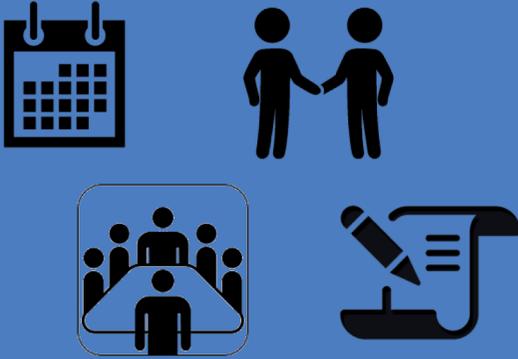
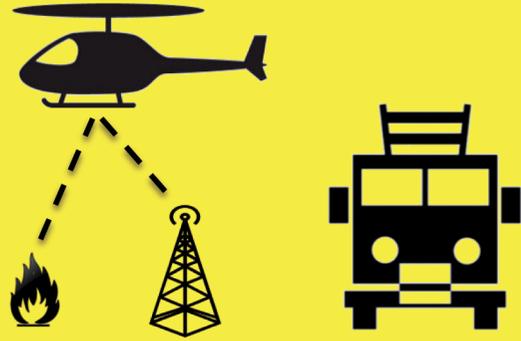


# PREVENTION



# PREPAREDNESS



## ASEAN GUIDELINES ON

# PEATLAND FIRE MANAGEMENT



one vision  
one identity  
one community

# RESPONSE



# RECOVERY



The Association of Southeast Asian Nations (ASEAN) was established on 8 August 1967. The Member States are Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam.

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## **ASEAN GUIDELINES ON PEATLAND FIRE MANAGEMENT**

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# INTRODUCTION

This set of guidelines and management practices on peatland fire management was developed at a joint workshop held in Singapore in 2015, comprising ASEAN Member State representatives and experts, with the objective of providing a set of strategies to mitigate fires in peatland ecosystems, and the ambition of eventually overcoming them. They were subsequently adopted by the Conference of the Parties to the ASEAN Agreement on Transboundary Haze Pollution (COP AATHP) on 29 October 2015 in Hanoi, Viet Nam.

## Integrated Fire Management

Integrated fire management (IFM) aims to holistically address problems posed by unwanted fires within the context of the natural environment and socio-economic systems. IFM combines the components of fire management, namely Prevention, Preparedness, Response and Recovery (PPRR), to provide a holistic and scalable framework (see Figure 1). IFM provides guidance for all stakeholders to implement actions at the appropriate time and scale to prepare for and manage fire situations.



Figure 1: Integrated Fire Management (IFM) cycle

IFM increases in effectiveness when it is linked with CBFiM. Through this link, the IFM plan becomes more integrated across community stakeholders. For example, CBFiM plans form the foundation of Myanmar's fire management approach at the community level, and are linked via an IFM plan at the landscape level.

IFM helps stakeholders take note of key fire principles and strategies within each component of the PPRR process, i.e. implementing specific actions to achieve lower ignition rates, well-designed training, fast and effective response with higher success rates of early suppression, and comprehensive recovery. The key principles are included in the previous diagram and the possible strategies are mentioned in the later pages.

## Resource Allocation

Currently, insufficient resources (money and manpower) are allocated to fire prevention activities such as ignition reduction, hydrological management and regulation enforcement, as compared to suppression efforts. This unbalanced fire management focus results in larger uncontrollable fires due to a lack of prevention and preparation across the landscape.

Agencies and companies should try to focus 70% of their resources on prevention, 10% on preparedness, response and recovery (see Figure 2 below).

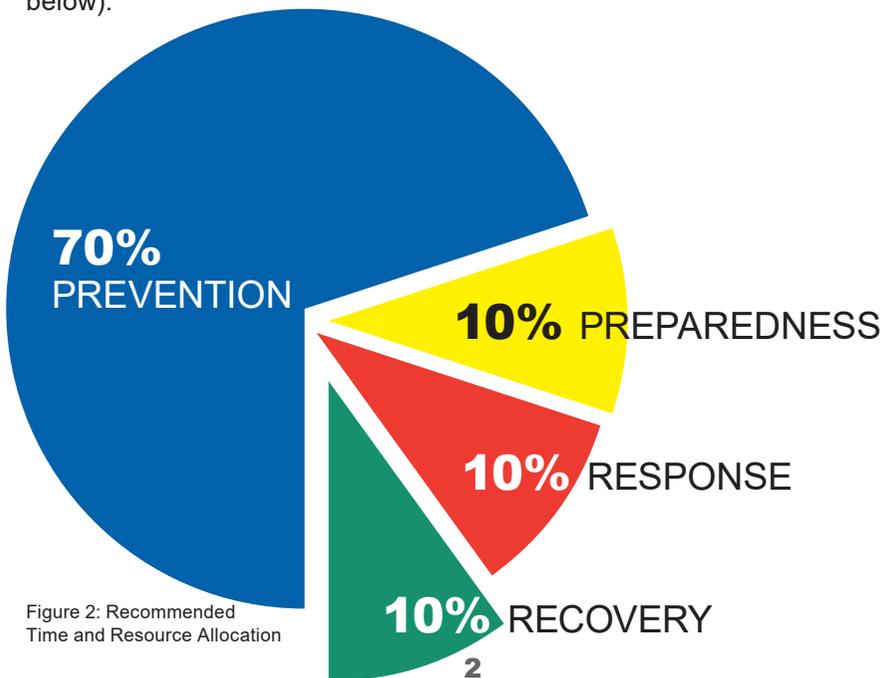


Figure 2: Recommended Time and Resource Allocation

# Hydrological Management

Hydrological management is the most crucial aspect of ensuring the sustainability of peatland ecosystems and preventing fires. High water table levels reduce fire ignitions and result in the spread of uncontrollable peatland fires under prolonged dry weather conditions.



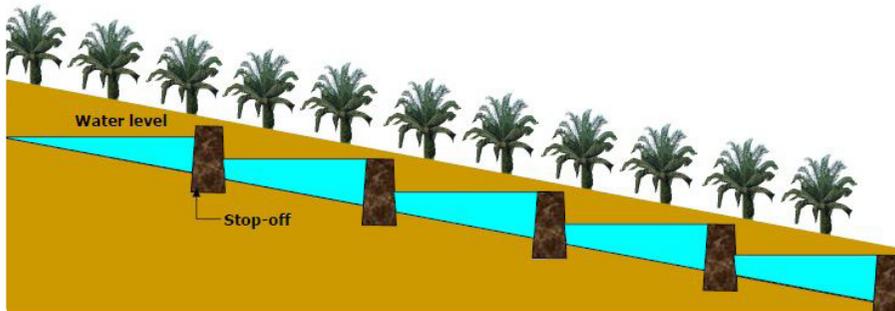
Example from United Plantation Malaysia.

Peatlands in their undisturbed state rarely burn. They fulfill important ecological functions such as the regulation of surface and groundwater. Hence, the draining of peatlands for agriculture development severely disturbs this finely balanced ecosystem by lowering ground water levels, bringing about a dry surface layer. This makes drained peatland ecosystems highly susceptible to fire incidents. The drying of the peat soil also promotes increased subsidence, which lowers the ground, making it more vulnerable to flooding during storm events, high tides and storm surges.



Flooded palm oil plantation due to peat soil subsidence.  
Source: Deltares.

Returning peatlands to a natural hydrological balance is important in fire prevention and peatland sustainability. Water table levels should be monitored and regulated throughout the year. Cascade canal blocking is one option that can be used to maintain constant water levels throughout the ecosystem.



Cascade blocking. Source: Global Environment Centre/Roundtable on Sustainable Palm Oil.



Source: Global Environment Centre/Asia Pacific Resources International Group.

# PREVENTION

The  
**Jakarta Post**

## Riau carries out compliance audit on fire prevention

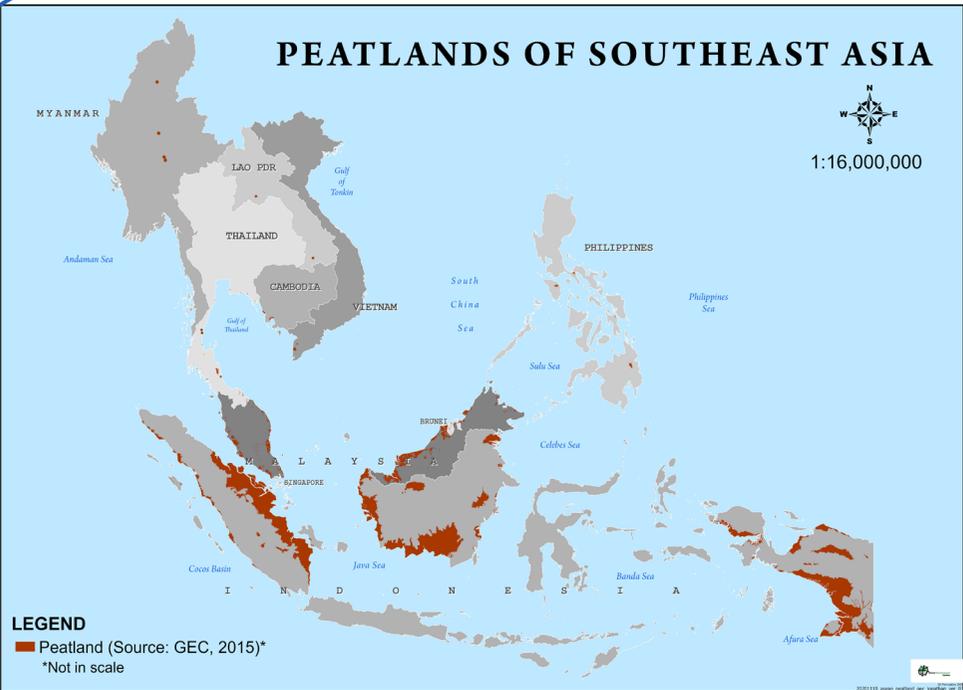
Source: [thejakartapost.com](http://thejakartapost.com), 2 July 2014.

