the causes and effects of fire within the sub district of On Nuea, located 40 Km from the provincial City of Chiang Mai, Northern Thailand.

By using both quantitative (fire data collection) and qualitative (Semi Structured Interviews) research methods the study gained a clearer understanding of the key factors determining the use of fire within the specified study area

In total an amount of 58 fires were recorded during the study period. The majority of which occurred within forests and a long roadsides and the open areas adjacent to them. Forests fires were mainly due to the collection of forest products of which a particular type of Mushroom (Hed Thob), due to its seasonal availability and therefore high market price, had a very lucrative allure of potentially doubling a farmers yearly income. In order to collect such products local farmers use fire either to clear the forest floor to make it easier to find the mushrooms or because the fire itself stimulates the growth of the actual mushrooms.

Roadsides and Open Areas are also set alight for two main reasons a) to clear old vegetation – Fire is 'Cheap and Fast' or b) encourage the re growth of certain grasses for cattle to graze on.

As well as providing empirical evidence of fires and the reasons for which they burn, the report also sheds light on the livelihoods of those who still rely on fire as a mechanism for survival. A trek into a National Forest Reserve with a local farmer provides insight into what he burns and why, despite being an illegal act, he continues to do it.

The role of the local authorities and the policies they have put in place to try and prevent/suppress fires from happening are also analysed. Strengths being that they are community focused and develop the capacity of local people to manage and prevent fire within their immediate vicinities. Unfortunately though, they're limited in their scope due to a lack of resources and an area of jurisdiction that is, at present, beyond their current capacity to manage.

In regards to grass roots fire management the report, using the example of both the Ban Sahakon 'Agricultural Cooperative' and the village's Community Forest, illustrates how ownerships of a particular resource i.e. 'land rights' is believed to play a crucial role in fire prevention, as a sense of ownership often creates a strong incentive for farmers to protect both theirs and the land around it from fire.

The comparisons between the great Smog of London in 1952 and that of present day Chiang Mai Smog, serves as a chilling reminder of the detrimental affects smoke pollution can have on the health of humans. The health of the forest is also examined. Vegetation transects illustrate how fire effects forest and the sensitive eco systems within them, to the point where they become degraded and void of life. A scenario, which also limits the forest's capability to naturally sequester carbon dioxide emissions and therefore exacerbate the issue of climate change.

In conclusion the report gives an overall summary of the current fire situation and, by building on the successful initiatives currently in place, sets out a plan of action for '2010 and Beyond' advocating a coordinated approach involving government, private and most importantly the local community so as to manage the fires in On Nuea in a more sound and sustainable way.

Acknowledgments

Although only carried out over a relatively small period of time, a large amount of effort has been dedicated to this project.

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Last but by no means least *Richard Rhodes* whose premier online eco company www.e-photoframes.co.uk provided the funding for the project .

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Abbreviations

CF – Community Forest
DNP – Division of National Parks,
– Wildlife and Plant Conservation
FP – Forest Product
GPS – Global Positioning Satellite
MoNRE - Ministry of Natural Resources and Environment
MSL – Metres above Sea Level
NFR - National Forest Reserve
NP – National Park
PM 10 - Particulate Matter Smaller than 10 Micro Gramms
RFD - The Royal Forestry Department
SAO - Sub District Administrative Office

CHAPTER 1 Introduction

In 2005 Richard Rhodes and his family decided to move to Chiang Mai on a 12-month sabbatical following 10 years working in the City of London. It was three years before they returned to the UK. They had found a beautiful location for building a house in the magical valley of On-Nuea "One of the most beautiful places I have ever been. Unspoilt, mountainous, lush and only 30 miutes from Chiang Mai" recalls Richard. However, after they moved in they were confronted head on with the horror of the winter burning season "There we were, on the top of a hill overlooking a man made disaster zone rather than one most spectacular views in Thailand. Fire after fire for a period of almost three months. The air was so bad that our youngest child was physically sick one morning. My wife could hardly breathe. As well as the detrimental impact the smoke was having on those closest to him, Richard was also well aware of the impact that the smoke was having on the natural environment - despite being one of the least discussed causes of climate change, forest fires account for 18% of global carbon emissions. They are the second biggest cause of climate change the biggest being energy generation at 24% (1).

Also, due to Richard having an interest in forestry through a tree-planting program sponsored by one of his eco businesses, it became clear that the forest was not natural "The forests are half dead. Trees are stunted and biodiversity is limited to species which can tolerate seasonal burning. I call them "ghost forests". They need to be returned to the land of the living"

Richard decided that a practical solution must be found. So therefore commissioned myself, an environmental consultant with a British degree in Geography, to head up a project researching the causes and effects of deliberate burning in the region of On-Nuea. This report is the result.

1.1 Smoke Cities - Learning from the Bitter Past The Great London Smog

Coming from a country that made world headlines with the worst case of air pollution in the United Kingdom's history, us Brits know from bitter experience that air pollution can kill, both in the short and long term.

Since the middle ages, a characteristic feature of our capital city London has been thick fogs. Centuries of urban coal burning and the onset of the industrial revolution made these urban fogs quite different from the natural white fogs seen in the countryside.

Smoke from domestic heating combined with gases and particles

from factory chimneys gave the mix of fog and smoke (or more famously coined: smog) an acrid taste, odour and a dirty yellow colour, which made smog incidents to be known as 'pea-soupers' or in the words of Charles Dickens as the 'London Particular'.

Londoners have over time become used to the smogs of their city as being just another aspectof living in the capital. For example in the1940s, travellers could bring a special souvenir to enjoy at home: tins containing 'fresh London fog'!

The onset of winter in 1952 had been nice withfresh and clear weather, but also colder than normal with heavy snowfall in southern England, causing people to use their coal - fired stoves more than usual to keep warm. In the beginning of December, conditions changed as breezes stopped and an exceptionally cold and heavy fog from the English channel came over the Thames valley and settled over London, a typical 'London Particular'.

The extra smoke from thousands of chimneys was trapped beneath an inversion layer formed by the dense mass of cold air, building up an yellowish pea - soup smog smothering the city's streets and houses. By nightfall on Friday 5th December, the mix of fog combined with smoke thickened and visibility in most of London dropped to a few meters. For five consecutive days, the density of the smog made simple everyday activities difficult.
Due to the smog making it almost impossible to recognize familiar landmarks, many pedestrians struggled to make it back to their homes. The dirty air and unpleasant taste of the smog made people wear home - made masks of gauze, scarves or handkerchiefs to cover and protect their faces.

A policeman uses a mask to protect himself from the Smog

A london double-decker bus driving through the smog in the early afternoon

Infrastructure was also effected as driving became difficult and even in some parts of the city impossible, leaving the roads littered with abandoned cars and buses. Also Heathrow Airport had to close for airborne traffic as visibility remained below ten metres for almost 48 hours from the morning of 6th of . December.

On the Isle of Dogs, almost enclosed by the Thames river, visibility was officially recorded as being nil, as people could not see their feet. Humans were not the only ones affected as the press reported stories from different parts of London.

Greyhound racing was halted as the dogs were not able to see the hare, a Mallard duck flying blindly across London smashed into Victoria station, Crash landing onto platform 6!

A bleaker story was told from a meat market, where suffocating cattle in their pens were killed and thrown away before they could be slaughtered and sold: their lungs were black.

The smog also seeped indoors. It caused screenings of films and concerts to be cancelled, as the audience could not see the stage and conditions became intolerable for the performers.

Eventually, due to strengthening winds on December 9th, the smog cleared as quickly as it had arrived, bringing normal life back to London. Or so it seemed. No one noticed immediately, but as undertakers began to run - out of coffins and florists found themselves ordering extra flowers to cope with demand, it became clear that something was very wrong.

Three weeks after the incident, mortality figures published by the registrar general revealed, that a major disaster had taken place. It was estimated by the British Committee on Air Pollution that 4,000 people more than usual had died over those five days from cardio-plumunary ailments with the majority of the victims being very young, elderly or at poor health. In the following weeks and months an additional 12,000 died and 100,000 fell ill from broncitus and pneumonia, directly caused by the smog.

The following summer, London's death rate was 2% higher than normal, but exactly how many people perished as a direct result of the fog will never be known.

The aftermath of the Great Smog was a significant turning point in environmental history. British officials passed laws such as the Clean Air Acts of 1956, banning the emission of black smoke and requiring industry to switch to cleaner - burning fuels. The effect has been dramatic with a hundred fold reduction in atmospheric particulate levels today.

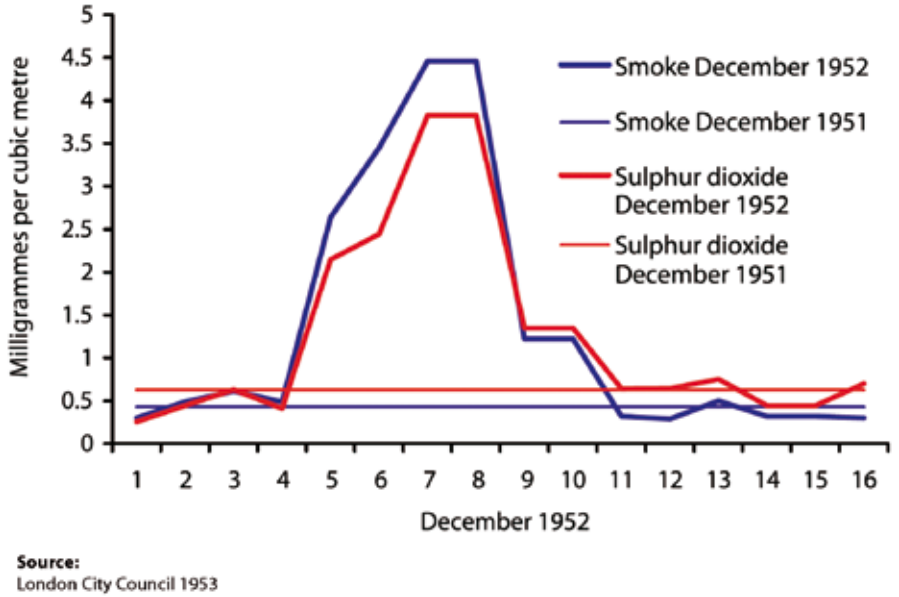
Analysis of what happened from the 5th to the 9th of December 1952 revealed that the silent killer of the London smog was mainly due to the firing of avaiable cheap sulphurous coal, as the good quality coal was exported to the USA earning much needed foreign currency.

High quantities of sulphur dioxides (SOx) was released, which reacted with oxygen and water in the moist foggy air to produce a dilute, but lung-corrosive mist of sulphuric acid (H_2SO_2). For some, this could induce a heavy inflammation of the lungs – just as the cattle at the meat market, people were dying almost through suffocattion.

Huge quantities of impurities were released into the atmosphere each day of the incident:

- 1,000 tonnes of smoke particles
- 2,000 tonnes of carbon dioxide (CO_2)
- 140 tonnes of hydrochloric acid (HCl)
- 14 tonnes of fluorine compounds

But perhaps most dangerously, as described above, 370 tonnes of sulphur dioxide (SO_2) were converted into 800 tonnes of sulphuric acid. The graph below shows how the concentration of SO_2 and smoke in the air increased from 0.4 milligrams per cubic metre (mg/m^3) on the 4th of December to the peak concentration of, 3.8 mg/m^3 and 4.5 mg/m^3 over the 7th and 8th.



Source:
London City Council 1953

Fig. 1 Smoke and $S0_2$ Graph London December 1952

1.2 The Great Smog of Chiang Mai (Present Day)

What is the connection between an incident occurring more than fifty years on a windblown rainy island and mountainous, sunny, northern Thailand?

The best way to illustrate this is to tell another, yet more contemporary, story from the surroundings of the city dubbed as the 'Rose of the North', Chiang Mai.

Being beautifully situated in a river valley, between rugged mountains set in a horizontal direction North to South, this 700 - year old city acts as the capital of northern Thailand. Amongst a myriad of attractions, arguably the most famous is the Wat Phrathat Doi Suthep temple placed on an escarpment some 700 m above the city on the nearest mountain.

This sacred site is renowed amongst every Chiang Mai citizen as a place of worship and peacefulness. However, in recent years a phenomenon has began to take place in which the view of this majestic temple and the mountain (Doi Suthep), which it's perched upon, is almost wiped from the landscape of Chiang Mai.

