

1. Introduction

1.1 Background

Over the past two decades, fires and haze in the ASEAN region have been influenced by rapid demographic changes, increased human activities and climatological factors. The pernicious practice of burning forests to clear land for commercial purposes and the extraordinarily dry weather combined to produce a pall of catastrophic proportions. The results have been devastating as severe droughts over the last two decades have combined with development and agricultural activities in the rain forests and indiscriminate use of fire for land clearance.

The ASEAN's Regional Haze Action Plan, which was adopted by the ASEAN Environment Ministers in December 1997, encourages formulation of policies for prohibiting open burning and enforcing strict control of slash-and-burn practices during the dry period. The ASEAN Environment Ministers at the 6th ASEAN Ministerial Meeting on Haze in April 1999 agreed to adopt the policy on zero burning and promote its application by plantation companies and owners and timber concessionaires in the region. The Ministers also committed themselves to the strict enforcement of zero burning policy. A number of dialogues have been conducted to promote zero burning practices among plantation companies and timber concessionaires. Guidelines on the Implementation of the ASEAN Policy on Zero Burning have been developed and disseminated to provide advice to plantation owners, managers, supervisory staff, and contractors on the application of zero burning techniques. The ASEAN Agreement on Transboundary Haze Pollution, which entered into force in November 2003, specifically calls for the development and implementation of legislative and other regulatory measures, as well as programmes and strategies to promote zero burning policy.

ASEAN member countries have noted the difficulties in implementing the zero burning policy at the local level, particularly by the local communities. It was therefore agreed that public awareness programmes and development of guidelines and techniques on controlled burning should be pursued. The ASEAN Environment Ministers at the 10th ASEAN Ministerial Meeting on Haze in March 2003 in particular noted the need for guidelines on controlled burning, where zero burning techniques could not be practiced, especially by smallholders, farmers and shifting cultivators. These guidelines were developed in recognition of the need and following the above ministerial-level decision.

1.2 Objective

These guidelines were developed to provide recommendations to smallholders¹, farmers and shifting cultivators in implementing controlled burning techniques, following the principles of sustainable forest management and environment-friendly land management and agricultural practices. The guidelines were based on selected controlled burning practices in Indonesia, various studies, and literatures. Field surveys were carried out in several locations in Sumatera and Kalimantan to provide further inputs for the development of the guidelines.

1.3 Scope and Methodology

1.3.1. Approach

The following were steps taken in the development of the guidelines:

- Conduct of literature search and review, field surveys, and interviews with community leaders, local NGOs, universities, relevant individuals and organisations.
- Preparation of the draft guidelines.
- Review of the draft guidelines by Ministry of the Environment, Indonesia;
- Presentation of the draft guidelines to the 13th Joint Meeting of the ASEAN Working Groups on Sub-regional Firefighting Arrangements (SRFAs) for Sumatera and Borneo (31 July - 2 August 2003).
- Revision and submission of the draft final guidelines to the ASEAN Secretariat.

1.3.2. Literature Search and Review

Literature search was conducted to review definitions, methodologies, and principles of controlled burning practices. Review of the relevant regulatory aspects of the ASEAN Agreement on Transboundary Haze Pollution and relevant regulations in Indonesia was conducted with the guidance of ASEAN Secretariat and Ministry of the Environment, Indonesia. An internet search was undertaken to find relevant definitions, methodologies, and principles of controlled burning used in other parts of the world (mostly in US and Australia).

¹ Smallholders are defined as independent owners or legal occupiers of small areas of agricultural land. Their land preparation activities are not for commercial purposes, and they are not associated with any commercial or illegal land development activities.

1.3.3. Field Surveys

Field surveys were conducted during the periods of 22 to 30 June 2003 in Bengkulu, Sumatera and 6 to 10 July 2003 in West Kalimantan, to verify information about controlled burning techniques found in the literatures, and provide an overview of current practices, applicable technology alternatives and successful examples of controlled burning practices. The following people were involved during the surveys:

- Farmers in Pal VIII village, Bengkulu, Sumatera.
- Government officials at the Local Forestry Office, Bengkulu, Sumatera;
- Farmers in Sungai Selamat, Rasau Jaya Umum, and Rasau Jaya III villages, Pontianak, West Kalimantan.
- Shifting cultivators in Pahauman village, West Kalimantan.
- NGOs in Rasau Jaya Umum, West Kalimantan.
- Academic staff of Tanjung Pura University, West Kalimantan.
- Government officials at the Environmental Impact and Management Agency, West Kalimantan.