### **Policies and Regulations**

Since about 90% of the transboundary smoke haze in Southern ASEAN is linked to peat fires, the introduction of national policies and regulations for protection and sustainable use of peatland resources is the first crucial step towards peatland fire management. Monitoring and enforcing these plans and regulations is the second most crucial step. The conduct of routine audits, company and agency fines for non-compliance, and holding the executives of companies and agency heads responsible for breaches of the regulations are all important steps toward increasing the effectiveness of policies and regulations for better peatland management. This effort can be facilitated with clearly defined land tenure and ownership.

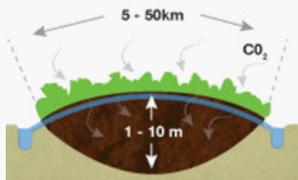
ASEAN Member States that have peatlands are all developing or have already developed National Action Plans for Peatlands (NAPPs). These NAPPs need to have a balanced approach which recognises that the drainage of peatland for commercial agriculture is not a sustainable practice. Furthermore, due to the sensitivity of peatland hydrology, draining a section of peatland will inadvertently and adversely impact the overall hydrological unit by causing the other areas of the peatland to dry out. Therefore, proper land use zoning should be conducted to minimise the use of peatland for development. Hydrological management regimes should be established to maintain appropriate water levels and reduce the vulnerability of peatland to subsidence.

# PEATLANDS OF SOUTHEAST ASIA

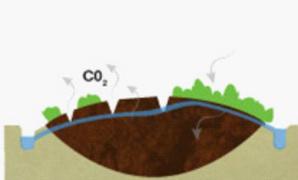


Map of peatlands in ASEAN. Source: Global Environment Centre.

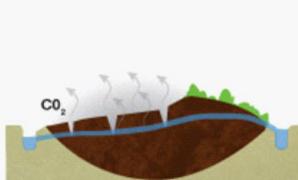
Reduction of water level due to drainage canals.



Dried-out peat becomes susceptible to fire events and flooding.



Drainage canals open access to previously inaccessible peatland forest.



Source: [www.greenpeace.org/global/](http://www.greenpeace.org/global/)

Lastly, the peatlands need to be recognised as an integral part of the lowland landscape and coastal protection system, which protect the inland forests and communities from storm surges and floods, and provide fresh water, timber and non-timber forest products (NTFP).

## Peatland Fire Prevention Measures

In peatland areas, it is critical to take measures to prevent fires through enhanced land and water management, and the promotion of land management and development approaches that minimise fire risk. The most important approach in this regard is water management. If water levels within fire prone peatlands are maintained at a high level throughout the dry season, the risk of fires can be reduced significantly. This can be done through blocking of any drainage ditches in peatland forest or abandoned agricultural land, and improving the water management in any existing plantation and agricultural land through the installation and operation of water control structures. Where possible, water levels should be maintained in natural peatland forest areas at no more than 20cm below the surface and in agriculture and plantation areas, no more than 40cm below the surface. In high fire risk areas, options to enhance the water level through tapping artesian water through tube wells or pumping water from rivers or lakes can be considered.



Source: Alue Dohong

Peatland fires can also be prevented by encouraging the adoption of agroforestry systems rather than annual crops. Agroforestry can generate enhanced income while reducing fire risk. Zero burning approaches to land preparation must also be practiced.



Source: Global Environment Centre.

# Information and Knowledge

Informed decisions on planning and allocation of resources can only be made by understanding the landscape. Therefore, information on terrain, road access, vegetation, soils, fire history, infrastructure, demographics, socio-economic status and land ownership must be collected frequently for future analysis and use (see Figure 3).

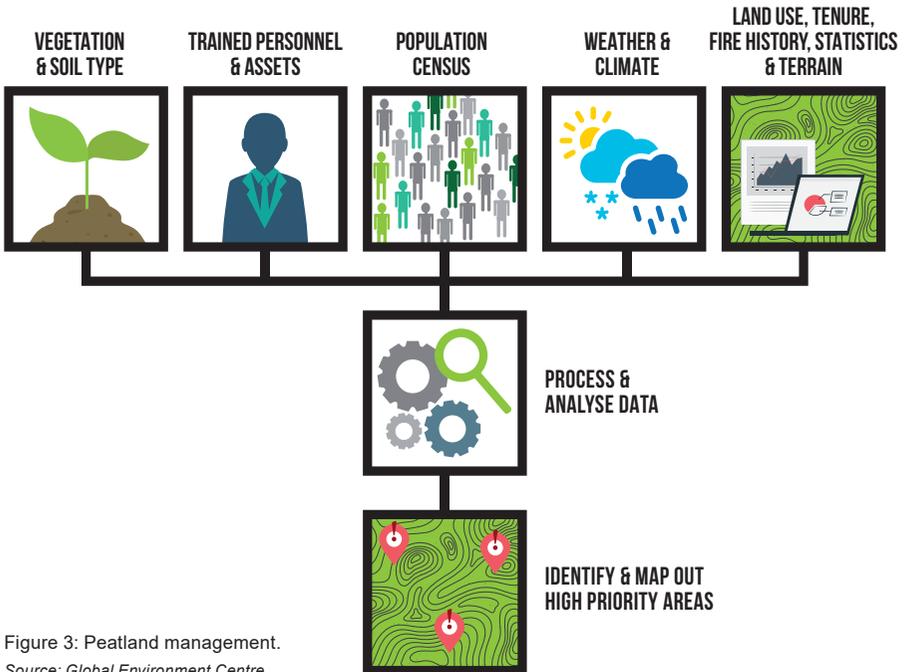


Figure 3: Peatland management.  
Source: Global Environment Centre.

After a fire, a report should be made to capture the cause, behaviour and the impact of the fire. The data should be analysed to provide context for better management and oversight in the future.

Lastly, fire managers should use the knowledge, experience and data from the previous fire seasons to review, improve and refine strategies, and to monitor their effectiveness during the next fire season.

## Planning and Coordination

A fire management plan helps all stakeholders understand the level of support that should be provided to plan for and manage various scenarios. During the fire season, the plan can be used to delegate roles and responsibilities amongst stakeholders to ensure a coordinated and efficient approach.

The plan can then be used to enable stakeholders to familiarise with one another and collate necessary information. The plan also ensures all stakeholders build a shared understanding of the issues and facilitate cooperation and to open the lines of communication in times of crisis.

Creating a fire management plan is the first step towards the collective improvement of stakeholders' knowledge. As part of the plan's development, considerable effort is required to instill cooperation and coordination amongst all relevant stakeholders. This includes government agencies, communities, companies and NGOs. The stakeholders should be listed and consulted in a cooperative fashion so that the roles and duties of each stakeholder are clearly defined and agreed upon to build an effective and complementary approach towards each possible scenario.

This fundamental basis of cooperative fire management is ingrained in IFM planning. An IFM Plan is required across all peatland landscapes, and should aim to gather the required landscape and community knowledge to better manage fire and engender cooperation amongst stakeholders.

An IFM Plan should also be tied in with a CBFiM plan. The IFM plan can cover the wider landscape such as protected areas, sub-district or district scale, and incorporate local community needs and variability via a nested CBFiM plan. This type of dual planning is implemented in Indonesia, Malaysia, Myanmar and Thailand.



Integrated Management Plan for North Selangor Peat Swamp Forest, Malaysia.



Example of stakeholder engagement.  
Source: Global Environment Centre.



Source: Global Environment Centre.

## Resources

Fire-fighting supplies, including equipment and consumables, need to be appropriate for the terrain, and constantly maintained and restocked once used. It is also important to ensure that sufficient supplies of Personal Protective Equipment are available to safeguard the fire-fighters' welfare and safety at all times.

Proactive management of peatland hydrology to re-wet peat and restore degraded land back into forest.



Hand tools, pumps and hoses.



Tractors with large tracks to distribute weight over soft soil.



Personal Protective Equipment, food and water supplies.

Source: ASEAN Guidelines on Peatland Fire Management, 2015.



Canal blockings to rewet degraded peatland area. Source: ASEAN Guidelines on Peatland Fire Management, 2015.



Canal blockings to rewet degraded peatland area. Source: Wardhana, 2016.

## Training

The development of training courses for peatland fire management is important and requires considerable attention to various details such as the materials, timing of training, and human resource management i.e. who is being trained and for what purpose. If there is a limited volume of equipment, the number of effective trained personnel on the ground would also be limited. Therefore, recruitment of talent is crucial and training must be conducted with personnel capable of assistance in the suppression effort. The agencies in charge must also be willing to empower these volunteers during emergencies.