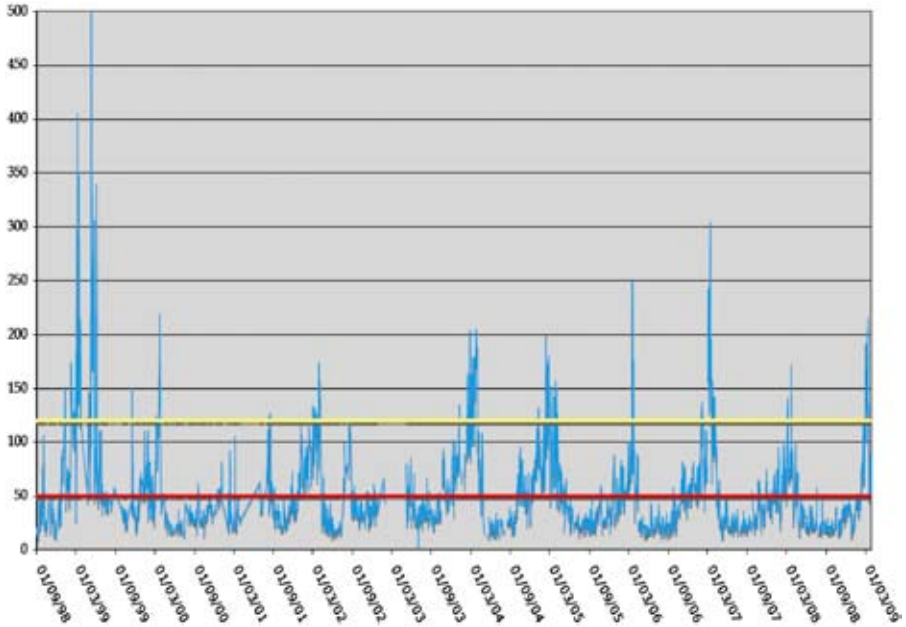
Each year during the months of Feb-April a haze of smoke similar to that of the 'London Smog' settles upon the city of Chiang Mai, although it's composition is different to that of the smog it still has an extremely detrimental affect on the citizens of Chiang Mai. The

View from Chiang Mai airport towards Doi Suthep in June

View from Chiang Mai airport towards Doi Suthep in March

graph below details how the air quality in Chiang Mai has continually, over the last decade, deteriorated during the months of Feb and March and how 'Chiang Mai Particular' has become a serious cause for concern.

Fig. 2 PM 10 levels in Chiang Mai



Source:
Pollution Control Department, Bangkok 2009

The graph indicates the levels of PM 10 (Particulate Matter smaller than 10 micro grammes) - a pollutant that is microscopic in size and if inhaled into the lung in large quantities can cause serious respiratory problems. The yellow line on the graph (120) is the standard level at which Thailand's Pollution Control Department consider PM 10 concentrations to become critical and dangerous to people's health. In contrast to this, the red line (50) is the standard for the USA, London and the rest of the European Union. It is clear to see that PM 10 levels, over the last decade in Thailand, has successively breached the safe level (120) and in some cases (2007) risen to seriously dangerous levels.

Along with the peaks in PM 10 levels comes a peak in hospital admissions. Data obtained from the Chiang Mai Public Health Department details how, during Feb - April 2007, the PM 10 level stayed above the safe level for a total of 34 days. Public Hospital admissions within the entire province of Chiang Mai for this period totaled 287,885. Where as during the same period in 2008, when PM 10 levels only breached the safe level for 6 days, admissions. were almost 25 % lower than 2007 levels at 216,530*.

In Feb 2009, a seminar was held at Chiang Mai University to discuss the ongoing problem of smog in the city. In attendance was assoc Professor Phongthep Wiwatthanadej, who stated that, due to constant exposure to seasonal smog, Chiang Mai residents face double the risk of Lung Cancer than people from other regions in Thailand. Phongthep said his theory was not supported yet by any research, but said the constant smog exposure had subjected Chiang Mai locals to lung cancer risk (2).

The present scenario in Chiang Mai has a chilling resemblance to that of the London Smog. Unlike the burning of dirty coal in London, the causes of the smog in Chiang Mai are harder to pin point. As of yet, no hard data exists indicating the exact source of the smoke. However, it is widely acknowledged that the notorious burning practices carried out during the dry season in the surrounding rural regions are one of the main causes. Hunting, land management and the collection of forest products are believed to be some of the key factors behind the fires.

So as to try and tackle the problem of smoke and the practice of deliberate burning the Thai Authorities have undertaken many campaigns to inform people about the problem of burning as well as implemented various strategies to try and prevent fire from happening in the first place, but as the experience of both Richard Rhodes and the citizens of Chiang Mai shows, burning still continues.

In order to gain a more insightful understanding of the phenomenon that is fire in Northern Thailand the following report aims to explore the main causes and effects of deliberate fire burning within On Nuea a sub district (Tambol) of the Mae - On district (Ampur), located 40 KM due East of Chiang Mai City. In addition the project will also propose solutions / recommendations to try and minimise / prevent the amount of fires occurring within the specific study region.

*** Based on the data sets from the public health department it is very difficult to determine the exact amount of patients suffering from smoke related illnesses. Nonetheless the correlation between PM 10 levels and Hospital admissions is a strong sign that smoke pollution from fires is a key contributor to the spike in admissions during the period Feb-April, a period of the year that coincides with the burning season.**

1.3 Thailand and Fire – from Benefit to Threat

Prior to the late 19th century all resources within the kingdom of Siam belonged to the King. However, local village people were able to manage forests using traditional practices and retain most of their benefits from the resources, provided they made a payment to the ruling prince (3). Local villagers were encouraged to expand into forested areas so as to clear areas for agriculture land. Rather than seen as assets, forests in Thailand during these time were viewed as wild, untamed wasteland areas, to the point whereby the Tra Sam Duang Law, which took effect during the early Rattanakosin era (1782) provided financial rewards for people that converted forest into agricultural practices. Fire was an intrinsic requirement of this process and therefore deemed essential for the development of the country's food production (3).

However, with the arrival of the British colonial powers to Thailand came a new scientific technique of forestry management. A technique manifested in the form of commercial logging.

- *The Establishment of 'The Royal Forestry Department' (RFD)*

Almost overnight forests, once considered to be worthless wastelands, became profitable resources. The most lucrative resources were the large stocks of Teak wood and their potential to make large amounts of income for the state from export (3).
To oversee the management of the forests and regain control of the wild jungles, The Royal Forestry Department (RFD) was setup in 1896 and, under the guidance and help of the British, set out to formalise the centralisation of forest management and gain complete state control of Thailand's forests (3).

Along with such radical changes in perception towards forest came a change in the perception of fire and what was once considered a benefit now became a threat. The RFD introduced the Forest Protection Law of 1913 which stated that trees were valuable assets that needed to be protected from cutting and burning by 'shifting cultivators'. This was the first forestry law in Thailand that banished the act of burning forested land (3).

Since the introduction of these laws and the setting up of the RFD, Thailand's forested areas have declined considerably. In particular Teak, which once dominated much of Northern Thailand's lowland forest, its downfall being its incredible durability, easiness to carve and its use in the construction of houses and Boats. First exploited by foreign colonial powers and then Thai timber companies. The extent of deforestation and commercial logging in Northern Thailand reached its peak during the 1970s. Official figures indicated that forest cover declined from 69 percent in 1961 to 43 percent in 1998 (4). (For a more detailed history of the RFD please see appendix)

1.4 Miss-Conceptions of Fire in Dry Dipterocarp Forest

The main type of forest cover within the study area of On-Nuea is dry dipterocarp a type of forest that sheds its leaves during the dry season in order to retain moisture. Therefore, such an abundance of dry leaf litter on the forest floor makes this particular type of forest very susceptible to fire (see appendix for an overview of the

A slow moving forest fire steadily engulfs a layer of leaf cover

different forest types in Northern Thailand).

In order to clarify the effects of fire on dry dipterocarp forest the following section will demystify some of the common miss conceptions held in regard to fire in dry forests.

Do fires naturally occur in Thailand's dry deciduous dipterocarp forests?

Fire is a natural part of all terrestrial ecosystems - but usually at very low frequencies. If fire were to be completely removed from such a forest type it would eventually, overtime, transform into mixed evergreen - deciduous forest. The problem today is that the frequency, intensity and extent of fires are well beyond what naturally occurred in the past (5).

Aren't fires a necessity in terms of the germination of certain seeds?

In certain environments fire does indeed stimulate seed release and germination, but this effect has yet to be witnessed in the forests of Northern Thailand (5). Their seeds do not need fire to germinate. In fact they are killed almost completely by even the 'coolest' fire temperatures. Therefore, forest is not dependent on fire for its reproductive ecology. When fire is suppressed for many years, biodiversity increases, as species, which are more sensitive to

A burnt forest in which most of the younger saplings have been killed by fire

fire, can move back and the forest type begins to change. Ground flora increases in species richness, small mammal populations recover and gradually mixed deciduous trees can recolonize the area (5).

Does fire Kill Trees?

Tree saplings require at least 3-5 years to grow large enough to have a chance to survive a moderate litter burn as this allows them to develop a thicker fire resistant bark, which protects the internal vascular system from the high temperatures of fire (5). However,

annual fires cause failure in the youngest age classes of trees to recover from regular fire. Eventually as the mature trees begin to die back, there are insufficient saplings to replace them and the forest gradually turns into savannah or grassland.

1.5 Forest Fires and Climate Change

The effect of forest fires on the climate is of growing concern amongst many prominent environmentalist and forestry experts. Recent studies suggest that the intentional fires used in the process of deforestation, many of which are set in tropical areas to expand agriculture or ranching, contribute up to a fifth of the human-caused increase in emissions of carbon dioxide, a heat trapping gas responsible for rising global temperatures. Although the following study didn't encounter the use of fire for deforestation measures it recorded the consistent use of fire to clear forest floors in order to collect forest products. A practice that is carried out throughout the Northern Hills of Thailand, during the dry season, and results in both large expanses of degraded forest and large amounts of being emitted into the atmosphere.

At present forests still absorb more carbon dioxide than they emit. However, according to Professor Risto Seppala from the Finnish Forest Research Institute, the sequestering ability of forest could be radically reduced over the coming decades. He states that:

"We normally think of forests as putting the brakes on global warming, but over the next few decades, damage induced by climate change could cause forests to release huge quantities of carbon and create a situation in which they do more to accelerate warming than to slow it down." (6)

Such an occurrence can be described as a 'Fire-Climate Feedback' a scenario in which forest fires, by releasing large amounts of carbon dioxide emissions which contribute to a rise in global temperatures, subsequently become more exacerbated and widespread resulting in both an increase of carbon dioxide emissions and consequently more degraded forest, thus limiting the long term capabilities of forests to sequester carbon dioxide.

Seppala and a team of forestry experts have compiled a report which is the first of its kind to globally assess the ability of forests to adapt to climate change.

As well as higher temperatures the report also states that prolonged droughts, more pest invasions, and other environmental stresses will also cause forest destruction and degradation (6).

The issue of forest fires and the subsequent degradation is a key theme emerging from this report. The extensive use of fire in the On Nuea region has resulted in forests becoming extremely degraded. Therefore, it is essential to realise the impact fires, in On

Degradation in On-Nuea limits the ability of a forest to sequester Carbon Dioxide.

Nuea and the surrounding region, have on the climate. The fires that are occurring in the forests of On-Nuea, as well as emitting large amounts of carbon dioxide, are also impacting upon the ability of the forest to carry out one of its essential tasks, naturally regulating the climate by sequestering carbon dioxide emissions.

CHAPTER 2 Study Area

2.1 On Nuea Sub-district

- *History and Present Day Status*

On Nuea is a tambol that is situated within the district Ampur of Mae -On. A region located 40km due East of Chiang Mai, covering an area of 30,268.25 km. According to an ancient stone inscription found at the Temple (Wat) of Chiang Sean the ancestors of the local population of Mae On (including the people of On Nuea) are believed to have migrated from a tambol in Chiang Rai province called Chiang Sean.

This community of settlers from Chiang Sean became known as the Mae On community due to their close proximity to the Mae On River and came under the jurisdiction of Chiang Mai administration. However, in B.E. 2445 (1902) during the reign of Phra Jao Inthawarorot, a pack of rebels from the neighbouring ampur of Phrae attacked and burnt down the Mae On regional

head office. Subsequently, in B.E. 2446 (1903) the head office was moved to a new area located within the neighbouring San Kam Phaeng district of present day.

As a consequence of inaccessible administrative operation due to the large district area, In B.E. 2537 (1994), six thambol were split off from San Kam Phaeng to set up the Minor-District (Ging-Amphoe) Mae On and as of the 8th of September 2007 the six tumbols were declared " Amphur Mae On" to commemorate His Majesty the King's 80th Birthday - 5th December 2007.

- *Topography*

Plains and mountains cover most of the ampur Mae On area with an average height of 300 Metres above Sea Level (MSL). Mountains horizontally set in a North to South direction. The Highest summit is about 1700 MSL and is the headwater of the On River, Mae Tha River and Mae Lai River.

- **C***limatic Conditions and Seasons in Mae - On*

Thailand's Meteorological Department states that Thailand experiences three seasons: winter, summer and rainy (South West Monsoon).

