GUIDING DOCUMENT

for Information and Data Collection and Results Management for Forest/Land Fire and Haze in ASEAN

June 2024

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Prepared by
Global Environment Centre

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Objective of the Guiding Document

This **Guiding Document for Information and Data Collection and Results Management for Forest/Land Fire and Haze in ASEAN** are intended to serve as a reference to support ASEAN Member States (AMS) to undertake information and data collection, analysis and reporting in relation to the ASEAN Standard Operating Procedure for Monitoring Assessment and Joint Emergency Response (ASEAN SOP MAJER[1]) and with respect to the framework of ASEAN Agreement on Transboundary Haze Pollution (AATHP[2]). This will support results management related to prediction, warning and monitoring of forest and land fire, and transboundary haze. This document will also support some aspects of implementation of the Roadmap on ASEAN Cooperation towards Transboundary Haze Pollution Control with Means of Implementation (ASEAN Haze-Free Roadmap[3]) (2023-2030) and are relevant to elements related to fire warning and monitoring in relation to the ASEAN Peatland Management Strategy (APMS[4]) 2023-2030. Further details on indicators, targets and monitoring towards the initiatives are given in the final APMS 2023-2030 and the ASEAN Haze Free Roadmap 2023-2030 documents adopted in August 2023 that related to the monitoring frameworks developed subsequently.

The AMS may wish to develop respective country specific guideline with reference to this regional guiding document, with modification if appropriate, based on internal country's institutional arrangements and needs.

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[1] ASEAN Standard Operating Procedure for Monitoring Assessment and Joint Emergency Responses (2021) https://asean.org/book/asean-standard-operating-procedure-for-monitoring-assessment-and-joint-emergency-response/

[2] ASEAN Agreement on Transboundary Haze Pollution (n.d) Action, ASEAN Haze Portal https://hazeportal.asean.org/action/asean-agreement-on-transboundary-haze-pollution/

[3] The Second Roadmap for ASEAN Cooperation on Transboundary Haze Pollution Control with Means of Implementation (2023-2030). https://asean.org/book/the-second-roadmap-for-asean-cooperation-on-transboundary-haze-pollution-control-with-means-of-implementation/

[4] ASEAN Peatland Management Strategy (2023-2030) https://asean.org/book/strategy-and-action-plan-for-sustainable-management-of-peatlands-in-asean-member-states-2023-2030/

Part 1: Introduction

This **Guiding Document for Information and Data Collection and Results Management for Forest/Land Fire and Haze in ASEAN** is a document outlining agreed reporting of information, data collection process and systematic results management practices related to fire and haze monitoring and prevention, as per stated in the relevant ASEAN procedures and documents. This guiding document will provide descriptive details to the listed elements below:

Assessment

Data collection at local and national levels to inform fire and haze risk and support risk management decisions

Verification

Verification process at local and national level for accuracy and consistency of information

Standardise reporting

Standardisation of national reporting on selective data/information using an agreed format/template and methodology for comparison and characterisation at regional level

Result management

Information and database administration and maintenance at national and regional levels

Roles and responsibility

Roles and responsibilities of related ministries/institutions as well as regional, national and local monitoring centres

Human resource

Key staff required for effective and sustainable data management

1.1 Defining Information, Data and Results Management

Before undertaking the activities surrounding information and data collection and results management, it is necessary to define the subject matter under discussion. Each of this term is defined as follows:

Information is the summarisation of analysed data. Information about fire and haze risk such as weather outlook, hotspot map, and Fire Danger Rating System (FDRS) indices and codes are shared through regional monitoring centres' websites.

Data is the raw information usually stored in the form of numbers, but it can also come as text, visual, graphic and sound. Data can be analysed and used to create information that could not be obtained by just looking at the original data. Data may be shared by regional monitoring centres such as ASEAN Specialised Meteorological Centre (ASMC) in a form of hotspot coordinates and confidence level threshold.

Result management is a management approach and a set of tools for strategic planning, monitoring and evaluation performance, reporting, and organisational improvement and learning.

1.2 Importance of Information, Data Collection and Result Management

The purpose to have structured information, data collection and result management is to improve efficiency and effectiveness of fire prevention and monitoring activity, as well as to fulfil accountability obligations through reporting. Key to its success is the involvement of stakeholders throughout the activity in achieving realistic results, assessing risk, monitoring progress, reporting on progress and integrating lessons learned into management decisions.

1.3 Aim, Intent and Target Audience for This Guiding Document

This guiding document aimed for:
- i) Better data collection, standardisation reporting and dissemination;
- ii) Improved data quality through data verification;
- iii) Strengthened regional and country capacities in collection, management and analysis of data/information; and
- iv) Promote data/information sharing, as well as best practices for land management at regional and country levels.

The target audiences for this document are stakeholders responsible for fire and haze prevention in ASEAN, including ASEAN Secretariat, the ASEAN Coordinating Centre for Transboundary Haze Pollution Control (ACC THPC), National Focal Points (NFPs) of Committee (COM) under the Conference of Parties (COP) for the AATHP, National Monitoring Centres (NMCs), competent authorities such as monitoring and evaluation (M&E) officers at local, sub-national and national levels, and ministries of the AMS responsible for monitoring (data collection, management, and analysis) and reporting on air pollution and haze.

1.4 Findings from Capacity Development Need and Gap Analysis (CDNGA)

The Capacity Development Need and Gap Analysis (CDNGA)[5,6] document was developed by ASEAN Secretariat in 2019-2021 with support through the MAHFSA Programme to help assess the regional and national capacity needs and gaps in relation to fire and transboundary haze prevention and control, as well as peatland management. It was developed in support of the ASEAN Peatland Management Strategy 2023-2030 (APMS 2023-2030) and the Second Roadmap for ASEAN Cooperation on Transboundary Haze Pollution Control with Means of Implementation (2023-2030) (also known as ASEAN Haze-Free Roadmap). It also assessed the options and constraints for the use of available information and results management system for monitoring and reducing transboundary haze pollution in the region. The outcomes from the CDNGA were intended to guide the activities to strengthen capacity of ASEAN to utilise information and results management systems for sustainable land and haze management. The CDNGA was adopted via ad-referendum by all AMS in July 2021. Findings from the CDNGA relevant to information, data collection and result management are summarised in **Table 1**.

Table 1: Key findings from the CDNGA relevant to information, data collection and result management

Categories	CDNGA findings
Reporting practices	The capacity and functioning of the NMCs in relation to tracking/reporting of the implementation progress of the ASEAN Haze-Free Roadmap indicators needs further enhancement
ASEAN SOP MAJER	Some AMS are not aware of the procedure suggested in the ASEAN SOP MAJER
National initiatives	Most AMS have national fire prevention programme. However, documentation and reporting practices are unclear
Situation report of ASEAN SOP MAJER	Minimum submission of the Form 1 from national to regional level
Information sources	Many effective tools and systems have been developed in ASEAN for fire prediction and early warning (e.g. ASMC, BMKG, DNP, MET Malaysia), in addition to the NASA platform
Data enhancement	Enhancement of weather-related information is required for the region (e.g. vegetation stress indices, soil moisture, drought, climate prediction, etc.) which link closely to land, forest fire and climate change matters

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[5] Report on Capacity Development Needs and Gap Analysis – Main Report (n.d) ASEAN Haze Portal: https://hazeportal.asean.org/publications/report-on-capacity-development-needs-and-gap-analysis-main-report/
[6] Report on Capacity Development Needs and Gap Analysis – Annexes (n.d) ASEAN Haze Portal: https://hazeportal.asean.org/publications/report-on-capacity-development-needs-and-gap-analysis-annexes/

Categories	CDNGA findings
Data sharing	Need to simplify and enhance data and result sharing practices at regional and national levels, by all relevant service providers, NMCs and related agencies in AMS
Monitoring capacity	All AMS have the general capacity to monitor weather information as suggested in SOP MAJER
Air quality	The capacity, coverage and utilisation of air quality monitoring systems in ASEAN is insufficient
Language	There are language barriers and complex content of current information
Simple mechanism	AMS require simpler mechanism or platform for communication and reporting
Fire Danger Rating Systems (FDRS)	There is inadequate utilisation of FDRS and warning systems at local level in most AMS
Burn scar information	Insufficient attention to tracking fire scars and subsequent recovery measures by AMS
Verification	Most AMS have established ground patrol teams
Fire and haze prevention	Prevention of land/forest fires and haze is a top priority of all AMS and is relevant to many ASEAN targets and frameworks
Fire and haze management	The current reporting and information sharing by NMCs and its subsequent use and analysis is insufficient to fully track fires and haze, as well as to determine the effectiveness on management measures
Air quality measurement index	Lack of harmonised measurement system i.e. Air Quality Index (AQI) or Pollutant Standards Index (PSI)
Communication challenges	There are challenges in communication to the ground level (e.g. lack of network and efficient medium)

1.5 Gaps and Challenges in Data Collection and Result Management
Based on the CDNGA and the Regional Workshop for Information, Data Collection and Results Management for Fire and Haze in ASEAN conducted, with support from MAHFSA, in April 2022, some gaps and challenges were identified in data collection and result management process that will be discussed in this section. Some elements in this section are briefly explained in other parts of the documents (i.e. Section 2.1.3 explaining about reliable sources of data; Section 3.1 explaining about data to be collected by AMS; Section 5.3 explaining about monitoring and reporting system).

1.5.1 Data Quality Issues
Raw data typically includes errors, inconsistencies and other operational and analytic issues. Fortunately, several sources in ASEAN as explained in Section 2.1.3 are reliable sources that are providing high quality and reliable data. AMS are encouraged to use this data source as a reference and apply for ground verification.

1.5.2 Finding Relevant Data
With a range of data provided by different sources and early warning systems in ASEAN, on-the-ground collection of relevant data for analysis can be a complicated task. Section 3.1 explains the relevant data to be collected by AMS that need to be verified with the ground truthing team before providing feedback in Form 1. These data are suggested accordingly by the ASEAN SOP MAJER.

1.5.3 Dealing with Big Data
Digital data nowadays (e.g. satellite images, Geographical Information System (GIS) layers, geospatial data) contain a huge volume of information which significantly increases the storage capacity needs in size that will grow exponentially with time. Therefore, a large digital storage capacity is necessary to archive this digital data in addition to capable staff to manage it properly. Data storage essentially means that files and documents are recorded digitally and saved in a proper storage system for future use. Archiving the data should consider several elements such as security, effective cost and accessibility along with several options of storage including physical hard drives, servers or virtual storage in the cloud.

1.5.4 Enhancing Capacity of Key Personnel
AMS need to elevate the skill levels of current staffs through appropriate capacity development courses. Following the establishment of the ACC THPC, each AMS should document and communicate the country needs to the ACC THPC. The ACC THPC will facilitate activities to strengthen and enhance the technical capacity of AMS to implement the AATHP[7] accordingly. ASMC[8] is among the dedicated entity to provide variety of capacity development course to strengthen the capacity of AMS in fire prevention and haze monitoring[9]. Concurrently, there are several organisations that are working closely with ASEAN Secretariat through fire and haze prevention projects, that could offer various types of capacity development activities to meet the AMS needs. The capacity development support advertised regularly in the organisation's website as well as shared in ASEAN Haze Portal website[10].