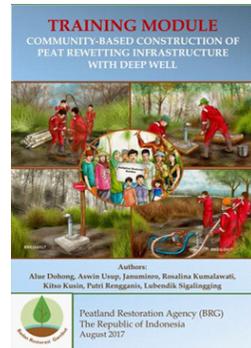
Source: Global Environment Centre.

Ideally, training materials should be designed so that the same course materials can be used across the different stakeholders i.e. the government, private companies and community. This would make training more efficient and effective as it can be replicated quickly. Furthermore, using similar materials would align the stakeholders to a common language and understanding.

Since fire prevention requires community effort, training must be extended to all stakeholders. This not only increases the overall fire-related knowledge and skills, but also empowers the community by giving all stakeholders a sense of shared responsibility to take initiatives toward fire prevention and suppression.

Within the peatland environment, several streams of training materials development and delivery are required:

1. Ensuring that all fire management crews are familiar with their roles and responsibilities (e.g. fire-fighter, crew leader, incident commander).
2. Training in land management without using fires, changing agricultural practices and improving water management in peatlands.
3. Alignment of the training courses to create linkages and cooperation amongst stakeholders, in order to build collaborative processes and shared ideas to work towards.



Training Material Developed by Peatland Restoration Agency, Indonesia (BRG).

Realistically, not all members of the community are young and fit and can be trained to become voluntary fire-fighters. However, these members can also play an active role by providing logistical support such as delivering water, food and supplies to a fire-fighting effort, building fire breaks, learning and applying sustainable agriculture practices, and developing and supporting alternative methods of clearing land. Community leaders can also educate others about fire behaviour, ignition and resource control, as well as planning and reporting tools that can be applied in times of emergency.

## Public Communications

Communicating effectively with communities and the public and private sectors in remote and rural landscapes is important. With the increasing use of smartphones and mobile applications, the design and development of useful and supportive communications in traditional and social media are also important. Tools such as one-stop information phone and web applications, to obtain information such as fire emergency telephone numbers or to send and receive fire alerts, could be developed and promoted so that all stakeholders can share important information with one another.

The communications team in the fire management organisation must be aware of the needs of the public and provide sufficient information without causing community alarm. In addition, they also need to filter and transfer the information to the relevant authorities to manage emergency circumstances.



Source: [www.aseanfirealert.org](http://www.aseanfirealert.org)

### BERSAMA KITA MENCEGAH KEBAKARAN TANAH GAMBUT

**PUNCA-PUNCA KEBAKARAN TANAH GAMBUT**

- ⊙ Aktiviti pembalakan tanah gambut yang melibatkan penggunaan api
- ⊙ Pembalakan tidak terkawal di atas tanah gambut bersejarah dan berair
- ⊙ Kemarau berpanja lamanya telah memusnahkan vegetasi di kawasan pembalakan gambut yang masih muda
- ⊙ Pembalakan gambut yang melibatkan api tanpa pemantauan yang rapat

**KESAN KEBAKARAN TANAH GAMBUT**

- ⊙ Kerosak peribumi yang mengakibatkan: merosotnya produktiviti tanah, hilangnya biodiversiti
- ⊙ Kemarau berpanja lamanya telah mengakibatkan: kemarau (dan 'droughting') yang mengakibatkan kemarau berpanja lamanya
- ⊙ Merangsang kemarau yang mengakibatkan: kebakaran tanah gambut
- ⊙ Menyebabkan pengapungan asap yang menyebarkan penyakit pernafasan kepada penduduk setempat
- ⊙ Menyebabkan taburan di antara negara-negara ASEAN

**BERSAMA SAMA MENCEGAH KEBAKARAN TANAH GAMBUT DAN HILANG BAHAN GAMBUT**

- ⊙ Elakkan daripada melakukan pembalakan di atas tanah gambut
- ⊙ Mengawal tindakan agar selalunya berlaku pembalakan terkawal
- ⊙ Lakukan rundingan dengan pihak berkepentingan tanah gambut
- ⊙ Simpan peralatan kebajikan keselamatan pernafasan di kawasan pembalakan gambut yang telah dibina dan ditinjau dengan kerap

**NOMOR-NOMOR YANG BOLEH DIBHUBUNGI SEKIRANYA BERAKU KEBAKARAN DI HILANG SIMPAN KUALA LANGAT UTARA:**

<b>Jabatan Bomba dan Penyelamat Malaysia</b> Ipoh: 05-2511 1111 Seremban: 05-2101 1111 Kuala Lumpur: 03-2111 1111 Johor Bahru: 07-2211 1111	<b>Jabatan Alam Sekitar (MNC) Selangor</b> 03-2611 1111 <b>Jabatan Alam Sekitar (MNC) Kuala Lumpur</b> 03-2611 1111 <b>Jabatan Alam Sekitar (MNC) Johor Bahru</b> 07-2211 1111	<b>MNC Pembalakan Gambut</b> 03-2111 1111 <b>MNC Pembalakan Gambut</b> 03-2111 1111 <b>MNC Pembalakan Gambut</b> 03-2111 1111
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Source: Global Environment Centre.

Communicating the right message to target audiences is an important consideration in fire management. For example, if you are attempting to reduce the incidence of fire ignition from agriculture practices, the key target audience will be local farmer groups and farmer cooperatives.

Great care must be taken when developing and delivering communications. An incorrect message can inadvertently cause an increase in fires - for example paying for the services of local fire-fighters may be perceived to be a good practice, but it could cause more intentional fires so the community could earn more money from fire-fighting. Perverse incentives like this need to be avoided.

## **Education**

Public understanding and support for fire prevention is important to create a strong social norm that balances the use of fire. The use of fires may sometimes be the only option open to smallholders for small-scale agriculture purposes where it may not be cost-effective to rent an excavator or tractor to mechanically clear and prepare the land. Therefore, affordable alternative mechanisms and techniques must be discussed, tested and made accessible. Governments may explore subsidised and collaborative activities and partnerships with larger companies to make such equipment available at a reasonable price to smallholders and encourage the adoption of mechanical clearing.

Research has shown that the burning of peat is an unsustainable practice as it results in increased peat loss and subsidence. Therefore, farmers need to be educated and trained on the best peatland agriculture methods to discourage harmful practices.

In order to create and increase public commitment to zero burning, the public must first understand that fires have a detrimental impact on themselves and their family's health. This would create a personal stake in this issue. Thus, it is important to propagate this effort via the use of educational materials to generate awareness about the impact of smoke haze pollution on human health.

If farmers and the public become educated and aware of the dangers caused by fires and have alternative land management methods, such knowledge can become an effective deterrent as the public becomes increasingly involved and active in spotting and reporting perpetrators who use fire illegally to the relevant authorities.

For any fire strategy to work, it is of utmost importance to develop and implement alternative land management strategies. Failure to do so would only force rural communities to violate the law in order to sustain their livelihood. This could instead create a social acceptance for the use of fires, further aggravating the problem.



*Source: Department of National Parks, Wildlife and Plant Conservation, Forest Fire Control Division, Thailand.*

# PREPAREDNESS

## Policies and Regulations

Fires cannot be completely prevented, so it is essential to prepare for and ensure the most expedient response to reduce the cost of suppression and loss due to fire damage. The faster a response to a fire in its early stages, the lower the cost of stopping the fire. Figure 4 explains why it is most cost-effective to respond to fire situations quickly.

As fires spread, the economic and environmental costs due to damages caused by the fires increase exponentially. The probability of it going out of control also increases and the fire becomes more expensive to extinguish due to the increased amount of time and resources required.

Therefore, to avoid increased costs and losses from delayed deployment of fire suppression resources, funds should be pre-allocated for rapid response to fires, with the intention that stakeholders have easy and quick access to resources when required. Similarly, the streamlining of approvals for access to these funds will assist in rapid and appropriate response.