In Mae-On the South West Monsoon brings rain from May to September. November - February is the winter season, during which the average minimum temperatures can drop as low as 9 degrees Celsius. From mid February onwards the temperature begins to climb reaching its Zenith in April with recordings of 40 and above. It is during these summer months up until the arrival of the Monsoonal rains that the landscape becomes parched and dry and very susceptible to fire - Feb - April are the months in which the majority of fires are lit.

- *Administration*

On Nuea is one of 6 tambols - On Nuea, On Klang, Ban Sahakon, Huai Kaeo, Mae Tha and Tha Nuea - that make up Ampur Mae On. In total Mae On is made up of 49 villages (Moo), 10 of which are located in On Nuea. Each tambol is led by a Sub-district Administrative Office (SAO), which is governed by an elected official, who has a term of four years. The Total population of the amper is 21,626. the gender ratio is evenly split with females at 10,699 and males at 10,957. In terms of families there is a total of 7,803. The total population of On Nuea is 3,507 - females 1,728 and males 1,779. Families 1,779 and a total of 10 villages.

***For an overview of Economic/Occupation indicators pleases see the appendix**

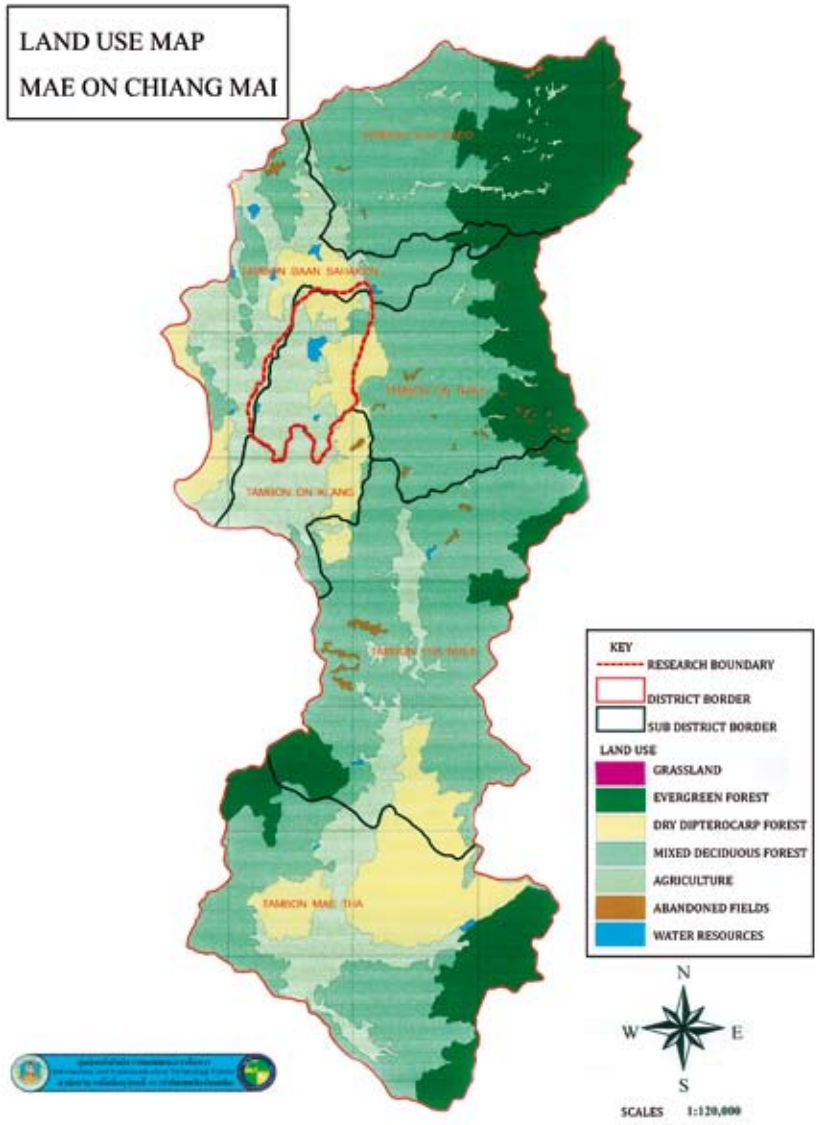


Fig. 3 The above map, as well as indicating the location of the study area, also breaks down the land use types within ampur Mae On

- *Land Use*

86% of Land in Mae On is Forest. Agriculture makes up 11.5% followed by residents at 3% .The following Map breaks down the land use types and locates them within ampur Mae On

2.2 Research Boundary

The research area is mainly located within the tambol of On Nuea, but at certain points crosses over into the neighbouring tambol Ban Sahakon the size of the area under study is 7 x 4 km. The particular area under study provided plenty of differing land use types – national parks, agriculture, national forest reserves, and two

The view at research HQ allowed for a wide surveillance of the surrounding hills

community forests. The area also had an extensive road network allowing for ease of access when spotting fires. The research Head Quarters was centrally located upon an elevated vantage point allowing for an almost undisturbed 360 panoramic view of the research area, from which fires could be viewed both at night and during the day.

In terms of identifying the research boundary, the existing road network played a key role. So as to allow for ease of access throughout the research area, the research boundary was defined using either a main road or side road. It is important to note that certain parts of this road network/boundary crossed into neighbouring tambol Ban Sahakon. Although the majority of fires were spotted in On Neua, due to the necessity of having to use these particular sections of road, it was decided that if fires were spotted along these sections of road then they would also be included in the data set.

CHAPTER 3 Methodology and Present Initiatives

3.1 Data Collection

The research was carried out over a two month period (Jan 28th - March 20th 2009) and involved the use of both quantitative and qualitative research methods. In terms of hard data the quantitative method involved weekly (Mon/Weds/Friday) surveillance - driving the same route each time, twice a day (Midday between 12.00-14.00 and early Evening between 17.00 19.00*), as these are considered to be the key times at which fires are lit. As well as surveillance using a motorbike three transect walks of the surrounding forest were also carried out. Every time a fire was spotted the following key data would be recorded:

- Location (GPS coordinates)
- Fire Detection Times
- Altitude
- Land Use Type

***The official times for collecting fire data were only used as a basic guide. If fires were spotted outside of these times then they too would be included in the data set.**

In terms of the qualitative (soft) research informal semi - structured interviews were carried out with both local villagers and officials from various private/governmental organisations (for a copy of the questions used in the interviews please turn to the appendix).

Due to a limited time frame of only two months and only one person being responsible for data collection and field-work, this report, instead of focusing on a specific fire issue within the region of On Nuea, provides a broad overview of the current fire situation within the local region. Recommendations have been suggested in the concluding chapter, where it was deemed necessary for further research to be carried out.

3.2 Present Initiatives Regarding Fire Management and Awareness

Within tambol On Nuea and ampur Mae On fire prevention and suppression strategies as well as awareness activities have made some headway at tackling the issue of fire:

- **1st Fire Control Office (Mae On)**

The local fire control centre is mainly responsible for the prevention and suppression of fires that occur within the Mae-On region, priority areas being Mae Takrai National Park and local Wildlife Sanctuaries. Another key role of the office is to carry out training sessions with local villages so as to train and develop their capacity, as local villagers, to prevent and manage fire within their local community (see below for more details).

- **Chief Officer (Or Bor Dor) of the Sub District Administrative Office (SAO)**

As well as help coordinate training sessions the role of the Or Bor Dor in terms of fire prevention and suppression are as follows:

Attend a meeting every month to discuss the issue of fire prevention with local officers from the fire control office, heads of each village, a representative from the RFD as well as local agricultural leaders.

Raise awareness about the problems associated with fire using signs and radio broadcasts the main aim being to get as many people as possible to tell their fellow villagers, responsible for lighting fires, to stop doing it.

Despite being in the 'Line of Fire' a roadside sign stating 'Smoke from fire causes Global Warming' is remarkably left untouched

- **One Day Seminar in Fire Prevention Training February (27/02/09)***

Objective

In conjunction with the local Fire Control Centre and locally elected officials (Or Bor Dor) a fire seminar was carried out to establish a local 'Fire Protection Network' amongst neighbouring villages in ampur Mae On. Prior to the event official papers were sent out to each village head (Pu Yai Ban) informing them of the event and

asking them to gather village volunteers to attend the event so as to train and inform them of the issues regarding fire and prevention. In total 250 people turned up from 10 villages within the Mae-On district, two of which were from tambol On - Nuea - Ban Nong Huai and Ban Ma Ba Kaeng.

Activities

The seminar opened with an introductory speech from the Chief of Mae On district outlining the aim of the **'Partnership Networks'** - a partnership between two neighbouring villages, overseen by an elected fire leader, is set up to allow for a more cohesive fire prevention strategy amongst villages.

The rest of the morning consisted of talks about the causes and effects of fire and it's negative impact on people's health and the degradation of natural resources. Demonstrations were also carried out explaining the use of particular types of fire equipment used to put out fires.

The afternoon session involved the process of electing 5 fire leaders for each of the village partnerships. Once each village network had elected their leader the two villages sat together to brainstorm some ideas as to how best to manage the problem of fire within their local areas. They then presented their fire prevention plans to the rest of the group. Each of the 5 presentations were similar in their approach to fire prevention and are as follows

Khun Piya, the Fire Chief, hands out fire equipment to the villagers

- Improve public relations
- Establish a local rule to stop fire burning
- Set up a fire control team and create fire breaks
- Training and education programme for young children

The day ended with each village being given a set of fire tools to use as part of their fire prevention strategy.

- Road Show at Ban Sahakon SAO Office (26/02/09)*

A road show conducted by the Pollution Control Department entitled:

'The Public Participation Project for Chiang Mai's Clean Air and Smoke free Environment'

Objective

To inform the people of ampur Mae-On about the problems associated with burning, particularly the problem of smoke pollution.

Activities

The start of event involved a parade of local officials and villagers walking 2km along the main road of Ban Sahakon holding banners stating the problems with fire and how fires need to be stopped in order to reach the objective of clean air in the province of Chiang Mai. So as to protest against the burning, local people in the parade also wore smoke masks to make the point that smoke affects the health of local people. After the parade, everyone gathered at the main road show stage opposite the SAO office where the head official of Mae On formally welcomed everyone to the event. This was then followed by various dance and singing acts all with the theme of fire and the environment. The final part of the road show involved an on stage discussion between the Or Bor Dor of tambol Ban Sahakon a local fire chief and a local public health officer. Some of the key points that came out of the discussion are as follows:

- The acknowledgment that the local SAO administration had limited resources to fight fire and that fire prevention skills amongst the local officials were amateurish at best.

A woman protests against the burning of fires

Local People take part in a parade to raise awareness about the problems of fire, particularly the smoke and its affect on people's health

- Fires that are lit on the roadsides present a serious problem as they often burn into adjacent fields and forest because they are unattended.

- New legislation is being developed by the local administration and is due to be enforced the following month (March 2009). The new laws will prosecute anyone who intentionally starts fires and causes smoke pollution and that this time there will be no compromising.

***The attendance at these two events was high, suggesting that the practice of fire is something that is becoming less tolerated by the local community.**

- **Alternatives to Rice Straw Burning.**

In conjunction with the 2006 act against open burning in agricultural fields the local department of agriculture has implemented a successful project that provides alternatives to burning rice straw, post harvest.

Instead of burning the rice straw, the project advocates a technique called 'Tillage-Bury' method. The method involves preparation (tillage) of the land by laying weeds and straw in field and allowing them to rot back into the soil naturally, either by manually or mechanically ploughing the waste back into the ground so as to enrich the soil prior to planting the rice crop. Although, more expensive than just burning the waste, the method of ploughing the organic waste back into the ground has been proved to give higher crop yields than crops that have been burnt prior to planting.

The person responsible for the project, Khun Siripan Weeratganseen, states that:

"The Project has so far been successful with a high uptake amongst farmers in Mae On. However, there are still problems regarding forest fires and roadside burning."