1.3.4. Review of Draft Guidelines

The Indonesian Ministry of the Environment organised a meeting in July 2003 to review and provide comments on the draft guidelines. The meeting involved relevant government institutions, namely Ministry of Forestry, Ministry of Agriculture, Meteorology and Geophysics Agency, Ministry of Foreign Affairs, Ministry of Health, and provincial forest and plantation services of Sumatera and Kalimantan.

The draft guidelines were then presented to the 13th Joint Meeting of SRFAs for Sumatera and Borneo on 31 July - 2 August 2003 in Jambi, Indonesia. The meeting requested member countries to give comments and suggestions for the guidelines. Comments were received from Ministry of Development, Brunei Darussalam; Department of Environment, Malaysia; Department of Environment and Natural Resources, Philippines; Ministry of the Environment, Singapore; Ministry of Natural Resources and Environment, Thailand; and Ministry of Agriculture and Rural Development, Viet Nam. ASEAN Secretariat reviewed the draft guidelines and worked with the consultant to ensure that comments received from member countries were incorporated. ASEAN Secretariat also edited the final draft of the guidelines and provided some suggestions to improve the guidelines.

2. Overview of Controlled Burning Practices

2.1 Definition

Controlled burning² is the controlled application of fire to fuels in either a natural or modified state, under specified environmental conditions that allow the fire to be confined to a predetermined area and at the same time produce the intensity required to achieve pre-determined management objectives. In other words, controlled burning is the use of fire in a knowledgeable manner to fuel on a specific land area under selected weather conditions to accomplish predetermined, well-defined management objectives.

Controlled burning as defined in the ASEAN Agreement on Transboundary Haze Pollution means “any fire, combustion or smouldering that occurs in the open air, which is controlled by national laws, rules, regulations or guidelines and does not cause fire outbreaks and transboundary haze pollution.”

2.2 Techniques

There are various firing techniques that can be used to accomplish a burning objective. The selected technique must be co-related closely with burning objectives, fuels, topography, and weather factors to prevent damage to forest resources. The technique can change as these factors change. Atmospheric conditions should be favorable for the smoke to rise into the upper air and away from smoke-sensitive areas, such as public roads, airports, populated areas, schools, hospitals, and factories.

Based on behavior and spread, fire either moves with the wind (heading fire), against the wind (backing fire), or at right angles/perpendicular to the wind (flanking fire). Heading fire is the most intense because of its faster spread rate, wider flaming zone, and longer flames. It has greater smoke volumes and burns faster than other kinds of fires. Heading fire burns cooler at the ground surface than backing fires or flanking fires. Containment is more critical when wind speed and fuel quantity increase. Backing fire is the least intense, having a slow spread rate regardless of wind speed. Backing fire has a narrow flaming zone and short flames. It is generally the easiest way to burn. It takes longer time to complete the burn, and the smoke density is generally less than in heading or flanking fires. Backing fire burns hotter at the ground surface and

² The term *prescribed burning* is widely used in other parts of the world.

does a better job of total fuel consumption than heading or flanking fires. Flanking fire intensity is intermediate. It has moderate flame heights and speed because it moves perpendicular to the wind. It is a modification of backing fires in that lines of fires are set to burn into the wind but at angles to the wind direction. The slope of the land has an effect on rate of spread similar to that of the wind.

There are other firing techniques, such as strip-heading fire, spot fire, and centre fire. There are no additional patterns of burning. Spot fire, for example, would exhibit the three burning patterns.

2.3 Benefits

- Controlled burning could be more economical and efficient compared to other land clearing methods. It does not require a lot of funds to mobilise heavy machinery and advanced technology. Fire could also clear unwanted fuels in a relatively short period of time.
- Controlled burning could improve soil fertility. Fire recycles nutrients, making them available for the crops. Fire could increase the soil pH so that nutrients, such as phosphates, could be made available for the crops.
- Controlled burning could clear away debris, such as limbs, stems and leaves, left from the cutting and felling process, so that planting, weeding and harvesting could be done easily.
- Controlled burning could control the growth of weeds and competing vegetation.
- Controlled burning can only be done within specific weather condition. Since it can only be done during specific time of the year, farmers will have a fixed schedule for doing controlled burning. The location and size of the land area to be burned can also be determined in accordance to the farmers' capacity and needs.
- Controlled burning minimises smoke production. With proper drying, fuels could be burned completely resulting in little residual smoke compared to when the fuels are not dried properly. Scheduled burning could also minimise smoke accumulation that may happen if numerous fires occur at the same time.
- Controlled burning could help in controlling pests and diseases.