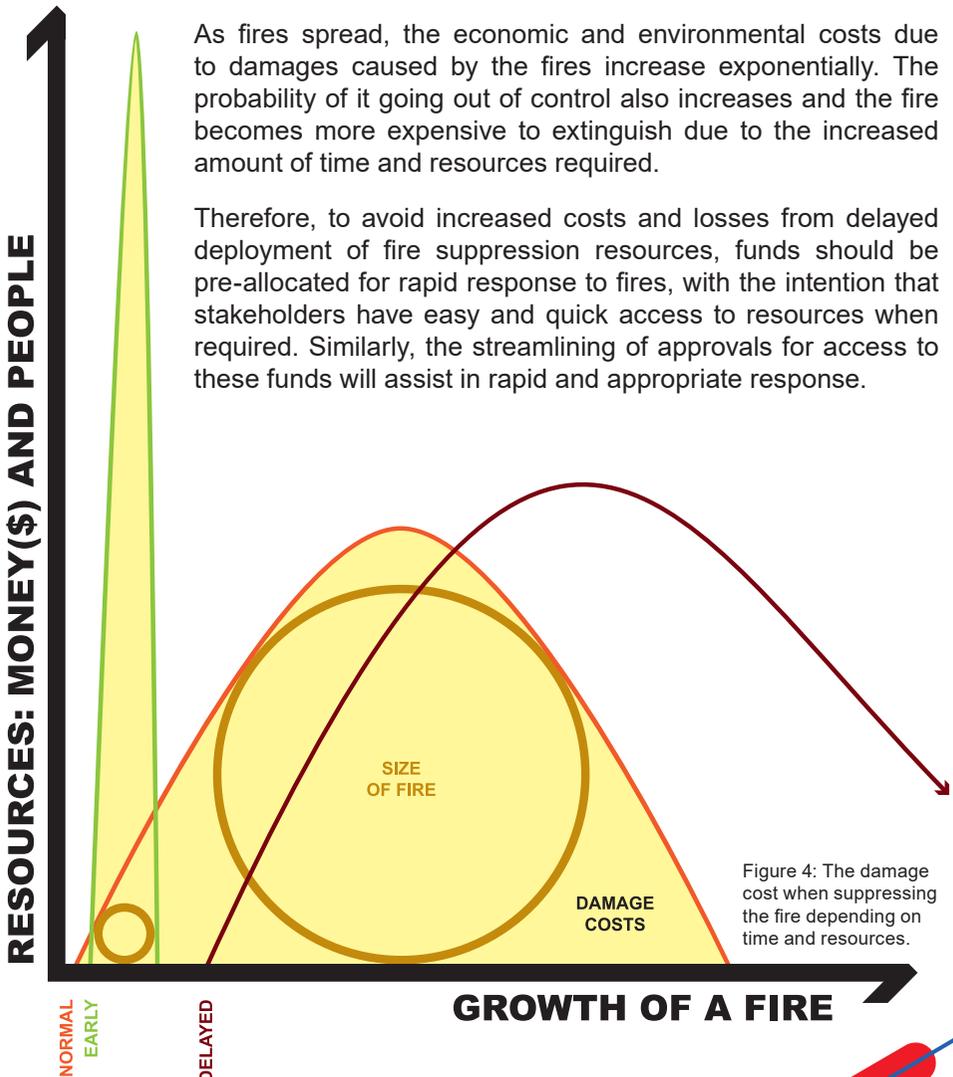


Figure 4: The damage cost when suppressing the fire depending on time and resources.

The current practice is to “build up” resources to the size of the fire. This means that small fires are allocated small amounts of fire suppression resource and attention. Only when the situation escalates are more resources then deployed to suppress it. This is counter-effective for lowering costs of peatland fires as they can burn uncontrollably for days and even months if not extinguished rapidly (preferably within 24-48 hours of ignition). Therefore, a change to the old ways is recommended to “ramp up early” the resources to suppress the fire rapidly when it is still small.

As seen in Figure 4, although the upfront cost is higher, rapid fire suppression will result in overall savings of money and manpower and reduction in peatland or forest areas burnt, and enable resources to be redeployed to fight fires in other areas.

### Information & Knowledge

To respond rapidly to a fire, the fire-fighting forces must be armed with information that will enable them to deploy rapidly, as well as have their equipment and training in order. Thailand’s fire-fighting teams called “Fire Tigers” and “Red Ants” are well trained, and well prepared for the coming fire season with maps, communications equipment, and training exercises to test their deployment and response capability.

Using the information collected during the prevention stages, maps of high fire risk areas and locations of fire-fighters and fire-fighting resources can be created for the area of interest and distributed to relevant stakeholders. The maps in Figure 5 show this in practice in Thailand.

Information such as access roads and their condition, water access points and important contact details for emergency purposes (e.g. hospitals, local fire managers, etc.) can also be updated.

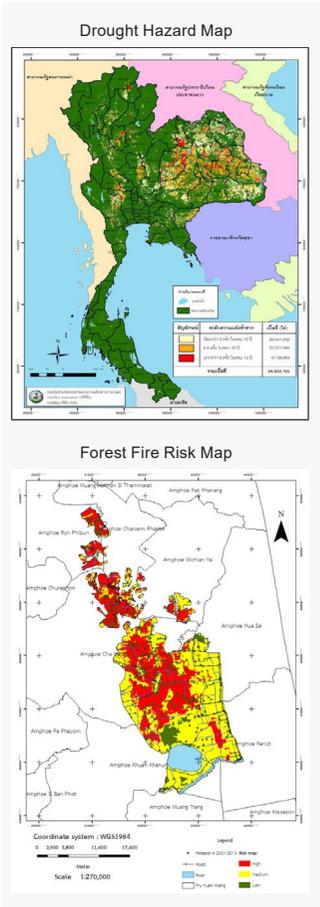


Figure 5: Drought Hazard and Forest Fire Risk Map.  
 Source: Department of National Parks, Wildlife and Plant Conservation, Forest Fire Control Division, Thailand.



# Planning and Coordination

With the onset of dry weather conditions, key personnel identified in the pre-determined command and control plan need to be called back to station posts to be on stand-by and resources should be prepared for immediate deployment when called upon.

Simulation and Table-Top Exercises can be conducted at regular intervals to ensure all equipment are operationally ready and to familiarise stakeholders with existing and new SOPs as well as other proceedings in the event of a fire. Lastly, networking sessions can also be held to familiarise stakeholders with important contact points and enhance camaraderie and support to obtain the necessary assistance.

Frequent and coordinated patrols of high risk areas corresponding with the FDRS should be conducted. During patrols, fire-fighters can update maps, access points and high risk areas, as well as report suspicious people who may be involved in burning activities to relevant authorities and local fire-fighting teams.

Equipment Check and Maintenance



Lookout Tower



Briefing and Networking Sessions



Plan and Test Communication Systems



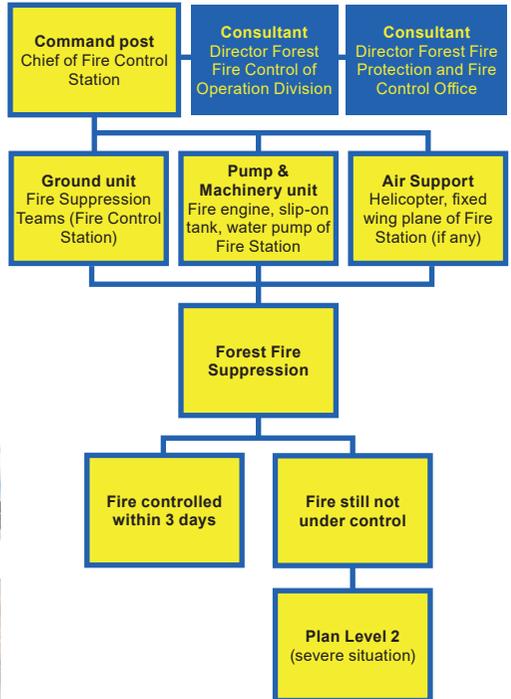
Aerial Patrol



Ground Patrol: Foot, Bike and Boat



Fire Suppression Mobilisation Plans



Source: Department of National Parks, Wildlife and Plant Conservation, Forest Fire Control Division, Thailand, Olle Wennstrom, APRIL Group and Mark Hale.

## Resources

Specialised equipment is needed on peat soils, some of which are readily used in ASEAN while other items are not widely adopted yet. Specialised heavy equipment resources to improve fire suppression capacity can be obtained from reliable third parties through various forms of government-supported or company agreements.

Companies that operate tractors and excavators with wide tracks suitable for use on peatlands are potential partners. As peat soil is soft, do exercise caution when moving heavy machinery into peat forests as standard excavators and tractors will get bogged down easily and become ineffective.



Source: [www.mytractorforum.com](http://www.mytractorforum.com)

Joint fire-fighting training between various stakeholders is a way to share knowledge and understanding. Preparation training should be intensified before the onset of the fire season. Volunteer, company and government fire-fighters should be recruited to join in the agency/community training sessions. During this period, training can include, but is not limited to:

- Fire-fighting and community safety in a fire situation
- Types of fire-fighting control equipment (use and maintenance)
- Understanding fire behaviour (peatland and mineral soil fires)
- Construction of fire breaks and containment features
- Water management to control peat fires
- Communication within each team and between teams of fire-fighters
- Logistics for food, water, fuel and supplies to support fire-fighting
- Strategies and tactics to fight a fire
- Reporting the current situation (Fire Situation Reports)

Community Fire Break



Teamwork at a Fire



Testing Equipment



Source: Dr Bob Fisher and Department of National Parks, Wildlife and Plant Conservation, Forest Fire Control Division, Thailand.

Standard camera view



FLIR view (fire spots glowing brightly)



Source: FLIR Systems showing peatland smouldering fire.

Available technologies can be tapped on to help fire-fighters in putting out fires. Fire detection systems such as the Forward Looking Infra-Red (FLIR) cameras can be also fitted onto planes to quickly identify and map smaller smouldering fires.

## Public Communications

Public education on the dangers of using fires during dry weather and the importance of staying vigilant can help to create social norms to reduce the incidence of fire ignitions. The public can also be urged to report fires and suspicious activities to the relevant authorities for follow-up.

Daily weather reports and media releases from National Meteorological Agencies should also incorporate FDRS information on dry weather conditions and outlook. Instructions to the public on ways to reduce fire ignitions can be shared on the daily news media.

FDRS boards can be installed in communities at prominent locations and updated daily. The community must be informed of the purpose of the FDRS, interpretation of the colours and recommended course of actions.