CHAPTER 4 Research Results

Fires that occur in the study area of On Nuea can be classed into five distinct categories **Forest*, Agriculture, Open Area, Roadside and Domestic.**

***10 of the forest fires were recorded at night from the research head quarters. Therefore, due to inaccessibility, exact GPS points could not be recorded. Instead points were plotted using Google Earth and are highlighted in 'Pink' on the following fire map.**

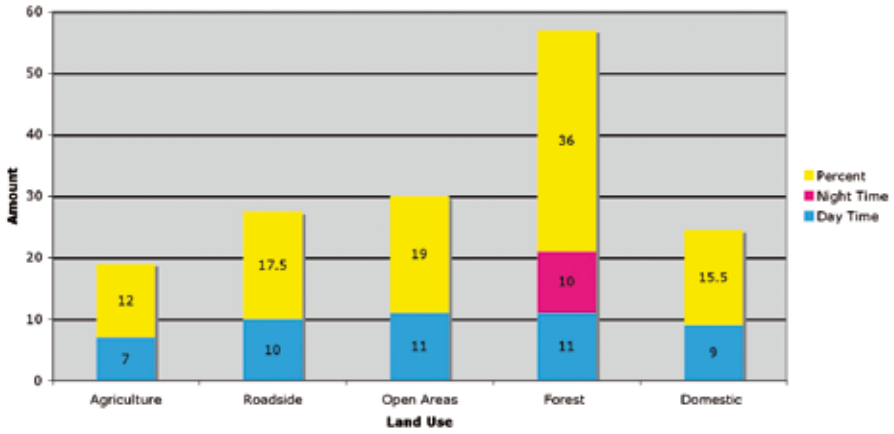


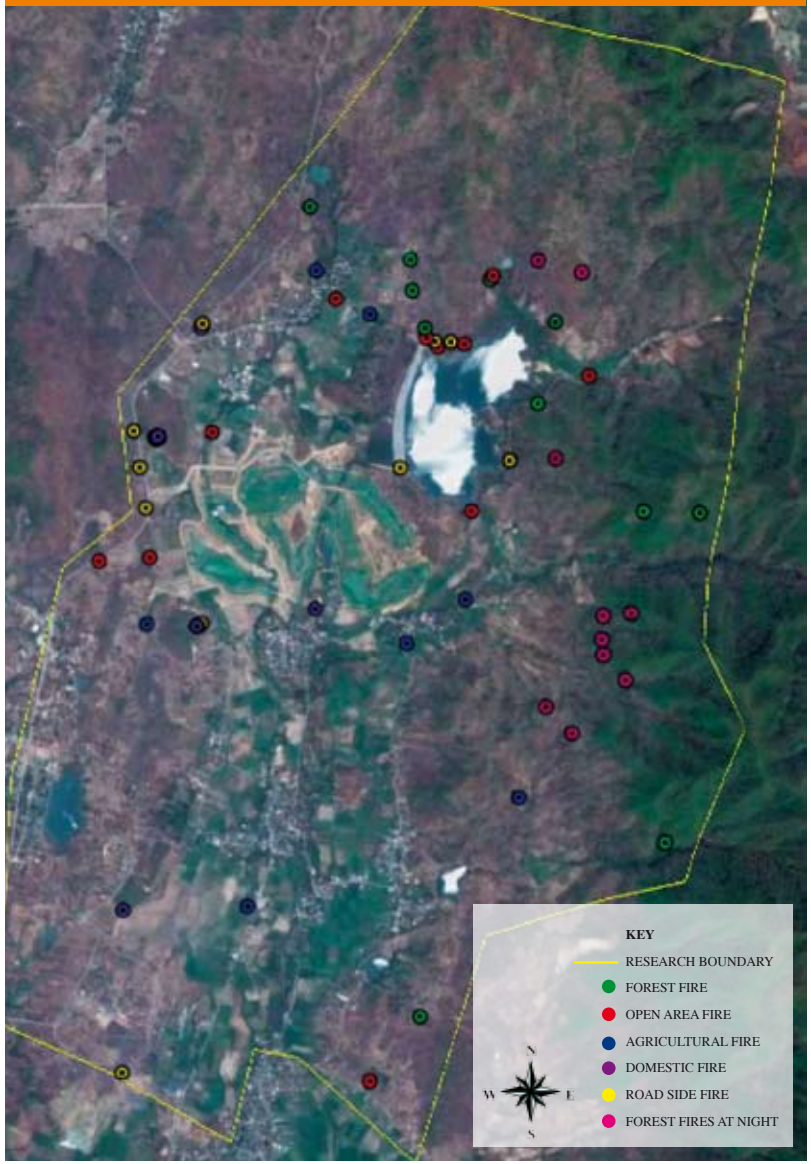
Fig. 4 Total Amount of Fires Vs Percentage Amount, Recorded within the Study Area

The above graphs and map clearly show that frequent fires occur within the research area. In total 58 fires were spotted during the two month collection period. The majority (36%) of fires occurred within forests located in the study area. Road Side (17.5%) and Open Area burning (19%) also made up a significant amount of the fire data. Whilst domestic (15.5%) and agricultural burning (12%) were the least amount of fires recorded.

Such an outcome mirrors the perception of the local Or Bor Dor, khun Niwath Suphamool, as he states that:

"Since I was first elected over eight years ago fires have been increasing every year. Two kinds of fire are occurring; number 1 is fire around the

Fig. 5 Fire Map



flat area particularly roadside and number 2, forest fires in the surrounding hills. Fire on the lower slopes/roadsides happen more frequently but still create less destruction than forest fires, which typically destroy larger areas of land and create larger amounts of smoke. The majority of the local community don't start fires, it is only the minority that do".

He also states that

"Forest fires are usually started in the afternoon and, due to no immediate efforts to extinguish them, fires often burn throughout the night until the next day. At which point the smoke will settle and cause eye irritation and respiratory symptoms, which can continue for up to a month. The local health office documents the amount of people suffering from smoke related illnesses and the numbers keep on rising"*

A forest fire burns through the night

The opinions of the pu yai ban of Hua Fai village, Khun Jirawut Suphamool also reflect the outcome of the data results. He states that:

"Nowadays, the traditional practice of burning agricultural has decreased because the younger generation either leave to work in the city or take up work as a local administrative officer. The real problem comes from the fires that burn in the forest which are 100% man made. Other types of burning are essentially to prepare areas for cultivation and to dispose of garbage, burning is fast and cheap."

The Chief of the Local Fire Control Centre, Khun Piya, also states that:

"From January until now (Feb) we have recorded 26 fire incidents which have burned a total of 126 rai in Mae-On. All of which were man-made and spread from lowland to upland areas destroying lots of cultivated and forested areas. Lowland People (90% of the population) are mainly responsible for starting fires. The upland hill tribes only use fire in the household."

The above quotes are just a selection of the many varied and insightful opinions put forward by local stakeholders regarding the causes and effects of fires within the On-Neua region.

***A request was made to the Local Health Office for data regarding the amount of people suffering from smoke related**

illnesses, but unfortunately, due to reasons of privacy, such data was unobtainable.

CHAPTER 5 Discussions

Before a detailed analysis is given explaining the possible reasons for fires, occurring within the research area, the following section will provide an overview of the current fire prevention and suppression strategies and some of the obstacles local authorities face when implementing them.

5.1 Fire Management- an Overview

The following overview includes extracts from interviews carried out with three separate people – The Or Bor Dor of On Nuea and two fire chiefs, one based in amper Mae On and the other in neighboring ampur Doi Saket.

In 2003, the RFD, under the order of the Ministry of Natural Resources and Environment (MoNRE), was divided into three departments:

1. Division of National Parks, Wildlife and Plant Conservation (DNP)
2. The Royal Forest Department
3. Department for Marine and Coastal Resources

As part of this agreement the Fire Control Office located within each ampur came under the jurisdiction of the DNP and therefore prioritises the fire management of national parks and wildlife sanctuaries, over other areas within the ampur.

Aside from the duties of DNP the rest of the forests within Thailand still come under the jurisdiction of the RFD who, since the restructuring of 2003, unfortunately have little in the way of forest fire prevention within their unit.

So as to try and improve this situation the RFD has transferred the responsibility of forest administration including fire prevention to the local level SAO office administration. The Or Bor Dor's fire agenda within the tambol, which already includes side-roads tracks, agriculture and Open Areas, now also incorporates forests. Therefore, so as to spread the load, the Or Bor Dor of each tambol, by working with the local community, endeavours to foster fire management skills amongst the separate village communities so as to take care of both the forested area and other areas which are susceptible to fire within the local vicinity of each village. Examples of community fire projects in On-Nuea and Mae On include the following;

- *Training Activities*

Although the attendance of the seminar-training day, held on the 27th of February, was high, it was the first time that such an activity like this has been held. Therefore, it is not yet possible to gauge how effective this initiative has been in which local villagers are empowered and trained as to how to both prevent and put out fires. During the non-fire season 10 fire control officers in Mae-On have also set up a fire training session in which volunteers are taught how to create fire breaks in key fire prone areas. Funding for this project has decreased this year though (exact reason not stated).

- *Radio Broadcast*

In terms of the radio broadcast the aim is to inform as many people as possible about the problems (particularly smoke pollution) with fire so as to try and encourage them to put pressure on those that are responsible for starting fires to stop doing it. However, The Or Bor Dor states that: "In practice this is hard to achieve."

- *Fire Support and Resources*

The SAO office has the support of a 'Volunteer Rescue Unit' that provides a fire patrolling radio service. Unfortunately financial support is inadequate for such a service. The office also has one fire truck at its disposal, a truck that can only extinguish fires that are either near roadsides or in areas with good access points for the truck. Fires in forests at higher elevations are inaccessible for the truck and therefore hardly ever attended to.

- *Laws and Enforcement*

In terms of Enforcement* the Or Bor Dor states that:

"The laws and fire regulations don't really work. The majority of people who are caught are poor farmers and therefore cannot afford to pay the fine. Usually they are let go with a warning."

***The current ampur rules regarding the lighting of fire stipulate that anyone caught either lighting forest fires or roadside fires, depending on the severity of the fire, will face a prison sentence of 2-15 years and a fine of 20,000 Bht – 150,000 Bht (see appendix for specific legislation regarding burning).**

The above points illustrate how the threat of fire within On-Nuea, due to a lack of resources, faltering enforcement policies and awareness campaigns, is being tackled, at best, with a lack-lusture response and at worse tolerated.

5.2 The collection of Forest Products

A common theme that has emerged from the interviews is the relationship between the use of fire and the collection of forest products (FPs), particularly Mushrooms (Hed Thob), and Herbs (Pak Wan).

The main reasoning behind the use of fire in forests is due to two distinct factors,

'Pak Wan' sprouting from the ashes.

Firstly, Ease of Access - burning of the leaf litter and surrounding ground vegetation allows the collection/foraging of FPs to be carried out in a quick and efficient way.

Secondly: - Fire is believed to encourage/stimulate the growth of FPs particularly Hed Thob and Pak Wan.

The majority of people we spoke to, both local villagers and official representatives, acknowledged the fact that fire in forests were used for the collection of FPs, however, opinions of whether or not fire was in fact a benefit or negative differed amongst those interviewed. Khun Som (Mr Som) a local dairy and arable crop farmer who also collects FPs from the neighbouring forests states that:

"We normally use fire in the forest because, sometimes, it's hard to walk and find the things we want to collect. We do not hesitate to use fire to burn small areas. A fire that accidentally gets out of control can sometimes happen but such fires often extinguish themselves".

Khun Niwath Suphamool also states that:

"Many villagers still use fire to stimulate the growth of mushrooms as they think that after the rains they will get a higher yield due to the use of fire."

Studies carried out by Khun Kanit Thanuthumjarearn, a Forestry Educationist based at the Forest Study and Development section at the Huai Hong Krai Royal Development Study Centre, ampur Doi Saket, indicated that forests, which were absent of fire, actually showed increases in the species number of edible mushrooms and therefore burning wasn't necessary.

5.3 Forest Products and Livelihoods

Despite such differing opinions regarding the use of fire in order to collect FPs, there is no doubt that the collection of FPs plays an important role within the socio-economic status of villages in Thailand.

A report carried out in 2005 analysing the functions of Community Forestry (CF) in North East Thailand stated that the main use of FPs was for home consumption, but that the income generated from FPs is also not insignificant (8).

The use of certain forest products particularly timbers for commercial sale is prohibited due to the 1989 national logging ban. The FPs, which are legal to collect, are often harvested by villagers in order to supplement diet, especially during times of hardship. The main types of FPs collected can be identified as follows; mushrooms, wild vegetables, wild fruits, insects, bamboo resin and bamboo shoots, rattan, fuel wood and medicinal plants. Each year villagers collect large amounts of FPs from CFs.

A case study from a village In the North East of Thailand Dong Keng CF, Nong Song Hong, Khon Kaen, estimated that about 1,277,964.85kg of FPs were collected by local villagers in 2004. 81.7% of the villagers indicated that such products were primarily used for household consumption, e.g. food, fuel and medicine. Only a minor amount of people (18.3%) reported selling FPs. Approximately baht 283,663.70 ($8,000) was brought into the local economy in 2004 through the sale of FPs. The money accounted for 5.26% of an average family income. Such a pattern is common throughout N.E Thailand. In which one third of harvested products are sold for income generation (8).