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[7] ASEAN Agreement on Transboundary Haze Pollution (2021): https://asean.org/wp-content/uploads/2021/01/ASEANAgreementonTransboundaryHazePollution-1.pdf
[8] ASEAN Specialised Meteorological Centre (n.d) About ASMC: https://asmc.asean.org/asmc-about/
[9] Qadri, S. T. (2001) *Fire, Smoke, and Haze*, The ASEAN Response Strategy. Asian Development Bank, pp.63: https://www.adb.org/sites/default/files/publication/28035/fire-smoke-haze.pdf
[10] ASEAN Haze Portal (n.d) Training Materials https://hazeportal.asean.org/training/

1.5.5 Insufficient Coordination and Communication

Insufficient communication and coordination between agencies is one of the main challenges in data collection and verification. Complex institutional arrangements at the national level might be one barrier to the communication. The appointed NFP should work to bridge the communication gaps between the agencies and enable clear information provision. The effort should be supported by establishment of proper communication system at national level. Findings from CDNGA suggested that the NFP should establish a governance and information flow system according to the respective national institutional frameworks. This system should clearly define the responsible agencies with delegation of task from national to ground level and reporting back to regional level. CDNGA also recommended NFP to play a bigger role to oversee and coordinate the system, while NMC should actively play the monitoring and reporting role.

1.5.6 Lack of Standard Reporting and Guideline

A new system has been proposed (see Section 5.3.3 below) for a better reporting system. It is expected that the ACC THPC, will play an active role in supporting AMS to utilise data and information as well as support in clear SOPs and guidelines.

Part 2: Institutional Arrangements

2.1 Roles and Responsibilities

This section will elaborate the roles and responsibilities of related agencies at regional, national and local levels in monitoring, data collection and result management.

2.1.1 ASEAN Coordinating Centre for Transboundary Haze Pollution Control (ACC THPC)

With reference to the AATHP, the ACC THPC[11] is established to facilitate cooperation and coordination among the relevant stakeholders in managing the impact of land or forest fires in particular haze pollution arising from such fires. With reference to the SOP MAJER, during the interim period, the functions are to be provided by existing institutions as follows:

   i)   The ASEAN Secretariat for coordination of joint emergency response, donor funding and assistance, development of the SOP, and development and maintenance of database; and
   ii) The ASMC for monitoring and assessment.

With reference to the ASEAN Haze-Free Roadmap (2023-2030), the ACC THPC will enhance appropriate measures in monitoring, assessment and early warning systems to prevent transboundary haze pollution arising from land and/or forest fires.

2.1.2 Specialised Expert Agencies

There are several specialised expert agencies in the region such as Regional Climate Center (RCC) Network, which includes Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), Meteorological Service Singapore (MSS) which also functions as the ASEAN Specialised Meteorological Centre (ASMC), the Malaysian Meteorological Department (MET Malaysia), and the National Agency of Meteorology, Climatology and Geophysics, Indonesia. The Asian Disaster Preparedness Center (ADPC) also provides various support services to assist the region to better manage climate risks.

The RCC Network[12] was established under World Meteorological Organisation (WMO) to enhance long-range forecast and climate monitoring for Southeast Asia. The RCC is a Centre of Excellence (COE) that assists the WMO members in the region to deliver climate services and products. Under the RCC, the WMO has mandated PAGASA to monitor climate information; Meteorological Service Singapore (MSS) to produce long-range forecasting and meteorological data for the region; and National Agency of Meteorology, Climatology and Geophysics (*Badan Meteorologi, Klimatologi dan Geofisika, BMKG*) Indonesia to provide an operational data service.

Through the mandate, the PAGASA has developed Southeast Asia Climate Monitoring Project[13] that provides operational and regularly updated information to help perform climate diagnostics including analysis of climate variability and extremes at regional and sub-regional

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[11] ASEAN Secretariat. (2023). Secretary-General of ASEAN witnesses soft launching of ASEAN Coordinating Centre for Transboundary Haze Pollution. retrieved from: https://asean.org/secretary-general-of-asean-witnesses-soft-launching-of-asean-coordinating-centre-for-transboundary-haze-pollution-control/
[12] Regional Climate Centres (RCCs) https://www.mss-int.sg/sea-rcc-network
[13] Southeast Asia Climate Monitoring Project by PAGASA https://seacm.pagasa.dost.gov.ph/

scales; establish an historical reference climatology for the region and/or sub-regions; and implement a regional Climate Watch. The provided climate information includes rainfall, temperature, wind, sea surface temperature, typhoon tracks, runoff, soil moisture, vegetation health index, standard precipitation index and a climate bulletin.

The ADPC through SERVIR Southeast Asia Program uses open satellite data to help address climate-related challenges in the region. It provides regional geospatial tools and services ranging from drought monitoring, flood forecasting and crop yield management to improve natural resources management, environmental conservation and protection. It also shares air quality information that enable to visualize current and forecast air quality condition. With support from the SERVIR Southeast Asia Program, decision-makers can apply science and technology to manage environmental resources and improve disaster resilience response[14].

As a mandated ASEAN regional centre, the ASMC provides comprehensive information to fire and haze warning and monitoring. In AMS that currently do not have national early warning system, ASMC supports the countries with the information of fire and haze prevention. Apart from ASMC, other entities that support regional early warning system are RCC through PAGASA and SERVIR Southeast Asia. They provide information related to climate change to support AMS community. SERVIR Southeast Asia also coordinates training and support the countries in need such as in air quality system. This information will benefit diverse sectors such as disaster management, agriculture, natural resource management and human health.

2.1.3 Related Agencies at Regional Level
Several monitoring systems have been developed in relation to peat/land forest fire and transboundary haze issues to provide information such as hotspot, weather forecast and fire risk, which geographically focusing within the ASEAN region. They are ASMC, BMKG, Department of National Parks, Wildlife and Plant Conservation (DNP) Thailand and Malaysian Meteorological Department (MET Malaysia). The various information provided by the regional service providers are summarised in **Table 2**. The information is very useful in peat/land forest fire prevention and haze management. It can also be used as a reference and input to Situation Report (Form 1) as per the SOP MAJER.

Table 2: Summary of regional information provided by different agencies in their respective website (Source: CDNGA report, 2021)

	Agencies			
	ASMC	**BMKG Indonesia**	**DNP Thailand**	**MET Malaysia**
Hotspot				
Coverage	ASEAN	ASEAN	Mekong sub-region	ASEAN
Hotspot source	• Aqua/Terra (MODIS) • Suomi-NPP (VIIRS) • NOAA20 (VIIRS)	• Aqua/Terra (MODIS) • Suomi-NPP (VIIRS) • NOAA 20 (VIIRS) • Himawari-9	No	NOAA20 (VIIRS adopted from ASMC)

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[14] The SERVIR SEA Project (n.d) About SERVIR SEA https://servir.adpc.net/about/about-servir-sea .

	Agencies			
	ASMC	**BMKG Indonesia**	**DNP Thailand**	**MET Malaysia**
FDRS				
Coverage	ASEAN (adopted from MET Malaysia)	ASEAN	Mekong sub-region	ASEAN
Forecast for FDRS	7 days	7 days	5 days	7 days
Regional weather updates	Yes	Yes	No	No
Regional haze/smoke	Yes	Yes	No	No
Regional wind speed/direction	Yes	Yes	Yes	No
Regional humidity	Yes	Yes	Yes	Yes
Regional temperature	Yes	Yes	Yes	Yes
Type/format of shared FDRS data	*.png	*.csv, *.png, *.shp and *.json	*.csv and *.kmz	*.png and *.kmz
Website	http://asmc.asean.org/home/	https://spartan.bmkg.go.id/peta-interactive/ or https://signature.bmkg.go.id/weather	https://wildfire.forest.go.th/fdrs/FDRS.php	https://myclimate.met.gov.my/fdrsWmsObsAseanMetPortal or https://myclimate.met.gov.my/fdrsWmsNwpAseanMetPortal (forecast data)

2.1.4 Related Agencies at National Level

With reference to the SOP MAJER, the NFP of COM/COP to AATHP is an entity designated and authorised to receive and disseminate information pursuant to the provision of the AATHP. NFP of ATFP is to monitor and guide the implementation of the APMS. The NFPs therefore play an important role in facilitating communication with other stakeholders and serve as the contact point for the country, before convey the collected and monitored information to ASEAN Secretariat or regional meetings.

NMC is an entity responsible to undertake appropriate monitoring measures in accordance with the respective national procedures. The elements to monitor are:
 a) all fire prone areas,
 b) all land and/or forest fires (including verification of hotspots),
 c) the environmental conditions conducive to such land and/or forest fires, and
 d) haze pollution arising from such land and/or forest fires.

The NMC should communicate at regular intervals to the ACC THPC directly or through the NFP about the above monitored elements, data obtained relating to fire prone areas, land and/or forest fires, the environmental conditions conducive to such land and/or forest fires, and haze pollution arising from such land and/or forest fires.

Hence, each AMS shall designate a NFP and at least one NMC, and inform ACC THPC including any subsequent change in their designations/nominations. **Table 3** shows the responsible NFP and NMC from each AMS as per SOP MAJER document published in February 2021.

Table 3: List of National Focal Point (NFP) for the COM AATHP and National Monitoring Centres (NMC) of AMS (*as at July 2023 – with updates for name changes*)

Country	NFP of COM AATHP	NMC
Brunei Darussalam	Ministry of Development	Department of Environment, Parks and Recreation, Ministry of Development
Cambodia	General Directorate of Natural Protected Area, Ministry of Environment	General Directorate of Environmental Protection, Ministry of Environment
Indonesia	Directorate of Forest and Land Fire Management (DFLFM), Ministry of the Environment and Forestry (MOEF)	Directorate of Forest and Land Fire Management (DFLFM), Ministry of the Environment and Forestry (MOEF)
Lao PDR	Natural Resources and Environmental Research Institute (NRERI), Ministry of Natural Resources and Environment (MONRE)	Climate Division, Meteorology and Hydrology Department, Ministry of Natural Resources and Environment (MONRE)
Malaysia	Department of Environment (DOE), Ministry of Natural Resources and Environmental Sustainability (NRES)[15]	Department of Environment (DOE) and Malaysian Meteorological Department (MET Malaysia), Ministry of Natural Resources and Environmental Sustainability (NRES)
Myanmar	Environmental Conservation Department (ECD), Ministry of Natural Resources and Environmental Conservation (MONREC)	Department of Meteorology and Hydrology, Ministry of Transport and Communications
Philippines	Department of Environment and Natural Resources (DENR)	Forest Management Bureau, Department of Environment and Natural Resources (DENR)
Singapore	National Environment Agency, Ministry of the Environment and Water Resources	Meteorological Service Singapore, National Environment Agency
Thailand	Pollution Control Department (PCD), Ministry of Natural Resources and Environment (MNRE)	Department of National Park, Wildlife and Plant Conservation (DNP), Ministry of Natural Resources and Environment (MNRE)
Viet Nam	Forest Protection Department, Ministry of Agriculture and Rural Development (MARD)	Centre for Environmental Monitoring, Ministry of Natural Resources and Environment (MONRE)

[15] Ministry of Environment and Water (KASA) was merged with Ministry of Energy and Natural Resource (KeTSA) to form the new Ministry of Natural Resources, Environment and Climate Change (NRECC) in 2022 and subsequently changed its name in December 2023 to Ministry of Natural Resources and Environmental Sustainability (NRES)

2.1.5 Related Agencies at Local Level

Ground patrolling and sustainable activities have been undertaken in most AMS at local level such as in protected areas and other key sites by management agencies. Sometimes the patrolling is being supported by regional or international frameworks such as Ramsar Convention or the ASEAN Heritage Park Network. Monitoring is part of required activities to ensure that the protected areas are well-managed and protected from threats such as fire and encroachment. Most countries have ground patrol teams that have been verifying the presence of fires at the hotspot coordinates provided by related agencies at national level.