To enable the public to register their feedback and report on fires and suspicious activities, public feedback systems such as telephone hotlines, text messaging systems and smart phone apps must be set up to capture local information. This is especially important, but also difficult, in rural areas where mobile network conditions may be poor. Establishing rural fire outposts (used in Thailand) or a village representative who has the communication equipment is important for sending and receiving community information about fires.

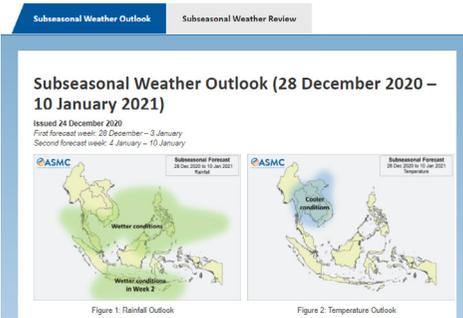
## Advisory

### Alert Levels

In addition to its given mandate to serve as the designated regional centre for weather, climate, and haze monitoring, assessments, and outlooks, the ASMC provides early warning on the occurrence of transboundary haze in the ASEAN region. The early warning is issued in the form of an advisory according to a three-tier system as outlined below. When assessing the risk of transboundary haze occurrence, ASMC takes into consideration factors including forecast of meteorological conditions (rainfall and prevailing winds, etc), smoke haze density, and hotspot counts and location.

Level 0	No transboundary smoke haze / Stand down.
Level 1	Dry season.
Level 2	Increasing risk of transboundary haze in the region: <ul style="list-style-type: none"> <li>Escalating hotspot activities with moderate to dense smoke haze observed over 2 or more consecutive days;</li> <li>Dry weather persisting;</li> <li>Prevailing winds blowing smoke haze from the hotspots towards neighbouring ASEAN countries.</li> </ul>
Level 3	High risk of severe transboundary haze in the region. <ul style="list-style-type: none"> <li>Significant and persistent hotspot activities with widespread moderate to dense smoke haze observed over 2 or more consecutive days;</li> <li>Dry weather persisting;</li> <li>Prevailing winds blowing smoke haze from the hotspots towards neighbouring ASEAN countries.</li> </ul>

### Subseasonal Weather Outlook and Review



Regional advisory on early warning of transboundary haze and seasonal weather outlook and review are available for ASEAN by ASMC.



FDRS signboard and outpost by Department of National Parks, Wildlife and Plant Conservation, Forest Fire Control Division, Thailand

# RESPONSE

## Policies and Regulations

The development of suppression response policies and regulations is often measured by organisational performance indicators, so that the public and government can review expectations and make additions and changes as performance and measures are improved. For example, once a fire is detected, guidelines on the expected time period which a fire of a certain size should be suppressed can be used as a “Performance Indicator”. These targets must be set appropriately and realistically to set the right expectations for both the fire-fighting crew and public stakeholders.

The fire-fighting crew and public can also take these indicators as a benchmark and a goal to achieve for motivation purposes. Some form of reward or recognition can be given if performance indicators are achieved by any fire suppression team or community group. These teams can then be invited to other areas to conduct training and share their best practices to improve capability and capacity across the country.

## Information and Knowledge

Fire situation reports (SitReps) are important for decision-making and needs analysis for an ongoing fire. A SitRep should be prepared each day for a fire and sent to the headquarters to update on resource needs and expected outcomes. A simple and intuitive template could aid reporting procedures to capture critical information for current fires as well as for future references.

Information can include location, type, administrative information, fire agency, person in command and control, resources present and additional control resources required, loss and damage information, and finally, whether the fire appears “suspicious” and if further investigation of the fire cause is warranted.

III. SOP FOR MONITORING AND ASSESSMENT

**FORM 1**

**SITUATION REPORT**  
REPORT FROM NATIONAL MONITORING CENTRES TO ASEAN CENTRE

1. **General Information**

Office Reference No. :  
From :  
To :  
Day / Date / Time :

2. **General Description of the Incident** (please provide general description of the incident, cause of fire, affected area, impact on human health and environment, possible threats and risks, problems encountered, and other relevant information)

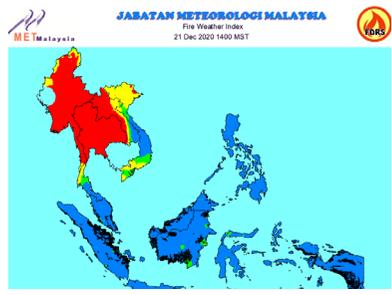
3. **Fire Related Information**

1. No. :  
2. Location :  
3. Number of fire :  
4. Latitude :  
5. Longitude :  
6. Size (ha) :  
7. Type of fire (forest fire/peat fire/other (please describe)) :  
8. Ecode :  
9. Topography :  
10. Causes (natural, incendiary, accidental, unknown) :  
11. Resources currently mobilised/actions taken :  
12. Additional resources required (apps) :

Form 1 of Fire Situation Report in ASEAN Standard Operating Procedure for Monitoring, Assessment and Joint Emergency Response.

Source: ASEAN

Fire agencies should also have a direct line of contact with their respective meteorological agencies to keep abreast with the weather situation and forecast, FDRS and hotspot information. Aerial and ground patrols should also report on conditions and necessary measures that could be taken to stop a fire's advance or prevent additional ignitions.

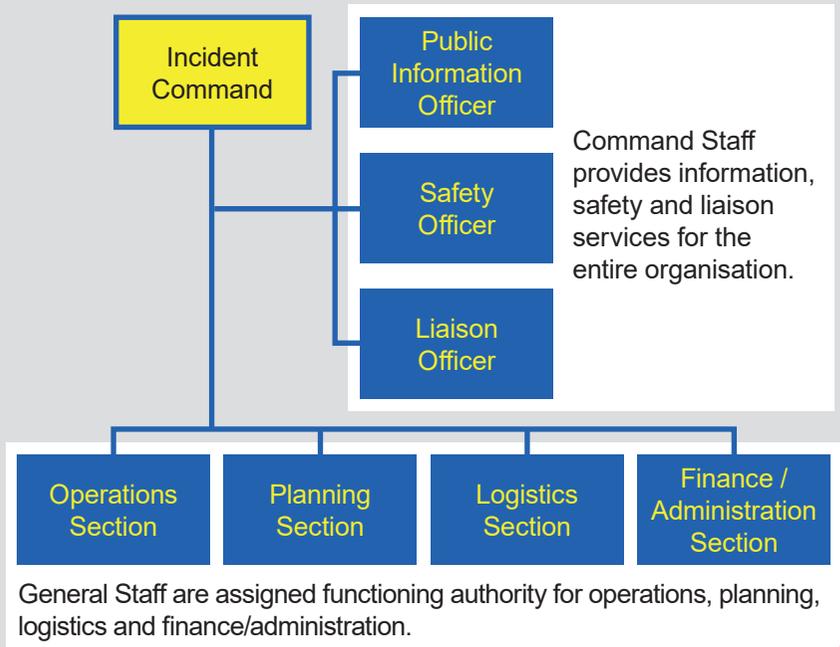


Source: Malaysian Meteorological Department.

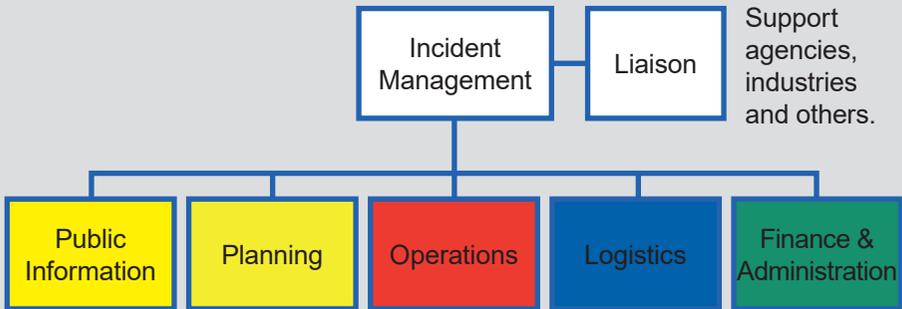
## Planning and Coordination

Once a hotspot is verified as a fire, an Initial Response Plan must be activated quickly. This is done using the “pre-determined” suppression mobilisation plan developed in the Preparedness stage. ASEAN countries could adopt the Incident Command System for managing emergency fire teams, so that both a mobilisation plan and standard fire management team can all be in place rapidly. An example of an Integrated Command System team structure and contact information of a rapid response fire-fighting crew can be found below.