A study carried out in the North of Thailand in 2008, within the boundary area of Dui Suthep National Park, Chiang Mai province, compiled data which detailed the earnings of villagers from specific types of Mushroom. The study found that some villagers were making up to 1,000bht ($29) a day and over an entire season a total of 50,000 Bht ($1,430) was recorded for the collection of Hed Thob. Such an amount is just above the average yearly wage per capita for amper Mae On. Therefore, for some villagers, the financial incentive to collect a particular type of forest product can play a key role in determining the use of fire. (12)

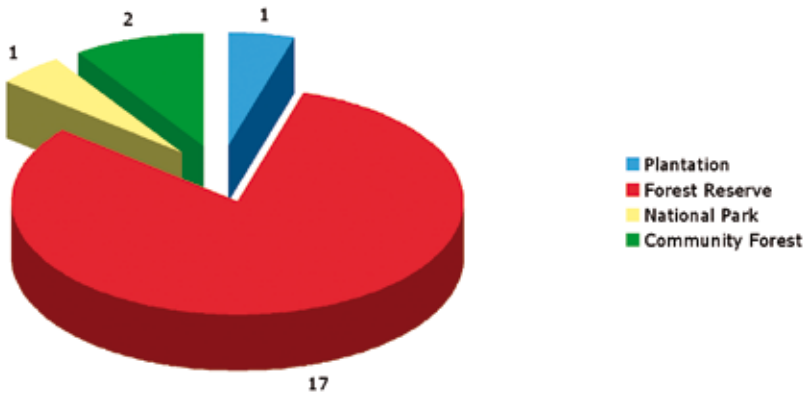


Fig. 6 Breakdown of Forest Fires

5.4 Forest Fires within the Study Area

The graph below is a breakdown of fires occurring within different forest classifications in the study area. National Forest Reserves have the largest amount of fires occurring within them (17) whilst the NP (1) and Plantations (1) have the least. Community Forests had two fires occur within them.

The following sections will discuss the reasons for fire within each forest type in more detail.

5.5 National Forest Reserves within the Study Area

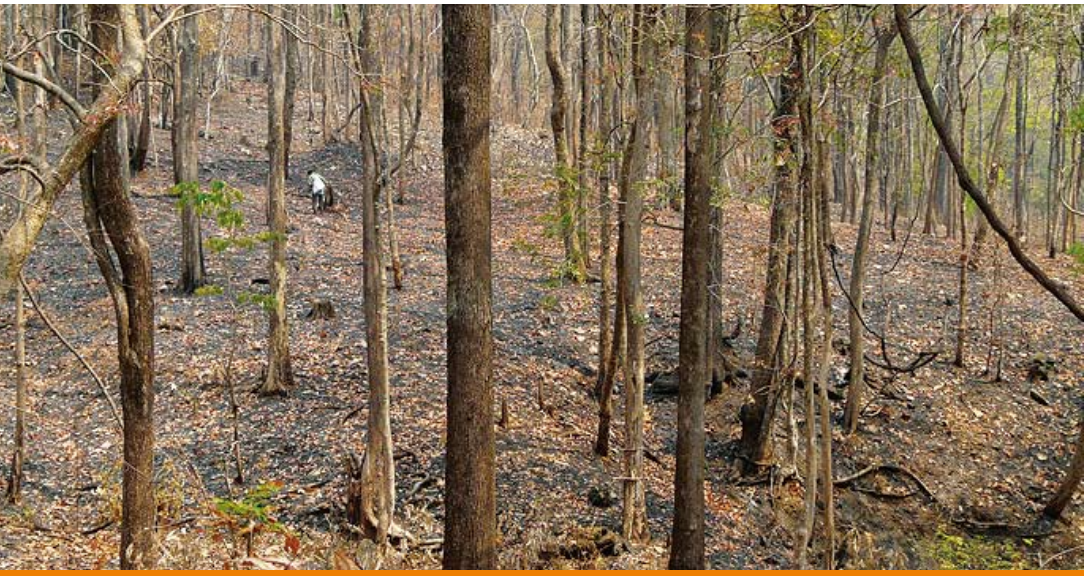
The National Forest Reserves (NFRs) within the study area are classified as 'Zone C Conservation Forest' and they make up the largest amount of forest cover within the study area. It is not surprising therefore that the largest amount of forest fires (17) were recorded within them. (See appendix for an overview of NFR forests)

Under section 14 of the NFR act 1964, unless a person has been granted a license to either collect forest products or acquire land, then all activities that may cause the forest to decay are prohibited. This includes burning, removal of forest products and timber (9). Despite this law fires have been frequently spotted in these areas. The majority of which have occurred from late afternoon and onwards into the night.

- *Controversy in the Forest*

Although this study didn't encounter any specific disputes over landownership and tenure, the concept of NFR has caused a considerable amount of controversy due to the way in which land is designated as reserves. The RFD, when marking out the boundaries for the NFRs, didn't take into consideration the customary resource usage of local people, a practice that, up until the introduction of the Forest Reserve act of 1964, had been an

intrinsic part of local people's livelihoods (9). The consequence of such enclosures led to local people being removed from the forests. Such a drastic dislocation between a farmer and his land can actually exacerbate the problem of fires as the incentive to protect and mange such a resource from the threat of fire is lost, due to the farmer being prohibited from using the area. In some cases it is believed that villagers continue to light fires not necessarily to collect or harvest forest products, but simply for political reasons to frustrate the forest authorities, who, they believe are responsible for their landless predicament. The only form of compensation for people who have been removed from land is monetary.



Scorched Earth

5.6 Thai Forests - A Local Perspective

In order to gain a clearer insight into why people are actually burning within the forests reserves, a local farmer called Khun Som kindly agreed to accompany us on a trek into a forest reserve and offer his thoughts on fire in the forests. The notes of the trek are detailed below:

As soon as we walked into the forest area, Som tells us that these woods have been used for over a 1,000 years to collect food and wood. The area where we were walking had been extensively burnt, scorched black earth spread out around us, Som tells us that some fires get out

Using a hacking technique to collect firewood and tap for resin. A technique that weakens the tree and makes it prone to being blown over in a storm.

of control and burn larger areas than intended. Som also states that he uses fire to make it easier for him to collect forest products. As we continued on our trek through the dry dipterocarp forest, Som began collecting wood, explaining that even though it was illegal he was confident of not being caught. The area was covered by large swathes of bamboo, an indication of degraded forest, as Bamboo is a fierce competitor against local trees in land degraded from multiple fires

As we reached the highest point of the trek, bordering on a National Park, we notice less signs of burning. Som explains that fires are started at the base of the mountain, and then gain in width as they ascend and then dying out as they reach the top. Towards the end of our descent we were surprised to see forests with green trees high as 30 meters. Som explained that this was the communal area around the village and prohibition on burning was understood amongst the villagers… The only set back was the usual presence of blackened earth due to uncontrolled fires lit in the neighbouring area.

Whilst walking out of the fallow area I began to see smoke emerging from the distance. As we got closer we realised that a fire was rapidly

The Mysterious Burning Tree

Khun Som about to set his land alight

taking hold of a fallen tree, which we weren't sure how it had started. One assumed that the area had been set alight so as to clear around the tree to make it easier to harvest its woody bulk. We stood and watched in awe, as the fire grew larger and larger, eventually engulfing the majority of the fallen tree. For some reason Khun Som was reluctant to come and see the fire and so our queries about the fire were left unsolved.*

As we began to leave the forested area, all of a sudden, Som knelt down on the path and lit the verge. We stood, astonished, as another blaze took hold. Som announced that this was now his land, and it was not illegal to burn to prepare the land to plant a crop of maize. Som then walked off, leaving the fire to tend itself. When I asked him about the complaints about fire burning, he replied, "It's just our normal way of life, we have used fire for many years. The issue about smoke is a recent occurrence due to the late rains and hotter air temperatures. It doesn't last forever. When the rainy season comes the conditions will improve."

5.7 National Parks and Enforcement

It turned out that the area in which the tree was set alight was within the boundary of Mae Thakrai National Park. To find out more about the types of fire practices that take place in the park an interview was carried out with Khun Chai Chaisiri, an operational expert for the National Park.

He made the interesting point that the main use of fire within the NP is for a particular type of hunting called 'Lai Long' in which fire is used by the hunters to chase animals to more open areas where they can be shot.

Despite the fact that hunting takes place in the NP, the actual use of fire for hunting wasn't detected during the study period. The only indication that hunting was taking place was the occasional sound of guns being fired all of which took place during the day and came from areas where fire was not present.

In terms of fire management the NP has three operation units responsible for fire Management, each team consisting of 10 people.

Due to the size of the park being 30,000 m^2 the Park also works in conjunction with two other organisations – The Local Fire Control Unit and the Hua Hang Krai Development Centre - who help to advise and offer support for fire prevention and issue strict fire regulations regarding the use of fire in the NP.

Such a comprehensive fire management strategy reinforces the fact that NPs and other protected areas, which come under the jurisdiction of the DNP, appear to be given priority, due to better resources and a coordinated effort to prevent and suppress fire, whilst areas within the jurisdiction of the SAO particularly the NFRs, due to a lack of investment and resources, have weaker fire prevention policies and are therefore more susceptible to the

threat of fire. As well as failing to address the issue of fire, such faltering management policies are subsequently neglecting the forest ecology. Whilst on the trek the degradation of the forests was very apparent, the forest ecology had, due to the annual bombardment of fires, been transformed into an environment in which trees were stunted and biodiversity limited to species that can only tolerate seasonal burning - forests which are almost void of life "Ghost Forests". If the threat of fire continues at the present unsustainable rate these forests will eventually, overtime, turn into savannah grasslands and be of no use to anyone. Examples of such a dire scenario can be witnessed first hand at Huai Tong Taew an area just North of Chiang Mai City

***Khun Som was reluctant to offer his thoughts about the fire in the NP. He even refrained from coming over to look at the fire. Again it may be the case that he is aware of the stricter fire regulations in NP and therefore less inclined to comment or take the risk of being spotted near a fire within a NP.**

5.8 Community Forests and Environmental Stewardship

Within the study area there are two officially recognised Community Forests (CF). One is located within Ban Mae Pa Kang Village 10 (Moo 10) and the other is situated on the boundary between tambol On Nuea and tambol Ban Sahakon and is part of Ban Sahakon Moo 6. CFs do not come under the jurisdiction of the local Or Bor Dor. Therefore, management and fire prevention is overseen by the pu yai ban of the village community who have requested for CF status.

The following extract is the rationale put forward by both Ban Sahakon Moo 6 and Ban Mae Pa Kang Moo 10 requesting for CF status:

"Natural forest destruction and household wood shortage are an important problem, which affect the communities' livelihood and wildlife status. Overexploitation and consumption have degraded the forest condition and the profits gained from the forests have decreased. Thus, to address this problem, the setting up of a community forest project will be proposed to The Forest Community Management Unit, Forest Resource Management Office, Chiang Mai. The community leader of each village will conduct a forest survey that, through the collaboration of local communities and governmental agencies, devises a suitable management system including regulation and policy to conserve and support the sustainable-use of the designated Community Forest."

The objectives for both CFs are the same and are as follows:

1. To conserve natural food resources for human and wildlife
2. To conserve wood collection sources for communities
3. To conserve traditional medicinal plant as an indigenous knowledge

4. Environmental Conservation
5. Create public awareness, participation, cooperation and strengthen the unity of the community
6. Project Duration 4 years (2006-2010)

So as to determine the state of the two CFs, and to see if the above objectives were being met, forest transects were carried out in both CFs. Forest Transects involves the assessment of vegetation type and the overall health of the forest.

The differences between the two forests were very pronounced (see Fig 7 below). The community forest of Ban Mae Pa Kang Moo 10 was of a significantly degraded nature. Throughout the forest there were large sections of burnt undergrowth and little to no tree saplings, which are normally a common sight in dry dipterocarp forest. Bamboo, which is essentially a large grass, due to its highly competitive nature, had taken over vast sections of the forest, which had been burnt by fire (during the two month period of study a total of two fires were actually spotted in this particular CF. However there were also two other fires spotted in close proximity to the forest and it is likely that these also spread into the CF).

The CF located in Ban Sahakon Moo 6 was at the opposite end of the vegetation spectrum. Little to no fire disturbance had meant that the undergrowth was awash with leaf litter (a common sight at this time of year, due to the trees shedding their leaves in order to retain water due to the dry season) tree saplings and grasses occurred in plentiful amounts and the blackened soil, typical of burnt forest was also absent. Despite the fact that the presence of fire was less apparent in CF Moo 6 there was still evidence of forest product collection - harvested bamboo poles were tied up in small stacks.

So as to gain a clearer understanding as to why the two CFs were in different vegetation states, one healthy, one degraded, informal Interviews were carried out with both of the pu yais.

The pu yai ban for Ban Sahakhon, who has held office since 1985, informed us of the history of the area and how the local forest was destroyed due to large scale logging (exact dates not specified) in which the wood was sold for the use of house construction. Such an activity resulted in a very dry landscape and subsequently a lack of water to irrigate the crops. This resulted in an exodus of labour to search for work elsewhere.

So as to try and improve such a dire situation a project, initiated by the King in 1981 established the 'Ban Sahakon Agricultural Cooperative' which aims to support poor farmers by providing the degraded forestland for landless farmers. The land provisions (about 8-10 Rai / family and 400-600 m^2 for residential) encourage them to live, work and carry out business in the cooperative system. Ownership of the land essentially belongs to the project itself, however members of the project can pass the land down to their descendants (see appendix for a history and overview of the project).