Apart from the management agency, patrolling activity at local level is also being supported by community groups and smallholders who are concerned about fire prevention. The most crucial element is efficient communication between national and local levels to enable a smooth and consistent reporting of the ground condition. The NFP and NMC must actively coordinate the two-way reporting flow that will involve different stakeholders.

Part 3: Type of Data and Result Management Information to be Collected

3.1 Data Collection as per SOP MAJER

According to the SOP MAJER, each NMC should undertake monitoring measures to include the following dataset or information:

Air quality	Weather	Wind	Rainfall
•PSI reading •Visibility in km	•Current •Forecast •Temperature •Humidity •Medium term weather outlook	•Current •Forecast •Direction •Speed	•Current •3 day forecast •Seasonal Forecast

FDRS	Fire Risk	Fire related info
•Fine Fuel Moisture Code (FFMC) •Drought Code (DC) •Fire Weather Index (FWI)	•Presence of fire-prone areas •Fire history maps •Peatland distribution •Fire risk maps	•Number of fires •Coordinates •Size (ha) •Type (forest fire. peat, fire, other) •Fuel •Topography •Causes (natural, incendiary, accidental, unknown)

Several regional systems are providing above-mentioned data and other information related to forest fire and haze, they are ASMC, BMKG, DNP, Geo-Informatics and Space Technology Development Agency (GISTDA) Thailand, MET Malaysia and SERVIR Southeast Asia (**Table**

4). Apart from these regional sources, AMS through their NMC can refer to their national mandated agencies to collect the data.

Table 4: Available weather and climate data from specialised agencies in the ASEAN region

	Website	Data
ASMC	http://asmc.asean.org/home/	• Air quality (for selected AMS) • Selected weather data • Rainfall • Hotspot • FDRS • Climate
Spartan BMKG Indonesia	https://spartan.bmkg.go.id/peta-interactive/	• FDRS • Hotspot • Radar observation
BMKG Indonesia	https://signature.bmkg.go.id/weather	• Wind • Rainfall • Temperature • Humidity • Cloud coverage
DNP Thailand*	http://www2.dnp.go.th/gis/FDRS/FDRS.php	• Selected weather • Rainfall • FDRS
GISTDA Thailand*	https://fire.gistda.or.th/	• Air quality • Selected weather • Wind • Hotspot
MET Malaysia	https://myclimate.met.gov.my/fdrsWmsObsAseanMetPortal	• Selected weather • Rainfall • Hotspot • FDRS
SERVIR Southeast Asia*	https://aqatmekong-servir.adpc.net/en/map/#aqi_content_tab	• Air quality • Hotspot

*Cover Mekong region only
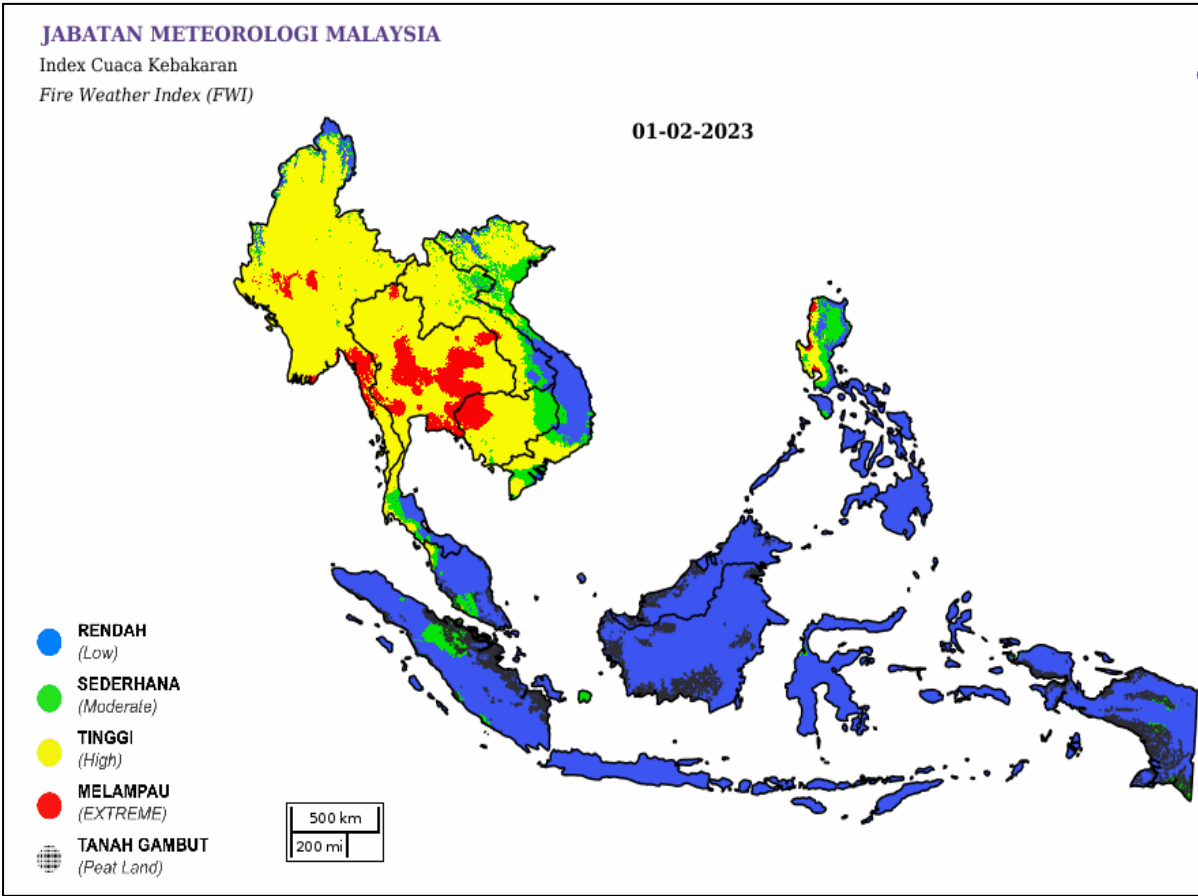
Figure 1: Example of ASEAN FDRS Fire Weather Index (FWI). (Source: MET Malaysia)
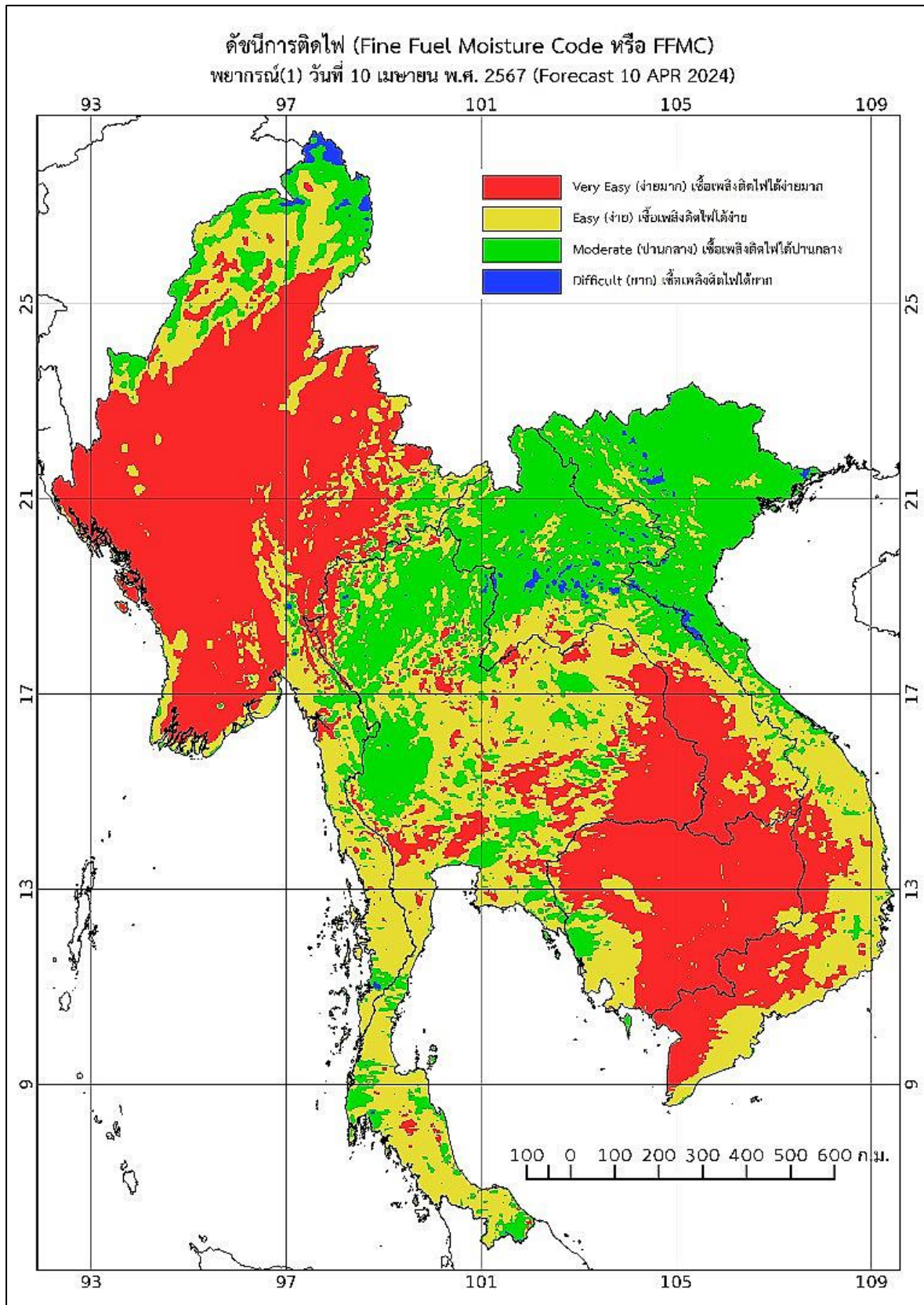
Figure 2: Example of FDRS map for Mekong sub-region (Source: DNP Thailand)
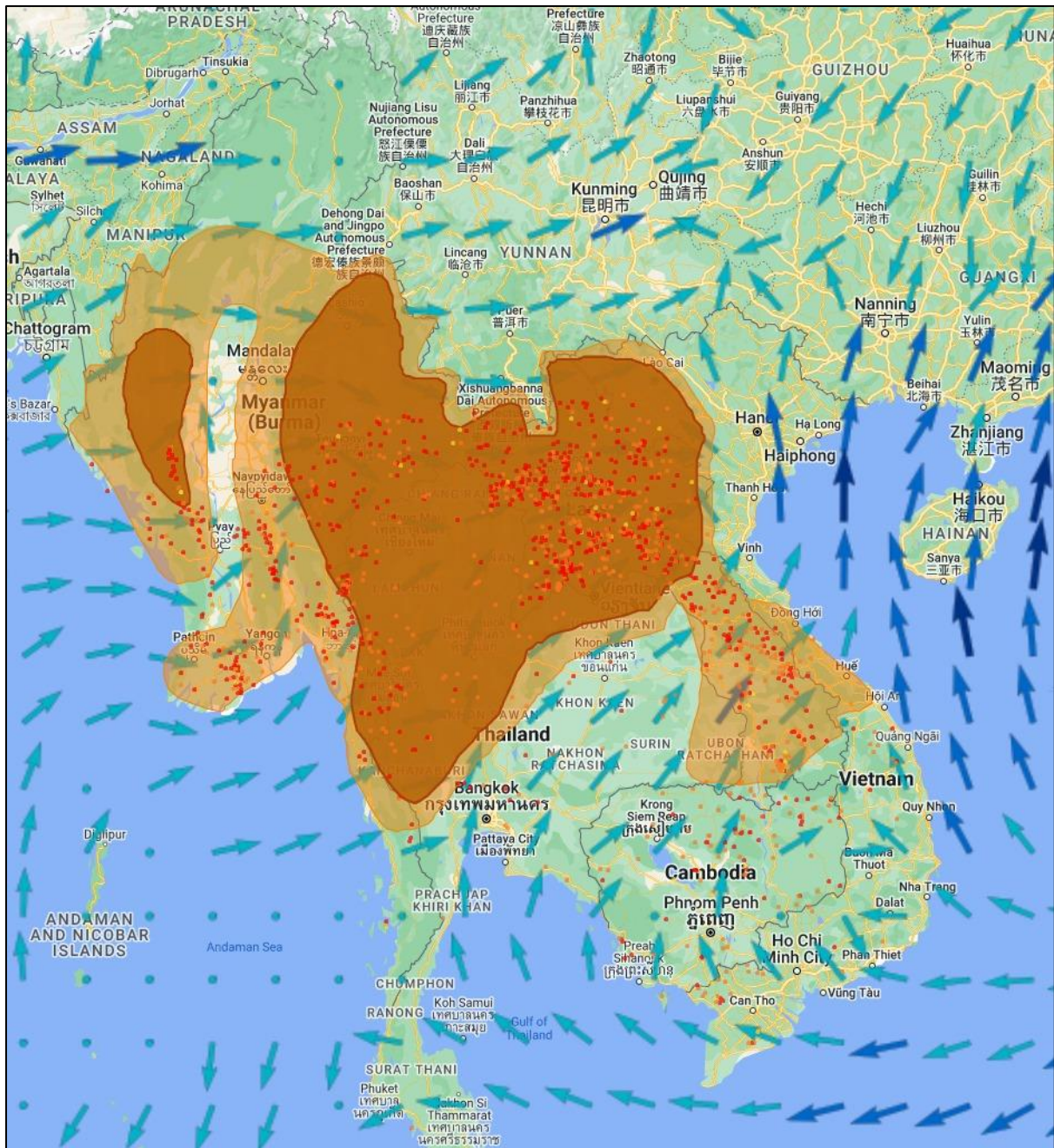
Figure 3: Example of hotspot, haze situation and wind information (Source: ASMC)