### Expanding the ICS Organisation



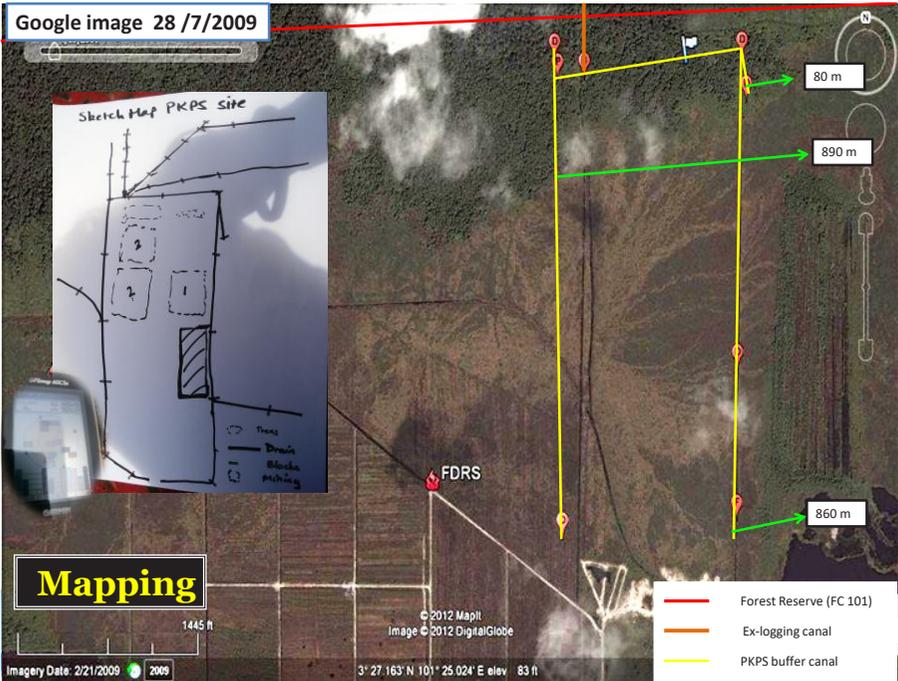
## Incident Command Team



NAME	AGENCY	ROLE	EMERGENCY PHONE CONTACT
Name 1	Agency 1	Commander	1234 6571
Name 2	Agency 2	Planning	1234 6571
Name 3	Agency 3	Logistics	1234 6571
Name 4	Agency 4	Operations	1234 6571

Following an “initial response”, if the fire needs additional time and resources, the Incident Commander (IC) would then develop a “main suppression” plan – a more detailed plan considering suppression strategies, water sources on-site, equipment and personnel availability, access routes, nearby assets and backup plan. These plans have to be created very quickly and require specially trained staff to develop them. The image shown is an example of a “main suppression” plan map developed for a peatland fire in the North Selangor Peat Swamp Forest in Malaysia. It used peat embankments and surface flooding to slow and stop the fire.

As part of the acquired information, the Incident Commander and planning team could consider whether additional support and resources are required and whether the pre-established contracts with third parties such as other government agencies, private companies and community teams should be activated to support the efforts.



Example of suppression plan. Source: Global Environment Centre.

## Resources

Due to the nature of the peatland fires, a combination of basic hand tools and people operating specialised equipment are required. Specialised equipment can be used to ferry people, excavators and water to remote peatland sites to create peat mounds for flooding small areas or “mixing” peat and water to wet the smouldering peat below the surface.

Helicopters can be used to drop water on small sections of a fire to slow a fire’s advance. Helicopters must be supported by ground-based field crews and heavy equipment to stop the fire. A helicopter can be “quick to respond” and slow the advancement of the fire until ground fire-fighters arrive.



Source: Cabinet Secretary, Republic of Indonesia.

Commonly use tools such as hand tools, water backpacks and water pumps.



Specialised carriers with wide tracks to move crew and other supplies in and out of peatland.



Excavators to mix water into burning peat to extinguish it.



Source: ASEAN Guidelines on Peatland Fire Management, 2015.

In peatlands, it is very difficult to control fires once they have started. The best way to stop peat fires is through intensive attack and wherever possible, flooding of the site by pumping water from adjacent areas.

## Public Communications

It is important to keep the public apprised of the ground situation so that they can avoid fire areas and determine what is best for their safety. Public health advisories can also be issued to caution the public about deteriorating air quality due to smoke.

**TORA** adalah kawasan hutan dan tanah yang dikuasai oleh negara untuk didistribusikan atau direhabilitasikan dalam rangka Reforma Agraria.

**Lokasi TORA** terdiri dari 3 kawasan, yaitu 3 kabupaten yaitu Kalimantan Tengah, Kalimantan Selatan dan Kalimantan Timur.

**Pada tahun 2018**, di Provinsi Riau, sebanyak 10 Kabupaten telah melaksanakan sekitar 2.300 hektare URA yang berawal dari program TORA.

**Luas tanah program TORA** saat ini sekitar 4.000 Ha atau akan bertambah dengan luas lahan seluas 10.000 Ha.

Dari luasan 4.000 Ha lokasi TORA ini, seluruhnya merupakan lahan **berambut** yang separuh lebih atau sekitar 2.100 Ha tepatnya berada pada areal lahan gambut yang masuk ke dalam target restorasi BRG.

Potensi Tanaman yang bisa dikembangkan di lahan TORA yang dijadikan sebagai pilot model uji coba:

- Kopi Liberika
- Ubi Kayu
- Nanas
- Jagung
- Belangeran

**Hasil Studi Badan Restorasi Gambut (BRG)** merekomendasikan untuk melanjutkan kegiatan pemanfaatan lahan yang ramah gambut. Dalam pengembangan pilot model uji coba ini harus memperhatikan prinsip-prinsip pengembangan komoditi lahan gambut agar memenuhi syarat "Ramah Gambut" antara lain:

- Perencanaan komoditas harus dilakukan dengan mempertimbangkan kemampuan lahan (pH, unsur hara, kandungan organik, dll) dan fungsi lingkungan yang harus diutamakan.
- Sebelumnya adalah pola budidaya lokal yang memperhatikan lahan gambut yang marginal (mempunyai banyak "lumpur" atau perakaran berkayu).
- Pengembangan komoditas harus bertahap berdasarkan siklus dengan penanaman prinsip-prinsip pelestarian.

www.brg.go.id | Badan Restorasi Gambut | @BRG\_Indonesia | #BRG\_Indonesia | Badan Restorasi Gambut - BRG

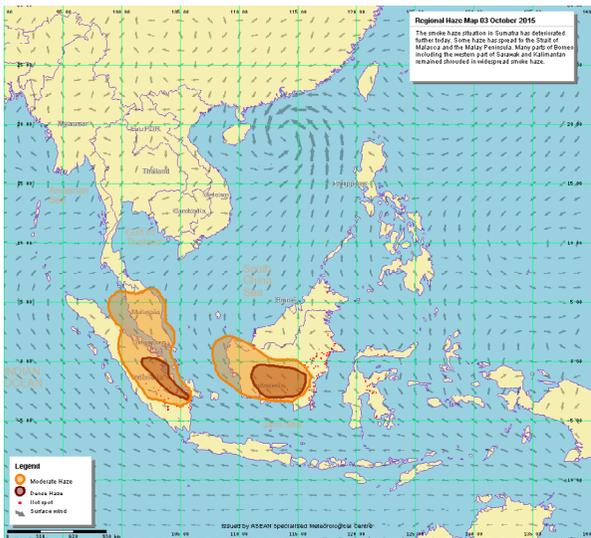
KEMENTERIAN KESIHATAN MALAYSIA

### TINDAKAN SEMASA JEREBU

- Kurangkan Aktiviti Di Luar Rumah & Cuba Berada Di Dalam Bangunan**
- Pakai Penutup Muka (Face Mask) yang Sesuai Seperti P100 dan N95 Jika Keluar Rumah**
- Banyakkan Minum Air Kosong Sekurang-Kurangnya 8 Gelas Sehari**
- Apabila Memandu, Gunakan Penghawa Dingin. Pilih Mode Kitaran Udara Dalam**
- Basuh Muka Dan Tangan Dengan Air Bersih Dan Sabun Setelah Melakukan Aktiviti Luar**
- Pastikan Udara Di Dalam Rumah/ Bangunan Sentiasa Bersih. Kurangkan Sumber Pencemaran Dalam seperti Asap Rokok**

Sumber: Integrasi URA KEMH

Source: Peatland Restoration Agency, Indonesia, and Department of Environment, Malaysia.



Source: ASEAN Specialised Meteorological Centre (ASMC) and Ministry of Health, Singapore respectively.