2.4 Potential problems

- Smoke as a result of the burning process consists of vapour, particulate matters, and other components. Burning could produce smoke that may affect the surrounding areas.
- Burning on peatlands may cause serious damage on the ecosystem, such as intensive drainage leading to the loss of peat resources and the loss of hydrological and carbon sink functions.
- Burning on peatlands could produce a large amount of smoke. Peat fire is dominated by smouldering process as incomplete combustion process. The smouldering process produces particulate matters ten times higher than those produced by complete combustion process. Peat fire also produces a large amount of water vapour. The particulate matters and the water vapour will converge in the atmosphere and form smoke.
- Most soil biological properties will be damaged at the temperature of 100°C. Heating between 220°C and 460°C will destroy soil structure. The extent of damage depends largely on the rate at which organic matter is replenished after fire. Soil chemical properties may be changed if the temperature exceeds 460°C.
- Fire may spread to other areas if controlled burning is not carried out properly. Therefore, controlled burning requires adequate planning and proper control.
- A weak government institution handling land and forest fire management at the local level will hinder effective coordination and cooperation between the government and the farmers.
- Concessionaries and plantation companies should not use these guidelines for development of plantations. Burning applied to a large area will produce a lot of smoke. Therefore, these guidelines are not recommended to be used by concessionaires and plantation companies. Zero burning principles should be strictly followed. In this regard, the Guidelines for the Implementation of the ASEAN Policy on Zero Burning could be used as a reference guide.

2.5 Prerequisites for effective implementation

The following should be considered by the government to ensure effective implementation of controlled burning practices:

- There should be some legal measures both at national or local level that specifically regulate controlled burning by smallholders, farmers and shifting cultivators.

- There should be some strict laws and regulations that impose plantation companies and concessionaires to apply zero burning practices.
- The government should continuously promote the change of shifting cultivation into permanent cultivation where smallholders, farmers and shifting cultivators have to settle in one place.
- Guidelines for implementing controlled burning practices should be continuously promoted among smallholders, farmers and shifting cultivators.
- The use of perennial crops that require less frequent land preparation should be promoted.
- Smallholders, farmers and shifting cultivators should be given incentives for doing proper controlled burning practices.
- Smallholders, farmers and shifting cultivators should be made aware of the impacts of uncontrolled use of fire and the resulting smoke.

3. Regulatory Aspects of Controlled Burning Practices in ASEAN and Indonesia

Recurrent episodes of transboundary haze pollution arising from land and forest fires have been and are still the most prominent and pressing environmental problems facing ASEAN today. The United Nations Environment Programme (UNEP) labelled the 1997-1998 fire-and-haze episode among the most damaging in recorded history. The total economic losses in terms of agriculture production, destruction of forest lands, health, transportation, tourism, and other economic endeavours have been estimated at US\$ 9.3 billion.

Following the 1997 fire-and-haze episode, the ASEAN Senior Officials (ASOEN) - Haze Technical Task Force (HTTF) was established in September 1995 and the Regional Haze Action Plan (RHAP) was adopted in December 1997. The RHAP outlines an overall framework for guiding the process of strengthening the region's capacity to address transboundary haze pollution problem. It contains three major components: prevention, mitigation, and monitoring. Different countries have been designated to spearhead the activities that fall under each of the three components. Malaysia coordinates activities on prevention, Indonesia on mitigation, and Singapore on monitoring of fires and haze. All ASEAN member countries also undertake national-level activities related to the RHAP components.

Since the adoption of the RHAP, the HTTF under the guidance of ASEAN Environment Ministers has undertaken various initiatives, as highlighted in Box 1.

One of the most important legal measures undertaken in response to transboundary haze pollution problem is the development of the ASEAN Agreement on Transboundary Haze Pollution. The agreement was signed by all ASEAN member countries on 10 June 2002. It entered into force on 25 November 2003, following the deposit of the sixth instrument of ratification by the Government of the Kingdom of Thailand on 26 September 2003. The agreement provided for its entry into force sixty days after the deposit of the sixth instrument of ratification. As of the finalisation of these guidelines, six ASEAN member countries, namely Brunei Darussalam, Malaysia, Myanmar, Singapore, Thailand and Viet Nam have deposited their instruments of ratification/approval with the ASEAN Secretariat.