3.2 Identification of Fire Prone Areas

3.2.1 Information on Fire History and Fire-Prone Areas

Information on fire history and fire prone areas can be collected through analysis of long-term data sets for hotspots drawing on data sources listed in Table 2 and 3 above. Cumulative hotspot data for 5-10 years can be analysed to indicate areas that are prone to frequent fires (see **Figure 4**). This can enable preparation of maps to identify fire prone areas. Identification of fire prone areas can assist in the deployment of resources for fire prevention and control and can help in the preparation of fire prevention or management plans.
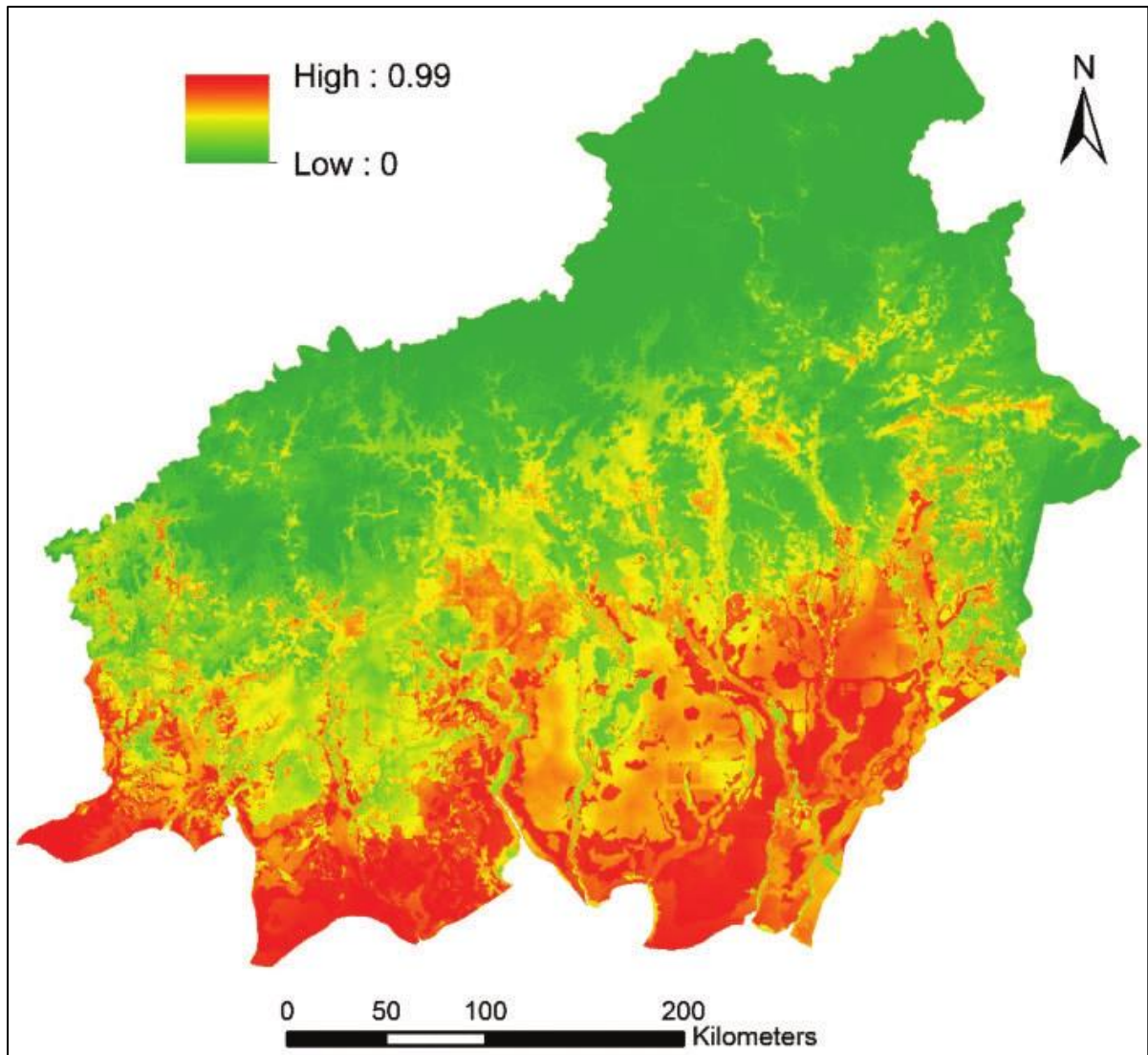
Figure 4: Map of predicted probability of fire hotspot distribution in Central Kalimantan, Indonesia, generated from logistic regression model (Source: Spatial Indicators for Human Activities May Explain the 2015 Fire Hotspot Distribution in Central Kalimantan Indonesia)[16]

Since the transboundary haze in southern ASEAN is closely linked to the drainage and burning of peatlands, it is important to have accurate and regular updates of maps of peatland extent and degradation status. This can also assist in developing priority areas for management action to prevent peatland fires. Maps of peatland extent are generally available in southern ASEAN, but in several countries in northern ASEAN (such as Cambodia, Myanmar and the Philippines), peatlands are still in the process of being identified and mapped. Overlaying hotspot maps on peatland distribution maps can rapidly help to identify fire prone peatlands (see **Figure 5a**) and be used to prepare a map of fire prone peatlands (see **Figure 5b**).

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[16] Sumarga, E. (2017). Spatial Indicators for Human Activities May Explain the 2015 Fire Hotspot Distribution in Central Kalimantan Indonesia. *Tropical Conservation Science*. https://doi.org/10.1177/1940082917706168

PETA TABURAN TITIK PANAS DI SEMENANJUNG MALAYSIA 2014-2019	PETA KAWASAN RISIKO KEBAKARAN TANAH GAMBUT DI SEMENANJUNG MALAYSIA

(a)   (b)
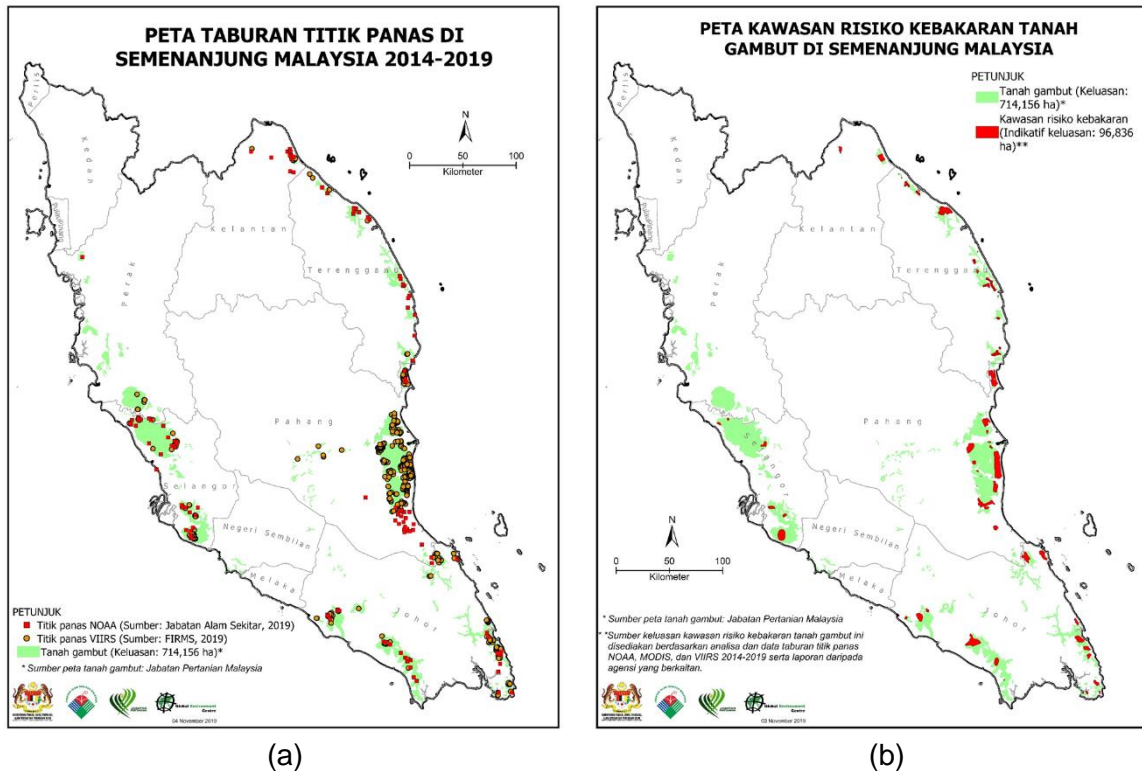
Figure 5a/b: Example of maps to show a) distribution of recorded fire hotspots in and adjacent to peatlands in Peninsular Malaysia 2014-2019; and b) fire-prone peatlands in Peninsular Malaysia derived from analysis of hotspot map verified by ground surveys and satellite identification of fire scars (Source: Department of Environment, Malaysia)