# HAZE 应对烟霾情况的 健康指示

MINISTRY OF HEALTH SINGAPORE

**Would you know what precautions to take if the haze levels rise? Here are some guidelines.**  
当烟霾情况加剧，您是否知道应该采取什么防范措施来保护自己？这里为您提供一些建议。

## 24-HOUR PSI FORECAST

24小时空气污染指数预测

PSI Level	Healthy Persons	Elderly, Pregnant Women, Children	Persons with Chronic Lung Disease or Heart Disease
0 - 50 Good 良好水平	Continue with normal activities 继续进行日常活动	Continue with normal activities 继续进行日常活动	Continue with normal activities 继续进行日常活动
51 - 100 Moderate 适中水平	Continue with normal activities 继续进行日常活动	Continue with normal activities 继续进行日常活动	Continue with normal activities 继续进行日常活动
101 - 200 Unhealthy 不健康水平	Reduce prolonged or strenuous outdoor physical exertion 减少长时间或激烈的户外体力活动	Minimise prolonged or strenuous outdoor physical exertion 尽量避免长时间或激烈的户外体力活动	Avoid prolonged or strenuous outdoor physical exertion 避免长时间或激烈的户外体力活动
201 - 300 Very Unhealthy 非常不健康水平	Avoid prolonged or strenuous outdoor physical exertion 避免长时间或激烈的户外体力活动	Minimise outdoor activity 尽量避免户外活动	Avoid outdoor activity 避免户外活动
> 300 Hazardous 危险水平	Minimise outdoor activity 尽量避免户外活动	Avoid outdoor activity 避免户外活动	Avoid outdoor activity 避免户外活动

**Prolonged** = continuous exposure for several hours  
长时间 = 连续几个小时

**Strenuous** = requiring a lot of energy or effort  
剧烈 = 消耗大量体力或力气

**Reduce** = do less  
减少 = 少做

**Minimise** = do as little as possible  
尽量避免 = 尽可能不做

**Avoid** = do not do  
避免 = 不做

The best form of protection is to stay indoors.  
最好的防护方式是留在室内最良好的环境里。

However, if you are healthy and have the resources for several hours when the forecasted air quality is poor (PSI index > 300), you can reduce your exposure to the harmful effects of haze by wearing a N95 mask.  
如果您是健康人士，若有资源在空气质量较差的情况下待几个小时，您可以通过佩戴口罩来减少您暴露在有害的烟霾中。

PHPC [www.phpc.gov.sg](http://www.phpc.gov.sg)

# RECOVERY

## Policies and Regulations

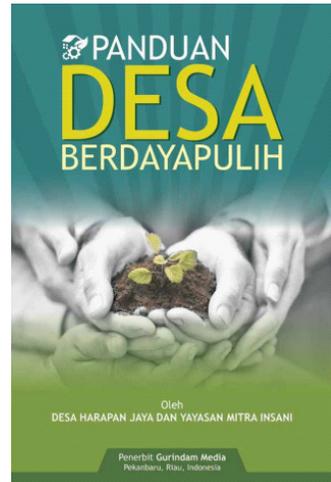
In general, very little or no effort is spent on peatland fire recovery in the majority of ASEAN Member States. For fire prone peatlands, it is important to support ecological recovery of burnt sites as this will help to reduce future fire risk. In addition, it is important that attention is given to careful management of social welfare since peatland fires are usually driven by social change and economic demand. The management of social recovery may reduce further damage to the ecosystems by opportunistic individuals.

Some communities such as Harapan Jaya Village in Riau, Indonesia, have established village laws whereby if a villager suffers crop damage and losses from fire due to the actions of another, the villager would be eligible to claim a certain amount of compensation from the perpetrator and this could be done during the recovery phase.

## Information and Knowledge

Before the Incident Commander and fire suppression managers conclude their work, they should deliver a report on the damages and losses caused by the fires. The report would allow the government to gain a greater insight into the ground situation and make better informed decisions on supporting the post fire recovery efforts to guide amendments in the country's fire policy where required.

Burned areas can be plotted by comparing satellite or drone imagery before and after the fire incident to determine vegetation loss and soil exposure. See the next images that can be used for these wide-scale assessments.

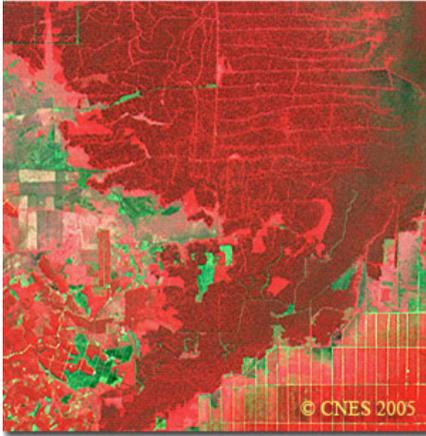


Guidelines developed by Harapan Jaya Village.

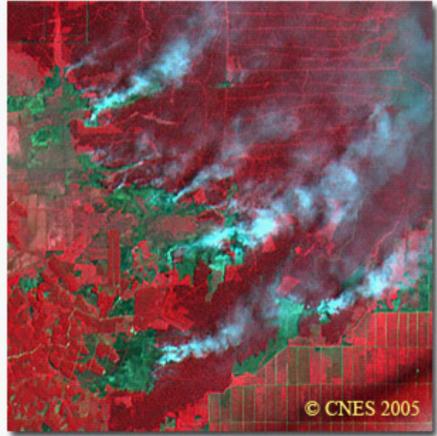


Series of drone footage of peatland fire event (Source: *Global Environment Centre*) and satellite image (Source: [www.planet.com](http://www.planet.com)) for fire event September 2018 in Malaysia.

More than half of the area of the scene (below right) has burnt or is burning. Dense forest areas appear as dark red patches with a rough texture, while the lighter red or pink patches are probably secondary forest or scrub. Note that forest areas are burning in the centre right of the image on August 8, 2005.



17 Jun 2005, 12 km X 12 km



8 Aug 2005, 12 km X 12 km

Source: [www.crisp.nus.edu.sg/coverages/fires/index.html](http://www.crisp.nus.edu.sg/coverages/fires/index.html)

As fire is not a naturally occurring ecological process in tropical forests, investigations into the origin of the fire will be useful to find the underlying reasons and perpetrators of the fires. It is also important to identify and prosecute the perpetrators to ensure effective deterrence against forest fires.

## **The Jakarta Post**

### **Record fine against plantation company upheld**

Hans Nicholas Jong, The Jakarta Post, Jakarta | Headlines | Sun, September 13 2015, 1:32 PM

#### **Headlines News**

Thousands displaced after

The Supreme Court has rejected an appeal by palm oil company PT Kallista Alam and ordered the company to pay fines totalling Rp 366 billion (US\$25.6 million) for illegally burning large swathes of the Tripa forest in Aceh, a verdict that many hope could set a precedent for future

News report on prosecution against company for illegal forest burnings.

## Planning and Coordination

Based on the data collected, a Burned Area Post Emergency Response Team comprising specialists such as hydrologists, foresters, ecologists, engineers, social scientists (community engagement experts), economists and others, should be engaged by the government to assess the damage and losses, and recommend timely and cost-effective treatments to enable affected areas to recover.

These areas should then be prioritised according to certain criteria set out by internal policies. Coordinating Agencies/Ministries should then gather the necessary resources and recommendations so that the state/provincial government in-charge can repair and rehabilitate the site.

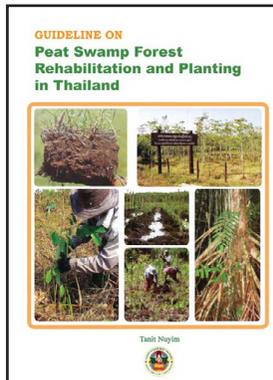
## Resources

Resources, such as seeds and seedlings and the construction of new infrastructure, should be provided to rehabilitate affected areas through replanting, reforestation, and the restoration of water levels.

Research can also be conducted to determine optimal planting methods that could be replicated throughout similar

ecological sites. A rehabilitation and planting manual can also be developed to provide guidance to field and volunteer teams.

If applicable, humanitarian and social groups should also be allowed to set up centres to deliver aid and support to affected communities.



Source: Department of National Parks, Wildlife and Plant Conservation, Forest Fire Control Division, Thailand/Global Environment Centre.

# BEST MANAGEMENT PRACTICES FOR COMMUNITIES LIVING ON PEATLANDS

www.aseanpeat.net

### Buying Living Tree System

As a result of the Living Tree System (LTS) in Kalimantan, Indonesia, the average local income has increased by 20%. The system consists of 1 system for ensuring optimal seedling survival. The system has been replicated in the Philippines.

### Seedling Buyback

Seedlings, local professionals, and technology to be used and sold when, when an area is rehabilitated. The system contributes to local economy while rehabilitating degraded peatlands.

### Green Contract: Community Livelihood Development

Green Contracts were established for local communities living in both eastern and southern peatlands in Sumatra and Kalimantan. These contracts provide a legal basis for ensuring that peatlands are managed sustainably for the benefit of the community and the environment.

### Serjan Farming

Serjan Farming is an innovation method for growing crops on degraded peatlands. It is a sustainable and profitable method for growing crops on degraded peatlands.

### Floating Gardens

The floating garden system has been developed in Indonesia. It is a sustainable and profitable method for growing crops on degraded peatlands.

### Peer Learning

Peer learning is a sustainable and profitable method for growing crops on degraded peatlands. It is a sustainable and profitable method for growing crops on degraded peatlands.

### Water Management

Water management is essential for peatland rehabilitation. It involves controlling water levels to prevent peat from oxidizing and releasing CO2.

### Research & Development

Research and development is essential for peatland rehabilitation. It involves developing new technologies and methods for peatland rehabilitation.

### Ecotourism

Ecotourism is a sustainable and profitable method for growing crops on degraded peatlands. It is a sustainable and profitable method for growing crops on degraded peatlands.

### Community Fire Prevention and Control

Community fire prevention and control is essential for peatland rehabilitation. It involves developing fire prevention and control measures for peatland rehabilitation.

Country	Peatland Area (ha)	Population (millions)
Indonesia	1,000,000	250
Malaysia	1,000,000	30
Philippines	1,000,000	100

NOVEMBER 2015

## PEATLANDS AND CLIMATE CHANGE IN SOUTHEAST ASIA

The role of drainage and fire on peatland carbon emissions and the 2015 haze crisis in SE Asia

### DEFORESTATION AND FOREST DEGRADATION IN TROPICAL PEATLANDS MAINLY CAUSED BY

**AGRICULTURAL**  
conversion to oil palm & acacia plantation

**FORESTRY**  
DRAINAGE FOR CULTIVATION AND LOG EXTRACTION

which lowers the water table in peatlands, enabling the peat to oxidize, thus releasing CO<sub>2</sub> into atmosphere. This will continue as long as the drainages exist.