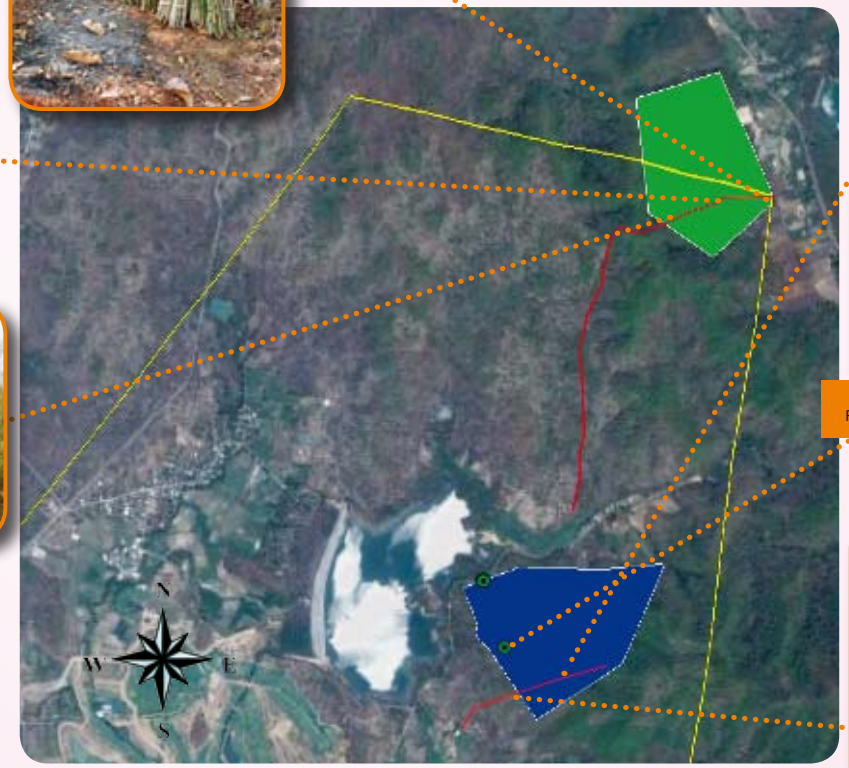


Figure 6.3 Evidence of forest product collection and also interestingly the use of fire which appears to have been controlled in order to prevent the fire from spreading into the CF

Figure 6.4 Standing in Ban Mae Pa Kang CF looking due west towards the reservoir - scorched black earth little to no leaf clover

Figure 6.2 Walking through a healthy section of Ban Sahakon CF no evidence of fire an abundance of leaf cover and young tree saplings

Figure 6.5 A night fire burns within Ban Mae Pa Kang CF

Figure 6.1 A sign indicates the boundary of Ban Sahakon CF no signs of burning and plenty of leaf cover.

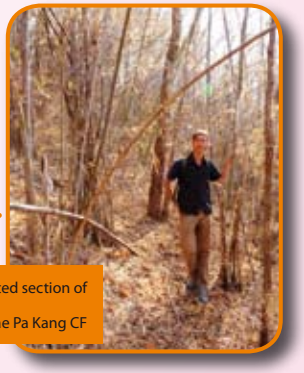


Figure 6.6 Bamboo dominated section of Ban Mae Pa Kang CF

BAN SAHAKON COMMUNITY FOREST

BAN MAE PA KANG COMMUNITY FOREST

TRANSECT WALK

FIRE

RESEARCH BOUNDARY

Fig. 7 A transect diagram illustrating the differences in forest health in each of the Community Forests

Aside from the agricultural project, one of the key points that the pu yai ban made was in regard to leadership within the local community. He stated that:

"Strong leadership is what is needed to prevent fire. Encouraging people to think about the area and take responsibility for their actions and how each individual has a role to play in protecting the local environment".

Unlike the pu yai ban of Ban Sahakon Moo 6 , who has been in office since 1985, the pu yai ban for Ban Mae Pa Kang Moo 10 has only held office for just over a year taking over from his elder brother, who stepped down at the end of 2007. He explains how the local villagers use fire for two main reasons:

Firstly, in order to protect their land, villagers carry out prescribed burning which involves making a fire break around the perimeter of their plot of land/fruit orchard so to prevent wild uncontrolled fires from entering their land whilst they are not present.

Secondly, the pu yai ban believes that fires are used to encourage the growth of mushrooms and other forest products such as Pak Wan. However, he believes that fire doesn't actually stimulate the growth of such products and that he has actually witnessed Pak Wan being grown in a local villager's garden.

A local farmer called khun Nong, who has lived in the local area for over seven years growing certain vegetable crops including garlic and sweetcorn and lives at the base of the CF in Ban Mae Pa Kang , also states that the main types of forest products collected from the CF are as follows;

Mushrooms (Hed Thob), Herbs (Pak Wan), Red Ant Eggs (Khai Mot Deang)

Each of the CFs has a set of rules and regulations that prohibit the action of burning as well as the removal of certain forest products. Despite this however, it is apparent as confirmed by the pu yai ban and various other villagers that fire in the CF of Ban Mae Pa Kang Moo 10 is actively practiced for the collection of certain forest products.

In terms of enforcement of the CF rules and regulations the pu yai ban for Moo 10 states that:

"Catching those responsible for the fires is difficult because it is quick and easy to light a fire. Smoke indicates that a fire has been lit, but by then the person responsible has fled."

Such a blatant disregard of community guidelines in Moo 10, due to the individual's desire to use fire to collect forest products, suggests a lack of understanding amongst farmers regarding the

Rules and Regulations	Fines
1. No Cutting any kind of Stalks	1000 ฿ per inch of stem
2. No Burning in the Forest	1000 ฿ per person
3. No Animal Hunting	5000 ฿ per person
4. No Extraction of Forest Herbs	1000 - 10000 ฿ per person
5. No Trespassing	5000 ฿ Per Person
6. No Deforestation	5000 ฿ per grove
7. No Extraction of any type of orchid	500 ฿ per person
8. No Animals allowed in the CF	500 ฿ per animal
9. No Extraction of Bamboo	500 ฿ per person

Table.1 Rules and Regulations for the Community Forest of Ban Mae Pa Kang Moo 10

importance of upholding the ideals of a shared community forest, a scenario, which has paralells with the 'Tragedy of the Commons'. A theory that describes how a resource, which a community have rights or access to - common land - but isn't managed or overseen in a fair way, can lead to a dilemma in which multiple individuals acting independently in their own self-interest can ultimately destroy a shared limited resource even when it is clear that it is not in anyone's long term interest for this to happen.

The two CFs within the study, based on the above findings, appear to be undergoing differing forms of fire management. The Ban Sahakhon community who have suffered in the past due to the

A fire about to take hold at the base of Ban Mae Pa Kang Community Forest.

destruction of their local environment which subsequently affected their livelihoods, have realised, due to the establishment of the agricultural cooperative, the importance of working together to protect local resources in a more cooperative way - putting the needs of the community above that of the individual. Another benefit of the cooperative project is that by giving landless farmers part ownership of land you create an incentive for them to prevent the land from burning. Studies have shown that where there is a sense of ownership over a resource then there is also a strong incentive to protect it (10).

Unlike Ban Sahakon, the Ban Mae Pa Kang community is yet to undergo any significant challenges to their immediate environment and appear to have no projects setup on their behalf, similar to that of Ban Sahakon. It may be the case therefore that the people of Ban Mae Pa Kang are less aware of the impact of fire on the forest and due to their 'burning as usual' mentality are unlikely to want or realise the need for change.

5.9 Roadside Burning

Roadside fires accounted for (17.5%) of fires spotted within the study area. From the interviews conducted the reasons were perceived to be accidental e.g. Dropping of cigarettes or simply because it is easy to clear an overgrown roadside with fire as it is cheap and fast. The pu yai ban of Moo 5 stated that:

"Roadside fires are seen as a cheap and fast way of clearing overgrown verges."

Although 'cheap and fast' is a plausible explanation for the use of fire to clear roadsides it is not the sole reason. Based on personal

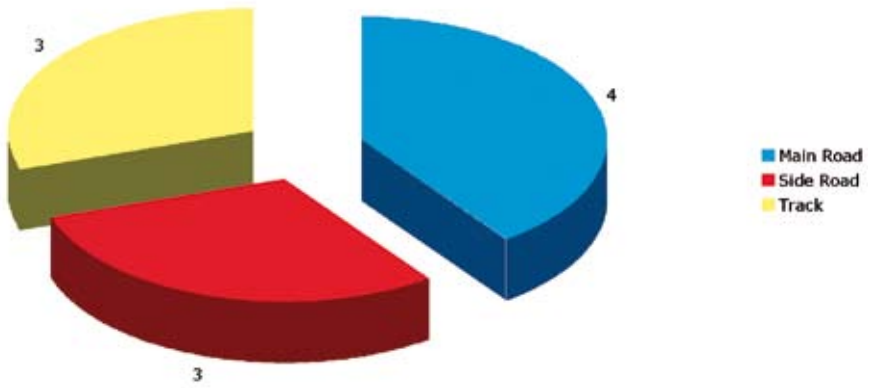


Fig. 8 Breakdown of Roadside Burning

empirical observation, the practice of roadside burning, like that of forest fires, is also used to stimulate growth. Certain areas where burning has occurred contain a specific type of grass called *Imperata Grass*, a grass that when in it's mature form has little nutrient value. Therefore, local cattle grazers prefer to burn back the old grass and, due to the grass's fire resistant nature, new shoots produced on burnt areas have a higher nutrient value, which is perfect for grazing cattle on (11).

Such an activity is widely practiced in Mae-On as there is a large amount of cattle farming, but unlike cattle farming in Europe where paddocks/fields are used for grazing, cows in Thailand appear to be given the 'rough end of the verge', so to speak. They have to forage alongside roads and other areas of less fertile importance, whilst the larger open spaces are prioritized for the cultivation of rice and other, more lucrative, cash crops. Such grazing practices have been practiced for many decades, and fire has no doubt been an intrinsic part of feeding cattle, but maybe all that is called for is a new growth encouraging practice, cutting back the grasses using a manual method instead of fire.

Roadside fires generally appear in 10 meter strips on either side of a road. All fires recorded during this study were left unattended, which, in many cases led to the fires spreading into surrounding areas of both open area scrub land and in some cases agricultural land.

Highway departments are also believed to carry out roadside fires so as to clear back overgrown vegetation on main roads. A study conducted in the region of Nan province managed to reduce the amount of roadside fires by planting trees along the roads (11).

A burning roadside

Cattle grazing on the verge

5.10 Open Area Fires

The following section describes Open Area Burning. It is important to note that the majority of Open Area fires were fires that had spread from Road Side fires. The examples below illustrate the types of Open Area fires that were recorded during the study. As well as uncontrolled fires, it is also believed that Open Areas which have become overgrown and unmanageable are simply cleared using fire because it's 'Cheap and Fast'. An Example of this is the way in which Khun Som, in order to clear his land for planting maize for his cattle, rather than clear his land manually simply sets light to it.

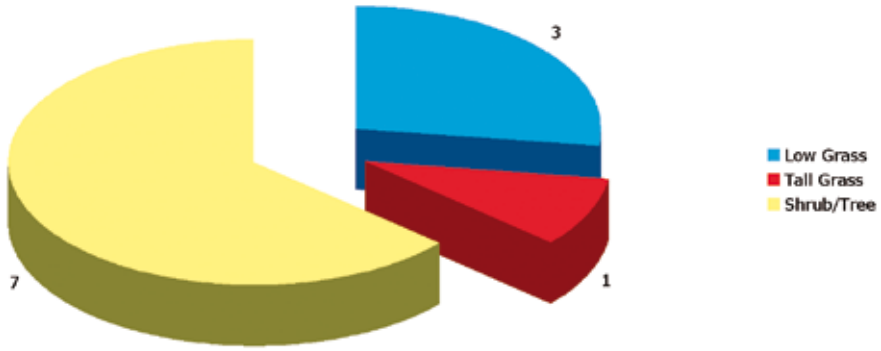


Fig. 9 Breakdown of Open Area Burning

The following pictures also illustrate other types of Open Area burning taking place within the study area

Fire spreads from a roadside and sets alight lakeside vegetation.