Another source of information on fire prone areas is burn scar mapping. The locations which have burnt can be identified through burn scar mapping. This is more accurate that use of hotspots solely and it can be a mechanism in verifying or validating the hotspots and confirming the actual area burnt. This method is, however, much more time consuming and therefore expensive to undertake the detailed analysis required. **Figure 6** shows the progression of burn scars in different areas in Indonesia between satellite images one month apart. **Figure 7** illustrates the process of mapping and validation of burn scars. The ASEAN Secretariat is currently developing a guideline for the identification and mapping of burn scars in collaboration with AMS and support of CIFOR and the MAHFSA project.
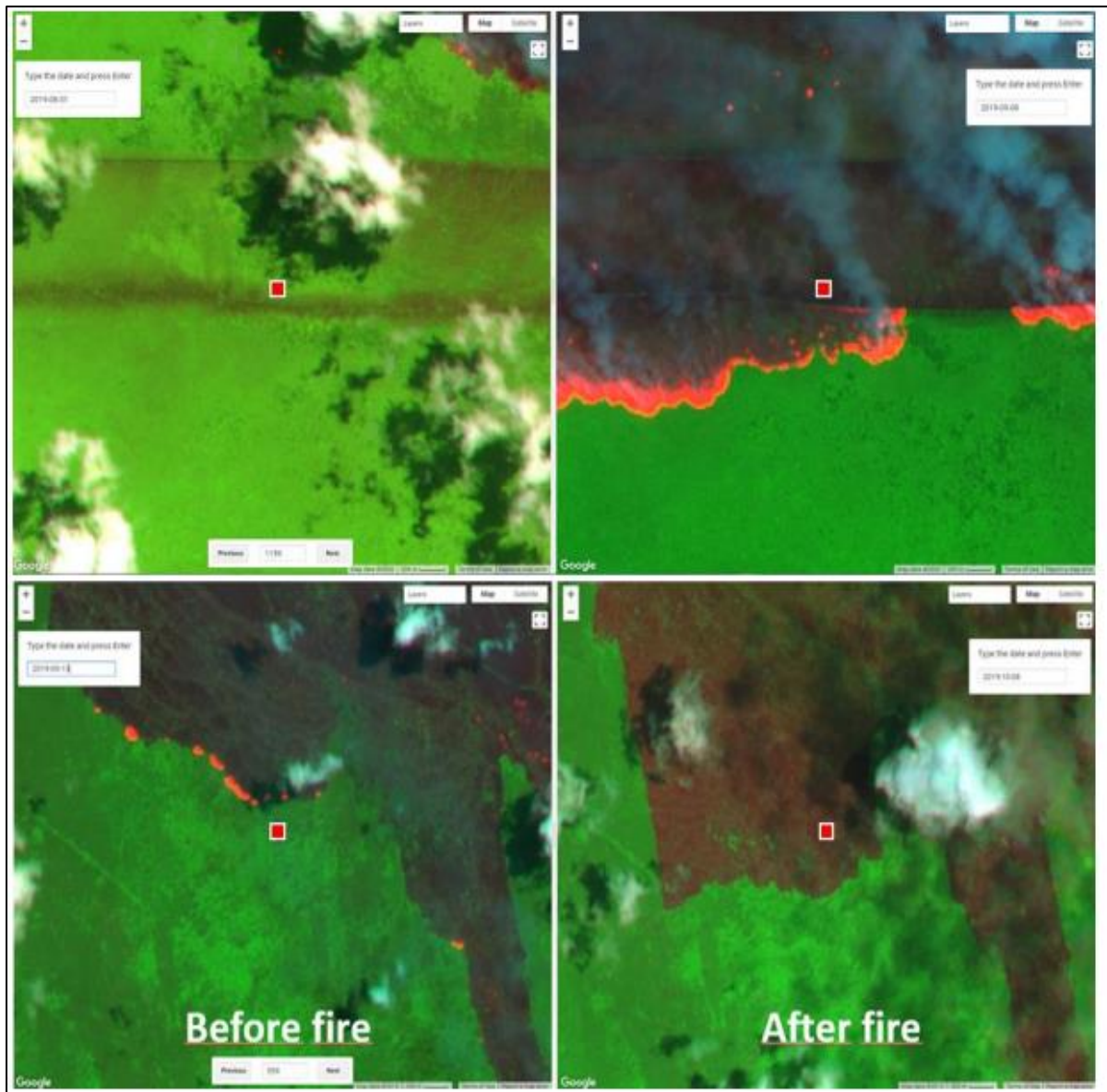
Figure 6: Two snapshots recording the pre-fire (left panel) and post-fire (right panel) original Sentinel-2 images acquired shortly before (13 September 2019) and shortly after (08 October 2019) fire for two reference sites.[17]

[17] David, L. A., Descals, G. A., Salim, M. A., Sheil, D., Sloan, S. (2021). Refined burned-area mapping protocol using Sentinel-2 data increases estimate of 2019 Indonesian burning. *Earth System Science Data Discussion*. https://doi.org/10.5194/essd-2021-113

Figure 7: Mapping and validating burned areas in Indonesia using satellite imagery and ground truthing. (Source: Ministry of Environment and Forestry, Indonesia/CIFOR)

Peatland maps can also be used as an underlay for FDRS maps – to identify peatlands with a high or extreme fire risk.

The history of fire can also be used to identify fire prone villages, districts or provinces – where fires occur in every year or most years. This information is very important for allocation of resources and effort to prevent and control fires. In Indonesia, for example, more than 700 fire prone villages have been identified which were targeted for integrated patrols and other measures for fire prevention.

Building on the fire history and identification of fire prone areas it is possible to develop a fire risk map. This is normally prepared at a landscape or management unit (e.g. forest reserve or national park) level. See **Figure 8.**
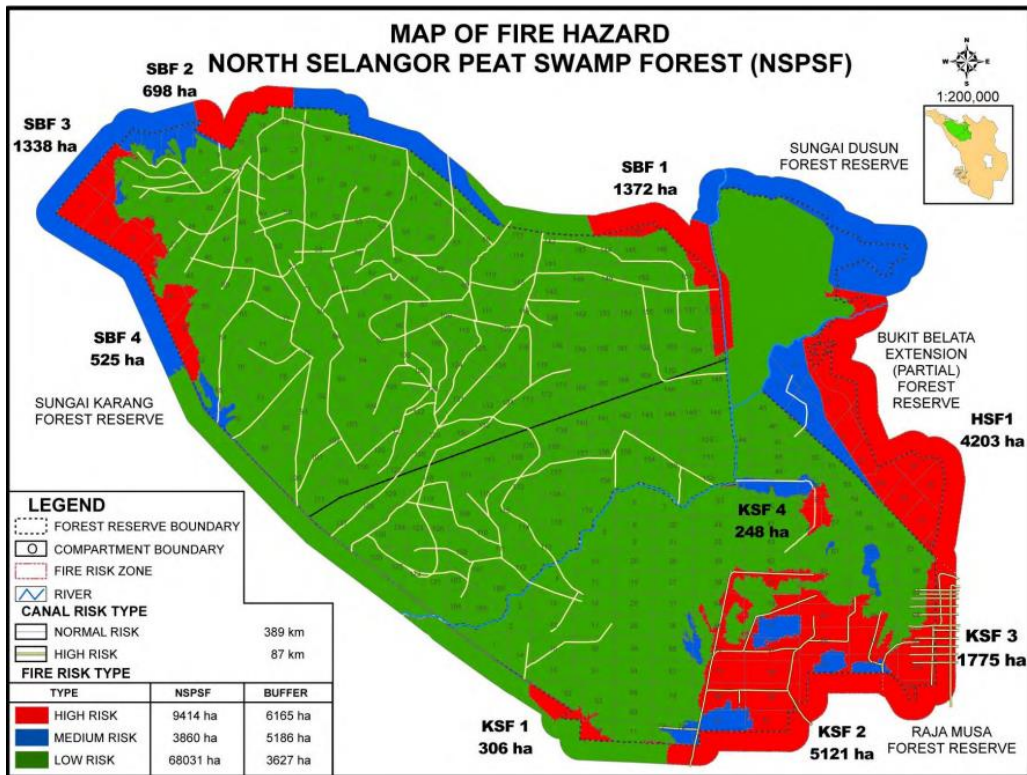
Figure 8: Example of fire risk map from North Selangor Peat Swamp Forest and Buffer Zone, Malaysia. (Source: Selangor Forestry Department, Malaysia)

Such maps can also be prepared on a Provincial level (**see Figure 9**).
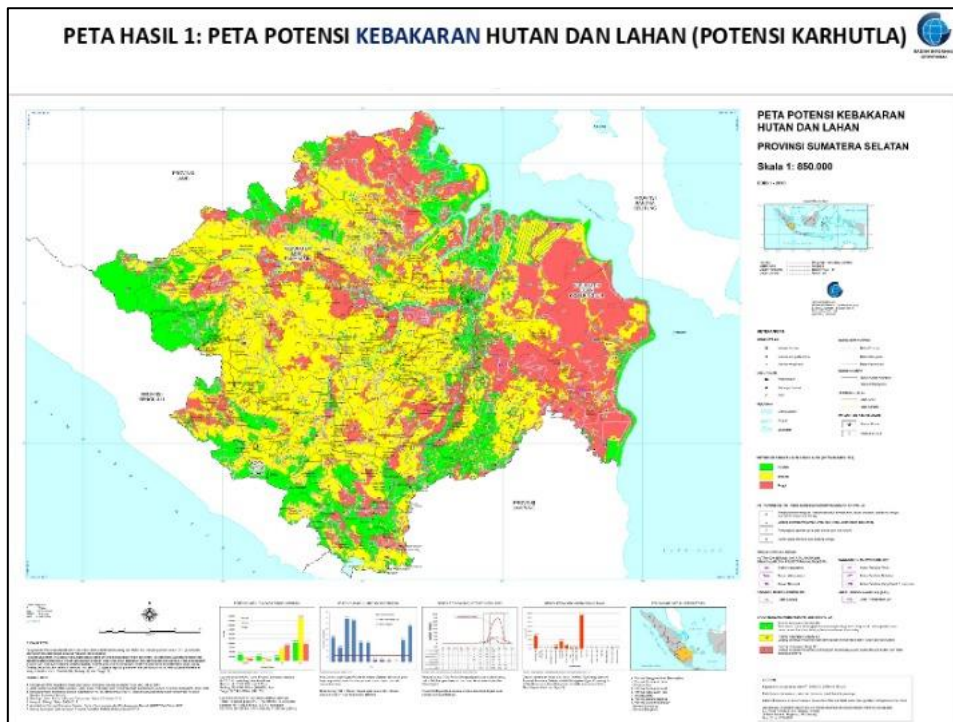
Figure 9: Map of South Sumatera Province, Indonesia to show fire risk at provincial level. (Source: Ministry of Environment and Forestry, Indonesia)

3.3 Additional Useful Data and Information to be Collected

AMS are encouraged to collect additional data and/or information which relates to occurrence of fire and haze as listed below:

3.3.1 Drought

Drought is a condition where below-average precipitation affects the amount of moisture in soil as well as the amount of water in streams, rivers, lakes, and groundwater. Drought is the second-most costly weather event after hurricanes. Its frequency, severity, and magnitude have increased in ASEAN, particularly over the past two decades. Severe droughts, furthermore during El Niño, increase fire risks, undermine all aspects of food security by reducing food supplies and led to acute shortages of drinking water. Regional drought information can be assessed in SERVIR Southeast Asia website.