Leaving behind dried peat that is easily combustible and is very susceptible to fire. When peat fire occurs, it can penetrate beneath the peat layer, making it difficult to put out and can continue to smoulder for weeks (or months) producing huge amount of CO<sub>2</sub> and smoke (haze) in short time. Emission from drained peatlands and fire contributed significantly to global GHG emission.

5,528,000 ha  
**34%**

**ARE STILL COVERED WITH RELATIVELY INTACT FORESTS (WEST PART OF SE ASIA).**

SOURCE: Miettinen et al. (2012)

### MITIGATION RECOMMENDED

**AVOIDING NEW EMISSIONS FROM LAND USE CHANGE**

**RESTORATION OF PEATLANDS TO REDUCE EMISSIONS AND ENHANCE SEQUESTRATION**

**IMPROVED MANAGEMENT PRACTICES TO REDUCE EMISSIONS FROM EXISTING PRODUCTION SYSTEMS**

**WATER MANAGEMENT, FIRE PREVENTION AND CONTROL**

### QUICK FACTS SOUTHEAST ASIA HAZE 2015

Arguably the worst in this decade, as thousands of hectares of peatlands in Sumatra and Kalimantan (some are intact forests) were deliberately and intractably set on fire, causing thick, yellow and acid haze across ASEAN countries.

2ml/h haze pollution in summer

smoke cloud covering 5ml/km<sup>2</sup>

1.6bil tonnes of CO<sub>2</sub> emissions from peatland fires in 2015

3,300 PSI in Indonesia (US-Centers for Disease Control)

Millions of residents evacuated

100,000+ premature deaths are expected

### NATURAL PEATLANDS

PEATLANDS STORE LARGE AMOUNTS OF CARBON

### DISTURBED PEATLANDS

PEATLANDS RELEASED TO AIR CO<sub>2</sub> AND CH<sub>4</sub> IN SHORT PERIODS OF TIME, WHICH CONTRIBUTE TO CLIMATE CHANGE

**REMITTING AND HYDROLOGY RESTORATION OF DRAINED PEATLAND IS THE MOST COST-EFFECTIVE WAY OF REDUCING EMISSION FROM DRAINAGES AND FIRE.**

Source: Global Environment Centre.

## Public Communications

Public engagement and education of the public on the importance of the continued protection and rehabilitation of the damaged peatland forests is necessary. This is to ensure that there is a continued sense of ownership and empowerment to protect the remaining landscape.

This effort can be supported by providing the public with information on various environmental and social support assistance programmes. If volunteers are available, resources could also be distributed to them to facilitate the rehabilitation efforts.

## CONCLUSION

Good fire management within the peatlands is crucial to protect natural capital, forest ecosystems and air quality, and sustain the peatland ecosystems into the future. These guidelines seek to raise awareness for some of the key fire management strategies practiced in various ASEAN Member States. While these strategies may not be directly applicable to all ASEAN Member States, it provides a good reference point for the countries to work upon and refine further.

The use of a holistic cycle such as IFM planning, coupled with CBFiM planning, is a valuable first step to draft out the landscape according to local knowledge. It is also a valuable step to draft out the plans for managing and sustaining the peatland ecosystems and protect them from fire.

An important aspect to note during the creation of the fire management system is that the combined efforts of the resources (people, equipment, money and time) must be applied to each section of the system. A failure to emphasise the prevention and preparedness aspects of fire management (even if there are only limited resources to begin with) will cause the continued cycle of unwanted fire to spread across the wider peatland landscapes.

A quick summary of the key points covered in this guideline is at page 36 for quick reference.

# Overview:

## ASEAN Guidelines on Peatland Fire Management

	PREVENTION	PREPAREDNESS
POLICIES & REGULATIONS	<ul style="list-style-type: none"> <li>Clearly defined land tenure</li> <li>Include management of peatland as a hydrological unit under spatial law</li> <li>Need for adequate regulation enforcement, auditing of compliance, and fines for non-compliance</li> </ul>	<ul style="list-style-type: none"> <li>Develop pre-allocated funds and ensure accessibility before a fire emergency</li> <li>Introduce concept of allocating more resources (funds) to aggressively conduct “initial attack” on a fire</li> </ul>
INFO & KNOWLEDGE	<ul style="list-style-type: none"> <li>Landscape fire history, behaviour &amp; knowledge of fire use</li> <li>Communities – demographics, number of communities, size, socio-economic situation.</li> <li>Landscape mapping, topography, vegetation, roads, rivers, water points and more</li> </ul>	<ul style="list-style-type: none"> <li>Weather, Climate, Fire Danger Rating and Hotspot data used to predict and prepare for coming issues</li> <li>Map high fire risk areas and location of nearest fire-fighting resources (Government, Private Company or Community)</li> </ul>
PLANNING & COORDINATION	<ul style="list-style-type: none"> <li>Develop an Integrated Fire Management (IFM) Plan that has embedded CBFiM planning, and coordinate activities amongst stakeholders</li> <li>Establish inter-agency task force (Government, Private Company and Community) and appoint lead people to coordinate inter-agency prevention efforts</li> <li>Set up a pre-defined Incident Command System to develop suitable response efforts</li> </ul>	<ul style="list-style-type: none"> <li>Ramp up preparatory activities once FDRS indicates dry weather conditions, such as activating more frequent and coordinated patrols</li> <li>Pre-define trigger levels to allocate more resources to aggressively attack fires at the initial stage</li> <li>Simulation exercises – to test all equipment, improve effectiveness of fire-fighters, develop better communications and coordination for fire management responses and better SOPs</li> </ul>
RESOURCES	<ul style="list-style-type: none"> <li>Proactive management of peatland hydrology via canal blocking, canal closure &amp; changing land use away from cropping systems that need drainage</li> <li>Develop and deliver training – e.g. in sustainable agriculture practices, fire plan development, construction of fire breaks, alternative mechanisms for land management without fire</li> <li>Appoint teams of Fire Prevention Officers, who work in the field and are coordinated in activities across the landscape by the inter-agency task force</li> </ul>	<ul style="list-style-type: none"> <li>Ensure sufficient and serviceable supplies of fire-fighting equipment and plan access routes to water supply for fire-fighting</li> <li>Pre-establish contract agreements with third parties on required resources (e.g. excavators, tractors)</li> <li>Hire temporary fire-fighters</li> <li>Intensify training for all fire-fighters</li> </ul>
PUBLIC COMMUNICATIONS	<ul style="list-style-type: none"> <li>Educate people in the use and improper use of fire, the dangers to health from smoke haze; create awareness via broadcast media and correctly targeted programmes</li> <li>Provide information on alternative land management techniques and equipment without the use of fire</li> </ul>	<ul style="list-style-type: none"> <li>Develop a range of communication tools that work via website, text, smart phone apps and via Village Networks</li> <li>Daily reporting of FDRS for early warning</li> <li>Establish hotlines and specialised communication mechanisms to report fire incidents</li> </ul>

RESPONSE	RECOVERY
<ul style="list-style-type: none"> <li>Establish management performance indicators – e.g. respond to fires within set time period; reduce number of fires starts/ per district; reduce PSI reading for the season</li> </ul>	<ul style="list-style-type: none"> <li>Welfare and support assistance for people</li> <li>Environmental rehabilitation</li> </ul>
<ul style="list-style-type: none"> <li>Daily situation reports (SitReps)</li> <li>Fire science information – e.g. daily weather reports; Fire Danger Rating, hydrology; expected fire behavior</li> </ul>	<ul style="list-style-type: none"> <li>Loss assessment calculations</li> <li>Investigation reporting</li> </ul>
<ul style="list-style-type: none"> <li>Activation of “Initial Response Plan” and using the Incident Command System</li> <li>Rapid development of “Main Suppression” Plans, i.e. landscape approach and use of dykes to flooding of fires</li> <li>Additional support and coordination of resources ready to be deployed from cooperative agencies and adjacent districts or provinces</li> </ul>	<ul style="list-style-type: none"> <li>Develop rehabilitation plans for human welfare, environmental landscapes and economic recovery for infrastructure losses</li> </ul>
<ul style="list-style-type: none"> <li>Use the rapid initial attack method on all fires to reduce the overall costs and losses</li> <li>Use appropriate and specialised equipment</li> <li>Ensure basic fire-fighting supplies are available</li> <li>Implement Incident Command System to manage fires</li> </ul>	<ul style="list-style-type: none"> <li>Human: Welfare support and assistance during and immediately after a fire</li> <li>Environmental: Provision of seeds; hydrological management</li> <li>Economic: Complete infrastructure assessments and reconstruction programmes</li> </ul>
<ul style="list-style-type: none"> <li>Public communications via broadcast media – e.g. information update on fires, danger areas to be avoided, public health messages and advisories</li> </ul>	<ul style="list-style-type: none"> <li>Well targeted education and development programmes</li> <li>Community outreach program</li> <li>Provide information on available support and assistance programmes</li> </ul>

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