A field adjacent to a roadside smolders after a burn

5.11 Agricultural Burning

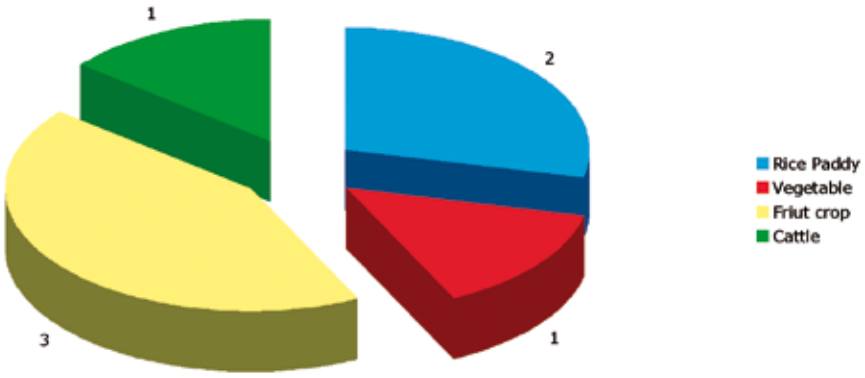


Fig. 10 Breakdown of Agricultural Burning

Agricultural burning within the study area was the lowest recorded type of fire (12%). Such a low amount would correlate with the recently introduced bury and tillage scheme overseen by the local agricultural office which has seen a large take up of subscribers and therefore a subsequent reduction in agricultural fires.

There are still cases in which crop burning is carried out either to burn off the stubble or burn the rice straw and other types of waste debris. The perceived reasons for such agricultural burning is that by burning the crop, ash left over from the burn nourishes the field and prepares the soil for the planting season. Despite this though, studies have shown that annual burning is actually detrimental to the soil as it reduces key soil nutrients such as potassium, calcium and magnesium as these are lost as fine particles in the smoke, whilst nitrogen, phosphorous and sulphur are lost as gases (5).

- *Prescribed Burning*

The practice of prescribed burning was witnessed on one occasion in which a farmer was creating a fire break around his banana plantation, by burning a meter strip of land around the perimeter of his plot. The reason he was doing this, he told me, was to prevent potential uncontrolled fires from spreading onto his land and destroying his fruit crop.

- *Protection from Pests and Insect*

Controlled spot fire burning within agricultural crops such as fruit orchards is to kill off pests and destroy certain weeds. A local farmer called Khun Tong Inn who raises cattle and ducks states that he burns off some of the old growth near where his cattle graze so as to kill off any insects or pests that may pose a threat to his cattle.

5.12 Domestic Burning

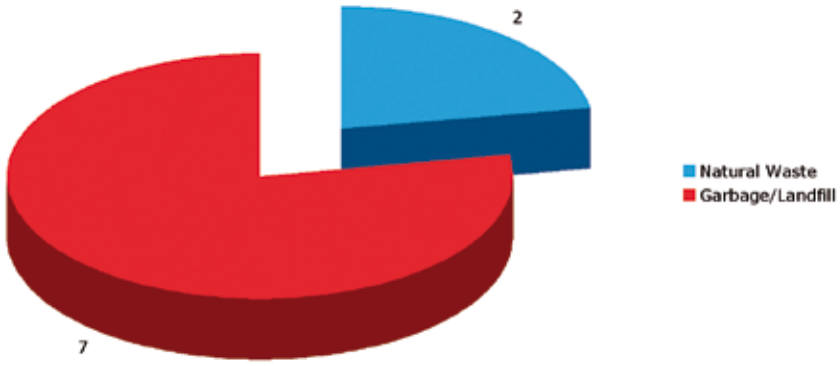


Fig. 11 Breakdown of Domestic Fires

Burning of household waste is a problem that continues throughout the year and is believed to contribute to the dry season smoke haze. Household burning involves the burning of both natural and refuse waste. Due to the fact the access to households was limited during the study it was hard to gauge how much waste villagers actually burnt within the home. However, within the study site there is a total of three landfills, which were recorded burning on seven different occasions during the study. Burning of natural waste was also recorded but only on two occasions in both cases the villagers were burning natural waste that they had collected from within the vicinity of their home. Each of them was burning the waste of the roadside adjacent to their homes.

Chapter 6 Conclusion

6.1 Current Scenario

The initial observations that instigated Richard Rhodes to commission this report has led to a study that has managed to gain a clearer understanding of the causes and effects of fire in the On-Nuea region

- *Anti Social Behaviour*

The findings above illustrate the many types of burning practiced and the subsequent negative effects they have on both the local On-Nuea area and the surrounding region. Although it was hard to determine the exact amount of people responsible for lighting the fires, the Or Bor Dor clearly stated that the majority of the local community are not responsible for lighting fires and that only the

minority are responsible for burning. However, due to the desire to either collect forest products or clear areas of land using a 'Cheap and Fast' method, the anti social act of one person setting light to an area of land often leads to fires becoming uncontrolled and in the process destroying large swathes of land. A short-term gain for the individual maybe, but in the long term a tragedy for both the local and global community as a whole.

The situation in On Nuea is at a point whereby the use of fire is posing a serious threat to both human health and the health of the forest. Also, In the context of climate change, the large amount of forest fires taking place in On-Nuea are contributing to a global phenomena of rising carbon dioxide emissions. As well as this, the degradation apparent in the On Nuea forests could lead to a scenario in which there is a significant decrease in the amount of healthy forest cover within the local region. Such an outcome would not just affect those in the local vicinity, whose agricultural livelihoods depend on the healthy status of the forests, but also the world as a whole, due to the fact that the essential requirement for one of the main natural sequestering techniques of large amounts of carbon dioxide is a large amount of healthy global forest stocks.

6.2 Current Initiatives - Strengths and Weaknesses

The key strengths of the current initiatives carried out by the local authorities in OnNuea to manage fire is that they appear to be acknowledging the importance of the local community as a force for good in preventing and suppressing fires, as it's often the case that local communities are in the best position to manage or prevent fire at the local scale (10). The Seminar training day was an example in which the local authorities helped to develop the capacity of local village communities to manage the problem of fires within their local vicinity.

However, the Or Bor Dor himself accepts that a lack of funding for key resources is limiting the scope of the types of training and awareness campaigns he can offer.

If such training is to be of any lasting effect then, as well as an increase in funding, there needs to be an increase in the amount of actual training. The only way in which to resolve the issue of fire is to have a comprehensive year round training programme that focuses strongly on prevention, it is only during times when fires are not burning that fires in the future can be prevented.

The efforts of the local authorities have helped to instill a sense of understanding and awareness within the local community about the problems related to fire, but actual action amongst local villagers to prevent and manage fires is still lacking. Training and awareness on its own will not solve the problem of fire, a holistic fire policy needs to have incentives to encourage people to become proactive fire fighters. The importance of ownership or the rights to utilise an area productively rather than be denied access is a key factor in determining whether an area is protected from fire

or not. The example of the 'agricultural cooperative' project in Ban Sahakon is an example of such good practice and therefore similar projects which emphasise 'cooperation' as well as endear a sense of responsibility and essentially ownership of a particular resource, should be explored further and applied elsewhere in the region of On Nuea.

The success of the Tillage-Bury method advocated by the local agricultural department also illustrates how farmers are willing to change their practices if they can see where a clear benefit can be made, in this case higher crop yields.

In terms of enforcement current regulations seem to create little impact at preventing fires. This is partly due to lack of resources available to enforce the law, but also due to the fact that collecting evidence on which to base charges can prove to be very hard indeed. Despite this, law enforcement is needed and a set of rules and regulations that act as a guide rather than a threat to preventing fires from occurring in both forests and other areas, would be a more productive way of managing fire.

6.3 2010 and Beyond – Proposals for Preventing Fire

The local authorities can't be expected to tackle the issue of fire on their own. Therefore the following section, will propose possible projects/solutions, which aim to involve all stakeholders within the On Nuea region, governmental, private and most importantly the local community.

- *Reforestation and Community Tree Banks*

By setting a side degraded forest in On Nuea a reforestation project could be set-up that involves the added incentive of creating a 'Community Tree Bank'. For every tree planted a small amount of money is put into a community bank. Once the bank has enough money to start doing business a committee is set up comprising of both male and female directors. In order to borrow from the community bank a villager must open a saving account and buy a certain amount of shares. Loans can be issued at a smaller rate than normal and be used to setup business ventures within the local community. Each year the trees are inspected and for all the trees that are healthy a financial bonus is put into the community bank. A deduction is made for all the trees that are dead. A certain amount of the profits made from the bank must be invested into other environmental causes in the local area, including funding for fire training activities and awareness.

Due to the potential benefit such a project would have on the local community, local villagers would have a strong incentive to protect both the reforestation area and the surrounding forest from burning. Such a scenario could lead to a point whereby the people responsible for burning would become social outcasts, due to the

fact that their individual desires to use fire threatens to undermine the collective work of the whole community.

Although, not carried out to prevent fire, this project has been carried out in various other regions of Thailand and has proved very successful indeed. Local Businesses could fund the planting of the trees an amount that needs to be no more than $1-2 per tree ($1 to plant the tree and the other $1 for the bank).

- *Composting*

Much of the natural debris that is burnt along roadsides and in open areas could be manually cleared such a practice would still allow for the re growth of the new grasses, but without the need for fire. In conjunction with the local agricultural office, villages could be encouraged to clear the roadside using a technique such as strimming for which they could be paid an hourly fee. The waste created would then be transferred to a communal composting station that could then be sold as organic fertiliser for use in the local fruit plantations and vegetable crops. The agricultural office could implement the project in conjunction with the tillage and bury project. Funding for the project could be partly sourced from the 'community tree bank' as well as government agencies, particularly the highways department.

- *Pheasant Hunting*

Although the use of fire for hunting didn't appear to be practiced in the majority of the forests within the study area, it was apparent that hunting was still practiced. Therefore, by introducing the concept of pheasant hunting in which pheasant pens would be setup within the forest, due to the fact that such birds like thicket and plenty of undergrowth the hunters would naturally want to protect such area from the threat of fire and the scorched baron landscape which it creates.

- *Recycling and Domestic waste*

The current scenario regarding waste disposal in On-Nuea mainly involves dumping waste into various landfill pits, where it is then burnt. Composting of organic household waste could be included in the above composting campaign. In terms of actual rubbish, educational initiatives could be setup to inform local people of the problems associated with the burning of waste and the health risks it poses for the local community. Again such an Initiative could potentially be part of the environmental projects that are an offshoot of the 'community tree fund'.

- *Financial Rewards*

Taking into respect that most people who are responsible for most of the fires are poor, instead of high fines to deter people from burning, financial rewards could be awarded for people who do

not burn. Farmers could be each given a plot of land to oversee and manage and depending on the amount of land that they manage to protect from fire a financial award could be issued at the end of each burning season.

- *Awareness Campaign*

A properly orchestrated media campaign that will spearhead all of the above initiatives and use them as examples of how a coordinated approach to is essential to tackle fire/smoke in Northern Thailand.

- *Carbon Offsetting and Climate Change*

As already mentioned above, the importance of forests as key sequesters of carbon dioxide gases means that protecting forest is an essential part of the climate change agenda. Therefore it may be beneficial to pursue such initiatives such as Carbon Offsetting and Clean Development Mechanisms (CDMs) in which farmers living within the local vicinity of forests are essentially paid to protect and manage forests in a sustainable manner. More research would be needed in order to determine whether or not Thailand is actually going to sign up to such initiatives as CDMs at present they are yet to do so.

6.4 Further Research Recommendations

Due to a limited time frame this study was unable to cover all aspects of the fire issue occurring within the study area, therefore the following section recommends areas in which more research is deemed necessary.

At present the exact reason for the use of fire when collecting forest products particularly mushrooms is still uncertain, from the findings of this project it would appear that the use of fire is simply to make the collection process easier rather than the actual stimulation of mushroom growth. However, more research needs to be carried out to confirm this.

In order to get a clearer understanding of the factors determining the difference in management between the two CFs within the study area, the types of fire prevention strategies carried out within each CF should be explored in more detail e.g. the building of firebreaks and other potential prevention measures that the villagers may or may not use.

This study didn't encounter any specific disputes over landownership and tenure. However, the ampur office, in its analysis of the development potential of Mae On, acknowledged the issue of farmers without the correct land rights as being a key area of weakness as it obstructs agriculture funding. Further study

into the effects of landless farmers may also reveal some interesting factors regarding the use of fire. Areas of particular interest being Ban Mae Pa Kang Moo 10 and Ban Sahakon Moo 6. So as to gain a deeper understanding of the differences in fire management between the two CFs, further research into the issue of landownership within both of the village communities should be carried out.

6.5 List of Appendices

History of The Royal Forestry Department

Prior to the setting up of the RFD, forests in northern Thailand were regarded as sufficiently abundant for people to cut or collect timber and other forest products freely for either home consumption or for commercial purposes. The only timber which villagers couldn't collect was teak (Tectona grandis Linn.). Any person who wished to cut teak forests had to obtain a permit from the local Chiefs of Forest. In exchange for this right, certain fees, called "the Stump Fees (Local Tax) had to be paid to the local Chiefs of Forest. Admittedly, during the initial period, there was no control on working of teak i.e. the locality of cut or the girth limits of teak to be removed. All of the efforts were for the sole collection of revenue. Owing to the partiality in granting permits and strong competition of teak, disputes always arose amongst the buyers (mostly British subject), and the local chiefs. To the point where the Government was often called upon to mediate and settle the matters.