3.3.2 El Niño-Southern Oscillation (ENSO)

The ENSO is a recurring climate pattern involving changes in the temperature of waters in the central and eastern tropical Pacific Ocean. On periods ranging from about three to seven years, the surface waters across a large swath of the tropical Pacific Ocean warm or cool by anywhere ranging from 1°C to 3°C, compared to normal.

This oscillating warming and cooling pattern, referred to as the ENSO cycle, directly affects rainfall distribution in the tropics and can have a strong influence on the weather to many parts of the world. El Niño (the warm phase) and La Niña (the cool phase) are the extreme phases of the ENSO cycle; between these two phases is a third phase called ENSO-neutral. During the El Niño, there is a significant reduction in rainfall in Southeast Asia and this is a key driver of fires and transboundary haze. Regional ENSO information can be found in the ASMC website.

3.3.3 Indian Ocean Dipole (IOD)

The IOD is similar to the ENSO but occurs in the equatorial Indian Ocean. It involves changes in the relative sea surface temperature between the Arabian Sea (western Indian Ocean) and an eastern pole in the eastern Indian Ocean south of Indonesia. The IOD affects the climate of countries located surround the Indian Ocean Basin, and is a significant contributor to rainfall variability in this region. During a positive IOD, there will be more rainfall in Africa and less rainfall in Indonesia and Australia. The impacts of a strong positive IOD may include: floods in the East African countries, stronger-than-normal Indian summer monsoon rainfall (ISMR), and droughts in Indonesia and Australia. Regional IOD information can be accessed in ASMC website. The ENSO can also affect the IOD, with approximately 30% of IOD events being induced by El Nino events. In the last 60 years, there has been an increase in occurrence of positive IODs combined with El Nino events[18].

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[18] Xiao, H. M., Lo, M. H., & Yu, J. Y. (2022) The increased frequency of combined El Niño and positive IOD events since 1965s and its impacts on maritime continent hydroclimates. *Scientific Reports 12*(7532). https://doi.org/10.1038/s41598-022-11663-1

3.3.4 Green House Gas (GHG) Emissions

When GHG are released into the atmosphere, they trap heat which changes our climate in multiple ways. The main GHG classified by the United Nations Framework Convention on Climate Change (UNFCCC) that bring negative impacts to the climate are carbon dioxide (CO_2), methane (CH_4), hydrofluorocarbons (HFCs), nitrous oxide (N_2O), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). These changes in climate will affect everything from surface, air and ocean temperatures, to precipitation and sea acidification. A warmer climate brings a host of risks from increased drought and wildfires to rising sea levels and heat-related illnesses and deaths. The main emissions released by forest and land fires and burning of agricultural wastes are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). In the case of forest and land fire, carbon emission should be recorded aligned with the duration of fire episodes. In addition to GHG fires and haze can have other significant effects on the climate. Wildfires emit large amounts of black carbon and light-absorbing organic carbon, known as brown carbon, into the atmosphere. These particles affect Earth's radiation budget through absorption of incoming shortwave radiation.[19] Black carbon is an important short-lived climate forcer whose global warming potential is estimated to be up to 5000 times that of carbon dioxide[20], positioning it as the second or third climate driver behind CO_2 on a global scale[21, 22].

[19] Chakrabarty, R. K., Shetty, N. J., Thind, A. S., Beeler, P., Sumlin, B. J., Zhang, C., Liu, P., Idrobo, J. C., Adachi, K., Wagner, N. L., Schwarz, J. P., Ahern, A., Sedlacek III, A. J., Lambe, A., Daube, C., Lyu, M., Liu, C., Herndon, S., Onash, T.B., Mishra, R. (2023) Shortwave absorption by wildfire smoke dominated by dark brown carbon. *Nature Geoscience*. 16, pp 683–688. https://doi.org/10.1038/s41561-023-01237-9

[20] U.S Agency for International Development (USAID), (2012), Guidelines for Water Reuse, United States Environmental Protection Agency (EPA), EPA/600/R-12/618. retrieved from: https://www.epa.gov/sites/default/files/2019-08/documents/2012-guidelines-water-reuse.pdf

[21] Bachmann J. (2009) Black carbon: A science/policy primer. *Pew Center on Global Climate Change*. pp.45. Retrieved from: https://www.c2es.org/wp-content/uploads/2009/12/black-carbon-primer.pdf

[22] Shindell, D., & Faluvegi, G. (2009) Climate response to regional radiative forcing during the twentieth century. *Nature Geoscience*. 2, pp 294-300, https://doi.org/10.1038/ngeo473

Part 4: Guidance How Data and Information to be Collected at Local, National and Regional Levels

4.1 Enhance Procedure for Standardised Data Collection and Reporting

Based on the CDNGA report and earlier sections of this document, there are many different sources of weather information that can be collected for the use of analysis. All of this available data is being collected and submitted to WMO platform, either automatically, semi-auto or manually by the WMO member countries. With the advanced science and technology nowadays, there have also been some integration of information with incorporation of research-based data from local level, for example cost-effective sensors/stations that are providing site specific weather information. The data and information to be collected are much relate to objective of the task.

Some guiding questions for data collection and analysis, as listed below:
1. What is the purpose of the data/information collection?
2. Who are the targeted audience to use the analysed results?
3. How to translate the results to the targeted audience?
4. What/Which data is needed for analysis?
5. Who to collect the data?
6. Where to collect the data?
7. When to collect the data? During dry or wet season or both?
8. How to collect the data? Specific site-based data by using mobile primary data collector, secondary data available online?
9. How much data (parameters and duration) is needed?
10. How to do analysis (which analytic software to be used)?

Despite the different sources, there is a need to standardise the overall coordinated data or information for regional monitoring purposes. As per guided by the SOP MAJER, there are forms to be completed by the AMS' NMC for submission to ACC THPC, as per listed below:
  i. Form 1: Situation Report (from NMC to ACC THPC), SOP for Monitoring and Assessment
  ii. Form 2: Situation Report (from ACC THPC to NFPs), SOP for Monitoring and Assessment
  iii. Form 3: Request for Assistance, for Joint Emergency Response
  iv. Form 4: Offer of Assistance, for Joint Emergency Response
  v. Form 5: Contractual Arrangement, for Joint Emergency Response
  vi. Form 6: Report after Joint Emergency Response, for Joint Emergency Response
  vii. Form 7: Report of ACC THPC on Lessons Learned, for Joint Emergency Response
  viii. Form 8: Recommendations from ACC THPC on Utilising Regional Resources
  ix. Form 9: Report of ACC THPC on Lessons Learned (when recommending the use of regional resources)

The above listed forms as per referenced from the SOP MAJER, have been providing guidance to AMS on specific information and data needed prior submission of the forms, for overall regional result management and analysis. There are some domestic efforts needed to do preliminary data analysis by NMC or NFP, in particular compilation of hotspot verification, fire incident (with coordinate), rainfall, temperature, FDRS indices/codes, etc. In addition to

the weather information, there is useful to utilise satellite images for analysis. This information can be collected or referred to the sources in **Table 5** below:

Table 5: Data and information to be collected from different sources

Data Type	National	Regional
Hotspot information	LAPAN/BMKG (ID), MOEF (ID), FORFIS (MY), GISTDA (TH), FireWatchVN (VN)	ASMC, FIRMS, Global Wildland Fire Monitoring System, NOAA20, MODIS (Aqua and Terra)
FDRS	BMKG (ID), MET Malaysia (MY), DNP (TH)	MET Malaysia (for ASEAN), BMKG (ID, for ASEAN), DNP (TH, for Mekong)
Air quality	Pollutants Standards Index (PSI by BD, ID, MY, SG), Air Quality Index (AQI by CA, PH, TH and VN), National Ambient Air Quality Standards (NAAQS by MMR), PAM Air (VN)	ADPC through SERVIR Southeast Asia Program
Peatland map	NRES (MY), MONRE (TH), MOEF (ID), DENR (PH), MoE (CA)	ASEAN Secretariat (Environment Division)
Burn scar map	MOEF (IND)	
Haze extent		Himawari, ASMC
Land use and land use change	Satellite images including Landsat, Spot, Sentinel, Planet.com	
Specific data	Ground water level data (for peatland management)	

In order to improve the reporting practices, AMS have proposed a simpler mechanism or platform for communication and reporting[23]. ACC THPC suggested to create a platform for the AMS for online or web-based reporting and not filling the form offline and submit through email to ACC THPC. There is a need to review and revise the required information and content needed in Form 1 by ACC THPC. For example, Box 3 on Form 1 is similar to fire incident report which normally used for local level and less suitable for national reporting.

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[23] Input from ASEAN Member States (AMS) during the Consultative Meeting for Information and Data Collection and Results Management for Fire and Haze in Southeast Asia workshop held on 4 July 2023

4.2 Collaboration with Different Agencies for Data Collection

There is a need of collaboration with specific technical departments/agencies within or across ministries and provincial offices to facilitate collection of data, in particular site-based that may involve local authorities and/or local community. Weather stations and air quality monitoring sensors/stations have been installed by different parties within the country and there is a need to compile the list of stations and utilisation purposes of the stations. This will assist to synchronise and maximise utilisation of available stations to provide more accurate analysis results to public.

Briefing sessions would be needed to inform the relevant agencies on the requirements, data parameters, frequency and duration of data collection. That would be calibration or configuration of some specific tools or equipment to ensure accuracy of data. In addition, discussions with stakeholders are needed to ensure appropriate data sharing to avoid bleaching of confidentiality, encourage willingness to share and collect data (by private sector and local community), and to synchronise and update data in the government systems.

For example, information and data related to fire, need to have cross-checking data from ground to verify results/analysis from satellite image interpretation. Forestry Department, Fire and Rescue Department and local fire brigade, as well as private sector would have more accurate data to verify the hotspot information if that were fire spots. As for burnt scar area, ground verification and satellite image interpretation would be able to support a burnt area map. If there is a need to standardise data to be collected, there may need some training sessions or roadshow to promote the methodology, that could also be put as one of requirements of certification system if that shall be considered for improved management.