Box 1. Various initiatives under the RHAP

- Institutional Arrangements
 - ASEAN Ministerial Meeting on Haze
 - Haze Technical Task Force
 - Sub-regional Firefighting Arrangements (SRFA) for Sumatera, Borneo and other areas in the region
 - RHAP Coordination and Support Unit within the ASEAN Secretariat
 - Sub-regional Climate Review Group
 - SRFA Legal Group on Law and Enforcement
 - SRFA Simulation Organising Committee

- Policy Initiatives
 - Regional Haze Action Plan
 - ASEAN Agreement on Transboundary Haze Pollution
 - Zero-Burning and Controlled Burning Policy

- Projects/Activities
 - Guidelines for implementation of zero burning policy
 - Dialogues with plantation companies and timber concessionaires
 - Community-based fire management programmes through pilot projects in fire-prone areas
 - Demonstrations/workshops on best management practices
 - Public and community awareness programmes at all levels
 - Development of ASEAN Haze Action Online website (www.haze-online.or.id) to promote implementation of RHAP
 - Peatland management initiatives and strategy
 - Strengthening of the ASEAN Specialised Meteorological Centre and the capacity of National Meteorological Centres
 - Capacity building and development of tools for early warning system
 - Development and updating of regional inventory of firefighting resources
 - Development of Fire Suppression Mobilisation Plans and Immediate Action Plans in fire-prone areas
 - Development of Sub-regional Standard Operating Procedures for joint emergency response
 - Training and simulation exercises to strengthen coordination in emergency response and disaster relief

The agreement seeks to “prevent and monitor transboundary haze pollution as a result of land and/or forest fires which should be mitigated, through concerted national efforts and intensified regional and international co-operation.” Article 4.1 of the agreement indicates that parties of the agreement “shall co-operate in developing and implementing measures to prevent and monitor transboundary haze pollution as a result of land and/or forest fires which should be mitigated, and to control sources of fires, including by the identification of fires, development of monitoring, assessment and early warning systems, exchange of information and technology, and the provision of mutual assistance.” The agreement, therefore, provides a basis for the development of best practices to control sources of fires. Article 9 of the agreement indicates that “each party shall undertake measures to prevent and control activities related to land and/or forest fires that may lead to transboundary haze pollution.” In doing this, the agreement, among others, encourages promotion of indigenous knowledge and practices in fire prevention and management. Article 9.f of the agreement specifically mentions the need to promote and utilise indigenous knowledge and practices in fire prevention and management.

In Indonesia, there are several government regulations related to land and/or forest fire. The most recent one is the Government Regulation Number 4, Year 2001 regarding Control of Environmental Damage and/or Pollution related to Land and/or Forest Fire. The following are main elements of the regulation:

- Prevent land and/or forest fire and environmental damage and pollution.
- Mitigate land and/or forest fire and environmental damage and pollution.
- Rehabilitate the impacts of land and/or forest fire and environmental damage and pollution.
- Provide clear responsibilities to the government at central, provincial, and district levels, as well as concession/license holders.
- Provide full authority to each province and district to develop its own land and forest fire management organisation.
- Make clear the responsibility of individual or concession/license holders in the event of land and forest fire occurrences.
- Enhance the community awareness through the development of traditional values and practices supporting land and forest protection, and the advancement of community-level organisation.

Article 11 of the regulation indicates that the traditional practices of local and indigenous communities in clearing land for farming or cultivation may result in land and/or forest fire. The same article also mentions that to prevent fire from getting outside the community respective areas, the local government should develop some preventive measures, such as improving the community awareness.

Ministry of Environment, Indonesia has recently developed general guidelines for land preparation using rotation burning, based on traditional values practised for generations. The guidelines contain burning techniques that minimise smoke accumulation and negative impact on the environment.

Local and indigenous communities practising slash-and-burn techniques for land clearing have often been blamed for the occurrence of transboundary haze pollution. Many of the indigenous communities, however, have established their own customary laws and traditional practices to protect their areas and minimise damage resulted from fires. Various studies also indicate that areas under community control experienced less burning activities. In these areas, the communities are actively engaged in managing fires and haze and developing their own management scheme for managing fires and haze. These guidelines, therefore, were developed based on selected traditional practices and values that have been used by the communities for decades. The guidelines have to be practical and simple and should not require the use of sophisticated and advanced technology.