As a consequence of this, the government in 1874 tried to exercise some control by promulgating a law requiring that any agreement between the local chiefs and foreigners could not be valid unless the Government duly ratified it. Closer control on the working of the teak forests was further attempted by the Government by inclusion in the Treaty of 1893 between Thailand and Great Britain of a clause prohibiting British Subjects from working teak forests without obtaining duly registered permits. Also, the local chiefs could not issue a permit to more than one person to work in the same tract of forest. In accordance with the provision of the Treaty A.D. 1893 the Government deputed a commission to Chiang Mai Province to deal with forest matters and to see that the terms in the treaty were observed and enforced effectively

In the lengthy report submitted to the Government on August 10, 1896 by Mr. H. Slade, having conducted a forest survey in Chiang Mai, the English forestry officer from the Indian government, pointed out two main weaknesses that were undermining the whole forestry operation in Thailand;

1. The ownership of the forest was completely in the hands of the local chiefs, instead of being under the charge or control of the Central Government.

2. The working of teak forests was so irregular that the principle of conservation for perpetuating the yield had never been employed.

Among several recommendations Mr. H. Slade proposed to the Government, the most urgent and important one was adopted - With the sanction of His Majesty King Rama the Fifth, The Royal Forest service was created as a department under the charge of the Ministry of Interior on September 18, 1896.

Because of trends and development of policy and general administration of the Government during different periods, The Royal Forest Department (RFD) was transferred to various ministries before it eventually became a unit of Agriculture in 1935. However, after the establishment of the Ministry of Natural Resources and Environment (MoNRE) in 2002 the RFD was duly restructured under the order of the (MoNRE) in 2003 a structure than remains until present day

The following timeline chronicles some of the key policy changes during the 20th century.

The Forest Reserve Act of 1964 encouraged conservation through the practice of gazetting (classification) so-called permanent National Forest Reserves Pa Sanguan Heang Chat.

1985: The National Forest Policy's main aim was to maintain at least 40 percent of national forest cover by setting aside 25 percent of Thailand's landmass as economic forest whilst 15 percent was identified as conservation forest.

However, due to the disastrous floods and landslides in the south of the country in 1989, a landmark national logging ban was announced. The bans led to key changes in policy and in 1992 economic forests were to be reduced from 40 percent to 15 percent and conservation forest increased from 15 percent to 25 percent.

The 1989 logging ban signalled a significant change in the management and focus of the RFD. The royal institution now focused its attention on the upkeep and protection of protected areas, reforestation and the administration of plantations.

Along with such dramatic changes in forest policy, the RFD'S policy on fire also became a lot more comprehensive. In 1970 the RFD requested the assistance of a Canadian expert on fire Mr.J.C Macleod. He was appointed to work with the Thai Government to develop a policy on fire control. After Seven months in the field researching fire, Macleod submitted a report which became the basis for the for the RFD's approach to fires. An approach that involved training initiatives in which Thais were sent to both America and Canada for specific training in fire prevention. The outcome of which resulted in the RFD setting up an official Fire Control Network with the main aim of preventing 'wild fires'.

Forest Types in Thailand

According to the RFD there are three main types of forests in the northern hills of Thailand; tropical evergreen forest, mixed deciduous forest and dry dipterocarp forest (4).

- Tropical Evergreen forest is mostly found above 1,000m and makes up 20 percent of the northern regions forested areas. Evergreen forests are characteristically dense with vegetation and have a tree height over 40m. They are often moist all year round.

- 70 percent of forest cover in the northern region is mixed deciduous forest and makes up the biggest portion of forest in northern Thailand. A forest type that is located within the intermontane valleys and in the lower to middle reaches of the upland areas, usually below 800m. Traditionally teak would have thrived in such forests, however, as explained above teak and its presence within northern forests has declined greatly due to logging. During the rainy season leaf cover is abundant. In January however, to retain water during the dry season the trees shed their leaves creating an abundance of leaf litter on the forest floor. Such an occurrence of dry leaf litter means that these forests are susceptible to fire.

- Dry Dipterocarp forest makes up 9 percent of forest cover in Northern Thailand. Dipterocarpaceae are a large family of hardwoods that are long lived and can grow to exceptional sizes. Many occur in wet evergreen forest. However, out of the 680 species 6 are deciduous and like the mixed deciduous trees are found at a similar height on slopes and ridges in hilly regions. These 6 species of tree are also classified as dry diterocarp forests as they too shed their leaves during the dry season in order to retain water and therefore are also prone to fire.

National Forest Reserves an Overview.

The concept of National Forest Reserves (NFRs) dates back to 1964 and was implemented in conjunction with the first ever Thai National Economic Development Plan 1961-1966, which stated that 50 percent of the land in Thailand should remain forested. Therefore, NFRs became the management arm responsible for over seeing such a process. However, despite an agenda of economic development, the NFR act caused a lot of controversy and has been described by some as part of a state driven mandate to gain complete control of states resources as such resources provided key financial gains in the form of logging. Vandergeest (1996) states that the history of forest management of Thailand is essentially territoralisztion of the forest by the state (9). Such "Territorialization" began with the establishment of modern territorial sovereignty initially in the form of control of various forest products developed into a process of demarcation of forestlands. Unfortunately these policies didn't take into

consideration the customary resource usage of local people, a practice that up until 1964 had been an intrinsic part of local people's livelihoods. The consequence of such enclosures led to local people being removed from the forests and in the process removing their incentive to protect and manage such resources. Such scenarios are believed to be the reasoning for the proposal of the Community Forestry Bill.

Essentially the NFRs were set up to manage and restore degraded forest. However, little in the way of management was carried out after the 1964 act as it became more and more apparent that the state didn't have the resources or manpower to manage the forests. Therefore, despite being illegal, encroachments by local villagers continued to go ahead. In the 1970s realizing that the initial bill was impractical various clauses allowed certain areas to be cultivated and settled. However, it wasn't until the early 1990s that the NFR act was completely restructured. In 1991 the reclassification of NFRs was carried out by the RFD, which involved 'zoning' areas into three distinct categories - 'protected forest (zone C)', 'economic forest (zone E)', and 'land suitable for agriculture (zone A)'

In 1993 the reclassification of the NFRs resulted in all degraded forest including all of zone A and zone E areas that were not actually forested being transferred over to the Agricultural Land Reform Office and over time re issued to landless farmers

Economic and Occupation indicators for the area of Mae On and On-Nuea

- *Income*

The Rural Development Information Centre reported the average annual income/per person in Mae On, 2008 as 41,052 Bht. The income varied for each sub-district. The average annual income per/person in tambol On-Nuea is 44,003 Bht.

- *Occupations*

The majority of the Mae-On population (55%) are engaged in the following types of agriculture, dairy production, small-scale animal farm, farm plants and ornamentals. Agricultural fields can be divided as follow

1)	Paddy fields	25 %
2)	Farm plant	26 %
3)	Vegetables	39 %
4)	Fruit orchards	10 %

The History of the Agricultural Cooperative: " Ban Sahakorn"

The Agricultural Cooperative of Ban Sahakon, San Kamphaeng district was established as part of the Ban Sahakon village's

development project, at the request of the King. The development project was set up to support the poor farmers by providing the degraded forestland for landless farmers. The land provisions (about 8-10 Rai / family and 400-600 m2 for residential) encourage them to live, work and carry out business in the cooperative system. Ownership of the land essentially belongs to the project itself, however members of the project can pass the land down to their descendants.

His Majesty King Bhumiphol stated that "The project should be supported and it is of urgent importance that action is taken to provide the land for citizens to accomplish their agricultural career in the form of Ban Sahakon villages and the land ownership belonging to the cooperative villages "(The Thai word "Sahakon" means "Cooperative")

One of the binding principles of the project is to encourage the villages to form a "Sahakon" to perform business services for the members. The Cooperative Promotion Department has a duty to set up an education/training program for the understanding performance of the farmers and paste the entity registration guidelines to become cooperative villages following the 1968 Cooperative Legislation Acts.

Henceforth, the project members established The Agricultural Cooperative aimed to support and help each other in a cooperatives agricultural approach. The Agricultural Cooperative were registered on 15 June 1981 and named "The Agricultural Cooperative of Ban Sahakon, San Kamphaeng ltd." and had been working until the present day. The members are 1,409 families settled in 6 villages. The families doing crop cultivations are highest in numbers follow by chicken rearing and the dairy cattle production. The Agricultural Cooperative's work from the last year (2008) including the reduction of the manufacturing costs and farming equipments enhancement for low trade, the purchasing of fertilizers and herbicides and the strengthening of the cooperative to increase its income from agricultural productivity (rice, maize, vegetables).

Legislation on Forest Fire and Open Land Burning

The Ministry of Pollution Control and the Ministry of Natural Resources and Environment formulated the current legislation regarding Open Land Burning. The law can be divided into 2 categories:

1. Forest Fire and Open Land Burning Regulations - The specified act concerned with forest fires is the **Forest Act B.E. 2484 (1941), National Reserved Forests Act B.E. 2507 (1964), National Park Act B.E. 2504 (1961) and Wildlife Preservation and Protection Act B.E. 2535 (1992).** All of these legislation acts state the same in reference to the use of fire, which is that

A Persons(s) is not allowed to construct, remove, clear cut, burn or destroy trees in the forest, National Reserved Forests, National Park and Wildlife Sanctuary, anyone who violates the laws will be punished by imprisonment or fined depending on the rule in each act. Other laws such as Penal law section 220 and Road Traffic Act B. E. 2522 (1979) also have penalties for anyone committed open land burning.

2. Public Health Protection Regulations - **Public Health Act B.E. 2535 (1992) section 74 and Fire Prevention Act B.E. 2542 (1999) section 29** have legal punishment for anyone who makes fire in open land, roadside or private place, which causes heat, smoke irritation that is harmful to public

Fires In Mae On - Questions for local Stake-Holders

Question	Probe
1 What are the activities, responsibilities and area of jurisdiction of your office?	- Which type of land use are you responsible for? - Who writes the Rules and Regs and Issues the Fines?
2 Are there any fires in the landscape in your area and beyond?	- Agriculture? - Hunting? - Mushrooms? Who is responsible for burning the forests, villagers/ outsiders?
3 Do you perceive that the occurrence and impacts of fires change over the year?	- Health, Economy, Environment
4 Is there a coordinated fire management or prevention programme/policy?	- What are your current fire prevention practices? - Does it involve the other local sub districts? - Which local sub districts are you in contact with the most and why?
5 Are all the efforts done presently sufficient for addressing the issue of fire in the open landscape?	Awareness Campaigns? Training Seminars? Funding?

Notes:

– *Probes* in this context are meant as additional explorative questio ns, which dig deeper into the subject (are often formulated during the actual interview).

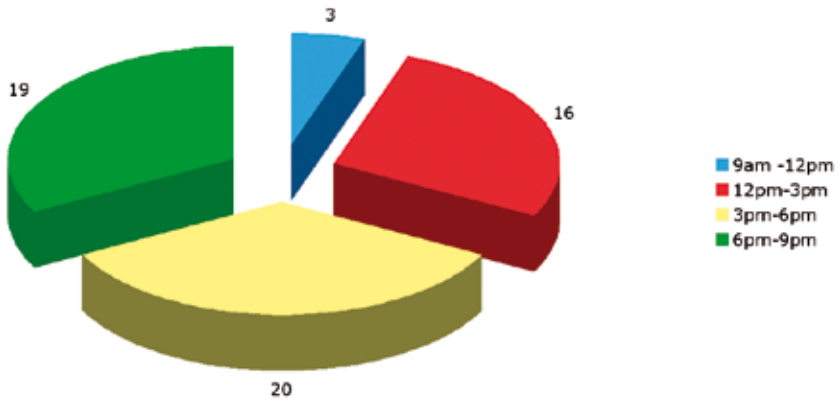


Fig. 12 Fire Detection Times

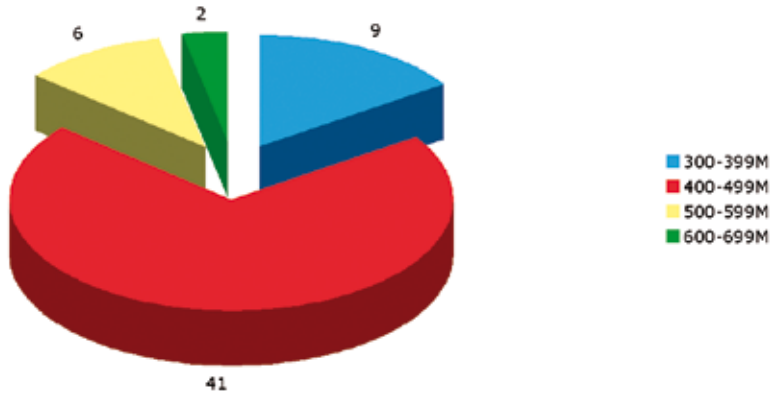


Fig. 13 Altitude of Fires

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