Part 5: Guidance How Data and Information to be Managed and Shared or Disseminated

5.1 Information Dissemination

Common dissemination tools available are telephone, fax, email, social media platform, web portal, messaging service such as LINE, WhatsApp, WeChat, Viber and Telegram. Mobile phone applications are convenient dissemination tools suitable for fire prevention and monitoring activities. These technologies offer many advantages as they have been used to disseminate the information generated by the specialised centres (e.g. ASMC, DNP or MET Malaysia) to reach users at regional, national and local levels in a timely manner. It is not limited by geographical location and can be accessed anywhere at any time with the appropriate technology and connections.

Using mobile devices for information collection also offers advantages over traditional forms of information collection. Since mobile technology can be taken anywhere, information can be collected in real-time in the field. Mobile phone applications help to make the collection of information easier and more efficient than traditional collection methods.

The information available at regional and national levels can be disseminated to local level for verification by local authorities and/or targeted groups including farmers and communities. It could also be a designated intranet to distribute relevant weather information to the nominated desk officers for further dissemination. In most AMS (except Lao PDR and Philippines), the hotspots information is being sent to local or ground level for verification (**Figure 10**). However, some countries such as Thailand and Viet Nam have their respective national systems and capacity to collect the information.

As included in the CDNGA report, the source information provided by respective regional or national agencies is or can be distributed by the NFP and NMC to local level for ground verification. The information flow to NFP or its relevant agency that is responsible for data or information monitoring before they share the information to ground team for verification.
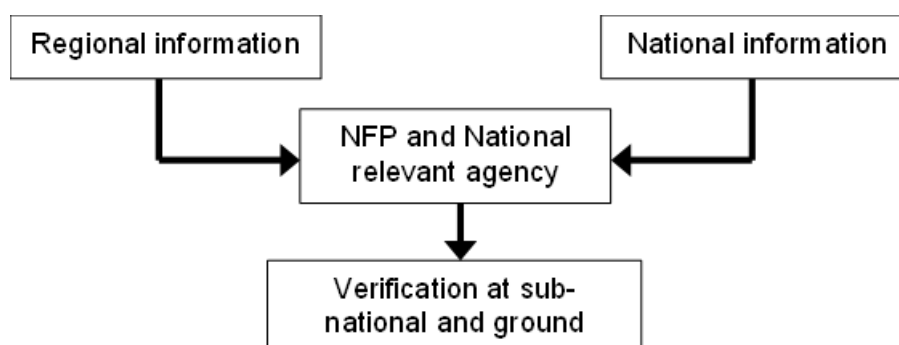
Figure 10: General circulation of information from sources to ground level for verification

In order to further disseminate the information, several options have been identified, as follows:

5.1.1 ASEAN Haze Portal

ASEAN Haze Portal[24] was established as the ASEAN knowledge management platform on sustainable peatland and haze management, and facilitate networking and knowledge-sharing among policy makers and other relevant practitioners in Southeast Asia. This website also serves as a place for all ASEAN Peatland Partners to share their project updates, stories, best practices, reports, and knowledge products that may be beneficial for relevant stakeholders. This portal also links directly to ASMC website to share regional weather, haze and hotspot situation.

5.1.2 Utilisation of Mobile Application

Several mobile phone applications have been developed to support forest fire prevention activity as well as information dissemination. The Government of Indonesia has developed the System for Monitoring and Reporting Technology for Fire Prevention Patrols (*Sistem Informasi Patroli Pencegahan Karhutla* or SIPP Karhutla Application[25]) to support the implementation of forest and land fire prevention patrols in Indonesia. This system has been proven to support the implementation of forest and land fire prevention patrols in the field and disseminate data efficiently.

The ASEAN Fire Alert PhoneApp Tool[26] is another mobile smartphone application that was initially developed in 2015 for public users and has been revised several times since. The main information provided by this application is related to hotspots and FDRS. The hotspot information is from ASMC and LAPAN, while the FDRS information is taken from MET Malaysia. Users received alert push notification tailored to their location of interest on the application in early stage but the users have been receiving pull notification in recent years. The alert consists of daily changes in fire danger risk rating as well as detection of hotspots on their registered location of interest. This application provides information for the whole ASEAN region. An updated version of the application to be released in mid-2024 will include additional features such as inclusion of FDRS codes and indices for Mekong subregion from DNP Thailand, data on rainfall, wind direction, haze layer, and weather forecast.

5.2 Results Management

This section elaborates the management approach to be applied to the data including documenting and storing. Several options for disseminating, monitoring and reporting will also be discussed. Excellent result management will improve the data organisational performance.

As per stated on the CDNGA report, as a formal ASEAN regional centre, ASMC provides comprehensive information to fire and haze warning and monitoring. In AMS that currently do not have a forest fire information system, ASMC helps countries engage in regional collaboration. Apart from ASMC, other service providers at the regional level that support early warning system are BMKG, DNP and MET Malaysia. Despite efficient information for fire

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[24] ASEAN Haze Portal. https://hazeportal.asean.org/
[25] RFMRC-SEA. (2022). IPB University Launching System Monitoring and Reporting Technology for Fire Prevention Patrol (SMART Patrol Information System) (SIPP Karhutla) retrieved from https://rfmrc-sea.org/ipb-university-launching-system-monitoring-and-reporting-technology-for-fire-prevention-patrol-smart-patrol-information-system-sipp-karhutla/
[26] ASEAN Fire Alert Phone App Tool https://aseanfirealert.org/

prevention, there is a need for enhancement of weather-related information to be used by these regional systems.

At the national level, a good example is the Peatland Ecosystems Protection and Management Information System (*Sistem Informasi Perlindungan dan Pengelolaan Ekosistem Gambut*, SiPPEG[27]) of Indonesia. This SiPPEG collates, monitors and manages the information and data from satellites and ground inputs for a better management of the peatland ecosystems across the country. The data and information include Peat Ecosystem Quality Index (*Indeks Kualitas Ekosistem Gambut*, IKEG), Water Balance in Peat Ecosystems (*Neraca Air di Ekosistem Gambut*), Corporate Performance Rating Assessment (*Penilaian Peringkat Kinerja* Perusahaan, PROPER), Early Warning Systems (*Sistem Peringatan Dini*), Hotspot (*Titik Panas*) and Groundwater Level (*Tinggi Muka Air Tanah*, TMAT) in peatlands, and Peat Ecosystem Protection and Management Plan (*Rencana Perlindungan dan Pengelolaan Ekosistem Gambut*, RPPEG). This data and information have been collected and managed by different government agencies but it is integrated into this sophisticated system for overall management of the vulnerable peatland ecosystems. This cross-sectoral and multi-disciplinary collaboration is the success key with strong governance and political will in addressing and overcoming challenges together, for collective actions and paradigm shift. There is a great need to establish local organisation or at least to engage local authority and/or local community to support local data collection. There should be updated approach to improve on data verification that could go through automatic analysis and reporting system or platform, and easy for the local people to fill-up. For example, Spatial Monitoring and Reporting Tool (SMART) could be considered to use for ground verification – this system can be used to train local people for citizen science program and it can generate automatic reports to managers.

5.2.1 Database Administration and Maintenance

As per stated on the AATHP[28], the ACC THPC shall play the role to receive, facilitate cooperation and coordination among the AMS, other relevant stakeholders, establish and maintain lists of experts, equipment and technical facilities, as well as establish and maintain a list of donors for mobilising financial and other resources for the prevention and mitigation of land and/or forest fires or haze pollution arising from fires and preparedness of the AMS. It is also stated that the ACC THPC shall establish and maintain an information referral system for the exchange of relevant information, expertise, technology, techniques and know-how, and make it available to the AMS in an easily accessible format. In addition, the ACC THPC shall compile and disseminate to the AMS information concerning their experience and any other practical information related to the implementation of the ATTHP, and assist the AMS in preparation of SOPs.

In addition, the ASEAN Haze Portal could serve as a repository of knowledge products or peatland related projects that have been implemented in the region. There has been a multi-stakeholder platform established for sharing of experiences and lessons learned for working on sustainable land management towards a haze-free environment in the region. ASEAN

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[27] Sistem Informasi Perlindungan dan Pengelolaan Ekosistem Gambut (SiPPEG) https://sippeg.menlhk.go.id/apps/
[28] ASEAN Agreement on Transboundary Haze Pollution (AATHP) (n.d) Action, ASEAN Haze Portal. https://hazeportal.asean.org/action/asean-agreement-on-transboundary-haze-pollution/ and ASEAN Agreement on Transboundary Haze Pollution (AATHP) https://hazeportal.asean.org/publications/asean-agreement-on-transboundary-haze-pollution/

Secretariat as the interim of the ACC THPC has been playing a key role in facilitating the exchange while waiting for full operationalisation of the ACC THPC.

For country that have specific national regulations of database storage, cloud server may not be possible due to security matter. However, some useful data is available for public reference on internet through simple animation and infographic format, text file, excel, picture, geographic data, etc. In addition, some data are available in archives.

5.3 Monitoring and Reporting

This section will discuss about the monitoring measures and reporting should be undertaken by AMS.

5.3.1 Monitoring Specified in the AATHP

As specified in AATHP Article 7 on Monitoring, each AMS shall take appropriate measures to monitor the following:

      a) all fire prone areas;

      b) all land and/or forest fires;

      c) the environmental conditions conducive to such land and/or forest fires; and

      d) haze pollution arising from such land and/or forest fires.

Each AMS shall also designate one or more bodies to function as NMCs, to undertake monitoring in accordance with respective national procedures. The AMS in the event that there are fires, shall initiate immediate action to control or to put out the fires.

In Article 8 on Assessment, it is stated that the AMS shall ensure that its NMC, at agreed regular intervals, communicates to the ACC THPC, directly or through its NFP, data obtained relating to fire prone areas, land and/or forest fires, the environmental conditions conducive to such land and/or forest fires, and haze pollution arising from such land and/or forest fires. The ACC THPC shall receive, consolidate and analyse the data communicated by the respective NMCs or NFPs. On the basis of analysis of the data received, the ACC THPC shall, where possible, provide to each AMS, through its NFP, an assessment of risks to human health or the environment related to transboundary haze pollution.

5.3.2 Monitoring as per ASEAN SOP MAJER

While waiting for the full operationalisation of the ACC THPC, the ASMC will provide technical support, will alert the ASEAN Secretariat in its capacity of Interim ACC THPC, when the dry season starts. The updated alert level is available on the ASMC website. **Table 6** below shows the early warning issued in the form of an advisory according to a three-tier system.

Table 6: Three-tier early warning alert level system used by ASMC

Level 0 (Green)	No transboundary smoke haze/Stand down.
Level 1 (Yellow)	Dry season.
Level 2 (Orange)	Increasing risk of transboundary haze in the region: • Escalating hotspot activities with moderate to dense smoke haze observed over 2 or more consecutive days; • Dry weather persisting; • Prevailing winds blowing smoke haze from the hotspots towards neighbouring ASEAN countries.
Level 3 (Red)	High risk of severe transboundary haze in the region. • Significant and persistent hotspot activities with widespread moderate to dense smoke haze observed over 2 or more days; • Dry weather persisting; • Prevailing winds blowing smoke haze from the hotspots towards neighbouring ASEAN countries.