4. Selected Controlled Burning Practices in Indonesia

For thousands of years, indigenous communities have been using fire in preparing land for farming or land cultivation. Fire has been used as a tool to clear the potential cultivated area because it is the cheapest and quickest means and it can improve soil fertility. Many of the indigenous communities have developed their own techniques to protect their areas and minimise damage resulted from fires. Such traditional techniques can serve as alternatives for the implementation of controlled burning practices.

This chapter reviews permanent and shifting cultivation systems used by local and indigenous communities in Indonesia, particularly in Sumatera and Kalimantan. For the purpose of discussion, these farming/land cultivation systems are divided into two large categories, namely: (i) farming/land cultivation systems for peatland, and (ii) farming/land cultivation systems for dry land. The systems include site selection, stages in land preparation, burning techniques, and planting techniques.

4.1 Farming/land cultivation system for peatland

4.1.1. Permanent agriculture practices in Sungai Selamat, Pontianak district, West Kalimantan

a. Land preparation

- Site selection: Land area with bushes and scrubs, with a flat topography and size of 1,000 - 5,000 m².
- Slashing: Slashing shrubs and undergrowth and felling trees that have a diameter up to ± 10 cm using machete. Fuels produced from slashing and tree felling are laid out evenly over the planting area.
- Drying: Drying of fuels is conducted in 5 days - 1 week, depending on weather condition. The drier the weather, the faster the drying process.
- First burning: Burning is preceded with constructing a firebreak of 1 to 2 m wide around the selected area. Fuels along the strip are cleared to make sure that fire will not escape. Burning is scheduled between 14:00 - 15:00. The firing technique used is ring firing as shown in the following figure:

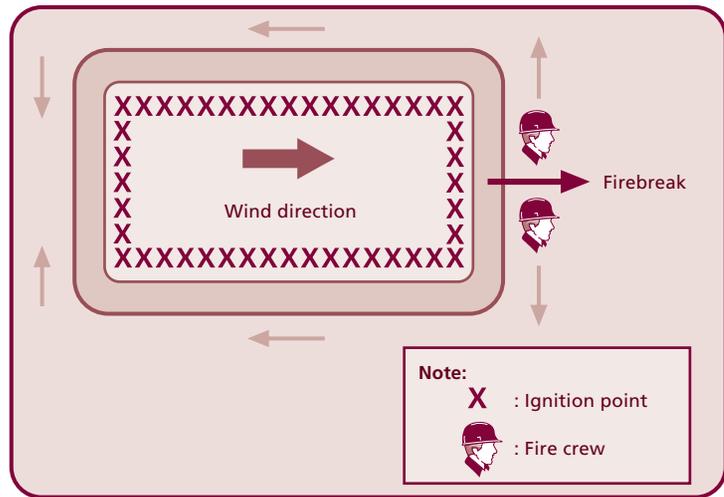


Figure 1. Ring firing technique

- Hoeing: The burn area is subsequently hoed to loosen the soil clods. Weeds and other remaining plants are collected and put in one location called the ash house.
- Construction of beds: For planting purpose, beds are constructed with a size of 1.5 m x 10 m x 15 cm.
- Second burning: Weeds and remaining plants collected in the ash house are burned into ashes.
- Ash spreading: Ashes left after burning are spread over the beds to improve soil fertility of the planting area.

b. Planting

- Sowing of seeds: Seeds of secondary crops, such as: *sawi* (*Brassica* sp), lettuce, *kangkung* (*Ipomoea*, sp.), spinach and *kucai*, are spread over the beds. To protect the growth of seeds, beds are covered with *alang-alang* (coarse grass) or palm leaves.
- Planting: Seeds which have become seedlings are then transplanted to another bed which has been covered by ashes. Additional fertiliser, i.e. manure (chicken manure) or shrimp heads is applied to every hole. Seeds of *kangkung* or spinach do not require transplanting, and the seedlings are allowed to grow in the seedbeds.
- Planting period: Conducted throughout the year.

Pictures and flow chart of permanent agriculture practices for peatland in Sungai Selamat, Pontianak, West Kalimantan are shown in Figures 2. a - c and Figure 3.



(a) Ashing process



(b) Seedbeds



(c) Planting on peatland in Sungai Selamat, Pontianak, West Kalimantan

Figure 2.