The procedures for monitoring and reporting as per stated on the SOP MAJER, are shown in **Figure 11** and explained further as listed below:

i. The ACC THPC will issue weather forecasts and haze outlook on a monthly basis throughout the year and publish the updates on its intranet. During the dry season, the ACC THPC will provide more frequent updates.

ii. At the start of the dry season, the ACC THPC will alert the NMCs to submit weekly situation report (Form 1) to the ACC THPC on every Monday. The ACC THPC will consolidate, analyse, and process the information into a user-friendly format.

iii. The ACC THPC will consolidate and analyse the situation reports received from NMCs and circulate the consolidated report (Form 2) to the NFPs at the end of the day through e-mail or other means of communication.

iv. When the air quality reaches unhealthy level in many areas of the region or when there is significant increase of hotspots activities, the ACC THPC will alert the NMCs to provide the situation report (Form 1) on a daily basis.

v. The ACC THPC will also provide the above situation reports in the password-controlled section of its website.

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                  │       ACC THPC       │
                  └──────────────────────┘
        ┌──────────────┼──────────────────────┐
        ▼              ▼                       ▼
┌───────────────┐ ┌──────────────┐ ┌──────────────────────┐
│               │ │ Alert Level  │ │ Alert Level 2 & 3:   │
│ Before dry    │ │ 1: Start of  │ │ Air quality reaches  │
│ season        │ │ dry season   │ │ unhealthy level in   │
│               │ │              │ │ many areas of the    │
└───────────────┘ └──────────────┘ │ region or when there │
        │              │           │ is significant       │
        ▼              ▼           │ increase of hotspots │
┌───────────────┐ ┌──────────────┐ │ activities           │
│ Monthly       │ │ ACC THPC     │ └──────────────────────┘
│ weather       │ │ will alert   │            │
│ forecasts and │ │ the NMCs to  │            ▼
│ haze outlook  │ │ submit       │ ┌──────────────────────┐
│               │ │ weekly       │ │ ACC THPC will alert  │
└───────────────┘ │ situation    │ │ the NMCs to provide  │
                  │ report (Form │ │ the situation report │
                  │ 1) to the    │ │ (Form 1) on a daily  │
                  │ ACC THPC on  │ │ basis                │
                  │ every Monday │ └──────────────────────┘
                  └──────────────┘            │
                         │                    ▼
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                  ┌──────────────┐   │ ACC THPC will        │
                  │ ACC THPC     │   │ consolidate and      │
                  │ will         │   │ analyse the          │
                  │ consolidate  │   │ situation reports    │
                  │ and analyse  │   │ received from NMCs   │
                  │ the          │   │ and circulate the    │
                  │ situation    │   │ consolidated report  │
                  │ reports      │   │ (Form 2) to the NFPs │
                  │ received     │   │ at the end of the    │
                  │ from NMCs    │   │ day through email or │
                  │ and          │   │ other means of       │
                  │ circulate    │   │ communication        │
                  │ the          │   └──────────────────────┘
                  │ consolidated │
                  │ report (Form │
                  │ 2) to the    │
                  │ NFPs at the  │
                  │ end of the   │
                  │ day through  │
                  │ email or     │
                  │ other means  │
                  │ of           │
                  │ communication│
                  └──────────────┘
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Figure 11: Monitoring measures as per the SOP MAJER

5.3.3 Reporting as per ASEAN SOP MAJER

Each AMS is required to submit Form 1 to the ACC THPC based on the current situation when the Alert Level notification issued as shown in **Figure 11**, that includes the information dissemination to local level for ground verification and reporting from ground level to confirm the alert and fire incident. Form 1 is the form to be used by the NMCs to communicate data to the ACC THPC.

The provision of reports by the NFPs and NMCs will allow close monitoring of land/forest fire and haze occurrence in the region. Hence ACC THPC shall periodically receive and consolidate report from NFPs as well as NMCs and provide further analyse including possible regional-level implications of their prevalence or likely disaster impact through Form 2. Form 2 is the form to be used by the ACC THPC to submit consolidated situation report to NFPs. Form 1 and Form 2 of the SOP MAJER are available through the following link. **Figure 12** suggests the process flow of the activities from data collection, monitoring and reporting.

The ASEAN Haze Portal has been playing a role to share information and knowledge products for sustainable land management, and there has been setting up a multi-stakeholder platform for knowledge exchange and experience sharing, the AMS and experts can utilise the platform for sharing. If there is a need for specific training, discussions can be initiated through the platform. Alternately, AMS may communicate directly with ACC THPC or ASEAN Secretariat for training arrangement.

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┌─────────────────────────────┐        ┌─────────────────────────────┐
│ Regional information from ACC│        │     National information     │
│            THPC              │        │                              │
└─────────────────────────────┘        └─────────────────────────────┘
              │                                        │
              └──────────┐      ┌─────────────────────┘
                         ▼      ▼
              ┌─────────────────────────────┐
              │ NFPs, NMCs and National     │
              │      relevant agency        │
              └─────────────────────────────┘
                            │
                            ▼
              ┌─────────────────────────────┐
              │ Verification at sub-national │
              │     and ground patroller     │
              └─────────────────────────────┘
                            │
                            ▼
┌──────────────────┐  ┌─────────────────────────────┐
│ Direct report to │  │  National relevant agency   │
│ relevant         │  └─────────────────────────────┘
│ ministries during│                │
│ critical fire    │                ▼
│ situation        │  ┌─────────────────────────────┐
└──────────────────┘──▶│ Report to decision maker    │
                      │  relevant ministry and NFP  │
                      └─────────────────────────────┘
┌──────────────────────────┐          │
│ National level activation│◀─────────┤
│ of Fire Prevention       │          │
│ Programme                │          │
└──────────────────────────┘          │
┌──────────────────────────┐          │
│ National level haze risk │◀─────────┤
│ and health advisory      │          │
└──────────────────────────┘          ▼
              ┌─────────────────────────────┐
              │ Regional level reporting by  │
              │   NMC to ACC THPC in Form 1 │
              └─────────────────────────────┘
                            │
                            ▼
              ┌─────────────────────────────┐
              │ Consolidate and analyse      │
              │ report from ACC THPC in Form 2│
              └─────────────────────────────┘
```
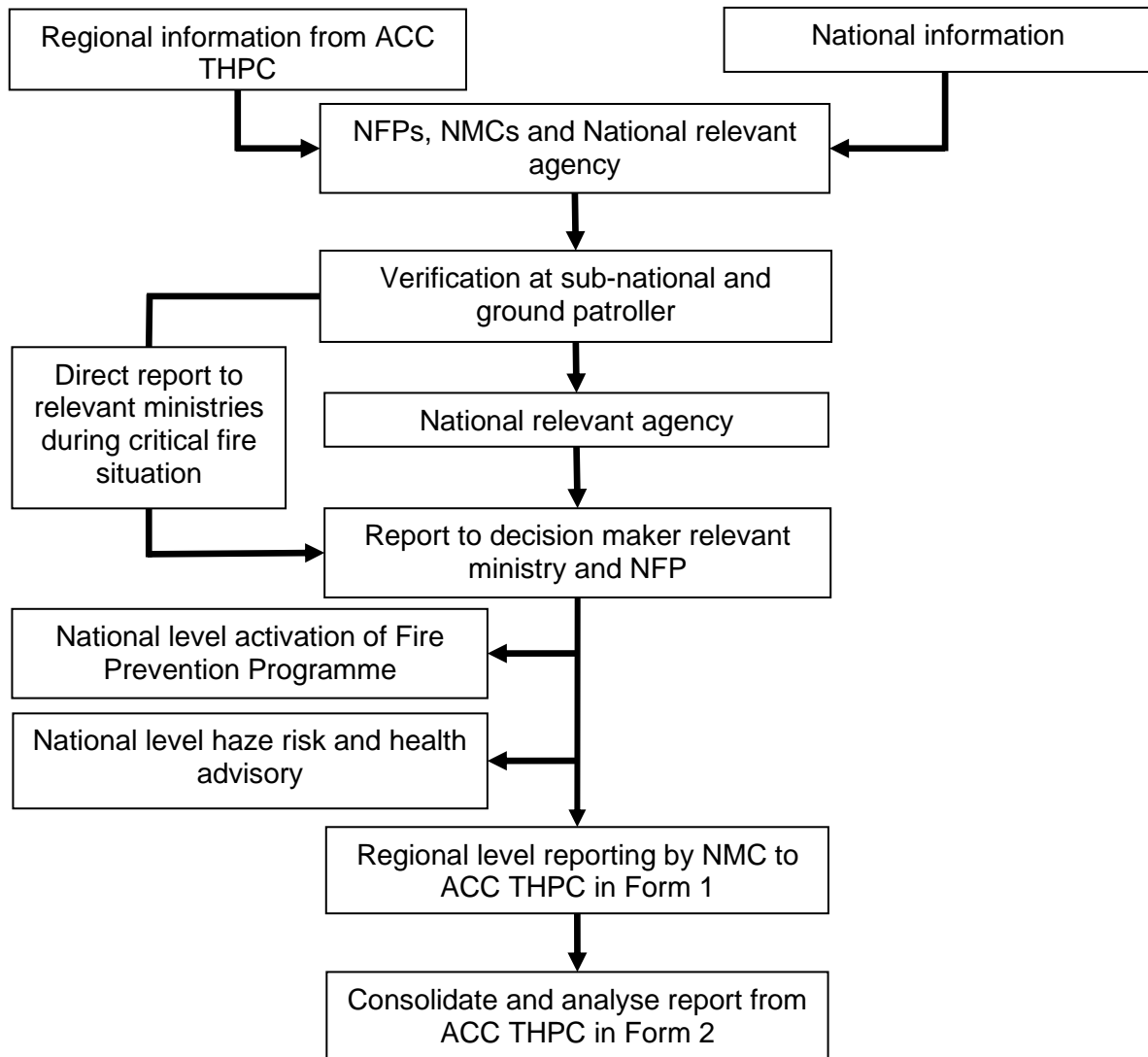
Figure 12: The process flow of the activities from data collection, monitoring and reporting

Part 6: Capacity Building and Support for Data and Information Collection, Management, Dissemination and Analysis

The AMS share similarities in many aspects such as an urgency to address issues in supporting data and information collection, management, dissemination and analysis. It is necessary to provide or make arrangements for relevant training, education and awareness-raising campaigns.

Therefore, enhanced awareness and capacity building are needed, through the aspects or elements as listed below:
   a. Educational programmes through learning platforms such as schools or universities;
   b. Improved information exchange and availability for dissemination;
   c. Training workshops and institutional strengthening, e.g. among agencies involved in fire prevention and control, including establishment of fire prevention units in agencies responsible for land management specifically forestry and agriculture activities;
   d. Data analysis with advanced science and technical support.

There are various of national, regional and international training programmes developed and supported by range of organisations or agencies, including centres in the ASEAN region. The training centres or programmes should be enhanced through provision of new training modules and Training of Trainers (TOT) Programmes. The training programmes can be conducted through online livestream and/or video-based training for rapid and continuous outreach, including self-paced learning programmes. The training materials can be adapted in English and local language versions.

The training programmes can be incorporated into existing ongoing regional programmes such as ASEAN-IFAD MAHFSA, GEF funded national and regional projects, Regional Haze Training Network which is coordinated by ASEAN, and/or new programmes to support ASEAN's effort in enhancing its data and information collection, analysis and dissemination, for Haze-Free ASEAN.